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THE FISHERIES INDUSTRY IN SELECTED ASIAN COUNTRIES*

prepared for UNIDO by INFOFISH**

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C O U N T R Y P R O F I L E S

C H I N A

I N D I A

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M A L A Y S I A

T H A I L A N D

INTRODUCTION

From mere coastal settlements engaged in fishing activities of a purely subsistence nature, Asian fisheries has today evolved into an important economic activity with the development of marketing and international trade. The region, endowed with substantial fishery resources, including many species in great demand on the world market, continues to play an important role in world fisheries. Preliminary data shows that total world catch reached an all-time high of 84.4 million MT in 1985, with landings by developing countries equalling the catch of developed countries for the first time. Developing countries in Asia alone accounted for more than 32 million MT of the global production. Four of the countries under study, namely China, India, Indonesia and Thailand, rank among the top twenty fishing nations in the world. The fifth, Malaysia, although not in the group, is fairly significant in the field.

Fisheries is important for all these countries as for most other developing countries, offering a vital source of food, employment and income. About 6% of the world supply of protein and about 24% of its animal protein comes from fisheries. On a regional basis, the contribution of fish to animal protein in the diet is greatest in Asia. In Southeast Asia, for example, 55% of animal protein consumed is derived from fish.

The fisheries in developing countries of Asia are largely small-scale or artisanal as several Asian countries have retained much of their traditional fishing activities. The bulk of the total labour force in fisheries is, in fact, associated with small-scale or artisanal fisheries. On a global scale this sector continues to be the backbone of world fisheries, accounting for about 25% of world catch and providing about 40% of total foodfish supply.

Notwithstanding their significant contribution, small-scale fisheries are plagued by several inherent problems - impediments which generally reflect the state of fisheries in China, India, Indonesia, Malaysia and Thailand as well as in other developing countries. These include: poor handling practices which render fish unsuitable for processing and lead to a high percentage of wastage; marketing inefficiencies which leave fishermen subservient to traders/middlemen who essentially control the market; fluctuating catches; low earnings; lack of capital and poor infra-structure.

Equally important are signs of over exploitation, for example in certain densely populated (coastal) areas in Indonesia and China, in inshore areas in Malaysia and territorial waters in Thailand. Just as some areas are over-fished, other areas particularly deepsea and inland (including aquaculture) sectors remain relatively lightly exploited and thus offer further potential for development.

An event that has also had far-reaching implications for international collaboration in fisheries research and management in Asia was the implementation of the new ocean regime which gives coastal nations jurisdiction over living resources in the Exclusive Economic Zone (EEZ). Already, it has attracted foreign fishing interest into the region, with countries (particularly developed ones) seeking fishing arrangements with coastal countries in the region.

In this respect, economic and technical cooperation in fisheries management and development play an increasingly important role in world fisheries. including the five countries under study Participants stand to gain many advantages from such cooperation. These include the provision or sharing of technical and management expertise. additional employment, improvements in infrastructure, training for local staff, improved resource knowledge, increased revenue and foreign exchange earnings and economies in the limited resource. Ultimately, this would facilitate a fuller, optimal and more rational exploitation of the fisheries, allowing for an increased contribution to national, economic, social and nutritional goals.

CHINA

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CHINA

1. Introduction

With a total annual fisheries production of over 7.05 million MT in 1985, China stands as the world's third largest fishing nation, after Japan and the USSR. Located in the northwestern part of the Pacific and bordered by Pohai, Yellow Sea, East and South China Seas and the Pacific, the country spans some 40 latitudes, from the tropical through the temperate zone. It is favoured by a long, indented 18 000 km coastline with many bays and harbours while its many islands provide another 14 200 km of coastline.

China is the most populous country in the world, accounting for a population of 1 034 million people (1984) or one-fifth of the world's population. The average annual population growth rate (1976-83) was 1.3%. Population density is about 104 people per sq km, though this varies greatly between provinces and autonomous regions.

In 1983, the country's GNP stood at US\$ 328.4 billion; the 1984 estimate is US\$ 285.3 billion. Average real growth rate of GNP for the period 1979-83 was 7.1%. In the case of per capita income, the 1983 figure was US\$335.00.

2. Fisheries sector

China's fisheries sector comprises both capture and culture production, from marine and freshwater sources. Geographically and ecologically, four distinct marine production areas are evident: the South China Sea fishery, the East China Sea fishery, the Yellow Sea fishery and the Pohai fishery. Together these accounted for a total marine production (both culture and captured) of 4.2 million MT in 1985.

Table 1: Total fisheries production 1950-85 (in 1 000 MT)

Year	Total yield	Marine		Freshwater	
		Fishing	Culture	Fishing	Culture
1950	912	536	10	300	66
1955	2 518	1 549	107	543	319
1960	3 038	1 749	121	668	500
1965	2 984	1 910	104	456	514
1970	3 185	2 097	124	322	582
1975	4 412	3 068	279	312	753
1980	4 497	2 813	444	338	901
1985	7 052	3 485	712	475	2 379

The remaining aquatic produce issues largely from inland aquaculture and the country's many rivers and lakes. Backed by a fairly long history of fishing and fish culture, China, in fact, ranks first in aquaculture production.

Table 2. Fish production, 1984-85 (in ' 000 MT)

	1984	1985 ¹	Rate of increase (%)
Capture fisheries			
Marine	3 305	3 485	5.4
Freshwater	439	475	8.2
Aquaculture			
Coastal	639	7 12	11.4
Freshwater	1 810	2 379	31.4
Total	6 193	7 052	13.9

¹ For a more detailed breakdown, see Annex IV.

Total fisheries production accounts for about 1% of the gross value of agricultural output. Production from both capture and culture fisheries has increased steadily reaching a record high of 7 05 million MT in 1985, an increase of 13.9% over 1984's 6.19 million MT. This was largely attributed to the significant increase (31.4%) in freshwater aquaculture production and the consequent increase (26.1%) in total aquaculture production from 2.45 million MT to 3.09 million MT in the same period. Production from coastal aquaculture (mariculture) also rose by 11.6% to over 712 000 MT while capture fisheries continued to register positive though comparatively minimal growth; the increase was a mere 5.8% in 1985.

Table 3 Output of aquatic products by category (in 10 000 MT)

<u>Item</u>	1983	1982	1983 as % of 1982
Total	545.8	515.5	105.9
I Seawater aquatic products	361.7	359.4	100.6
By origin			
1. Naturally grown	307.2	309.9	99.1
2. Artificially cultured	54.5	49.5	110.1
By category			
1. Fish	251.4	257.9	97.5
2. Shrimp and crabs	49.1	46.9	104.7
3. Shellfish	36.8	31.7	116.1
4. Algae	24.4	22.9	106.6
II Freshwater aquatic products	184.1	156.1	117.9
By origin			
1. Naturally grown	42.0	36.2	116.0
2. Artificially cultured	142.1	119.9	118.5
By category			
1. Fish	175.9	148.0	118.9
2. Shrimp and crabs	5.6	5.5	101.8
3. Shellfish	2.6	2.6	100.0

III Of seawater aquatic products

1. Greater croaker	3.4	5.9	57.6
2. Lesser croaker	2.9	3.1	93.5
3. Hairtail	45.2	49.3	91.7
4. Scad and mackerel	36.6	28.8	127.1
5. Kelp	23.1	21.9	105.5

2.1 Marine fisheries

Marine fishing which includes harvests from mariculture coastal fisheries and distant-water fisheries, is an integral part of China's fishery. China confines most of her fishing effort to territorial waters which amount to some 4.73 million sq km. The 200-metre isobath continental shelf encompasses about 1.5 million sq km. Several rivers including the Yangtze, Yellow and Pearl River, flow into the sea, creating excellent conditions for the growth and propagation of marine animals and plants. The continental shelf mentioned above is one of the largest and most productive in the world where a great variety of fish, molluscs, and crustaceans, including pomfret, octopus, chub mackerel, Spanish mackerel, Chinese herring, porgy, squid, jellyfish, shrimp and swimming crabs can be found.

2.1.1 Marine capture fisheries

The traditional fishing grounds are generally confined to the 100-metre isobath which is over-fished. Present fishing activities take place primarily in waters within the continental shelf which is being exploited to the fullest, with evidences of overfishing in coastal areas. Very little fishing takes place beyond the continental shelf, key constraints being a lack of funds and technical know-how, and unattractive financial returns vis-a-vis higher fuel costs. Measures are being taken to protect and stabilise the over-exploited domestic coastal fishing grounds while studying distant water fishing opportunities in the Pacific and joint ventures with Third World countries.

The principal marine fish species caught are croaker, hairtail, mackerel and shrimp. The annual marine catch makes up about half of the country's total fishery production and is the main source of supply for the domestic market and exports.

The main fishing method is bottom trawling though purse-seining, gill netting, hand lining and various fixed gears such as trammel nets are also used. More than one million people are involved in marine fishing using some 109 000 motorised fishing boats of about 40 hp per unit. More than 1 000 of these boats belong to 40 state-run enterprises, the rest belonging to the collective fishery and some private owners. About 75% of all marine fishing vessels are small trawlers.

2.1.2 Mariculture

Mariculture is well developed in coastal provinces. The country's long coastline with its many estuaries and mudflats offers ideal conditions for fish farming. Yields are comparable to those in other Southeast Asian countries. There are basically two types of operations: intensive or semi-intensive operations in a pond area of approximately 2 ha; and extensive operations in considerably larger (eg. 200 ha) culture ponds.

Total mariculture area was close to 300 000 ha in 1985 with a record yield of 712 000 MT. Crustaceans, molluscs, seaweeds and fish are cultured in brackishwater ponds including two species considered gourmet foods in China, namely jellyfish and sea cucumbers. The white shrimp species, Peneaus orientalis, is the main shrimp species cultured. Mollusc culture, extensively practised in Liaoning and Shandong Province, centres on high-value species which are mostly exported. The main species cultured are the blue mussel (Mytilus edulis), scallop (Patinopecten yoessensis and Argopecten irradians) as well as the Pacific oyster (Crassostrea gigas). The main seaweeds cultivated are kelp (Laminaria japonicus) for its alginates, while laver (Porphyra sp.), agar agar (Gracilaria sp.) and giant kelp (Macrocystis sp.) are the other species cultured in coastal regions of China.

Table 4. Selected marine species cultured in China

<u>Category</u>	<u>English name</u>	<u>Scientific name</u>
Fish	Giant sea-perch	<u>Lates calcarifer</u>
Shellfish	Blue mussel	<u>Mytilus edulis</u>
	Razor clam	<u>Sinonovacula constructa</u>
	Oysters	<u>Ostrea plicatula</u> , <u>Crassostrea gigas</u> .
		<u>C. talienwhanensis</u>
	Abalone	<u>Haliotis discus hannai</u>
Others	Scallop	<u>Chlamys farreri</u>
	Shrimp	<u>Peneaus orientalis</u> , <u>P. merguensis</u>
Others	Sea cucumber	<u>Stichopus spp.</u>
	Kelp	<u>Laminaria japonicus</u>
	Giant kelp	<u>Macrocystis pyrifera</u>

Hatchery culture techniques are being applied for most of the molluscs but the developed mussel industry in the north and oyster culture in the south mostly rely on natural seed collection.

In the case of the rapidly evolving fish culture, three major tilapia species have been introduced Tilapia mossambica, T. nilotica and T. auria, as well as indigenously bred hybrids. Experimental production of tilapia in hot springs in Wendeng County is reportedly yielding 5.25 MT/ha.

Pen culture of silver salmon is being carried out on an experimental basis in Dalian. In the South of China, giant sea-perch (Lates calcarifer), which was introduced from Malaysia is being bred.

Mariculture is viewed as the main means of increasing nearshore fisheries production. It also allows for the production of high-value species, both for domestic consumption and export. Government policy has therefore, provided for major research and development effort in this area.

China's marine farm harvest is expected to increase at an annual rate of 11.4% during the period 1985-90 to reach 1.2 million MT in 1990 while value-wise it will be twice as much. The area devoted to marine culture will be doubled to more than 600 000 ha and the emphasis will be on shrimp (projected to double), crabs, scallops, abalone, oyster, sea cucumber and eel.

2.2 Freshwater fisheries

Fish culture which dates back some 2 000 years is well developed throughout China. Freshwater fish and shellfish, both from the wild and fish culture projects, are harvested. The country has over 20 million ha of freshwater rivers, reservoirs, lakes and ponds although only 5 million ha of river channels and the shallow parts of lakes, reservoirs and ponds, and 1.3 million ha of coastal waters are suitable for aquaculture. Of these, however, only about 3 million ha (60%) and 170 000 ha (13%), respectively, are being utilised. In addition, there are some 600 000 ha of low-lying land not suitable for agriculture crop production but which can be converted into fish ponds.

China's freshwater fisheries output is mostly produced by collective and state-owned fish farms. Ponds account for about one-third of the total 3 million ha presently cultivated, and 75% of the total output.

2.2.1 Freshwater capture fisheries

The fishing area of rivers and lakes encompasses about 14 million ha. With the improvement in fishery management plus the introduction of resource protectionary measures and artificial propagation, yields have increased in recent years. The harvest for 1985 was 475 000 MT, which is 6.7% of the country's total fish catch. Several commercial fish and shrimp species proliferate in the Yangtze, Pearl, Yellow River and the Lakes of Taihu, Hongze, Chaohu, Boyang, Honghu, Dongtin and Weishan. These include the various carp species like the common, crucian, black, grass, silver, bighead and mud carps as well as bream, sturgeon, hilsa, herring, mandarin fish, salmon, eel, turtle, crab and shrimp.

Various highly labour-intensive gears such as large seines and traps are employed in this fishery. Altogether, some 43 000 fishing vessels of about 17 hp each are used.

2.2.2 Freshwater fish culture

As the freshwater capture fishery is unable to meet domestic demand, freshwater fish culture is being promoted. China prides itself on being the world's leading producer of farmed freshwater fish. The cultivated area exceeded 3.4 million ha (including 1.25 million ha of ponds) in 1985. Freshwater culture production was more than 2 4 million MT, the main species being grass carp, black carp, big head carp, mud carp and tilapia. Most of the harvest is consumed domestically. On average, the annual production per hectare is 1.3 MT of fish.

Table 5: Average yield from main freshwater bodies, 1985

<u>System</u>	<u>Yield (kg/ha)</u>
Pond	1 388
Lake	232
Reservoir	150
River/canal	518

Freshwater fish culture in China is practised as a primary occupation on collectives and state-owned farms mostly and as a secondary or sideline activity in backyard fish ponds and paddy fields. The Government is, in fact, encouraging expansion of both paddy field and backyard fish farming so as to increase fish consumption in rural areas. Currently, about 600 000 ha of rice fields are being utilised for fish breeding, yielding on average 0.8 MT/ha annually. Backyard fish ponds, an increasingly popular sideline, is practised mainly to supply the farmer's own household or for sales in the neighbourhood. Labour input and investment are relatively low as are yields (0.8 MT/ha).

Another type of extensive fish culture is practised along Lake Tai Ho where small bays are enclosed by nets and stocked with fingerlings.

Besides the cultivation of freshwater fish, there is now a tendency to grow freshwater shrimp (Macrobrachium). In addition to the more extensive pond culture of freshwater fish, there is also intensive net culture, for example in the Shanghai Municipality.

The key characteristics of these culture systems and which are largely responsible for the success of freshwater fish culture in China are: multiple use of water resources; integration of fish farming with animal husbandry and agriculture; mixed species cultivation or polyculture of various compatible species, mainly carp; and finally the existence of communes that specialise in hatchery production and fry rearing for distribution to fish farmers. The personnel at these hatcheries is skilled in induced spawning, selective breeding, larval rearing, disease prevention and treatment, and feeding. The districts reputedly having the longest history of fish farming and the most advanced techniques include Shunde, Zhongshan and Nanhai in Guangdong Province. Wuxi and Suzhou in Jiangsu Province and Huzhou and Jiaying in Zhejiang Province.

Polyculture in a static water body with limited water exchange is well-developed and practised extensively throughout China. Initially, the common carp (Cyprinus carpio) was cultivated, but this is now largely replaced by the four so-called "family" or "home" fish - silver carp (a phytoplankton feeder), bighead (a zooplankton feeder), grass carp (grass and aquatic plants feeder) and black carp (molluscs and snails feeder). Because of their different feeding habits, these species may be cultured with other non-predator species such as common carp, mud carp (dace) and tilapia.

The polyculture system is very labour-intensive. Its cyclical operation and links with the farming of crops and farm animals virtually eliminates any wastage. However, owing to the considerable large stocks handled, disease is a major problem. The grass carp particularly (the most expensive fish) is subject to high mortality rates.

Introduction of contract fish farming by specialised households has helped boost yields. Fish farming has gradually become a technical profession. In 1985, there were altogether 419 400 professional fish farming households producing 425 900 MT and 5.48 million households rearing fish on a part-time basis and producing some 240 300 MT from 300 347 ha. Annual yields vary widely, averaging about 0.9 MT/ha in the north and 2.5 MT/ha in the south, largely because of the lack of standardisation in design and management practices. The introduction of

household aquaculture has undoubtedly prompted increased yields and production. However, further growth in line with Government projections will require broader dissemination of known technologies, market-oriented pricing, and a strengthening of the role of commercially operated supply and marketing services.

2.3 Fishing infrastructure

There are more than 700 large and small fishing ports scattered along the coast, 300 of which have adequate facilities. The ports, the bases of marine fishing, generally provide facilities for shelter, coldstorages, material supply, warehouses, transportation and weather forecast as well as other amenities such as clinics and schools.

Trawling is the main fishing operation in China, undertaken by fully commercial vessels. These operate primarily as pair trawlers and less frequently as stern trawlers. They are typically about 30-40 metres long with a crew of about 20. Boats, as mentioned earlier, are either owned by state-run enterprises, or belong to collective fishery or some private owners.

Seiners represent only a small proportion of the fleet. Modern purse-seining methods are hardly being practised. Traditional wooden hulled fishing junks seem non-existent, most of the vessels being steel-hulled and built for trawling. Small-scale or artisanal fishing appears not to be very common except perhaps in the more southerly provinces.

China has more than 100 state-owned fishing boat shipyards, machinery and fishing gear factories. These enterprises have a total labour force of some 50 000 people with annual production of about 100 steel trawlers averaging 300 GRT, engines and associated stern gear as well as winches, windlasses and electronic fishing and navigational aids. They also undertake boat repairing operations, and the building of aquaculture equipment, refrigerators and processing equipment.

In the field of ship equipment and machinery, China is self sufficient. An increasing number of fishing boats and machinery are also exported.

China also manufactures her own nets, lines, ropes, floats and hooks. Current annual output of various nets and ropes amounts to 20 000 MT and 50 000 MT, respectively. Raw materials include polythylene, nylon, polyester, polypropylene, polyvinyl alcohol fibre and palm.

Since the 70s, extensive trawler and seiner construction programmes have been initiated to strengthen China's short and middle distance fleet. There has been large-scale production of 600 hp trawlers and some large purse-seiners. Shipyards and factories also produce FRP fishing boats.

It is deemed necessary to utilise foreign capital to build a number of ocean-fishing vessels with good performance, bigger HP and equipped with more sophisticated equipment to render better economic results, increased exploitation of offshore resources as well as upgrading of the existing ocean fishing fleet. The Chinese solution to the problem is to seek to introduce vessels from abroad into their fishing fleets.

Meanwhile the China Marine Industries Corporation plans to build 50 shrimpers for the South China Sea. The vessels will be built in the country but using imported diesel engines, propulsion systems, generators, navigators, communication systems and freezers. The Government hopes that the venture will capture the interest of foreign investors.

3. Disposition of catch

3.1 Domestic per capita consumption

Despite the growth in production, China has a rather low and stagnant annual per capita fish consumption of 5 kg. It is low by comparison to several other developing countries, e.g. Bangladesh (8 kg) and the Philippines (35 kg). This is mainly attributed to a corresponding growth in the country's population. Nonetheless, demand is expected to increase steadily over the next two decades in response to increasing per capita income and moderate population growth. Based on consumption patterns in other countries, there is likely to be a substantial restructuring of consumption involving a marked reduction in direct per capita consumption of grain and a corresponding increase in the intake of meat, eggs, fish, milk, fruits, sugar and vegetables.

Although China grossed a record catch of 7.05 million MT of fishery produce in 1985, this still appears insufficient to meet the demands of a large population with rapidly improving living standards.

3.2 Exports

It is estimated that about 1.7% (or 119 595 MT) of the total fish production in China is exported to other countries, in live, fresh, frozen or processed form. The total annual export value of all aquatic products hovered around US\$300 million in recent years. Exports comprise mainly shrimp, yellow croaker and freshwater fish.

Table 6: Volume and value of marine exports¹, 1983-85 (in MT and YRMB 1 000)

	1983	% change	1984	% change	1985
Volume	105 336	+17.7	124 016	-3.6	119 595
Value	54 911	+23.7	67 917	+21.1	82 243

¹ Aquatic products (fish, crustaceans and molluscs)

In the past, fishery export trade was controlled by the China Cereals, Oils and Foodstuffs Import and Export Corporation of the Ministry of Foreign Trade and Economic Relations. Now, however, fishery production units have begun running their own import/export business, marketing a variety of canned products produced by the state fish cooperations, including mackerel, dace and Chinese herring.

Since 1979, exports to Japan have been in excess of 30 000 MT, making it the second largest outlet. The exports to Japan comprise mostly shrimp, clams, crab, jellyfish, and seaweed and, to a lesser extent, eels, Spanish mackerel and herring. The rest of the exports go either to Hong Kong, other Southeast Asian countries or North America.

The main routes through which fish and fish products leave China are either directly via the major domestic ports or via Hong Kong. Hong Kong is, in fact, believed to be the largest market, though it is not known how much of the exports are re-exported.

In the case of the US, exports comprise mostly shrimp. Generally three grades of shrimp are shipped - superior, good and marginal. Shipments of abalone, clams, crab, oyster and scallops to the US showed a significant increase in 1983, with the trend continuing in 1984.

3.3 Imports

China reputedly imports few fishery products, although the country is eager to import high technology equipment for fish capture culture, processing, marketing and distribution activities.

3.4 Tariff barriers

China has a protective tariff policy with tariffs being adjusted from time to time, as and when deemed necessary.

Effective 10 March 1985, new custom regulations for various goods, including fishery products, were announced. Duties are assessed according to the country of origin.

Two types of tariff rates on imports are employed: a) Minimum Tariff Rates applied on goods originating from countries with which China has signed reciprocal commercial treaties or agreements; and b) General Tariff Rates levied on imports from countries that have not concluded such treaties or agreements. There are about 85 countries that have such bilateral relations with China. The Minimum Tariff Rates are classified into 21 scales, from 5% up to 200%, while the General Tariff Rates are divided into 25 scales from 7.5% to 250%.

The duty to be paid on imports is calculated on the basis of their c.i.f. value. (The duty on exports is calculated on the basis of f.o.b. value.)

Tariff rates on imports of certain fishery products and fishing vessels have been reduced, as China's fish supplies cannot meet demand and also for want of high quality fishing vessels.

Table 7: China's Customs Regulations, before and after 10 March 1985

	Tariff rate	
	Pre-10 March 1985	Post-10 March 1985
	%	%
Powered ships	20	9
Freshwater and marine fish species	80	30
Abalone	150	60
Shark fins	150	60
Sea cucumber	150	60

4. Handling, processing and quality control

4.1 Handling on board and on shore

Fish handling practices on board fishing vessels in China vary extensively depending on the kind of vessel and fish species involved. However, generally speaking, there is a lack of awareness of good handling practices. By modern standards, storage and preservation practices on board are very poor. Only a few vessels are equipped with insulated and refrigerated fish holds, and horizontal plate freezers. Some transport vessels have refrigerated sea-water systems on board. Physical abuse and general disregard of fish as food is also common especially where low priced species are concerned.

The quality of landed fish is in general poor and this is especially true for small pelagics. Certain highly priced species receive careful treatment, being always layered with ice and well protected.

Post-harvest handling of cultured fish is undertaken with varying degrees of competence. Around the central and southern provinces of eastern China, where the most intensive freshwater aquaculture activities are to be found, live fish are transported either to local markets or (in the case of southern Guangdong province) exported to Hong Kong by trucks equipped with compressors and with, at least, crude shading of the tank. Further north, however, considerable loss of fish is reported due to inadequate transport vehicles (horse-drawn carts and lorries without provisions either for aeration or shade) Losses of between 20 - 50% have been reported.

In general, quality problems in China arise mainly because of poor methods used to handle and preserve fish on board and on shore. Even with a 1:1 ice to fish ratio, spoilage is excessive in summer months.

With regard to plants, some are operating at below required standard. This may be due to the fact that the premises occupied were not initially designed as fish plants. The more recent plants are of good to excellent quality, where the use of good manufacturing practices is evident.

In the case of exports, a quality control inspection certificate and health/sanitary certificate has to be issued by the China National Import/Export Commodities Inspection Corporation.

4.2 Processing technology and industry structure

Before the 1950s, only simple processing methods such as salting, drying, wine-pickling and smoking were used. After 1949, large-scale industrial processing gradually commenced.

Today, there are 430 processing factories with more than 50 000 workers all over China. The 240 state-owned factories process nearly 2 million MT of raw fish annually, producing 1 480 000 MT of fish products. The annual output is valued at YRMB 1.1 billion.

Products may be classified into five categories: frozen, canned, salted, cooked and others. By weight, frozen products make up 72%, canned 8%, salted-dried 13%, cooked 4% and others (including seaweed) 3%. Surimi (imitation) seafoods and some traditional products have also been developed in recent years. The processing industry also supplies raw, supplementary material and half-finished products to the chemical and pharmaceutical, printing, dyeing and textile industries as well as other light industries.

The structure of the processing industry calls for considerable up-grading of simple, basic facilities. Generally, the equipment and techniques in use are out-dated and product diversification is limited resulting in keen internal competition of a limited number of products in the market. Simple basic facilities such as tables and containers need up-grading. Mechanical features are poor though efforts are being made at improving quality. Equipment is mainly manufactured locally, and old fashioned. The older establishments are of very poor standards by any measure. The more recent ones are well laid out, airy and generally satisfactory. Modern, imported equipment lends to its sophistication. Considerable attention is paid to hygiene. The work rate is slow by western standards, and the processing activities rather labour intensive.

4.2.1 Freezing and cold storage

Before 1949, only 1 or 2 coastal towns had freezing and cold storage facilities. Since then, processing facilities, including some canneries, have been established and a large expansion has taken place in freezing and cold storage capacity.

Today, there are 370 cold storage facilities of various sizes having a total capacity of 250 000 MT. The freezing capacity amounts to 8 000 MT/day, ice-making capacity to 7 000 MT/day and the total ice storage capacity is 190 000 MT. These facilities and processing plants are distributed along the coast and in the key inland fishery districts.

Freezing of fish is done either by plate or blast freezers, and products are almost exclusively frozen in large blocks.

With the improvement in living standards and the increase in home refrigerators, small retail packaging is increasingly done. Considerable potential also exists for the provision of cold storage and ice-making equipment. Yet, individually quick frozen (IQF) products are still virtually unknown. Great interest is being expressed in the acquisition of such equipment.

Cheap labour, cheap raw materials and particular emphasis on details and quality control are the basic characteristics of the frozen food industry in China today.

The main aquatic products frozen are marine fish and shrimp. The freezing of fish and seafood products destined for export is at a low level of development. This is particularly true for shrimp which are frozen along with fish and, therefore, suffer in quality. There is loss of quality and quantity as at times there is insufficient capacity to process the catch. Products such as mussels, scallops and oysters remain at a low rate of exploitation due to a lack of processing techniques and facilities, both freezing and canning.

4.2.2 Canning

Fish processing is mainly confined to bulk freezing in State fish processing factories and is either utilised for canning or sent for distribution to the local market. The canning industry suffers from out-dated equipment and technology and an insufficient number of economically viable product lines.

The canned fishery products of China registered with the United States Food and Drug Administration (USFDA) include: fried carp, fried dace, fried long tail anchovy, sardines, mackerel, marine eel, clams, cuttlefish. To-date, canned fish products are still mainly preparations of various typical Chinese specialities, such as fried spiced fish, fish with fermented soya beans, etc. They are largely packed in glass jars (domestic markets) and in three piece cans for export. Some products are packed in retortable pouches. One canning line in a factory is used for both lean and oily fish, destined for both the domestic and export market.

It may be of interest to note that most of the exported canned products are aimed at the ethnic Chinese markets abroad. The major constraints for canned fish exports include the limited variety of products offered, the packaging quality, and the quality of printing on the can.

Considerable interest is expressed in acquiring modern processing and packaging machinery and material such as the easy-open ring pull cans.

4.2.3 Drying

About 50% of the total marine catch is still dried or dried/salted. Dried and dried/salted products, including fish, shrimp, mussels and seaweed, are still processed in the traditional way either by air or sun drying, or both. The product is transported over long distances before it reaches the final consumers. Improvement in quality will enlarge the market potential. Artificial drying through heated chambers or tunnels is also undertaken in major fish processing plants.

In recent years, dried/roasted file fish (Balistidae) is being produced and exported in large quantities to Japan. Filleting is done by hand; the process is very clean and hygienic. The dried product is about 8% of its initial weight. Quality standards are high when the export market demands it.

4.2.4 Other processing methods

About 56 factories process seaweed. The kelp industry mostly produces alginate and iodine. Reasonably equipped, but often with out-dated machinery, the factories cannot cope with some of the difficult separation procedures necessary for the manufacture of algin. The result is a poor quality product.

There is an urgent need to improve the quality of alginate to make it more competitive on the international market. Also, diversification of products extracted from kelp for human food and as a component for compounded fish feed is required.

Liver oil, made almost exclusively from shark livers, is used for medicinal purposes. Final products include tablets, capsules, and oil-in-gelatin spheres. The Chinese have their very own sophisticated fish liver oil capsulating machinery.

Fishmeal and oil also produce peptone 'culture-media' which is used widely in China for the culture of anti-biotics. Fish oil and various vitamins and chemicals are also extracted from fish.

Waste products and by-products (material left from filleting, heading and steaking operations, fish offal and unwanted or undersized fish) are processed into fishmeal.

The present processing facilities are often inadequate for the production of high-grade animal food. Therefore, much of the raw material useful for fishmeal production is used unprocessed as fertiliser. It is sometimes sun-dried and ground, producing a low grade fishmeal. The fish used for this is usually in an advanced stage of spoilage.

4.3 Main constraints and development efforts in processing

Fish processing in China is constrained by three factors: a) traditional demand and taste for fish products; b) distribution; and c) infrastructure problems.

The depletion of some of the traditional fishery stocks has made the problem of fish supply in China more pressing. It is estimated that some 900 species of marine fish are taken during fishing operations, but only 80 species are used as foodfish. In order to increase the supply of foodfish, the Government places greater emphasis on the better utilisation of existing fishery resources.

The State Bureau for Aquatic Products (SBAP) recognises that handling, processing and distribution of fish is backward in China and places high priority on this aspect of its work. Great interest and demand has been shown in recent years on the need to modernise the processing industry through: a) up-grading of processing techniques; b) research and importation of technology, engineering expertise and equipment; and c) also through diversification of product lines. These activities are pursued in an effort to:

- a) target for new domestic and overseas markets;
- b) more fully utilise fishery resources especially under-utilised species; and
- c) increase the production of value-added products.

4.4 Training and research institutions

As fishery production develops, the Government, enterprises and fishermen are now attaching greater importance to the systematic conducting of education and training courses at different levels. To-date, there are five fishery institutions located in Shanghai, Dalian, Zhanjiang, Xiamen and Zhejiang. In addition, a fisheries department has been established in 10 other institutions of higher learning, in which there are over 6 000 students. The courses include marine fishing, resources, freshwater farming, mariculture, refrigeration technology, fishery economics and management, boat building and repairing, food preparation techniques, food inspection, engine management, fishery mechanism, aqua-product processing, canning, harbour construction, fishing boat power installations, fishery instruments and electronic technology.

Apart from institutes of higher learning, there are 16 technical schools of fisheries where mid-level managerial and technical personnel are trained. Currently, these schools have nearly 5 000 students. In addition, short-term training courses of all kinds are conducted in different schools and enterprises to increase the managerial abilities and technical skills of the working staff members.

There are more than 100 fishery research institutes and nearly 1 000 technology stations in China. They conduct research in fishery resources, aquaculture, propagation, fish processing, boat building, vessel machinery and instruments, and fishery engineering.

An area that deserves special mention is that of product research and development, particularly those activities directed at the better utilisation of under-utilised fish species. An interesting item is the use of file fish, a species previously rejected by the Chinese because of its unattractive appearance. Domestic consumer acceptance of file fish products has evolved with the development of the processing industry. Currently, filefish products range from: those where the identity of the fish is fully preserved; those where the outward appearance of the fish is lost; and those prepared mainly from fish flesh, where the identity of the fish is partially or completely lost.

In general, they include salted and dried, dried, deep fried and canned, wine-cured, dried fish meat, minced products, simulated products and products of the fish flour type. Wastes from filleting are converted into fish sauce (produced largely by fermentation), fish protein concentrates and sometimes fishmeal. Undersized hairtails are used in fish cracker production and fish fluff.

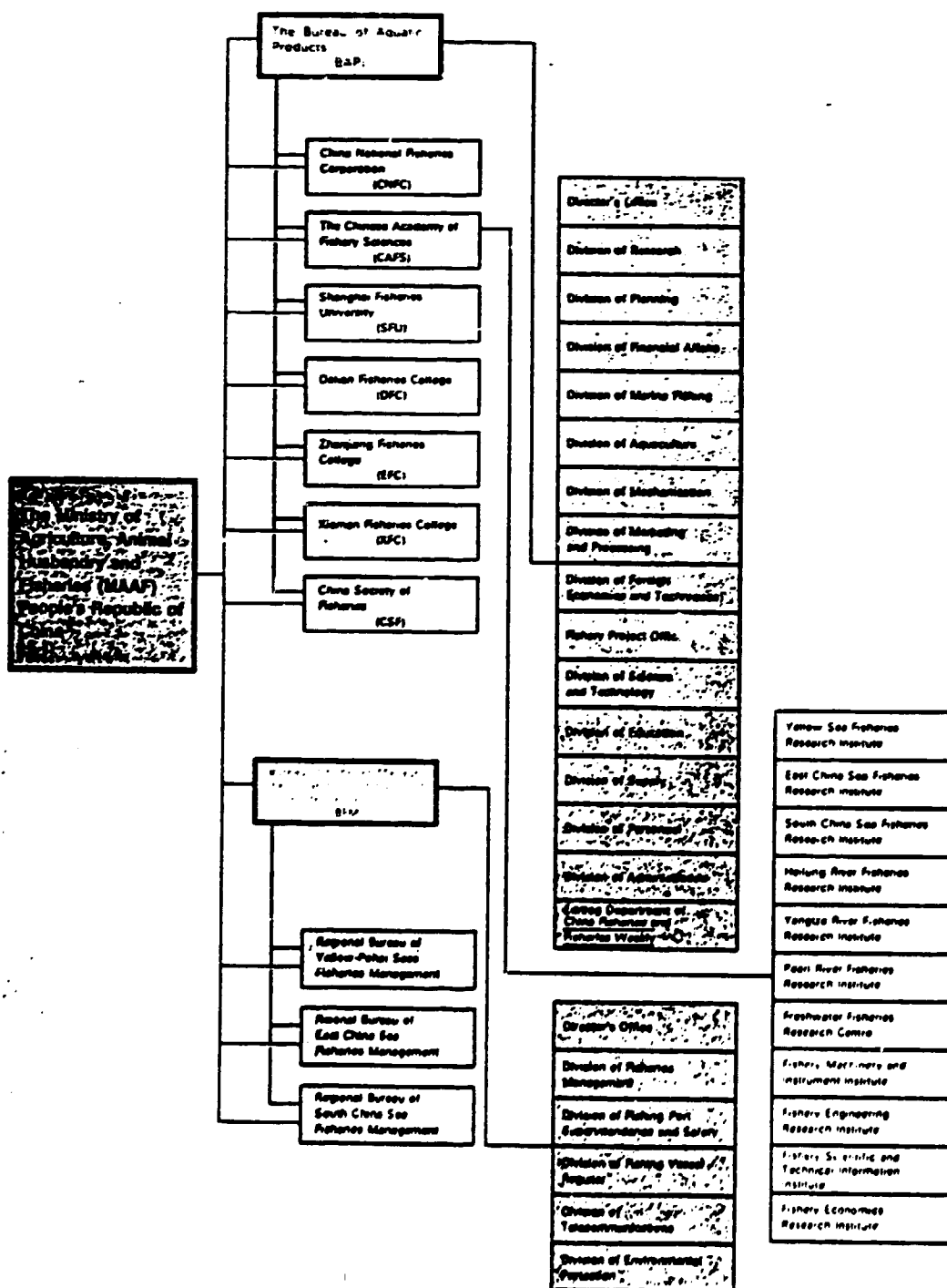
Anglerfish, also not initially appreciated because of its unattractive appearance and taste, is used to prepare simulated scallop adductor muscle - a delicacy in China. Like filefish, because of its low lipid content, it has an advantage over other fish for making processed foods. Anglerfish may be used in salted/dried meat, crackers, fish fluff and simulated food products.

5. Industry organisation

5.1 Fishery production sector

The primary responsibility of the fisheries industry rests with two bureaus within the Ministry of Agriculture, Animal Husbandry and Fisheries (MAAF): the Bureau of Aquatic Products (BAP) and Bureau of Fisheries Management and Fishing Port Superintendence (BFM). The BAP is responsible for a broad range of fisheries development activities while the BFM is entrusted with the specific task of administering marine fisheries regulations, including regulations for fishing port operations and maritime communications and safety. Besides these two Bureaus, MAAF has established special agencies to handle marketing and investments in fisheries. The Aquatic Products Supply and Sales Corporation, for example advises the Government on fish prices, fish distribution and supplies, and investments in local fish farms.

Figure 1: Infrastructure of the fishery system under MAAF



Municipal and county Governments have begun to establish autonomous fisheries corporations, largely service companies designed to provide a comprehensive range of services to fish producers on a commercial basis. These include feed and fingerling supplies, cold storage, transport, equipment procurement, as well as extension, marketing construction and engineering services.

Under the present social system in China, all production facilities such as fishponds, vessels, gears and land belong to the State. There are two distinct types of organisations in the marine fishing industry, namely the State Fishing Companies and the Communes or Collectives.

5.2 Domestic marketing and distribution

In China's state-planned economy, marketing and distribution of fish and fishery products are not regulated by supply and demand forces. Instead, they are administered through the State Plan. State planning departments monitor and adjust the production and marketing of various factories, to ensure a balance between supply and demand. The State also establishes bodies to administer the marketing and distribution channels of fish products.

The domestic market is controlled by the CNFC. Provinces and cities have set up provincial and municipal supply and marketing companies to undertake their own purchases, sales, storage, transportation, processing and so on.

Under the responsibility system, state farm production teams are allowed to sell privately reared produce in excess of the State quota requirements. There appear to be several arrangements for fish cultivation and marketing, with the volume of fish going to the State varying from zero to 60%.

The marketing and distribution planning system has been modified to make it more flexible and more responsive to market forces. Distribution targets are now determined by the production teams in the communes in consultation with commune and municipality officials. The State Plan merely sets guidance targets on the amount of fish to be made available to consumers.

Supply and marketing cooperatives, structured at different administrative levels, are the main distribution channels for the purchase of fish and fishery products and for inputs such as gears and feeds. There are marketing and supply cooperatives at the State, province, autonomous region, municipality, prefecture and county levels, which have their own specialised corporations and wholesale stations responsible for the purchasing, distribution, supply and storage of fish products. The cooperatives operate on a commercial basis, having their own management teams and are responsible for their profits or losses.

5.2.1 Retail outlets

In China, two types of market outlets for fish and fishery products exist: state-owned markets and free markets or rural trade fairs.

By Asian standards, the State-owned markets are generally large and modern and handle more than 90% of the total fish distributed. Supplies to institutional customers such as hotels and restaurants are ensured either on a contract basis between the hotels and the market or through direct purchases from the market.

The free markets or rural trade fairs, are generally small and not very well-maintained. Neither do they have proper facilities to sell live freshwater fish. These markets were opened only recently, and operate outside the state-run procurement and sales apparatus.

In general, more extensive marketing of fish throughout China is hampered by an inadequate transportation network. Fish are transported primarily by boat or rail, the former being the only quick means of bulk transport in many rural places. Motorised transport is rather scarce while road transport is mainly by bicycle, or cart.

Initially, only the supply and marketing cooperatives were allowed to transport and distribute fish from the communes. Bottlenecks were common owing to difficulties in handling all available fish. The problem has been eased somewhat by now allowing enterprises run by the communes or their production teams to transport and market their products. Fishermen are now also allowed to sell their products directly in free markets.

5.2.2 Pricing system

There is a dual pricing system for fish. Fish falling within the State quota is sold at a subsidised rate of 33% while privately sold fish does not have a controlled price. For example, in early February 1985, the subsidised price for grass carp was Y2.2 (US\$0.68) per kg in Shanghai as opposed to the free market price of approximately Y3.6 (US\$1.3) per kg. Prices vary depending on the product and preservation form of the fish (dead or alive), size, variety and the marketing level (wholesale, retail and farm).

6. Government policy

6.1 Development strategy

To help meet the expected shift in consumption patterns to meat, eggs, fish and so on over the next two decades, the Government has accorded priority to boosting fisheries production. The latter presently represents a mere 1% of the Gross Value of Agricultural output. Very little change is expected in the annual output of marine and freshwater capture fisheries. The continental shelf where most of the marine fisheries is concentrated is already fully exploited while there is some evidence of overfishing in coastal areas. Similarly, output from freshwater capture fisheries is expected to decline over the next fifteen years as a result of overfishing and worsening pollution. Therefore, development of freshwater culture fisheries, particularly pond culture, has been earmarked because of the potential for significant yield increases from existing freshwater ponds and the availability of unused or low-lying land suitable for conversion into fish ponds.

Overall, the Government aims to double output by the year 2000, with freshwater fish culture projected to increase nearly threefold or by 8% annually and to account for about three-fourths of the projected increase in total fisheries output. By 1990, total output of aquatic products is expected to reach 9 million MT, an increase of 29% over 1985.

In line with this objective, the Government has formulated several new policies aimed at quadrupling the country's aquatic output and the production value by the end of the century.

The new policies provide for the following:

- o State purchase quotas will be abolished for all fish and other aquatic produce while their prices will be allowed to float at free market rates.
- o With the exception of a certain amount of fish which will be provided at State prices to the municipalities of Beijing, Tianjin and Shanghai for special purposes, all aquatic products should be sold at negotiated prices.
- o In the event of too high or too low prices, the State will regulate them by purchasing more fish or putting more fish on the market to protect the interests of both consumers and producers.
- o All levels of Government are to give attention and effort to exploiting water resources.
- o Fish breeding and upgrading fish catching and processing will be accorded top priority to achieve the growth objectives.
- o Efforts must be intensified to guarantee sufficient fish supplies for big and medium-sized municipalities within three to five years.
- o The whole country is urged to work hard to produce sufficient to triple the per capita consumption of fish by the end of the century.
- o Municipal Governments in urban areas are to play an active role in developing fish farming in the suburbs of the cities, placing as much emphasis on fisheries as they do on dairy, poultry and vegetable industries.
- o Fuller exploitation of water bodies available for farming is seen as a way of helping urban areas to produce enough for themselves.
- o Land in rural areas, lakes and marshes that have been transformed into cropland and are not suited to growing grain, should be turned back into water bodies for fish production.
- o All fish producers are to take concrete measures to protect and manage fish resources, strive for rational utilisation of near shore resources and also check pollution so as to increase resources.
- o The responsibility system in fishing is to be further encouraged and perfected as more and more fish farmers avail themselves to the system through contracts.
- o There is a need to upgrade technology and equipment to keep aquatic products fresh. State investments in cold storage will be increased and collectives and individuals are encouraged to do the same on smaller scales. By 1990, the objective is to strive to supply fishery products to the cities primarily in live, fresh and frozen form as well as in packages and as delicatessen.
- o There will be reforms in the management of the industry mainly to simplify administration and give fishery enterprises and businesses more power in decision-making, making them independent economic entities responsible for their own profit and loss.

- o Management of aquatic research institutions will also be reformed to closely link research results with production while the number of technical secondary schools and training classes related to fisheries will be increased throughout the country.

Recently, legislation was approved that will provide the framework for conservation and management of fishery resources, and the promotion of certain operations. The new legislation, effective 1 July 1986, provides for 1) conservation and management; 2) establishing a fishery license system for domestic operations; 3) promotion of far-seas fishery operations and 4) permit requirements for foreign fleets operating in China waters.

7. Foreign collaboration

China's long-term economic policy to open its door to the world, inviting economic and technical interchange and cooperation with foreign countries has paved the way for active participation in international fishery activities.

Foreign Governments, international organisations and enterprises are welcome to participate by way of capital and know-how in China's fishery development. The organisation entrusted with the task of developing international fishing cooperation is the China National Fisheries Corporation in Beijing (CNFC). China began fishing in foreign waters in 1985. CNFC operates fishing fleets in foreign waters as well as companies in countries such as Senegal, Spain, New Zealand, Guinea Bissau, Sierra Leone, Mauritius and USA (Alaska). Various vessels have also reportedly left for Iran to carry out a two-year fishing cooperation between the two countries.

China does not have a 200-mile Exclusive Economic Zone but has fishing agreements with Japan and Hong Kong. Following a pact signed with Japan in 1985, both countries have satisfactorily worked out fishing operation arrangements in the South China Sea. A wide range of cooperation, from joint-ventures, expanded fishing operations and shrimp farming, to research and expertise is being established between the two countries. Efforts to obtain Japanese assistance in developing fisheries has led to the purchase of numerous Japanese fishing vessels. The agreement with Hong Kong concerns fishing licences for Hong Kong fishermen, in return for a fee and part of the catch.

China has also set up ties with many other international organisations and is widening its scope in foreign funds utilisation to include such fields as scientific research, academic and technical exchange, trade, joint ventures, personnel training and provision of advanced technical equipment.

In the field of mariculture, China has initiated cooperation with foreign enterprises based on her own know-how. A recent example is the China - New Zealand shrimp farming joint venture. The venture marks the first time China will utilise, on a commercial scale, her own shrimp farming expertise in another country.

Similarly, in the case of freshwater fishery, China has to date provided many countries with her farming know-how and has achieved good results.

8. Conclusion

The policies of the Chinese Government since 1979 have improved the environment for fishery development. It is estimated, however, that more than 80% of the resources along the coasts are still left untouched and about half of the inland waters are unexploited. Great potential does indeed exist for China's fishing industry and the prospects for aquatic production are bright.

Various problems, however, confront the fishery industry, all of which need to be ironed out before any significant progress can be made. The main problems appear to be:

- o Improper handling practices of fish on board, during transport to landing areas and before and during processing;
- o Lack of technology and equipment for fish processing;
- o Lack of capital for modernising the industry;
- o Poor infrastructure which hampers realisation of increased fish consumption in provinces away from fish culture areas; and
- o Little extension work undertaken to spread developments to commercial farm level, despite the fact that China has an extensive system of national, provincial and county fisheries institutes.

In the light of these obstacles, the Government is eager to import high technology equipment for fish capture, culture, processing, marketing and distribution. The authorities anticipate that the main avenues for gaining these technologies will either be barter trade or through joint-ventures.

In the first case, the equipment is "paid for" by a pre-determined volume of product over a three-year period. Joint-ventures, on the other hand, involve a form of cooperation providing for the repartition of profits, tax exemptions and subsequent reduced corporation tax rates, and strong incentives to re-invest profits in China. Joint-ventures appear to be the only form of cooperation appropriate for output consumed entirely in China. For output partly consumed locally and partly exported, the choice of barter trade or joint ventures depends on a number of individual factors. Depending on the priority of the technology involved, payment in foreign exchange in part or, in full (rarely), is also possible.

Although in certain limited areas, integrated carp polyculture has achieved very high yields, the vast majority of existing fishing ponds in China produce annual yields of less than one Mt/ha. This is mainly due to poor pond layout, use of inappropriate breeds of fish, low stocking rates and poor feed management. To overcome these constraints, the Government has developed a programme of increased investments in aquaculture development. The proposed World Bank project, for example, would build 11 100 ha of new ponds as well as improve 6 100 ha of existing ponds. Attention would be given to a range of activities specific to the development of freshwater fisheries, beginning with training new farmers, assessing the availability of inputs (fry, chemical fertilisers, fish feed concentrates), strengthening extension services for guidance in adopting new technology, and providing disease control and assistance in marketing.

Meanwhile, the Government also plans to shift the concentration of fisheries from overfished coastal waters to deepsea operations in the Yellow Sea, the East China Sea and the South China Sea. Fishing vessels are being purchased from Japan, Hong Kong and Norway for the short term, but the Chinese intend to construct their own deepsea fishing vessels. Shipyards, machinery factories, cordage plants and cold storage facilities are being expanded or constructed.

Although China has declared its intention to establish a 200-mile fisheries zone "when the time is right", it has yet to do so, having instead resorted to fishery agreements.

Annex I: Output of aquatic products, 1949-85 (in 10 000 MT)

Year	Seawater aquatic products			Freshwater aquatic products			
	Aquatic products	Sub-total	Naturally grown	Artificially cultured	Sub-total	Naturally grown	Artificially cultured
1949	45	-	-	-	-	-	-
1950	91	55	54	1	36	30	6
1951	133	81	78	3	52	40	12
1952	167	106	100	6	61	47	14
1953	190	122	115	7	68	50	18
1954	229	139	130	9	90	62	28
1955	252	166	155	11	86	54	32
1956	265	171	164	7	94	60	34
1957	312	194	182	12	118	61	57
1958	281	171	162	9	110	55	55
1959	309	186	175	11	123	63	60
1960	304	187	175	12	117	67	50
1961	231	143	134	9	88	53	35
1962	228	150	141	9	78	47	31
1963	261	176	167	9	85	49	36
1964	280	188	180	8	92	52	40
1965	298	201	191	10	97	46	51
1966	310	218	206	12	92	40	52
1967	305	219	205	14	86	36	50
1968	271	192	178	14	79	30	49
1969	290	205	189	16	85	30	55
1970	318	228	210	18	90	32	58
1971	350	256	233	23	94	32	62
1972	384	291	266	25	93	31	62
1973	393	291	269	22	102	36	66
1974	428	325	300	25	103	32	71
1975	441	335	307	28	106	31	75
1976	448	342	312	30	106	32	74
1977	470	362	320	42	108	31	77
1978	466	360	315	45	106	30	76
1979	431	319	277	42	112	30	82
1980	450	326	281	45	124	34	90
1981	461	323	277	46	138	36	102
1982	516	360	310	50	156	36	120
1983	546	362	307	55	184	42	142
1984	620	395	331	64	225	44	181
1985	706	420	349	71	286	48	238

Annex II: Output of aquatic products by province, 1983 (in 10 000 MT)

<u>Province</u>	<u>Total aquatic products</u>	<u>Of which fishes</u>	<u>Seawater aquatic products</u>	<u>Of which fishes</u>	<u>Freshwater aquatic products</u>	<u>Of which fishes</u>
Beijing	0.55	0.55	-	-	0.55	0.55
Tianjin	4.11	2.41	3.27	1.58	0.84	0.83
Hebei	9.16	5.14	8.07	4.13	1.09	1.01
Shanxi	0.13	0.13	-	-	1.13	1.13
Inner Mongolia	1.53	1.52	-	-	1.53	1.52
Liaoning	51.25	27.76	49.56	26.09	1.69	1.67
Jilin	1.79	1.77	-	-	1.79	1.77
Heilongjiang	4.27	4.24	-	-	4.27	4.24
Shanghai	18.41	17.47	15.65	14.80	2.76	2.67
Jiangsu	49.09	41.20	21.55	16.05	27.54	25.15
Zhejiang	83.25	62.56	73.46	52.97	9.79	9.59
Anhui	12.16	11.27	-	-	12.16	11.27
Fujian	60.62	40.89	57.88	38.36	2.74	2.53
Jiangxi	11.55	11.12	-	-	11.55	11.12
Shandong	67.48	37.26	62.31	32.88	5.17	4.38
Henan	3.78	3.72	-	-	3.78	3.72
Hubei	20.98	20.24	-	-	20.98	20.24
Hunan	23.48	22.21	-	-	23.48	22.21
Guangdong	92.83	87.77	58.28	53.67	34.55	34.10
Guangxi	16.62	15.82	11.64	10.84	4.98	4.98
Sichuan	8.34	8.34	-	-	8.34	8.34
Guizhou	0.82	0.82	-	-	0.82	0.82
Yunnan	1.93	1.39	-	-	1.93	1.39
Tibet	0.03	0.03	-	-	0.03	0.03
Shaanxi	0.33	0.33	-	-	0.33	0.33
Gansu	0.03	0.03	-	-	0.03	0.03
Qinghai	0.39	0.39	-	-	0.39	0.39
Ningxia	0.11	0.11	-	-	0.11	0.11
Xinjiang	0.79	0.79	-	-	0.79	0.79
National total	545.81	427.28	361.67	251.37	184.14	175.91

Annex III: Output of seawater aquatic products, 1957-83 (in 10 000 MT)

<u>Year</u>	<u>Greater croaker</u>	<u>lesser croaker</u>	<u>Hairtail</u>	<u>Scad and mackerel</u>	<u>Jellyfish</u>	<u>Kelp</u>
1957	17.8	16.3	20.0	1.7	3.3	
1958	6.4	10.4	18.2	1.5	4.6	0.6
1959	8.5	9.8	21.4	2.1	3.7	2.4
1960	6.6	13.6	28.0	1.1	5.9	4.9
1961	11.0	10.1	20.2	0.8	1.5	3.6
1962	13.9	7.2	26.2	1.1	2.7	3.9
1963	7.7	8.2	31.2	1.6	1.5	2.9
1964	7.2	5.6	38.7	2.3		2.1
1965	10.3	4.4	37.8	2.2	2.6	2.7
1966	13.0	4.9	37.3	1.9	5.4	4.4
1967	19.6	5.0	40.5	1.3	2.1	7.0
1968	18.3	2.9	28.6	1.1	1.3	6.1
1969	12.2	2.8	35.1	1.0	3.9	7.6
1970	15.9	3.0	39.2	1.4	5.1	8.8
1971	14.4	3.4	43.0	1.3	1.6	13.4
1972	14.9	2.1	49.5	1.2	1.7	15.9
1973	13.8	3.2	56.4	3.3	5.8	13.4
1974	19.7	4.6	57.7	4.0	2.2	14.5
1975	14.0	5.5	48.4	2.9	1.7	16.0
1976	12.4	5.0	43.4	1.0	0.5	15.0
1977	9.1	4.2	39.3	2.5	1.2	22.2
1978	9.4	2.4	38.7	3.8	0.4	25.1
1979	8.3	3.6	47.3	3.3	0.9	25.3
1980	8.6	3.6	47.3	3.3	0.9	25.3
1981	8.0	3.5	49.9	2.9	1.8	22.0
1982	5.9	3.1	49.3	1.7	1.8	21.9
1983	3.4	2.9	45.2	2.9	-	23.1

Annex IV: Output of aquatic products by species, 1985 (in 1 000 MT)

Marine fishing	3 485
Large yellow croaker	26.1
Little yellow croaker	30.6
Chinese herring	17.3
Filefish	272.7
Pacific herring	3.2
Japanese spanish mackerel	90.6
Hairtail	450.7
Round scad	233.9
Pomfret	66.7
Cuttlefish	53.1
Jellyfish	60.9
Paste shrimp	209.1
Seabob	84.6
Mariculture	712
Kelp (dry)	253.8
Mussel	128.8
Freshwater fishing	475
Freshwater culture	2 379
Grass carp	285.5
Silver carp	832.7
Bighead	832.7
Black carp	4.7
Mud carp	118.9
Common carp	190.3
Crucian carp	47.6
Eel	2.2
Tilapia	35.7
Total	7 052

India

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INDIA

1. Introduction

In 1984 the population of India was estimated at 746.4 million, with an annual growth rate of 2%. The real GNP growth rate was 1.8% in 1983, but averaged 5.2% for the period 1979-83.

India has a coastline of about 7 517 km, a continental shelf stretching over 452 000 sq km and an Exclusive Economic Zone (EEZ) encompassing 2.02 million sq km. The continental shelf (0-200 metre depth) varies along the coast, from 32 km off the coast of Andhra Pradesh to 177 km off the coast of Maharashtra state. The inland fisheries consists of 4.5 million ha of natural and manmade water bodies and some 75 000 km of rivers and channels. Indian fisheries, both capture and processing can be considered to be under-developed despite the remarkable progress made over the past years. Interest from the Government and private industry to further develop and upgrade the industry is very keen.

2. Fisheries sector

The traditional small-scale fisheries sector plays a significant role as it contributes about 62% of the country's fish production. The total fishermen population was around 5.5 million in 1984 of whom 0.9 million were in active employment. This latter group showed the following distribution in 1979:

Table 1: Employment of active fishermen population, 1979

Type of employment	Total number	Percentage
Full-time fishing	453 300	25.77
Part-time fishing	439 100	24.58
Fish marketing	364 300	20.40
Net-mending	209 500	11.72
Fish-processing	91 100	5.10
Others	229 300	12.87
Total	1 786 600	100.00

Many small-scale fishermen also perform other economic activities like boat-building and salt-making. There is no uniform pattern in the socio-economic organisation of fishery activities. However, there appears to be a progressive shift from individual operations into joint ventures with other fishermen, money lenders, etc.

Very little data is available on the income of fishermen, the latest being from a 1969 survey.

Table 2: Annual income of fishermen operating non-mechanised and mechanised boats. 1969

State	Total income (Rs) per family		Per capita income (Rs)	
	Non-mechanised boat operators	Mechanised boat operators	Non-mechanised boat operators	Mechanised boat operators
Gujarat	3 620	5 165	543	666
Maharashtra	1 593	2 374	58	121
Karnataka	2 572	2 558	362	351
Kerala	576	920	216	75
Tamil Nadu	4 387	4 086	924	558
Andhra Pradesh	4 437	2 803	600	479
Orissa	1 480	2 524	172	312
West Bengal	8 313	2 341	1 855	431

The overall income situation of fishermen in 1985 had improved considerably although small-scale fishermen continue to be a group with limited means. Good progress in education has also been recorded with the literacy rate having improved markedly since the enforcement of compulsory education for children up to 14 years old in 1968.

The fisheries sector comprises basically marine and inland fisheries. The marine fishing sector remains the most important both in volume and value of production as well as the number of people involved. Its production increased from 683 600 MT in 1961 to 1.5 million MT in 1975 and to 1.8 million MT in 1984. The inland fishery sector showed an even more dramatic growth from 260 000 MT in 1961 to 783 800 MT in 1975 and 1.0 million MT in 1984.

The Indian marine fisheries has been very much identified with a shrimping industry as shrimp is the main money spinner both for fishermen and processors/exporters. Recently a sustained trend towards a more diversified production and exports pattern has developed. The Indian fish export industry is essentially a private sector activity. The Government is involved in this sector through various advisory and regulatory bodies, particularly in the field of quality control and improvement.

Table 3: Marine and inland fishery production, 1979-84 (in MT)

	Marine	Inland	Total		Marine	Inland	Total
1979	1 388 380	848 547	2 236 927	1982	1 463 540	891 180	2 354 720
1980	1 249 836	887 579	2 137 415	1983	1 560 612	980 398	2 541 010
1981	1 385 205	999 125	2 384 400	1984	1 809 067	1 031 108	2 840 175

3. Resources

Marine resources fall into three categories, namely inshore, offshore and deepsea resources. Inshore resources (0-50 metre depth) are estimated at 2.3 million MT, the current exploitation rate being about 1.3 million MT. Offshore resources (50-200 metre depth) are estimated at 1.5 million MT and exploitation has so far been limited. Deepsea (beyond 200 metre depth) and inland resources are estimated at 700 000 MT with hardly any exploitation having taken place. Its current landings

contribute less than 1% to the total marine landings. Total estimated potential annual yield in the EEZ adds up to about 4.5 million MT of which only 40% or 1.8 million MT are landed (1984).

Inshore and offshore resources that are still underexploited include catfish, whitebait, cephalopods, perches, carangids, ribbonfish and tuna. The deepsea resources consist mostly of tuna and cephalopods while a recent survey in waters beyond 100 metres depth also revealed commercially attractive concentrations of deepsea shrimp and lobster, carangids and barracuda.

Exploitation along the Indian coast is uneven, with the west coast contributing about 65% of the present production. The major species landed are oil sardines, Bombay duck and Penaeid shrimp.

Pelagic resources (oil sardines, mackerel, whitebait, horse mackerel and catfish) are mostly found off the south-west coast while demersal resources are mainly found on the north-west coast. Shrimp resources appear to be concentrated off the coasts of the States of Orissa, Bengal, Maharashtra and Kerala. Demersal stocks and shrimp resources are moderately to heavily exploited.

Table 4: Major marine species found in Indian waters

Shad	Emperor	Carangids
Flatfishes	Croaker	Sardinella
Bombay duck	Seabream	Anchovy
Sea catfish	Black pomfret	Wolfherring
Pike congers	Threadfin	Clupeoids
Bass-like species	Grouper	Hairtail/ribbonfish
Pony fish	Butterfish	Mackerel
Shark	Shrimp	
Rays	Lobster	
Seerfish	Cuttlefish	
Tuna	Squid	

As the export sector receives a lot of attention because of the large volume and value of marine shrimp, inland resources (mostly used for domestic consumption) tends to be easily forgotten. This sector has good potential but has hardly been tapped. Of the 750 000 ha of water surface available in the form of tanks and ponds, only 150 000 ha are used to produce fish. Landings total only about 106 000 MT per annum. Water reservoirs cover 145 000 ha but only produce 25 000 MT, while brackishwater production from 26 000 ha is only about 10 000 MT out of an estimated potential harvest of 90 000 MT.

4. Production

Total fishery production in 1984 was 2.8 million MT. Of this, about 60-62% came from the marine sector and 38-40% from the inland fisheries sector.

In the case of marine fisheries, production figures by coastal State show that Kerala and Maharashtra are the most productive States contributing about 45% of the total marine landings. Other States of major importance are Gujarat, Tamil Nadu and Andhra Pradesh.

The major marine fishing season in India is the period October-December. For Maharashtra and Gujarat, the period July-September, and for Kerala and Karnataka, the period April-June are relatively poor seasons. On the east coast, January-March is the major fishing season for Tamil Nadu and Andhra Pradesh.

Total marine landings in 1984 registered a 16% increase over 1983 reflecting an upward trend noticeable since 1980. Production has increased by 45% during the period 1980-84.

Shrimp remains the most important marine species landed, both in volume and value. This pattern is expected to continue despite recent diversification efforts in fishing as well as exports. During 1984, shrimp catches represented about 11.6% of total landings indicating a 1.6% increase over 1983.

Table 5: Annual marine fish landings in India by species, 1979-84
(in MT)

	Species	1979	1980	1981	1982	1983 ^a	1984 ^b
1.	Elasmobranchs	52 843	57 862	56 009	64 316	52 435	52 703
2.	Eels	7 155	12 082	5 027	7 479	6 918	8 361
3.	Cat fishes	48 817	43 745	59 390	67 664	64 415	72 030
4.	Chirocentrus	10 274	12 805	11 794	15 222	17 960	20 055
5.	a) Oil sardines	153 971	115 744	221 026	205 294	219 973	186 012
	b) Other sardines	68 351	67 053	61 980	55 496	35 213	101 324
	c) Hilsa ilisha	12 068	6 996	5 407	3 168	19 307	21 019
	d) Other hilsa	8 672	9 127	18 267	13 375	5 126	5 215
	e) Anchoviella	26 588	33 684	54 667	878	115 099	114 732
	f) Thrissocles	16 628	19 342	13 637	19 312	12 811	7 534
	g) Other clupeids	33 965	38 270	24 817	26 024	31 090	59 848
6.	a) Harpodon nehereus	126 044	95 505	13 779	86 476	98 891	116 487
	b) Saurida & Saurus	11 154	11 332	10 982	12 260	9 714	5 772
7.	Belone and Hemirhamphus	1 577	1 653	1 799	2 629	6 293	9 602
8.	Flying fish	2 546	1 255	3 109	1 996	1 883	1 606
9.	Perch	35 657	38 541	31 325	45 026	29 091	28 331
10.	Red Mulllets	3 130	2 416	3 453	5 184	9 774	26 620
11.	Polynemids	5 809	6 056	4 248	6 845	7 317	5 888
12.	Sciaenids	93 018	89 360	82 686	87 247	106 930	141 045
13.	Ribbon fish	71 349	62 690	41 566	48 875	54 175	68 184
14.	a) Caranx	28 942	24 265	9 166	10 102	23 223	21 781
	b) Chorinemus	3 307	4 182	4 985	5 694	5 093	7 084
	c) Trachynotus	195	40	6 748	7 186	623	3 479
	d) Other Carangids	465	945	23 194	24 229	11 391	4 848
	e) Coryphaena	146	302	-	-	-	51
	f) Elacate	880	379	-	-	692	9 681
15.	a) Leiognathus	55 266	54 400	69 449	72 668	56 817	50 271
	b) Gazza	197	185	8 211	13 872	11 198	7 687
16.	Lactarius	4 474	7 415	48 728	49 698	58 602	46 432
17.	Pomfret	40 427	38 231	48 660	28 007	32 165	54 655
18.	Mackerel	71 514	55 279	27 553	33 197	32 978	32 294
19.	Seerfish	29 547	25 986	17 803	20 597	23 432	20 964
20.	Tunnies	26 595	20 371	2 125	3 626	3 041	2 925
21.	Sphyraena	2 265	1 782	2 155	2 155	5 412	4 807
22.	Mugil	1 400	2 030	464	69	1 745	980
23.	Breguaceros	638	916	-	-	-	-
24.	Sole	12 203	13 633	13 382	22 699	17 506	21 855

25. a)	Peneaeid shrimp	113 665	112 037	83 539	110 797	109 176	118 200
b)	Non-Peneaeid shrimp	63 917	58 700	61 430	51 148	98 082	92 312
c)	Lobsters	1 136	679	1 481	1 764	-	-
d)	Crabs & other crustaceans	20 303	25 386	43 934	52 618	21 864	20 796
26.	Cephalopods	15 032	11 335	9 548	15 799	9 398	19 857
27.	Miscellaneous	106 250	65 840	177 682	162 849	133 059	214 820
	Total marine fish landings	1 388 380	1 249 836	1 385 205	1 463 540	1 560 612	1 809 067
	Total inland fish landings	848 543	887 579	999 195	891 180	980 398	1 051 108
	Total	2 236 923	2 137 415	2 384 400	2 354 720	2 541 010	2 840 175

^a Provisional; ^b Estimate

The inland fishery production increased by 16% during the period 1980-84. The 1984 production shows a recovery to the level achieved during 1982. Major producing States are West Bengal, followed by Tamil Nadu, Andhra Pradesh and Bihar. The remaining States produced less than 5% of total inland production.

The level of inland production is expected to have reached 126 400 MT at the end of the sixth plan period (1984-85). The production target for the end of the seventh plan period (1989-90) is 167 600 MT.

A further increase in both marine and inland landings is anticipated for 1986.

5. Disposition of catch

5.1 Domestic market

India is a large market for fish and fishery products, although the low annual per capita consumption figure of 5 kg would indicate otherwise. Almost all of inland fish landings is consumed domestically while only shrimp from brackishwater ponds and other water bodies are used for export. In the absence of adequate marketing infrastructure and the unfamiliarity of inland people with marine fish, about 95% of the marine landings available for domestic consumption is consumed in the coastal States which support only about 50% of the total Indian population. Of these, fish producing centres and nearby areas consume 49% of the catch.

Urban areas which support 23% of the total population account for 40% of the consumption of marine products. The largest market for fish in India is Calcutta.

There are six principal types of market intermediaries: auctioneers, purchase commission agents, wholesalers, retail commission agents, retailers and vendors. For the dry fish trade, processors form an additional link in the chain. Some 16.4% of the total fresh fish is sold directly through retailers/vendors while 70% pass through three intermediaries or less. Extension of loans by auctioneers, wholesalers and purchase commission agents is quite common in all the States. About 43.5% of fresh fish is sold through auction by fishermen. Direct sales are at pre-fixed prices. Fishermen's share of the consumer price is the highest (95%) in the case of direct sales to consumers and lowest (21.9%) in sales involving the multilocational distribution system.

The fast rise of fish prices on the domestic market compared with other commodities and food items is a clear indication that demand has outstripped domestic supplies.

Of the total shrimp production, only non-penaeid shrimp (about 10% of the total production) are used for domestic consumption.

Marketing is mainly in the hands of the private sector. Fish is either sold directly to the consumer or to agents and middlemen for auction and wholesale. Facilities for handling, preserving and distributing of fish are limited and, due to this and the distances involved, fish has an uneven distribution and is generally of low quality.

5.2 International trade

The Indian fish export industry has changed from a dried and preserved fish oriented industry to one of fresh and frozen products.

Since the fiscal year 1983-84, the volume of exports has shown a declining trend though the value continued to increase.

Table 6: Pattern of marine product exports from India, fiscal year 1981-82 to 1985-86 (in MT and Rs 1 000)

Items		1981-82	1982-83	1983-84	1984-85	1985-86
Frozen shrimp	Q:	52 180	55 002	54 444	55 398	50 349
	V:	2 479 458	3 161 517	3 148 081	3 296 954	3 298 187
Frozen froglegs	Q:	4 065	1 896	2 422	2 726	1 746
	V:	112 007	47 192	66 836	77 749	74 273
Frozen lobster tails	Q:	694	749	648	1 082	1 650
	V:	51 468	68 551	51 508	78 910	144 528
Frozen cuttlefish/ fillets	Q:	1 819	2 305	1 526	1 966	5 010
	V:	41 244	62 683	33 797	50 950	108 045
Frozen squid	Q:	1 337	1 222	2 050	1 663	4 619
	V:	17 437	20 079	26 911	30 020	55 153
Fresh/frozen fish	Q:	6 760	12 847	22 573	9 091	10 561
	V:	96 193	188 669	290 986	143 980	171 498
Canned shrimp	Q:	82	65	41	29	12
	V:	4 168	4 354	2 406	2 049	605
Dried fish	Q:	1 022	2 597	6 492	11 828	8 151
	V:	7 371	20 978	53 525	99 966	76 139
Dried shrimp	Q:	55	90	28	80	73
	V:	800	731	465	1 075	548
Shark fins & fish maws	Q:	358	156	250	249	231
	V:	37 308	19 936	32 714	33 892	31 200
Frozen clams	Q:	-	510	654	1 033	392
	V:	-	9 736	8 325	14 871	6 237
Fish oil	Q:	402	248	302	469	161
	V:	1 630	1 020	2 103	3 925	1 618
Beche-de-mer	Q:	56	28	?	12	11
	V:	2 793	1 896	4 114	1 154	1 219
Canned crabmeat	Q:	32	57	36	1	-
	V:	1 909	3 300	1 759	24	-
Cuttlefish bones	Q:	34	14	21	12	?
	V:	548	279	229	183	87
Others	Q:	1 159	389	1 119	564	673
	V:	5 720	2 692	6 450	7 195	10 621
Total	Q:	70 105	78 175	92 691	86 205	83 651
	V:	2 860 054	3 613 613	3 730 204	3 842 897	3 979 998

Source: MPEDA, Cochin

The 1985-86 export data reflect the growing product diversification which began around 1980. A further increase in the export of value-added products was also achieved. Products of special interest in this respect are IQF and freeze-dried shrimp. Freeze-dried shrimp exports increased from 3 MT in 1984-85 to 15 MT in 1985-86.

Countrywise, Japan has been the major outlet since 1973. However, its position is expected to change with improving product diversification, improved transport and port infrastructure, decreasing importance of shrimp exports and improved marketing skills of Indian importers.

Table 7: Major importing countries of Indian marine products (%)

		1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
Japan	Q	34.0	47.8	42.1	58.6	44.9	42.1	43.5	41.4	49.96	55.47	53.61	43.44
	V	48.0	58.7	51.6	68.1	64.6	61.0	66.7	68.2	69.65	71.25	71.47	66.67
USA	Q	44.1	27.7	31.4	27.5	33.7	31.6	22.9	15.9	10.35	13.99	16.70	15.40
	V	39.1	25.2	32.1	21.7	25.8	25.8	18.2	15.	9.17	11.69	12.91	13.35
France	Q	2.8	2.0	0.7	1.8	5.1	4.4	7.2	3.9	3.21	2.64	2.64	1.83
	V	2.9	2.1	1.0	1.9	4.1	3.9	5.5	3.2	2.65	1.67	1.65	1.19
Netherlands	Q	0.7	0.4	0.3	0.2	0.1	0.9	1.5	2.5	4.07	3.18	2.38	2.13
	V	0.8	0.4	3.6	0.2	0.1	0.8	1.2	2.6	3.74	2.53	1.74	2.26
UK	Q	1.9	3.4	1.9	0.4	0.4	0.5	0.5	1.7	2.33	4.00	3.94	4.20
	V	2.4	4.2	3.6	0.3	0.4	0.6	0.6	2.2	2.61	3.52	3.52	4.55
Australia	Q	2.1	2.0	2.1	2.3	1.3	0.9	0.4	0.5	0.65	0.61	0.55	0.27
	V	2.2	2.3	2.4	2.6	1.2	1.2	0.5	0.9	0.87	0.73	0.67	0.36
Belgium	Q	0.2	1.6	2.0	1.0	0.7	1.1	0.5	0.6	1.57	1.13	1.08	0.87
	V	0.2	1.6	2.0	0.8	0.6	1.1	0.6	0.7	1.09	0.99	0.80	0.84
Sri Lanka	Q	8.2	7.4	4.5	3.7	6.7	6.2	7.6	3.7	5.47	1.14	3.28	5.59
	V	1.1	1.2	0.8	0.5	0.8	1.2	1.3	0.6	0.84	0.16	0.55	1.10
Others	Q	5.0	7.7	16.0	4.5	7.1	12.3	15.9	29.8	22.39	17.84	15.82	26.27
	V	3.3	4.3	2.9	3.9	2.4	4.4	5.4	6.3	9.38	7.46	6.69	9.62
<u>Actual exports</u>													
Qty (MT)		Q 46 629	53 412	62 751	64 964	77 946	92 184	74 542	75 375	75 136	86 169		
Value Rs (100 000)		V 763127	1049063	1798620	1797574	2121574	2620292	2188756	2867128	3422429	3623231		

Fishery products are not imported into India. Only small quantities are allowed against foreign exchange under actual users licenses.

6. Handling and processing

6.1 Handling on-board fishing vessels and at landing centres

Indigenous fishing crafts and small mechanised boats do not carry ice for preserving catch. After landing, catch are sorted according to species and size. The shrimp and fish suitable for export are collected by agents, stored in ice until sufficient quantities are collected and then transported to the factories which may be located hundreds of kilometres away from the landing centres.

At present, refrigerated seawater is not used for preserving fish on board fishing vessels. Larger fishing vessels, which can stay at sea for 3-6 days, have insulated fish holds with a capacity of 5-12 MT depending on the size of the vessels. Some of the even bigger vessels, mostly shrimp trawlers, are equipped with freezing systems and cold storage facilities.

Handling on board and ashore has been improved recently by the introduction of ice and insulated boxes by the Marine Products Export Development Authority (MPEDA). MPEDA is directing efforts toward making all catamarans carry ice. However, further improvement is desirable. Of the numerous fish landing centres scattered along the coast, the majority are open beaches where basic facilities for handling the catch are not available.

Most of the 1 000 odd peeling sheds (mainly in South India) are run by middlemen. In Kerala, the largest processing area, shrimp peeling is undertaken in sheds. The product is then sold to packers who freeze and export it. Existing peeling sheds are registered and must conform to

prescribed standards. Major improvements have been undertaken in peeling sheds since 1979, but significant improvements are still required.

At major collecting centres throughout the country, there is scope for improvement e.g by providing potable water, cold storage facilities, ice and improved hygienic conditions. None of the wholesale markets has proper storage facilities. Improvised stores are used for storing fish on ice for short periods. MPEDA is trying to cope with the situation by installing more cold storage facilities at major ports.

6.2 Processing sector

There are three distinct processing sectors: namely: drying, freezing and canning. Prior to 1950, the bulk of the catch was utilised for curing or as agricultural manure. Fish was also eaten fresh.

With the introduction of modern coldstorage holdings and processing facilities, the preservation of catch has changed drastically. Production of dried fish has made way for fresh and frozen fish. Foreign importers very often deal through local agents in order to ensure adherence to quality, packing and other contractual obligations.

6.2.1 Curing

Curing as a means of preservation is becoming less popular, although domestic demand is still good particularly in remote areas. It has also lost importance with improved conservation facilities. Fish curing, in particular fish drying, still continues to employ traditional methods.

The major methods of curing in India are:

- (i) sun-drying without salt where the fish is dehydrated through direct exposure to the sun;
- (ii) dry salting where the fish is first salted, and then sun-dried after partial extraction of water;
- (iii) wet salting where the fish is heavily salted and marketed without any further drying; and
- (iv) Ceylon-type pickling where fish is pickled with salt and tamarind.

Fish are cured in small quantities, in one of the above forms, by individual fishermen households. In some instances, the fish are split open and salted, and some laminated.

The 'Ceylon-type' pickling mostly involves mackerel, and is meant for export to Sri Lanka.

In the case of shrimp, two methods of curing are practised:

- (i) simple sun-drying of whole shrimp especially the smaller varieties; and
- (ii) cooked and dried, where the shrimp are boiled, sun-dried and shells removed. In Orissa, there is a special method of drying shrimp, over a quick but smoky fire.

Owing to the good export value of frozen penaeid shrimp, only non-penaeid shrimp are used for drying and sold in the domestic market on a large scale. Dried fish processing and marketing has still not risen to the status of a modern industry.

6.2.2 Freezing

Freezing is mainly carried out for shrimp and to a lesser extent for lobster tails, froglegs, cuttlefish and fish. Some 36% of the freezing capacity is in Kerala, followed by Maharashtra with 20%.

Commencing with the first Five Year Plan period, construction of ice plants, freezing plants and cold storages has taken place. With increasing demand for shrimp in the international market, such facilities have also been built by the private sector.

Table 8: Development of refrigeration facilities for storage and distribution - plan-wise

<u>Plan</u>	<u>Ice plant capacity (MT)</u>	<u>Cold/frozen storage capacity (MT)</u>	<u>Freezing plant capacity (MT)</u>
Pre-plan	-	42	0.75
First Five-Year Plan (1951-56)	39.00	300	14.00
Second Five-Year Plan (1956-61)	74.50	735	21.00
Third Five-Year Plan (1961-66)	170.75	686	20.50
Annual Plan (1966-67)	10.50	20	-
Annual Plan (1967-68)	19.00	126	9.00
Annual Plan (1968-69)	88.50	494	14.50
Fourth Five-Year Plan (1969-74)	162.00	956	52.50
Cumulative as on 31.3.1974	564.25	3 263	132.25
Cumulative as on 1.12.1980	1 915.75	35 942.35 ^a	1 486.13

^a Includes 4 718 MT of frozen storage

Table 9: State-wise distribution of refrigeration facilities, 1980

<u>States</u>	Freezing		Ice making		Cold storage	
	No.	Capacity (MT/day)	No.	Capacity (MT/day)	No.	Capacity (MT/day)
Kerala	117	533.80	56	643.75	141	11 547.85
Karnataka	29	12.84	15	212.00	31	2 612.00
Tamil Nadu	46	180.44	36	334.50	60	5 423.50
Andhra Pradesh	21	85.50	23	254.00	25	2 096.00
Pondicherry	-	-	-	-	1	5.00
Lakshadweep	-	-	-	-	-	-
Maharashtra	41	288.30	5	218.00	46	7 336.00
Gujarat	11	92.00	9	96.50	23	3 283.00
Goa	12	45.00	2	19.00	9	560.00
Orissa	14	52.00	5	48.00	15	1 150.00
West Bengal	31	96.25	5	90.00	27	1 929.00
Total	322	1 486.13	156	1 915.75	378	35 942.35

Source: MPEDA, Cochin

Following disruption of the US market in 1979, plant owners made strenuous efforts to improve processing and sanitation. They have been successful to a large extent.

Cold storage rooms are mostly small, less than 50 MT, and attached to processing plants. The Government is a major builder of cold storage facilities. For example, a 500-MT store has been built at the port of Cochin by MPEDA. Other 300-MT stores are proposed for Calcutta and Bombay. There is clearly a need for assistance in design and construction of cold storage.

Cheap labour and a strong conservative attitude on the part of entrepreneurs, perhaps resulting from many small businesses, has had a negative effect on equipment development and use. However, larger companies have opted for mechanisation. More recently, IQF machinery is being introduced in view of the increasing demand for retail packages. Only a few tunnel freezers have been installed.

6.2.3 Canning

India has built a strong production base for canned shrimp, which at present involves 64 canning plants having a total daily canning capacity of 238 MT. However, much of this installed capacity now lies idle. Shrimp canning is, in fact, the main business, though lately the canning of sardines, mackerel, skipjack, crab and mussel has also commenced.

The major obstacle to the growth of the canning sector of the industry has been identified as the restricted availability of cans acceptable to the major world markets. Indian canners continue to use thick gauge tin-plate cans that are difficult to open. The cost of the cans alone is about 33% of total costs.

Canning is usually carried on along with freezing operations. Often canning only occurs during times of surplus and low market prices for fresh and frozen products. In addition to the high production costs in the canning sector, quality has been another problem limiting its success in the export market.

6.2.4 Fishmeal

Though there are only very few fishmeal plants scattered throughout the country, none of them is working at full capacity because of the lack of raw material. When these plants were established, their economy was based on trash fish. But, the demand and prices for trash fish have increased drastically within the country that it has been found unworkable to use them to feed the fishmeal plants.

Table 10: State-wise capacities for fish canning and fishmeal manufacture, 1980

State	Canning		Fishmeal	
	No.	Capacity (MT/day)	No.	Capacity (MT/day)
Kerala	42	156.49	3	62.50
Karnataka	9	38.00	5	150.00
Tamil Nadu	3	4.50	6	62.00
Andhra Pradesh	1	0.05	-	-
Pondicherry	-	3.00	-	-
Lakshadweep	1	3.00	-	-
Maharashtra	3	5.50	6	95.00
Gujarat	1	6.40	12	194.00
Goa	7	33.50	1	12.00
Orissa	1	1.00	-	-
West Bengal	-	-	1	14.00
Total	68	251.44	34	589.50

Source: MPEDA, Cochin

6.2.5 Chitin/chitosan

Along with shrimp, squilla with a high chitin content is caught. This is an excellent material when converted into chitosan. Shrimp heads are also good raw material. Commercial production of chitosan finds extensive use in clarification of water, flocculation of algal material and sizing and printing of textiles. The muscle portion of squilla is produced into bactopectone for microbiological work.

6.2.6 Miscellaneous

Smoking of fish has not been practised in India so far, though some experiments are being conducted on a pilot scale.

Preparations such as fish paste, fish powder and fish curry in various combinations and styles are also made in different parts of India. Other products of commercial importance are sharkfins, fish maws beche-de-mer, fish oil, shark liver oil, 'mas min' (dried skipjack), dried turtle meat, etc. Many of these are exported to different parts of the world.

7. Fish processing equipment

Special machinery for fish handling have yet to find application in Indian industry. These might have relevance to products manufactured on a large scale for domestic or export markets.

Washing of fish and shellfish which is essential during several stages of handling and processing, is now being done manually. Spray or rotary washers could be fabricated for specific needs on the basis of available know-how.

Machinery for grading, skinning, splitting and beheading of fish might find application in the processing of sardines and mackerel and shrimp deveining equipment.

A machine to separate fish flesh from bones and skin by extruding the flesh as a mince has been developed in India. This would help develop new products based on minced fish meat.

Most imported processing equipment is subject to heavy import duties. For some types of machinery (e.g. IQF machines), duties have been lowered as the Government wants to encourage a certain sector of the industry. A number of machines are being produced domestically, but for the more modern equipment, know how and technological development have not yet advanced to the required level.

8. Product development

Head-on shrimp

Realising the great potential for this product in the Japanese and European market, processing and marketing of this product with technical assistance from ITC was successfully carried out.

Accelerated freeze-dried shrimp

Production increased from 2.5 MT in 1983 to 15 MT in 1985. There is to date only one freeze-drying plant in India.

Squid

Processing of frozen and dried squid has been successfully developed (4th major item of export) for the European and Japanese markets.

Semi-processed sharkfin

Importers and processors buy skinned sharkfin to prepare rays themselves. Although the technology of extracting rays is known and standardised in India, skinned dried fins was generally preferred. Trial processing and marketing are showing positive results.

Underutilised resources

- (a) Clam meat - deperated and processed into frozen form, this product was developed for export mainly to Japan in 1981 and has continued to be a regular item of export. New markets now include FR Germany, USA, UAE and Kuwait.

- (b) Boiled, dried anchovies - dried anchovies were mainly for traditional markets like Sri Lanka and Mauritius. New markets identified preferred boiled and then dried products. This product packed in consumer packs has new markets in Asia.
- (c) Acetes indicus (dried) - this used to be a locally consumed product with market potential in Japan. The shrimp is now dried and processed hygienically. Product acceptance has been very encouraging.
- (d) Jellyfish - which finds no local use is being processed on a trial basis for the Japanese market.

9. Infrastructure

Despite strenuous efforts by the Government to upgrade and develop infrastructure since the First Five-Year Plan, there continues to be a critical shortage of facilities. This shortage is felt on the domestic market as well as in the export-oriented industry.

On the domestic market, a shortage of fish is already obvious, and this can be partly blamed on post-harvest losses which are the result of inadequate infrastructure (including landing point facilities) in the capture sector, and an inefficient domestic marketing system. The limited freezing and coldstorage facilities available are almost exclusively used by the export-oriented sector. These constraints result in a very uneven regional distribution of fish consumption, substantial post-harvest losses and limited progress in the development of new product and preservation forms offered to the final consumer.

In comparison to the domestic market sector, the export oriented processing industry is rather well equipped, although there remains a lot of room for improvement. The structure of the industry varies from place to place. A large number of small, often family-controlled, businesses make up a large share of the industry.

In view of the Government's policy to restrict imports of machinery and because of the lack of foreign exchange, the introduction of up-to-date processing equipment has been slow. However, more recently the Government is encouraging imports of equipment particularly faster (liquid-nitrogen) freezers and IQF machinery.

9.1 Vessels

At the end of 1985, the number and type of vessels used in marine fishing operations consisted of 153 495 non-mechanised crafts, 20 854 small mechanised vessels and 87 deepsea vessels. Most of these deepsea vessels are actually exclusively used for shrimp trawling. The small mechanised vessels, ranging in size from 28 to 35 ft, are mostly engaged in bottom trawling for shrimp. However, it is estimated that between 20 and 25% of the total annual shrimp landings are obtained from non-mechanised crafts. The large number of these non-mechanised crafts could also be the reason why the average catch per unit is estimated to reach only 5 kg per man-hour.

No breakdown in the types of mechanised vessels is available for 1985. However, a survey conducted in 1980 indicated an estimated 19 000 units of mechanised marine fishing vessels at that time, comprising 11 590 trawlers, 3 990 gillnetters, 2 850 bagnetters and 380 purse-seiners.

Fishing gears commonly in use in the country consists mainly of gillnets, bagnets and boat and beach seines. However, several new designs and types of gears have been introduced and these include otter trawling, outrigger trawling, mid-water trawling, pair trawling, purse-seining, long-lining, etc. Several mechanical fishing accessories, ancillary fishing equipment and electronic equipment of practical value in fishing operations have been introduced recently, improving efficiency.

In order to increase production and exploit more evenly the Indian waters, the Government has been encouraging the development of a deepsea fishing sector.

The Indian Government launched four schemes for the import of deepsea fishing trawlers in the years 1968, 1973, 1977 and 1983. Under the 1968 scheme, only 12 trawlers were imported although the intention was to achieve importation of 40 trawlers. However, in 1973 all the 30 vessels anticipated to start operations were taken delivery of. But, the immediately succeeding scheme of 1977 ended with the figure of only about 10 vessels as against import authorisation for over 120 vessels. The more recent public notice of 1983 has also elicited very poor response from the industry.

The success of the 1973 scheme was due to the fact that the Government of India itself took a leading role in finalising the specifications, selecting the foreign shipyard, fixing the price, arranging for deferred payment and providing an umbrella guarantee for the same. The 1977 scheme signalled the dangers of giving freedom to the entrepreneurs to select the source of import, decide on the specification and negotiate the price.

In the Sixth Five-Year Plan, a target of 300 deepsea trawlers was sub-divided as follows:

i) Vessels on charter from foreign countries	150
ii) Vessels constructed at indigenous yards	40
iii) Vessels by outright import	60
iv) Vessels by obligatory purchase in consequence to (i)	50

However, this target was never achieved. The reasons for this failure were given as: 1) the non-availability of soft loan facilities at the beginning of the Sixth Five-Year Plan; 2) withdrawal of chartered foreign fishing vessels; 3) absence of trained personnel; 4) lack of data on resources; and 5) lack of adequate infrastructure. To improve the situation, the Government has taken corrective action on all of the above points.

It is envisaged that to exploit the target of 1 million MT from the offshore/deepsea areas a fleet of about 700-750 vessels may be required. The breakup of these boats would be roughly as follows:

For shrimp	: 50 vessels
For tuna	: 50 vessels
For cephalopods	: 350 vessels
For finfishes	: 300 vessels

9.2 Transportation

All means of transport commonly employed for carrying other agricultural produce are also used for transporting fish. The use of a particular means of transport depends on the distance, the quantity and the value of the product. Only products destined for export normally receive better treatment and specialised transport.

Raw material supplies (mainly shrimp) to the processing factories are transported either by truck, train or carrier. Vehicles used for transportation of fish to the processing factories are either open, closed (uninsulated) or insulated trucks. Open and closed (uninsulated) trucks account for about 75% of the total number.

Packaging quality has been an issue with Indian product because paper used is recycled. Since cartons may be a source of contamination if not properly lined, most companies employ plastic liners and bags to help provide thorough moisture vapour proofing.

Bamboo baskets and wooden boxes are often used for domestic market oriented fish. This packaging material is cheap, but has poor insulation properties and is not hygienic. Aluminium and galvanised iron vessels are used for transporting iced fish to the processing factories. Rigid plastic containers are rarely used.

Improvements to the traditional bamboo baskets have been introduced, by making additional inside linings with bitumen-coated kraft paper or polythene. A more sophisticated container has been developed for long distance transport of fish (both iced and frozen). A drip-proof insulated bamboo basket for transport of iced fish has also been introduced.

10. Quality control and existing standards

India has a long-established and extensive compulsory fish inspection and quality control programme. The legal basis for the programme is the Export (Quality Control and Inspection) Act, 1963 which empowers the Central Government to enforce compulsory inspection and control of a wide range of export goods, food and non-food. The requirements of the Act are implemented by the Ministry of Commerce. The Government is advised by the Export Inspection Council on the products which should be subjected to inspection and on the measures required to carry out inspection. The Act also empowers the Government to establish Inspection Agencies for the purpose of carrying out sampling inspection and testing of the products.

The other institutions involved with inspection and quality control entering international trade are:

- (i) Indian Standards Institution;
- (ii) The Marine Products Export Development Authority (MPEDA); and
- (iii) Central Institute of Fisheries Technology (CIFT).

The Indian Standards Institution has issued standards of quality for a wide range of fish products including those for which there is mandatory inspection.

MPEDA plays an important role in promoting quality control and in improving quality. Its main task is to support and develop the export of fish products. There is a quality control division among its specialised divisions. This division works in cooperation with the Export Inspection Agency. It frequently organises courses at various levels, sometimes in cooperation with the CIFT, on fish handling, processing and on quality control.

The CIFT carries out research in aspects of quality control and gives necessary scientific support to the Export Inspection Agency. The Institute also trains inspectors and organises courses on quality control and on methods for testing fish products.

All fish product exports are subject to compulsory quality control and pre-shipment inspection. A very comprehensive inspection and quality control programme covers almost all marine products and certainly all important marine export products.

Mandatory end product inspection is only part of the totality of quality control and the Central Inspection Agency has emphasised the importance of in-plant quality control. In 1977, the Government of India introduced the In-Process Quality Control (IPQC) scheme. This requires processing plants wishing to export frozen fish products to meet certain minimum standard facilities for processing the products. The requirements, published by the Ministry of Commerce as a code of practice, were very much in line with the various Codex Alimentarius Codes of Practice for the production of frozen shrimp and other frozen fish products.

In 1981, a modified scheme was introduced, referred to as the Modified In-Process Quality Control (MIPQC) scheme. Under this programme, the companies assume greater responsibility for monitoring the process and for testing the end-product. An important feature of the MIPQC is that the plants must have their own quality control laboratories and must carry out their own analysis. By the end of 1983, more than 30 processing plants had qualified for licences to operate under the MIPQC scheme.

11. Research, training institutions and extension services

Prior to 1947, fishery research activities were very modest. It was the realisation of the importance of development and management of fisheries for India's economic progress which motivated intensified research on multiple aspects of fisheries.

A number of institutes effectively handle various aspects of research, development, education and trading. In addition, some universities and agricultural institutes also pay increasing attention to research and education.

The Central Marine Fisheries Research Institute, Cochin, concentrates on resources, aquaculture development (fish, shellfish, seaweed), fishery biology and oceanography. It also investigates various aspects of fishing and fish processing methodology and equipment. An integral part of its function is training of personnel required by the fishing industry.

The Central Inland Fisheries Research Institute covers scientific research for inland fishery resources, development of suitable methods for management and conservation and culture fisheries.

The Central Institute of Fisheries Education, Bombay, is largely a training facility for in-service personnel. Other research, training and extension service institutes include the Central Institute of Fisheries Nautical and Engineering Training, Cochin; the Exploratory Fisheries Project, Bombay; the Integrated Fisheries Project, Cochin; the Pelagic Fisheries Project, Cochin; the Central Food Technological Research Institute, Mysore; and the National Institute of Oceanography.

12. Government policy

Under the Indian Constitution, both the Union Government and States share responsibilities for the development of fisheries. Each of the States is directly responsible for the development of fisheries within the territorial marine and inland water. The Union Government is responsible for the development of fisheries beyond the territorial waters and for fisheries research, although these are shared by the State Governments as well.

The principal objectives of the fisheries development programme for the Sixth Five-Year Plan (1980-85) were:

- a) to achieve a considerable increase in fish production both in marine and inland sectors;
- b) to promote inland fish production on a scientific basis through extension, education, training and provision of inputs with a view to increasing the productivity of available water bodies;
- c) to organise intensive surveys on marine fishery resource assessment and ensure optimum exploitation of marine resources through a judicious mix of traditional country boats, mechanised boats and deep-sea fishing vessels;
- d) to intensify efforts so as to improve processing, storage, transportation, and marketing;
- e) to tap the vast potential for exports of fish and fishery products; and
- f) to improve the socio-economic condition of fishermen.

The Government policy during the Seventh Five-Year Plan (1985-90) focuses on the encouragement for the further development of the deepsea fishing sector. The exploitation of off-shore and deepwater resources will preferably take place through joint ventures and collaboration

programmes. The chartering of deepsea fishing vessels from third countries is discouraged. In view of the importance of seafood exports as a source of substantial revenue for the country, the seafood processing sector will be further encouraged.

In addition, in the maritime States, together with accelerated development of brackishwater fish production, attention would be paid to the development of marine fisheries for export. For increased production of inland fish, the States would have to give priority to hatchery development.

Table 11: Seventh Five-Year Plan: central and centrally sponsored schemes (in Rs 100 000)

	<u>1985-90</u>
I Central Sector Schemes	
1. Fishery survey of India	2 425.00
2. Integrated fisheries project	700.00
3. Central Institute of Fisheries Nautical & Engineering Training	700.00
4. Central Institute of Coastal Engineering for Fisheries	75.00
5. a) Trawler Development Fund	9 400.00
b) Building of wooden hull trawler	30.00
6) a) Project preparation and strengthening of Technical Wing at the Centre and Technical Wings of States and U.Ts for survey, investigation and conservation	160.00
b) Training/seminar/workshop etc.	50.00
7) a) Fishing harbour facilities at major ports)	1 700.00
b) Construction of dry dock (C.S)	
8) Enforcement of maritime zones of India Act	Nil
9) Development of inland fisheries statistics	80.00
10) Rastriya Matsya Nigam (National Fisheries Development Board)	500.00
11) Post harvest support to fisheries development	Nil
Total (Central Sector Scheme)	15 820.00
II Centrally Sponsored Schemes	
12) Infrastructural development for fish seed production	550.00
13) a) Development of aquaculture (FFDA-I))	
b) Inland Fisheries Project with World Bank assistance (FFDA-II))	1 550.00
14) Development of reservoir fisheries	400.00
15) Development of derelict water bodies and utilisation of organic waste for aquaculture	165.00
16) a) Fishing harbour facilities at minor ports	1 900.00
b) Establishment of industrial estates	
17) Brackishwater aquaculture	500.00
18) Introduction of beach landing craft and upgradation of small mechanised sector	300.00
Welfare Schemes for Fishermen	
19) National Welfare Fund for Fishermen Society	400.00
20) Group Accident Insurance Scheme for Acting Fishermen	150.00
Total (Centrally Sponsored Schemes)	5 915.00
Grand total (Central and Centrally Sponsored Schemes)	21 735.00

13. Fisheries administration

The fisheries wing in the Department of Agriculture and Cooperation under the Ministry of Agriculture is in charge of all important matters relating to policy and administration of fisheries. It is responsible for the formulation of national policies and programmes of fisheries development, fishing harbours, processing and preservation of fish, fisheries education and training, fish trade, etc. so designed as to achieve the optimum development and utilisation of the country's fishery resources and to achieve the objective of self-reliance in this field. It is also responsible for taking all necessary steps for making available timely and adequate supply of inputs and services required; for participating in international organisations, promoting bilateral and multilateral cooperation and collection and maintenance of relevant statistics. It assists State Governments in the formulation of policy, plans and project, and in the setting up of fisheries corporations, and offers technical advice and guidance whenever required.

At the Union Government level apart from the Ministry of Agriculture, the Ministry of Commerce also looks after certain functions concerning fisheries. These relate to export promotion, developing the production base and quality control.

Fisheries education and research are the responsibilities of the Indian Council of Agricultural Research (ICAR). The Government has established various specialised institutions to deal with the various aspects of the fisheries. This also includes universities. With a view to providing the flexibility necessary for undertaking activities of a promotional nature, it was decided at the end of the Third Five-Year Plan Period to establish fisheries corporations. The corporations in inland States are recent developments, most of them being fish seed corporations. The fisheries corporations in marine States mostly concentrate on marine fisheries, undertaking activities such as deepsea fishing, processing, marketing, boat-building, net-making and ice-making. The financial performance of most corporations has been disappointing so far.

The fisheries cooperative system in the country was organised with a view to providing assistance to the actual producers, the fishermen. Fisheries cooperatives are societies governed by a separate set of rules to channel government assistance on the basis of self-help and management.

The fisheries cooperative structure in India is broadly three-tiered. It consists of a primary cooperative for a village or group of villages; a district or regional federation; and a state-level apex body constituted as a cooperative federation.

The primary fishery cooperative is expected to function as a multi-purpose agency providing credit, supplies, elementary guidance and supervision on the utilisation of loans, assembly of fish catch and its transportation to marketing centres. Member education and extension programmes are supplementary functions expected to be undertaken by primary cooperatives in collaboration with other concerned agencies. In practice, however, primary fishery cooperatives are mainly engaged in

the provision of loans to member fishermen. Some cooperatives have organised the provision of supplies and only very few societies are engaged in activities such as construction of fishing boats and processing.

The regional federation is the district-level organisation which is expected to act as a useful and conveniently located intermediate agency between the apex body and the primary cooperative. It is expected to play an important role in marketing and, for the purpose, is located in the larger towns. Most of the other functions of the federation are similar to those of the primary cooperative but on a larger scale and catering to a wider area in providing assistance to the member-primary cooperatives.

The apex federation is the state-level organisation and is expected to provide support to the primary and district-level cooperatives. Through its location, size and capacity to command resources of men, material and market, it is expected to provide leadership to the entire movement.

14. Credit facilities

Three main banks which finance seafood production are: (a) the United Commercial Bank; (b) the United Bank of India; and (c) the United International Bank Ltd. A few other nationalised banks also play a part, but to a smaller extent.

The financing pattern changes from bank to bank but generally loans are released on fixed norms.

Subsidies of 25% of project cost are offered to specified social classes and fishermen tribes.

For the export production sector, financial institutions give the following types of loans/facilities:

- (a) packing credit loan;
- (b) term loan for machinery and plant;
- (c) overdraft against hypothecation of finished goods; and
- (d) foreign bill discounting facilities.

Certain finance corporations are offering term loans for construction of seafood processing units.

In order to eliminate speculators and 'hit and run' processors, MPEDA asked banks not to loan money to firms which do not have a stake in the production end of business. MPEDA also subsidises interest on loans taken for plant improvement apart from subsidies to fishermen and peeling sheds for insulated boxes. One of the main factors hampering development in infrastructure and processing machinery has been the lack of finance on the part of processors. A very high import duty on processing equipment also hinders modernisation. However, these duties have already been considerably reduced.

Existing financing arrangements permit one to obtain up to 80% of the cost of capital goods, such as trawlers, freezers, ice plants, etc.

15. Foreign collaboration

India is actively associated with international endeavours in fostering cooperation for fisheries development. She is the recipient of international assistance for fisheries under multilateral and bilateral programmes; and of her own also gives cooperation and assistance in fields where it can be beneficial to other countries.

Among past assistance programmes, TCM Aid, Norwegian project assistance and UNDP/SF assistance are important. Norway continues assistance by way of commodity aid, assistance for fishing vessel construction, strengthening of facilities at Goa Shipyard and a small area development project at Balasore (Orissa). The Netherlands, Denmark and Japan provided aid for the acquisition of exploratory and training vessels. Denmark, Sweden and the United Kingdom have shown interest in undertaking area development projects in Karnataka, Andhra Pradesh and Orissa. A Danish proposal for an area development project at Tadri (Karnataka) is nearing finalisation.

India has also obtained World Bank assistance for two integrated marine fisheries projects, one in Gujarat and the other in Andhra Pradesh and for an inland fisheries project covering West Bengal, Bihar, Orissa, Uttar Pradesh and Madhya Pradesh.

Only recently did India join the Asian Development Bank and consequently more funding from that source for projects can be expected. Also in the private sector foreign investments have recently increased, particularly in the deepsea fishing sector, but also in infrastructural works like labour facilities and shipbuilding.

16. Conclusion

There exist good possibilities to increase production both in the marine and the inland fisheries. However, the available infrastructure appears inadequate to absorb a major increase. In addition, to inadequate infrastructure improper handling (on board, during processing and transportation), results in substantial post harvest losses. An improvement in these areas could mean a considerable gain in volume available for the local market and export sector.

An increase in educational and training facilities could play an important role. The capture sector would benefit significantly from research data.

Annex 1: Summary of assistance to the fisheries sector

<u>Project/activity</u>	<u>Source of assistance</u>	<u>Assistance Committed (US\$ equiv)</u>	<u>Duration or starting date</u>	<u>Nature of assistance</u>
<u>Technical assistance</u>				
<u>(1) Operational</u>				
Assistance to Fishing Research Institute (Phase I) (GOA)	Norway	240 500	1977-79	Technical Assistance Phase I
Equipment of Government Fisheries Station	Norway	570 000 p a	Since 1972-ongoing	
Boat-building Programme	Norway	7 881 000	1975-82	To assist the construction of 6 research/survey vessels to be built at Goa Shipyard (First 2 trawlers to be delivered in early 1980)
Pelagic fishery investigations on the southwest coast (Phase II) IND/75/038	UNDP	2 603 000	1976-79	To develop more precise estimates of the size and location of pelagic resources: to determine most effective methods and equipment required for exploitation and utilisation of the resources
Intensification of freshwater fish culture and training IND/75/031	UNDP	582 000	1979-84	To formulate research and demonstration programmes to train specialised staff, and to strengthen central research training
Support of pisciculture/fisheries under the UNICEF Applied Nutrition Programme	UNICEF	92 500 p.a.	1963-80	To support the construction of ponds and the training in pisciculture
Fishery Survey and Training	Denmark	10 273 000	1978-80	The project will employ 4 vessels
Grant aid for fishery	Japan	3 000 000	1978-80	Two fishery vessels for research and training
Green Algae Project	Germany FR	785 000	1972-80	Post project cooperation
Fishermen Living Conditions - Ermore/Tamil Nadu	Harnosand-Indian Development Collaboration Agency (Sweden) (SIDA contribution)	73 040	1979-80	To improve the living conditions in Ermore through creating possibilities for the fishermen to fish in the sea after the destruction of channels and lagoons through industrial activities

Post Graduate Agricultural Education and Research IND/78/020	UNDP/ UNESCO	4 570 050 (the whole project)	8.6.79- 7 6 86	Fisheries subproject: mariculture centre at the Central Marine Fisheries Research Institute Cochin
Fish Breeding Project	Italy	130 000	1979-80	

(2) Project proposals

Fishery development east coast Orissa	Norway	n.a	1980	
Assistance to Fishing Research Institute (Phase II) (GCA)	Norway	n a	1980-81	Extension of Phase I project approved, but agreement not signed
Exploratory fishing survey on east coast IND/71/622	UNDP	7 250 000	3 1/2 years	To carry out exploratory fishing investigations of direct interest to commercial fishery development. To develop exploitation technology

Capital aid(1) Operational

Project loan for fish production in the State of Gujarat	IBRD IDA	14 million 4 million	1977-82	The project envisages improvement of the Manegrol and Veraval harbours with provision of necessary shore facilities for handling and storing fish, development of infrastructure for eight fishing villages between the two ports and granting credit for investment in motorised fishing vessels and canoes
Supply of fishery research vessels and fishing vessels	The Netherlands	23.5 million (gift)	1978- ongoing	12 fishing vessels in 1979 from the Netherlands, programme might be expanded
Improvement and expansion of existing harbour	IDA	17.5 million	1978- ongoing	About 75 000 subsistence fishermen will benefit from a project aimed at improvement and expansion of existing harbour and shore facilities in 3 locations in Andhra Pradesh, an expansion of the mechanised fishing fleet and seafood processing capacity and provision of village access roads

(2) Project proposal

Krishnapatnam - fishing harbour and road improvement	UK	10.2 million	5 years	Provision of an all-weather harbour at Krishnapatnam and roads to link the harbour with 53 coastal villages
Astoreng fishing harbour	UK	3.1 million	5 years	To provide a harbour and shore facilities in southern Orissa adjacent to a good fishing area, and credit for an initial fleet of 60 vessels
Andhra Pradesh Fisheries Co-operation (APFC). Fish marketing	UK	2.5 million	6 years	To improve fish production to raise living standards of fishing communities, ice plants, chill rooms, cold stores, etc
Andhra Pradesh Fisheries Co-operation (APFC). Fish processing equipment	UK	128 000	(Discussion Sept. 78)	Supply of equipment to enable APFC to undertake product development studies
Inland Fisheries Project	IDA	20.0 million	April 80- April 85	The project will assist GOI and 5 participating States (West Bengal, Bihar, Orissa, Madhya Pradesh and Uttar Pradesh) in their efforts to implement fish farming programmes: (i) increase carp production (ii) provide a basis for the future commercial development of the carp seed industry.

INDONESIA

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INDONESIA

1. Introduction

Indonesia consists of a large number of islands (about 13 000). the combined coastline of which is some 36 600 km. The islands have a land area of nearly 2 million sq km and 5.8 million sq km of marine waters. The latter can be divided into 3.1 million sq km of territorial waters and 2.7 million sq km of Exclusive Economic Zone (EEZ) waters. About 775 000 sq km of marine waters comprise productive shelf area less than 200 metres deep. Indonesia declared its 200-mile EEZ in 1980.

The population of Indonesia was about 162.2 million in 1984 with an average annual growth rate of 2.1% during the period 1979-83. Most of the population is concentrated on a few of the islands, namely Java, Bali, Madura and Lombok which together account for about two-thirds of the national population. The annual per capita income was US\$ 510 in 1983, reflecting a real growth of 4.2% of the GNP. The average real growth of the GNP during the period 1979-83 was 6%.

2. Fishery sector

The fishery sector very much reflects the population distribution. The majority of fishermen can be found in the most densely populated areas, with the coastal areas being over-exploited. This is largely because the Indonesian fishing industry is basically an artisanal, small-scale industry. Small scale operations, in fact, provide about 98% of the total production, and account for 99.8% of the employment in the fisheries capture sector. The industrial, export-oriented fisheries sector is gradually growing, but depends on only a few products, i.e shrimp and tuna.

The fisheries sector is a major source of employment, engaging a total of about three million persons, or 5% of the national labour force. However, labour productivity is low because of the nature of the industry. It contributes only about 1.7% to the GNP (1983).

Table 1: Growth of GNP in Indonesia at current prices, 1979-85 (in Rp billion)

	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>
GNP (national)	32 025	45 445	54 027	59 632	73 697
GNP of agri- culture sector	8 995	11 290	13 642	15 668	21 423
GNP of fisheries sub-sector	575	802	911	1 052	1 220
% of fisheries sub-sector to agri. sector	6.39%	7.11%	6.68%	6.72%	5.70%
% of fisheries sub-sector to national level	1.80%	1.77%	1.69%	1.77%	1.66%

Source: 1) Marine Fisheries Development Programme for Ten Years.
Directorate General of Fisheries. Indonesia
2) Indonesian Statistics, 1985

The Indonesian fishing industry can be classified into two sectors: 1) the marine fisheries sector, comprising small and medium scale, and industrial fisheries; and 2) the inland fishery sector, comprising capture and culture fisheries.

The marine capture fishery sector has traditionally played an important role. The majority of marine landings is still produced by small-scale fishermen often using traditional fishing methods. Resource exploitation has mostly been confined to inshore waters, particularly in areas with a high population density, such as Java and Bali.

Inland capture fisheries production has increased slowly compared to the tremendous increase in marine landings. This is mainly due to the lower level of investments in that sector and the diversion of labour traditionally involved in inland fisheries to other economic activities, particularly the timber industry. In the case of the inland fish culture fisheries, production has shown a gradual increase over the years as a result of the introduction of more modern techniques as well as improving marketing opportunities.

Table 2: Fisheries production by fishery sub-sectors in Indonesia, 1980-84 (in MT)

	1980	1981	1982	1983	1984
Marine fishery	1 394 810	1 408 272	1 490 719	1 682 014	1 712 804
Inland open water	254 498	264 983	265 348	265 562	269 321
Brackishwater pond	97 898	112 916	129 279	134 072	142 404
Freshwater pond	66 379	78 224	69 245	79 681	76 528
Paddy field	35 495	49 529	42 060	52 165	50 880
Cage culture	582	581	890	982	1 052
Total	1 849 662	1 914 505	1 997 541	2 214 476	2 252 989

Source: Fisheries Statistics of Indonesia, 1984

2.1 Resource potential

The Indonesian marine resource potential is estimated to be very high in view of its geographical location, topographical characteristics and the size of its territorial and EEZ waters. Nevertheless, it is difficult to estimate the exact resource potential because of the limited resource research conducted to date.

As in the case of most countries surrounded by tropical waters. Indonesia's marine resources are characterised by many species with relatively thin shoaling. The Bali Straits sardinella is probably the only exception. More than 200 commercial marine species have been identified but only about 65 are regularly reported in the catch statistics.

In general, Indonesia's fisheries resources are only lightly exploited with the exception of certain densely populated areas, where over-exploitation is evident. Exploitation of offshore resources is still limited as the majority of marine fishing operations are carried out by small-scale fishermen in inshore waters.

Table 3: Potential and exploitation of fishery resources in Indonesia, 1983 (in 1 000 MT)

<u>Fishery type</u>	<u>MSY/annum</u>	<u>Production</u>	<u>Rate of exploitation (%)</u>
Marine fishery	6 625	1 682	25.4
- Archipelagic water	4 510	NA	NA
- EEZ	2 110	NA	NA
Inland fishery	1 400	532	38.0
- Aquaculture	700	267	37.9
- Open water	700	265	38.1
Total	8 025	2 214	27.6

Source: Marine Fisheries Development Programme for Ten Years, Directorate General of Fisheries, Indonesia

Table 4: Potential pelagic and demersal resources and rate of exploitation by geographical area, 1982

	<u>Potential resources</u> (MT/year)		<u>Production</u> (MT/year)		<u>Rate of exploitation (%)</u>	
	<u>Pelagic</u>	<u>Demersal</u>	<u>Pelagic</u>	<u>Demersal</u>	<u>Pelagic</u>	<u>Demersal</u>
West of Sumatra	243 500	169 100	46 109	25 318	18.95	14.97
South of Java	159 000	112 700	38 289	21 778	24.08	19.32
Straits of Malacca	126 500	78 300	69 409	75 749	54.86	96.74
East of Sumatra	413 600	631 200	109 567	83 474	26.49	13.22
North of Java	363 500	322 900	211 170	122 288	58.09	37.87
Bali and Lesser Sunda						
Island waters	244 900	215 700	64 805	16 055	26.46	7.44
South and west of Kalimantan	156 000	245 200	27 576	47 136	17.67	19.22
East of Kalimantan	127 400	199 500	56 640	39 326	44.45	19.71
South of Sulawesi	90 400	69 000	87 072	61 321	96.31	88.87
North of Sulawesi	308 800	80 500	43 601	18 795	14.11	23.34
Moluccas - Irian Jaya	1 286 500	470 900	62 184	32 645	4.85	6.93
Total	3 520 100	2 595 000	816 422	543 885	23.19	20.96

Source: Directorate General of Fisheries, Indonesia, 1982

For shrimp and tuna resources, the rate of exploitation was 68.99% and 22.85%, respectively in 1982. The annual tuna resource potential is estimated at 275 400 MT, while the annual maximum sustainable yield (MSY) of shrimp is believed to be around 48 000 MT.

Exploitation of tuna currently concentrates on skipjack, while bigeye stocks which are found North of Java and Bali, south-west of Sumatra and in the Banda Sea are hardly exploited.

In March 1980, trawlers of over 10 GRT were prohibited from operating within 20 miles offshore. This drastic measure was prompted by the belief that trawling had seriously damaged demersal fish stocks in inshore waters while also creating problems for artisanal fishermen. Off the island of Java, such trawling has been prohibited since 1 October 1980 and off Sumatra since 1 January 1981. Elsewhere, the ban took effect on 1 July 1981. However, some 1 000 trawlers under foreign investment capital and joint-venture arrangements were allowed to continue operating in areas other than Java and Sumatra.

Before the ban, trawling accounted for 178 000 MT or 75% of the demersal catch (1979). At that time, demersal catches west of Longitude 130°E accounted for over 90% of total demersal production.

Substantial areas are still open for development as becomes clear from Annex II.

In the inland freshwater capture fisheries and aquaculture sub-sector, Indonesia has about 13.7 million ha of inland open waters and 265 000 ha of existing culture areas. Resource yield is estimated to be approximately 1.6 million MT annually. In the case of aquaculture, its potential yield is rather flexible and could be increased through further development and improvement of culture techniques, pond management practices, and expansion of the culture area. Aquaculture is concentrated mostly in Java, Sumatra and Sulawesi. Brackishwater fish/shrimp ponds, in particular, are located mainly along the coast of North Sumatra, Java and in South Sulawesi. Both inland water capture fisheries and aquaculture are small-scale in nature.

Freshwater culture output is also seen to be increasing as a result of improved productivity of existing ponds and the development of new ponds. However, the expansion will not be as great as that for brackishwater culture activities although a shortfall in the availability of seed stock for the latter is expected to pose a growing constraint to the expansion of its production. Freshwater prawn culture shows excellent potential for accelerated development.

Fish culture production in paddy fields is expected to increase through 1988 with improvements in productivity and the utilisation of additional fields for fish culture; however, the increasing use of pesticides in the production of rice is likely to pose a serious constraint for this sector.

The inland capture fishery is not expected to expand during the coming years in view of the low yield per fisherman/effort; the high level of exploitation; current and potential pollution problems from increasing population pressure; competing uses of inland waters (eg. irrigation); and the attractiveness of other economic activities.

3. Production

During the period 1980-85, total aquatic production increased by 28%. Marine landings continue to be the main contributor to total production. The growth percentage of the marine capture sector (29%) is well below that of the cultured fish sector (49%). The total 1985 cultured fish output was only 298 880 MT or 12.6% of the total aquatic landings. Inland open water capture production has virtually stagnated since 1980.

Table 5: Fisheries production by sub-sectors, 1960-85 (in MT)

Year	Total	Marine Fishery		Inland Fishery					
		Sub-total	Open water	Sub-total	Brackish water	Culture Fresh-water	Cage	Paddy field	
1960	756 765	410 043	346 722	249 674	97 048	43 078	39 801	-	14 169
1968	1 159 040	722 512	436 528	320 410	116 118	43 528	53 348	160	19 082
1969	1 214 399	785 344	429 055	314 201	114 854	51 876	42 180	574	20 224
1970	1 228 512	807 391	421 121	286 519	134 602	55 908	51 345	3 126	24 223
1971	1 244 555	820 447	424 108	285 745	138 363	60 788	54 647	399	22 540
1972	1 268 909	836 289	432 620	301 412	131 208	51 203	50 100	10 196	19 709
1973	1 277 512	888 518	388 994	249 592	139 402	60 481	51 870	345	26 706
1974	1 336 268	948 566	387 702	240 893	146 809	66 756	54 739	503	24 811
1975	1 390 074	996 856	393 218	228 571	164 647	78 776	55 403	480	29 988
1976	1 482 942	1 081 589	401 353	246 711	154 642	80 158	52 631	470	21 383
1977	1 571 852	1 157 691	414 161	254 243	159 918	87 604	54 341	272	17 701
1978	1 647 664	1 227 386	420 278	249 146	171 132	87 995	57 680	330	25 067
1979	1 748 397	1 317 744	430 653	248 161	182 492	93 644	59 359	369	29 120
1980	1 849 662	1 394 810	454 852	254 498	200 354	97 898	66 379	582	35 495
1981	1 914 505	1 408 272	506 233	264 983	241 250	112 916	78 224	581	49 529
1982	1 997 541	1 490 719	506 822	265 348	241 474	129 279	69 245	890	42 060
1983	2 214 476	1 682 014	541 497	265 562	275 935	134 072	79 681	982	52 165
1984	2 252 989	1 712 804	548 205	269 321	273 884	142 404	76 528	1 052	50 880
1985	2 375 470	1 810 000	564 470	265 690	298 880	150 100	82 430	1 100	65 250

3.1 Marine fisheries

The relative rapid growth in marine capture fish landings over the past decade has mainly been due to the large increase in the number of powered boats which grew from some 17 500 units in 1976 to 69 700 in 1980 and 85 100 in 1982. The average annual expansion of marine production was 5% during the period 1980-85, with major landings coming from Sumatra, Java and Sulawesi.

During 1985, Sumatra produced 28% or 668 660 MT of the total marine landings of 2 375 470 MT. The shares of Java and Sulawesi were 28.5% and 18%, respectively.

Table 6: Marine fisheries production by major species, 1976-82 (in MT)

Species	1976	1977	1978	1979	1980	1981	1982
FISHES	918 936	976 700	1 029 335	1 120 669	1 218 167	1 206 985	1 326 447
- Tuna	9 354	13 204	13 412	17 899	20 898	25 239	28 080
- Skipjack	30 851	30 410	33 515	42 834	51 818	57 430	61 577
- Eastern little tuna	52 235	62 382	55 244	66 582	76 797	87 731	106 012
- Narrow barred king mackerel	28 013	26 359	26 394	27 711	35 156	37 382	42 727
- Indian mackerel	61 647	71 144	78 790	84 485	83 590	85 747	99 311
- Scads	72 887	67 596	69 284	78 162	64 107	65 637	77 366
- Indian oil sardinella	41 400	62 507	49 617	45 625	52 354	44 172	56 987
- Black pomfret	6 976	6 059	5 732	5 988	6 959	8 142	6 508
- Silver pomfret	7 284	5 432	5 750	8 809	9 419	8 469	9 746
- Yellow tail	8 505	9 777	8 403	10 087	9 953	7 835	8 156
- Trevallies	41 851	40 528	36 212	47 094	47 533	48 189	52 394
- Fringescale sardinella	55 565	65 054	75 627	79 168	92 646	108 714	98 980

- Giant sea perch/ barramundi	11 138	8 817	9 314	8 456	10 938	9 845	9 697
- Mullet	14 323	13 066	12 685	14 420	15 964	15 390	15 943
- Hairtail, cutlass fishes	11 806	10 946	13 267	12 717	11 694	10 735	15 846
- Croakers, drums	27 265	26 340	25 960	26 747	34 344	18 641	18 136
- Anchovies	68 532	80 519	105 388	96 147	101 002	99 681	104 575
- Others	369 303	376 560	505 741	447 728	492 995	468 004	514 406
CRUSTACEANS	113 051	129 004	131 508	137 092	117 879	140 042	108 499
- Giant tiger shrimp	9 252	7 716	9 275	9 027	10 703	9 100	10 068
- Banana shrimp	18 974	24 346	31 597	31 620	38 554	22 196	30 693
- Metapenaeus shrimp	12 611	13 848	11 446	14 652	13 909	12 095	15 961
- Panulirid spiny lobster	1 570	697	285	258	216	996	562
- Other shrimp	65 840	78 672	75 848	75 618	49 190	66 957	43 206
- Mud crab	1 818	728	887	1 081	872	1 684	1 930
- Others	2 966	2 997	2 170	4 836	4 435	27 014	6 079
MOLLUSCS	35 972	45 840	58 336	51 069	49 898	50 947	45 200
OTHER AQUATIC ANIMALS	9 880	2 049	2 586	2 969	1 018	3 049	3 094
SEWEEED	3 750	4 098	5 621	5 945	7 848	7 251	7 479
Total	1 081 589	1 156 691	1 227 386	1 316 744	1 394 810	1 408 272	1 490 719

Source: Fisheries Statistics of Indonesia, 1982.

Shrimp and tuna remain the major products for export purposes. Marine shrimp landings were slightly affected by the trawler ban imposed in 1980 and 1981. Currently, landings appear to have stabilised at around 110 000 MT per annum. The brackishwater shrimp culture sector is expected to contribute significantly to total production (and exports) in the near future in view of the extensive land areas available, recent capital investment and the introduction of modern technology and know-how.

Table 7: Shrimp production, 1983-85 (in MT)

	<u>1983</u>	<u>1984</u>	<u>1985</u>
Marine fishery	111 384	103 360	108 630
Inland open water fishery	6 924	7 337	-
Culture (brackishwater)	27 754	32 093	36 450
Total	146 062	142 790	145 080

Tuna resources form an important part of the Indonesian production and export potential. The MSY of skipjack is estimated at 275 000 MT per year, while other tunas have an annual MSY of 166 000 MT. A skipjack fishery has developed rapidly in the Eastern part of Indonesia, particularly in North Sulawesi, Moluccas and Irian Jaya.

Table 8: Production of tuna and tuna-like fishes in Indonesia, 1974-83
(in 1 000 MT)

	Eastern	Western	Total	Total by category		
	Indian Ocean	Pacific Ocean		Tuna ¹	Skipjack	Tuna-like ²
1974	14.1	72.3	86.4	11.3	28.0	47.1
1975	12.5	74.0	86.5	12.0	27.2	47.3
1976	17.0	75.5	92.4	9.3	30.8	52.2
1977	21.5	84.5	106.0	13.2	30.4	62.4
1978	16.0	86.1	102.1	13.4	33.5	55.2
1979	18.5	108.7	127.3	17.9	42.8	66.6
1980	26.1	123.4	149.5	20.9	51.8	76.8
1981	27.4	143.0	170.4	24.2	57.4	88.8
1982	38.4	157.3	195.7	28.1	61.6	106.0
1983	41.8	164.9	206.8	26.1	76.8	103.9
1984	45.0	181.0	226.0	30.5	77.6	118.0

1 Mostly yellowfin

2 Other tunas such as kawakawa, longtail tuna, bullet and frigate tunas

In the industrial marine fishing activities, joint ventures are mostly involved in the catching of shrimp and tuna. These joint ventures are mainly between Indonesian and Japanese interests. In the tuna industry, joint ventures with various nations are operational.

3.2 Inland fisheries

The inland fishery sector can be subdivided into capture fisheries and culture fisheries. Overall, production of this sector has shown only a limited increase, from 454 852 MT in 1980 to 564 470 MT in 1985. This can be blamed entirely on the poor performance of the inland open water capture fisheries which, as mentioned earlier, has been stagnant since the early 1980s, at about 265 690 MT. Major producers of inland aquatic products are Kalimantan (52%), Sumatra (11%) and Java (8%).

Aquaculture production has shown a steady growth over the past decade. Production per hectare as well as acreage expansion have significantly contributed to the increase in production. By 1984, there were 225 197 ha of brackishwater ponds, 40 942 ha of freshwater ponds and 113 732 ha of paddy fields. Java is the main producer of cultured fish contributing about 50% of total production.

Table 9: Freshwater pond culture production by major species, 1976-82 (in MT)

	1976	1977	1978	1979	1980	1981	1982
Common carp	17 465	20 937	14 830	15 600	16 742	19 784	19 815
Java barb	7 490	8 553	9 495	9 766	9 789	12 456	11 954
Nilem carp	4 123	5 811	7 192	7 163	14 409	16 914	13 655
Mozambique tilapia	2 000	6 804	10 522	11 732	8 146	9 506	7 402
Nile tilapia	1 115	3 523	4 955	4 709	5 609	5 772	5 281
Giant gourami	2 972	2 381	3 060	3 255	3 727	4 137	3 734
Snakeskin gourami	217	1 016	653	887	873	1 051	1 071
Kissing gourami	4 261	2 608	3 731	3 843	4 285	4 959	3 239
Catfishes	186	191	298	310	357	537	610
Others	12 802	2 517	2 944	2 094	3 242	3 108	2 584
Total	52 631	54 341	57 680	59 359	66 379	78 221	63 245

Table 10: Cage culture production by major species, 1976-82 (in MT)

	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>
Common carp	445	210	334	308	310	279	498
Java barb	10	6	0	0	-	0	-
Mozambique tilapia	-	6	-	-	-	-	27
Others	15	50	56	61	272	311	364
Total	470	272	390	369	582	581	890

Table 11: Brackishwater culture production by major species, 1976-82 (in MT)

	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>
FISHES							
Milkfish	44 027	48 641	48 287	46 187	52 922	61 041	73 330
Mulletts	2 200	3 937	3 489	4 856	3 272	4 158	4 463
Giant sea perch/ barramundi	500	659	571	745	850	883	966
Mozambique tilapia	7 746	8 075	8 049	10 165	7 925	10 105	11 667
Others	14 064	4 830	5 802	7 265	8 914	8 092	7 771
Total	55 537	66 142	66 198	69 218	73 883	84 279	98 197
CRUSTACEANS							
Giant tiger shrimp	5 099	4 079	4 600	6 965	6 317	7 219	8 783
Banana shrimp	5 003	10 475	10 584	10 070	9 436	11 867	10 634
Macrobrachium shrimp	3 957	6 618	6 434	6 821	7 879	9 025	11 185
Mysids	-	43	12	69	164	130	147
Mud crab	562	247	167	501	217	390	323
Total	14 621	21 462	21 797	24 426	24 015	28 637	31 082
Grand total	80 158	87 604	87 995	93 644	97 898	121 916	129 279

Table 12: Paddy field culture production by major species, 1976-82 (in MT)

	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>
Common carp	18 275	15 527	17 313	18 009	20 751	27 016	20 304
Java carp	1 462	345	1 783	3 269	5 097	4 228	4 131
Nile carp	122	215	226	181	333	166	129
Mozambique tilapia	169	477	1 021	644	983	996	1 124
Nile tilapia	74	90	82	119	163	204	323
Snakeskin gourami	77	127	86	96	145	261	290
Kissing gourami	349	30	28	67	176	22	12
Catfishes	49	125	101	109	315	290	251
Others	806	765	4 427	6 626	7 532	15 346	15 496
Total	21 383	17 701	25 067	29 120	35 495	49 529	42 060

Table 13: Inland open water capture fishery production by major species, 1976-82 (in MT)

	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>
FISHES							
Common carp	3 276	3 274	2 843	1 906	4 235	3 211	2 567
Hoven's carp	5 637	5 319	6 633	5 004	5 136	5 096	5 016
Asian barb	6 895	8 173	8 891	9 560	10 896	10 689	11 235
Java barb	12 598	12 346	18 663	16 550	19 431	22 826	21 882
Mozambique tilapia	9 232	14 533	12 038	11 374	9 150	6 929	8 269
Catfishes	3 485	11 558	10 388	10 865	13 335	12 257	12 118
Snake heads	29 148	35 115	35 869	37 155	36 579	35 385	32 216
Glass cat fishes	11 069	9 388	10 168	10 933	11 195	11 865	12 832
Indonesian snake head	9 946	9 513	8 145	8 189	8 801	8 482	7 619
Snakeskin gourami	23 123	22 897	19 641	21 288	20 399	21 691	26 959
Kissing gourami	15 052	17 948	13 054	11 490	13 065	12 529	14 697
Knife fishes	5 700	4 746	5 911	5 786	5 770	6 054	5 698
Sleeper gobies	586	512	767	833	893	776	809
River eels	176	729	694	482	567	605	609
Others	103 389	87 176	83 483	84 968	82 186	92 706	89 595
Total	299 312	243 227	297 163	296 383	241 638	251 101	252 485
CRUSTACEANS							
Freshwater giant shrimp	1 940	2 759	4 193	3 691	3 746	3 139	3 427
Freshwater shrimp	2 243	3 257	2 981	2 700	2 474	2 271	2 229
Athyids	385	81	63	197	264	159	1 054
Others	1 342	4 106	4 050	3 450	4 529	6 585	4 603
Total	5 910	10 203	11 287	10 038	11 013	12 154	11 313
MOLLUSCS							
Snails	441	159	64	456	409	485	452
Clam (Mussels)	131	172	174	195	222	12	243
Others	52	136	48	88	369	498	104
Total	624	467	286	740	1 000	995	799
OTHER AQUATIC ANIMALS							
Frogs	402	139	226	519	418	470	642
River and lake turtles	3	33	7	305	278	4	-
Crocodiles	266	-	1	-	6	-	-
Others	194	174	176	176	145	259	109
Total	865	346	410	1 000	847	733	751
Grand total	246 711	254 243	249 146	248 161	254 498	264 983	265 348

3.3 Employment

As mentioned earlier, the Indonesian fishing industry is basically a small-scale industry. Of the six million people depending on fisheries for their livelihood, the total number of fishermen/fish farmers active in the small-scale sub-sector exceeds two million.

In 1984, nearly three million people were employed in marine and inland open water fisheries, and aquaculture. This equals about 5% of the total Indonesian labour force. Of the workforce active in fisheries, about half are marine fishermen, 15% inland open water fishermen and 40% aquaculturists. Of the aquaculture farmers, some 75% operate freshwater units, the remainder brackishwater ponds.

The number of persons active in the fishing industry continues to increase, but this increase is not translated into a proportional increase in production as most resources currently exploited by small-scale fishermen are already subject to a certain degree of overexploitation. In fact, productivity per vessel has shown a decreasing trend over the years.

The extent of marine fishing activities is very much related to the distribution of the population. Fishermen are mainly found on Java, the eastern part of Sumatra and South Sulawesi. These three areas account for about 50% of the total number of fishermen.

Table 14: Number of fishermen, fishfarmers, production and productivity, 1980 and 1984

Activities	Number of fishermen & fish farmers		Production (in 1 000 MT)		Productivity per person (MT)	
	1980	1984	1980	1984	1980	1984
	Capture	1 582 394	1 733 425	1 649 308	1 982 125	1.19
Marine	930 731	1 294 472	1 394 810	1 712 804	1.44	1.32
Inland	411 663	438 953	254 498	269 321	0.62	0.61
Culture	849 121	1 150 294	200 354	278 864	0.24	0.24
Total	2 231 505	2 883 719	1 849 662	2 260 989	0.83	0.78

Source: Fisheries Statistics of Indonesia, 1984

Table 15: Number of marine fishermen by category, 1976-82

Fishermen category	1976	1977	1978	1979	1980	1981	1982
Full time	423 516	435 416	442 914	468 676	516 853	579 336	585 746
Part time (major)	297 867	292 720	297 922	319 511	350 224	411 792	433 573
Part time (minor)	90 129	87 811	91 129	95 810	103 654	113 521	151 545
Total	811 512	815 947	831 965	883 997	970 731	1 104 649	1 170 864

Table 16: Number of inland open water capture fishermen by category, 1976-82

Fishermen category	1976	1977	1978	1979	1980	1981	1982
Full time	167 862	144 117	119 172	112 832	150 097	160 636	157 637
Part time (major)	223 750	198 492	163 647	156 778	192 320	206 732	196 741
Part time (minor)	90 950	59 411	47 941	45 874	69 246	78 408	85 227
Total	482 562	402 020	330 760	315 484	411 663	445 776	439 605

Table 17: Number of fishfarmers by type of culture, 1976-82

Type of culture	1976	1977	1978	1979	1980	1981	1982
Brackishwater pond	95 060	89 439	94 746	99 956	113 162	111 269	117 034
Freshwater pond	489 153	398 179	425 518	591 495	519 634	610 476	657 447
Cage	4 133	3 060	4 602	4 813	5 264	5 439	18 152
Paddy field	157 546	118 893	139 329	130 875	211 041	236 248	204 436
Total	745 892	609 571	664 195	827 139	849 121	963 432	997 069

The role of women and children in the fishing communities varies with the various geographical areas. Their activities consist primarily of the collection of seaweeds, shellfish picking along the shore and working in the processing industry. The proportion of women in the total fisheries' labour force is estimated at between 7.5 - 10%.

3.4 Income

The rapid changes in the capture sector, in terms of more powered boats and more modern gear, have not resulted in a proportional increase in income for the fishermen. This is partly attributed to the ineffective use of boats and gears, and the decreased landings.

Another factor that negatively influences the increase in income is the relationship between fishermen and money lenders. Fishermen and fishfarmers often find it difficult to fulfil administrative requirements imposed by formal money institutions. On the other hand, it can also be argued that these formal money lending institutions have so far been unable to efficiently absorb the services provided by the money lenders.

Table 18: Annual income per caput of fishing operator's households and fishing labourer's households in marine fisheries on the North Coast of Java, 1975 and 1980 (in 1 000 Rp)

Scale of undertaking			1975 ¹	1980	
Fishing labourer's household	Total		66.6	126.5	
	Small-scale fisheries	Without boat	31.7	59.1	
		With non-powered boats	Canoe	51.5	88.2
			Small boat	61.2	85.8
			Medium boat	55.3	132.4
			Large boat	127.5	125.3
		Outboard motor	142.6	362.2	
	Medium-scale fisheries	Sub total	235.5	1 033.5	
		10 GT	-	279.3	
		10 - 50 GT	-	1 027.4	
		50 - 200 GT	-	3 259.8	
		200 GT	-	18 766.0	
	Fishing operator's household			45.1	65.0

¹ Adjusted with increase of living expenditures in Jakarta, Semarang and Surabaya from May 1975 to April 1980 totalling 94.3%.

The middlemen provide essential services to fishermen such as financial assistance and credit, in particular during the off-seasons. Such an arrangement ties the fishermen to the middlemen who are also usually the buyers of their produce, and thus fully control the prices.

4. Disposition of catch

With the exception of frozen shrimp, frozen and canned tuna and a selective number of other products, the entire aquatic production is consumed locally. Major national consumption centres are cities located on the islands of Java and Bali.

About half of the marine landings destined for domestic consumption are processed into dried and salted products with smaller quantities being fermented, smoked, canned or boiled in brine. The majority of these processing activities takes place at cottage industry level.

The other half of the marine landings is offered in fresh state to the consumers. The volume of fresh (and frozen) fish supplies is gradually increasing due to the introduction of more modern facilities such as ice-making, freezing and cold storage equipment.

Freshwater fish supplies are mostly destined for the domestic market in live, fresh or smoked forms.

Table 19: Disposition of marine and inland capture fisheries landings, 1980 (in MT whole fish equivalent)

	<u>Marine</u> <u>fish</u>	<u>Inland</u> <u>fish</u>	<u>Total</u>	<u>%</u> <u>of total</u>
Fresh fish	657 329	167 707	825 036	50.0
Dried/salted fish	516 142	76 264	592 406	35.9
Boiled fish	83 058	997	84 055	5.1
Fermented fish	37 426	883	38 309	2.3
Smoked fish	30 802	6 142	36 944	2.2
Other processed fish	9 946	1 701	11 647	0.7
Freezing	47 408	804	48 212	2.9
Canning	9 196	-	9 196	0.6
Fishmeal	3 503	-	3 503	0.2
Total	1 394 810	254 498	1 649 308	100.0

Note: No data are available on the disposition of aquaculture production.

Source: Directorate General of Fisheries, Indonesia

Table 20: Disposition of marine fishery production, 1976-82 (in MT)

	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>
Fresh	553 467	559 557	591 002	624 350	657 329	690 685	778 520
Dried/salted	316 809	384 109	435 738	470 343	516 142	464 944	451 347
Boiled	52 044	69 600	65 985	76 151	83 058	81 836	99 003
Fermentation							
- blachan	50 143	52 472	55 135	53 860	29 053	52 160	37 522
- fish peda	4 040	3 798	5 055	5 650	7 860	8 375	8 956
- fish sauce	227	282	262	482	513	538	269
Smoked	18 829	22 384	24 461	27 986	30 802	34 901	42 814
Others	6 922	8 525	5 895	9 445	9 946	10 863	16 000
Freezing	54 190	54 014	33 703	36 439	47 408	48 555	40 683
Canning	405	10 832	6 015	8 540	9 196	10 561	9 844
Fishmeal	6 504	12 138	4 135	4 494	3 503	4 856	5 761
Total	1 063 580	1 157 691	1 227 386	1 317 744	1 394 810	1 403 272	1 490 719

4.1 Per capita consumption

Fish has traditionally been the principal source of animal protein in the Indonesian diet. The Government estimates that fish provides about 62% of the domestic animal protein supply, followed by meat (23%), dairy products (9%) and eggs (6%). Due to the uneven distribution of the population, per capita consumption varies very much from area to area. Per capita consumption in Java is 6.3 kg per year, while it is 27.9 kg per year in Irian Jaya and as high as 41.4 kg in Kalimantan. The average annual per capita consumption of fish was only 13.5 kg in 1984, compared to a national goal of 22.5 kg.

Table 21: Per capita consumption, 1978-84

<u>Year</u>	<u>Kg</u>	<u>Year</u>	<u>Kg</u>
1978	11.43	1982	12.80
1979	11.80	1983	13.7
1980	12.19	1984	13.5
1981	12.07		

A major point of worry is the regional imbalance between production/potential on the one hand and population on the other. Java being the primary domestic fish market for fishery products in Indonesia has 70% of the nation's population but produces less than 30% of the total domestic fish landings. This serious imbalance between supply and demand necessitates a well functioning transport network from the outer islands to the densely populated urban centres, and the introduction of modern preservation methods. Unfortunately, both are inadequate.

Per capita consumption is expected to increase at a slow rate as most of the increase in available supplies will be absorbed by the rapidly increasing population.

4.2 Exports and imports

In view of the declining revenue from oil and gas exports, foreign exchange earnings from seafood exports have taken a more prominent place. However, only a minor portion of domestic production is being exported. In 1984, this was a mere 3.3%. Exports consist primarily of high-value products, such as shrimp and tuna. These two items have dominated the export scene since the early beginning of the Indonesian export-oriented industry.

Shrimp export volumes remained relatively stable until 1980 after which they dropped drastically due to the imposition of the trawler ban in traditional production areas. Shrimp exports have since gradually recovered to reach 30 980 MT in 1985.

Tuna exports have also increased rapidly. Most of the tuna caught is exported, although small tuna are consumed locally in either fresh, smoked, boiled or salted forms. The majority of exports are directed towards canneries in the region, though an increasing volume of sashimi grade yellowfin and bigeye is exported to Japan. A decline in exports of frozen tuna for canning purposes is anticipated, as more tuna will be processed in the domestic canneries for the production of canned tuna for the export market.

In 1983, about 96% of the fisheries exports originated from marine fisheries, and an estimated 60% of this volume was produced by large scale, industrial fleets. The dependence on tuna and shrimp as major and almost sole export items makes the entire export sector very vulnerable.

Fishery exports were reported to have reached 84 490 MT valued at US\$ 259.5 million (fob) in 1985. For 1986, a further increase in both volume and value is anticipated, namely to 96 300 MT and US\$ 350.3 million, respectively.

International marketing of shrimp, tuna and other seafood products is often in the hands of multinational corporations. Domestic companies involved in exports are mostly of a substantial size and also undertake other activities. Several state-owned companies have successfully entered the field of shrimp and tuna production and exports.

The major market for Indonesian products is Japan. This is partly the result of the involvement of the many Japanese joint ventures and the proximity to Japan. The USA and Europe are the next major outlets. A substantial volume of fresh and frozen fish is exported to Singapore, often directly by the fishing vessels.

Table 22: Volume and value of fishery product exports, 1978-85 (in MT and US\$ 1 000 fob)

	1978		1979		1980		1981	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Shrimp	32 319	161 954	34 743	200 485	31 934	180 905	24 971	162 827
Tuna/skipjack	9 426	6 193	9 797	8 005	11 139	12 900	14 013	15 416
Other marine								
fishes	4 202	1 574	6 712	2 227	20 169	6 473	15 303	5 747
Froglegs	2 325	6 236	2 657	7 184	1 612	4 754	2 778	9 431
Jellyfish	1 860	3 982	1 436	2 651	1 474	2 018	3 088	5 196
Shrimp crackers	1 332	2 190	1 841	3 549	2 551	3 921	3 188	5 605
Ornamental fish	359	96	399	114	473	136	364	114
Others	11 362	11 199	10 679	12 616	9 353	15 249	11 473	21 051
Total	63 485	193 424	68 264	236 827	78 705	226 354	75 178	225 387

	1982		1983		1984		1985	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Shrimp	25 576	181 640	26 166	194 447	28 025	195 552	30 980	202 710
Tuna/skipjack	18 788	19 863	20 311	14 776	14 702	10 674	17 890	13 770
Other marine								
fishes	26 336	9 975	NA	NA	8 429	3 919	9 100	4 610
Froglegs	1 517	3 585	3 296	8 753	2 200	4 122	2 800	6 570
Jellyfish	2 238	4 457	4 108	8 181	2 556	4 672	1 875	2 720
Shrimp crackers	2 647	5 010	-	-	-	-	-	-
Ornamental fish	217	98	196	166	204	190	235	470
Others	12 310	24 788	NA	NA	19 579	28 954	21 924	28 600
Total	89 629	249 416	NA	NA	75 695	248 063	84 490	259 450

Source: Fisheries Statistics of Indonesia, 1982

In the case of fishery product imports, a very rapid increase was evident, mainly due to the rise in fishmeal imports. However, preliminary 1985 statistics show that fishmeal imports during that year amounted to only 17 790 MT, a 75% decrease compared to 1982. Total 1985 imports were reportedly only 54 290 MT, valued at US\$ 23.9 million.

Table 23: Volume and value of fishery product imports, 1978-82 (in MT and US\$ 1 000 cif)

	1978		1979		1980		1981		1982	
	Volume	Value	Volume	Value	Volume	Value	Volume	Value	Volume	Value
Fishmeal	18 948	2 247	27 957	3 338	34 195	15 997	53 033	33 626	72 008	38 995
Fish canned	7 527	?	2 556	2 105	1 763	2 438	1 120	1 283	1 781	2 646
Agar-agar	?	557	62	393	159	848	43	301	262	542
Fish oils	?	247	248	276	195	327	287	312	324	364
Fresh/frozen Fish	31	72	44	107	2 853	666	7 437	1 826	7 670	2 098
Others	139	244	151	497	353	695	1 300	1 127	1 285	901
Total	27 059	10 029	31 018	6 716	39 517	20 971	63 220	38 475	83 410	45 544

4.3 Domestic market

Distribution in domestic markets is almost entirely in the hands of the private sector. Much of the fish is brought in from outlying islands into Java and other urban centres.

Marketing procedures vary from place to place. Fishermen can sell their catch directly to consumers or through brokers, middlemen or by auction. Except for Java, small-scale fishermen tend to sell their produce to middlemen because of their weak bargaining position, non-availability of local outlets and financial dependence on middlemen.

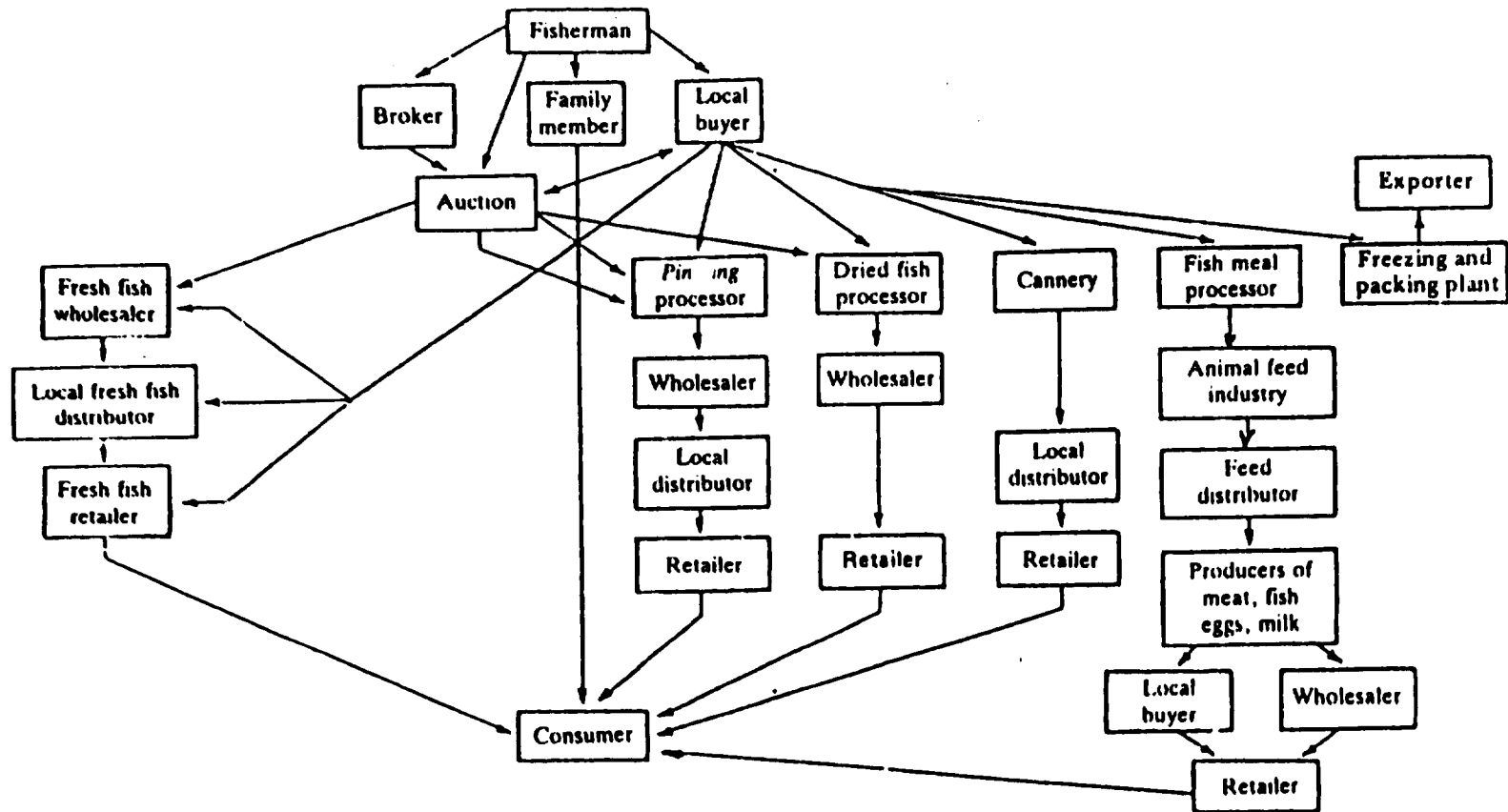
The marketing of fish through auction is best established on the island of Java where most landing places are provided with auction halls. However fishermen with small catches usually do not sell through auction, but directly to fish dealers/collectors, in which case they do not have to wait too long for payment.

The annual sales through the auction markets vary considerably, depending on the size and intensity of fishing activities, ranging from 11 MT at Painan, West Sumatra to 52 000 MT at Pekalongan, Central Java.

The fresh fish marketing chain involves many transactions before the fish reaches the final consumers. Fish is sold by the fishermen at coastal landing sites to buyers who then bring this catch to nearby auctions. Wholesalers buy the fish, pack and transport it to urban markets where it is again sold or auctioned to wholesalers. The dried fish marketing chain is more direct; sales are from provincial traders to urban wholesalers and retailers.

In general, fresh fish is sold by local fish dealers operating fixed-location shops or stalls inside market places where other food and household goods are also sold. Salted fish outlets are mostly in the vicinity of the consumers' homes. Fish pedlars operate on a small scale, often in an unorganised way and, therefore, do not provide a permanent service to the consumers in a specific area. General food stores that also sell household goods are very common in the country. In most cases, such stores sell canned fish and sometimes salted as well as smoked fish. Supermarkets are found only in the larger towns, but the number is increasing every year. These markets are generally well-organised and sell many kinds of local and imported canned fish products, salted fish and smoked fish of high quality, as well as locally made speciality products such as fish paste and shrimp crackers.

Figure 1: Structure of fish marketing and distribution



5. Handling and processing

5.1 Handling on board and on shore

Almost 98% of the fish caught in Indonesia are landed by artisanal fishermen who fish from small, canoe-like boats with handlines, long lines, gillnets and seinenets. Only 18% of the country's 274 000 fishing boats are powered, mainly with outboard motors.

Fish handling practices onboard fishing vessels in Indonesia are rather primitive. Ice is expensive and generally not taken on board except in the case of high-valued species such as shrimp, pomfret and red snapper. Block ice, which is crushed at sea, is preferred to other kinds of ice. Bulk icing is the most popular storage method. Sorting of fish is done only in the case of certain valuable species needing special care.

Chilled sea water (CSW) tanks were successfully introduced in purse-seine fishing mainly for oil sardine (Sardinella longiceps). Since its introduction in 1983, 78 purse-seiners operating in the Straits have been equipped with CSW fish tanks. The bigger boats such as double-rig trawlers, tuna long-liners, skipjack purse-seiners and carrier vessels have refrigerated holds and freezers.

The double-rig shrimp trawlers dump most of the by-catch back into the sea, although some higher value fish is retained. It is reported that around 250 000 MT of by-catch of shrimp trawlers are not utilised but thrown back to the sea every year in the eastern part of Indonesia.

Shrimp are frozen whole and kept in cold storage, for further processing and packing on shore. The same process holds for skipjack, but other tuna is usually eviscerated before freezing and storage, depending on the final product use.

The Indonesian fisheries scenario is characterised by small villages scattered along the coast of its many islands, thus making the provision of facilities such as jetties, auction halls, potable water supplies and ice more difficult. This results in considerable quantities of fish remaining un-iced during handling and auctioning. Where icing is practised, this is usually carried out several hours after catching. Ultimately, the end products are of low quality due to poor handling. About 20% of the high-valued raw material (shrimp, etc) shows advanced deterioration on arrival at the processing plants.

Generally, upon arrival at the port of landing, the catch is unloaded from the holds and put into bamboo or rattan baskets. Plastic trays or containers are being introduced in place of the traditional baskets at some pilot landing places. Sorting, if any, according to species and quality, is done simultaneously at this stage. The fish is re-packed in ice for further forwarding to distant markets or transported un-iced to local processing plants and markets. Rural consumers do accept un-iced fish; however, in the bigger cities, the fish marketed is usually iced. Trucks or pick-up vans are the vehicles mostly used for fish transport. Insulated and refrigerated vans are gradually replacing these within and between big cities. It is noted that about 20-30% of the fish caught in remote areas are spoilt, mainly because of the unavailability of ice.

The Government has attempted to improve the overall quality level by increasing the number of ice factories and introducing fish containers and insulated boxes. Infrastructure and modern technology are also being provided to processors especially in the fish drying sector.

Freshwater fish species caught in brackishwater are handled as poorly as marine products on board fishing vessels, with the exception of freshwater cultured species which are usually handled carefully and distributed alive.

5.2 Processing technology and industry structure

The bulk of 1985 landings consisted of pelagic and demersal fish which were marketed for domestic consumption. About 50% of these is processed into dried, boiled, smoked or fermented products because the fish cannot be distributed fast enough. As the distribution process is long and slow, rapid deterioration, physical deformity and contamination are common.

Fish processing for the domestic market is done largely on a cottage-industry level. In 1980, over 8 000 traditional processing units operated throughout the country. These processed a total of 763 000 MT of fish accounting for about 46% of all the domestically marketed fish. More than 50% of the processors handle salted and dried fish.

Dried, salted, boiled-in-brine and fermented fish products remain extremely important in the national fish supply/consumption picture due to their popularity, low price, and easy storage and transport. Both pelagic and demersal fish are used as raw materials.

Boiling in salt solution is very popular for short-term preservation. Pelagic fish species such as chub mackerel, skipjack and little tuna are mainly used as raw material.

Smoking is done either as a drying process or as a flavouring process. The dried product has a long shelf life while the relatively wet product, which is a delicacy, is rather perishable.

Due to the poor process technology and hygiene practices observed, cured fish products in Indonesia deteriorate rather rapidly. In general, there has been little improvement in the technique of fish curing, except in the use of improved packaging of some speciality products. There is also a lack of good quality salt in some remote areas where fish supply is abundant throughout the year. The moisture in smoked fish is usually high because drying is carried out for a fixed time span regardless of the size of fish. It is also very much influenced by the weather. Insecticides are also sometimes applied during the drying process to deter insect infestation.

In the case of fish canning, canneries almost exclusively utilise pelagic fish, particularly oil sardines. For this reason, cannery operations are located mainly in the area of the Bali Straits. Fishmeal production usually takes place in conjunction with canning. New and bigger canneries are being planned mainly for tuna canning.

5.3 Quality control and existing standards

An inspection and quality control programme for both domestic consumption and export products has been established. It is a joint regulation on the quality improvement of fishery products issued by the Directorate General of Fisheries and the Directorate for Drug and Food Control (Ministry of Health). The regulation requires plants to comply with minimum standards of construction, hygiene and sanitary operation.

The Directorate for Standardisation, Normalisation and Quality Control which certifies that export products conform to standards, does not, however, certify fish products for export. This is instead done by fishery products quality testing and development laboratories. Twenty-four such laboratories have been built throughout the country. At central level in Jakarta, a newly set-up National Centre for Fish Quality Control and Fishery Processing Development functions as a guiding laboratory. In addition, 20 provincial fishery services have been appointed as sample agencies. Products sampled and tested are frozen shrimp, frozen froglegs and frozen tuna.

All export products require an 'Export Quality Certificate' issued by the Directorate of Fisheries following inspection and analyses of the consignment. In addition, certain types of fish products have to be examined by the Ministry of Health and receive examination certificates.

The main work of inspection laboratories is to certify frozen shrimp, froglegs and frozen tuna for export. Sensory and microbiological analyses are performed and a fee is charged for this service.

On 5 January 1986, revised quality standards for frozen shrimp, froglegs and tuna came into effect. The programme has not been fully implemented yet. Partly as a consequence, Indonesia faces problems in exporting overseas especially to some European countries and the USA, eg. automatic block-listing of shrimp by USFDA.

The official inspection system does not always prevent contaminated batches from being exported. The general opinion is that laboratory testing facilities and personnel cannot cope with the quantity of samples to be tested. In-plant quality control would more effectively improve standards than end-product quality control.

6. Infrastructure

The Government recognises that geographic distribution and capacity of existing fishing ports, fish landing sites, ice plants, cold storage and freezing facilities, boatbuilding and repair facilities, and other support services are inadequate to facilitate the required expansion of fish production, domestic supplies and exports in an efficient and cost-effective manner. The Government is aware that failure to increase the number of facilities and upgrade existing ones will lead to serious shortcomings in the future supply of food fish to its increasing population.

6.1 Fishing ports

Except for a few large ports built close to major concentrations of fishermen's villages, most landing places are very small. These smaller ports are scattered all over the country, but their number, size and available facilities are still considered insufficient to serve the industry adequately and to allow for an increase in quantity and quality of the products landed. The Government, with financial assistance from the Asian Development Bank and the Islamic Development Bank, has embarked on an ambitious plan to build a large number of new ports and upgrade existing ones.

There is a substantial number of shipyards, but only a few can produce steel-hull vessels. Technical know-how is also lacking. Many wooden boat-building yards are confronted by increasing costs and difficulty in obtaining high quality wood. Repair facilities are generally insufficient in number and substantial delays in repairs are normal.

6.2 Vessels

In 1982, of the 304 752 fishing establishments, 9% did not own a boat, 65% owned non-powered boats while 25% owned motorised vessels. The number of establishments operating motorised vessels has increased rapidly over the past years.

In 1983, 99.8% of the capture units could be considered as belonging to the small-scale fishermen's fleet. This sector also accounted for 98% of the total marine production.

Table 24: Number of marine fishing boats by size of boat, 1976-82

Size of boat	1976	1977	1978	1979	1980	1981	1982
Non-powered boat							
Dug-out boat	87 655	91 621	95 392	99 135	102 359	106 759	102 454
Plank-built boat							
small	83 781	77 373	67 406	73 936	76 066	71 389	70 653
medium	46 758	48 731	47 786	43 352	40 375	41 580	36 036
large	10 050	10 503	11 234	8 972	7 607	6 221	6 263
Sub-total	228 244	228 228	221 121 ¹	225 804 ¹	226 866 ¹	225 949	251 446
Powered boat							
Out-board motor	7 746	9 601	13 226	17 343	26 523	31 105	55 265
Inboard motor	9 735	10 715	12 766	14 758	18 467	19 951	29 818
1 - 5 GT	(5 036)	(5 417)	(7 035)	(8 936)	(11 324)	(13 140)	(22 265)
5 - 10 GT	(2 598)	(2 866)	(2 387)	(2 639)	(3 417)	(4 001)	(4 548)
10 - 20 GT	(1 270)	(1 338)	(1 806)	(1 744)	(2 053)	(1 624)	(1 610)
20 - 30 GT	(500)	(702)	(780)	(1 124)	(1 205)	(877)	(1 023)
30 - 50 GT	(136)	(187)	(232)	(144)	(307)	(148)	(180)
50 -100 GT	(78)	(86)	(128)	(43)	(28)	(28)	(28)
100-200 GT	(83)	(57)	(78)	(77)	(80)	(77)	(82)
> 200 GT	(34)	(62)	(50)	(51)	(53)	(56)	(46)
Sub-total	17 481	20 316	25 992	32 101	44 990	51 056	85 085
Total	245 725	248 544	248 113	257 905	271 856	277 005	300 549

¹ Includes number of boats from East Timor, not separated by category.

Source: Fisheries Statistics of Indonesia, 1982

In 1980, the number of marine fishing boats was 271 856 increasing by an average of 4% to reach 313 640 in 1984. Although the number of motorised vessels has increased more than proportionally, sail-powered fishing vessels remain the major component of the marine fishing fleet, accounting for 70% of the total number of vessels in 1984.

Table 25: Number of boats in marine fisheries, 1980-84

<u>Year</u>	<u>Total</u>	<u>Powered boat</u>	<u>Outboard motor</u>	<u>Inboard motor</u>	<u>Sail fishing boats</u>
1980	271 856	44 990	26 523	18 467	226 866
1981	277 005	51 056	31 105	19 951	225 949
1982	300 549	85 083	55 265	29 818	215 466
1983	307 057	86 351	57 490	28 861	220 706
1984	313 640	93 711	61 789	31 922	219 929

Source: Fisheries Statistics of Indonesia, 1984

Table 26: Number of boats in inland open waters, 1980-84

<u>Year</u>	<u>Total</u>	<u>Non-Powered</u>	<u>Outboard</u>	<u>Inboard</u>
1980	134 417	130 870	3 259	288
1981	141 593	136 411	4 888	294
1982	133 475	128 011	5 151	313
1983	138 236	132 659	5 232	345
1984	133 989	128 358	5 246	388

Source: Fisheries Statistics of Indonesia, 1984

6.3 Gears

Usually, the dominance of a certain type of gear in a certain region is related to the availability and abundance of fish species accessible to a fishing community. The types of gears used range from simple handlines, troll-lines, pole-and-line, bottom longliners, traps, gillnets, seines, dragnets, trawls and so on. Of these, the otter trawl, seine, pole-and-line and the various gillnets are the major contributors to total production.

Table 27: Number of fishing units by type of fishing gear, 1982

<u>Types of fishing gear</u>			
<u>Trawl</u>		<u>Hook and line</u>	
Double rig trawl	188	Tuna long line	73
Otter trawl	453	Drift long line other than tuna	
Other trawl	171	long line	7 701
<u>Seine net</u>		Set long line	541
Seine, including lamparae	13 133	Skipjack pole-end-line	98 641
Danish seine	2 897	Troll line	39 214
Beach seine	7 202		
Purse seine	4 933	<u>Trap</u>	
<u>Gillnet</u>		Guiding barrier	8 494
Drift gillnet	65 749	Stow nets/tidal trap	3 732
Encircling gillnet	5 230	Portable trap	6 610
Shrimp gillnet	31 567	Other trap	11 046
Set gillnet	29 880	Muro-ami/coral fish trap net	324
<u>Lift net</u>		Shell fish collector	4 840
Boat/raft liftnet	6 493	Seaweed collector	2 593
Stake/fixd liftnet	12 536	Cash net, harpoon	21 271
Scoop net	6 274	etc.	
Other liftnet	8 442		

Source: Fisheries Statistics of Indonesia, 1982

6.4 Freezing, ice plants and cold storage facilities

Refrigeration equipment in Indonesia falls into two categories: those constructed from matched components and those which have 'evolved' from a variety of items. The latter are mostly small, old and based on limited technical knowledge and experience of the designers. The difficulty in obtaining suitable equipment has resulted in systems with dubious characteristics and questionable efficiency.

Most commonly used freezing methods in the country are air blast and contact plate freezing. There were 38 freezing units in 1980 with a daily freezing capacity of 284 MT. There appears to be only about 50% capacity utilisation of facilities.

At present, the majority of the facilities are used for shrimp and fish that are destined for export. A small portion of the facilities is utilised to preserve high-value fish being transported from remote production areas to consumption centres.

Table 28: Number and capacity of freezing plants by region, 1980

<u>Region</u>	<u>No. of freezing plants</u>	<u>Capacity (MT/day)</u>
Sumatra	9	38
Java	13	99
Bali and Nusa Tenggara	1	10
Kalimantan	5	20
Sulawesi	7	57
Moluccas and Irian Jaya	3	60
Total	38	284

Source: Directorate General of Fisheries, Indonesia

In 1980, there were 365 ice-making plants in the country with a total capacity of 7 000 MT/day. A large proportion of the country's ice production is concentrated in urban areas and much of it is devoted to non-fishery uses.

Table 29: Number and capacity of ice plants by region, 1980

<u>Region</u>	<u>No. of ice plants</u>	<u>Capacity (MT/day)</u>
Sumatra	97	21
Java	140	1 681
Bali and Nusa Tenggara	18	64
Kalimantan	54	1 681
Sulawesi	32	1 283
Moluccas and Irian Jaya	14	71
Total	365	7 019

Source: Directorate of Fisheries, Indonesia

There are about 69 cold storage facilities scattered throughout Indonesia with a total capacity of about 145 000 MT. These are mostly privately owned and are used primarily for shrimp and tuna destined for export or storage of fish for first class hotels and restaurants.

6.5 Canning facilities

There are 12 fish canneries in Indonesia, with a daily capacity of at least 198.5 MT. In 1982, about 9 844 MT of fish were processed by the canneries.

Following its introduction in Indonesia, canning could not develop quickly because of the absence of cans. There was no domestic tin-plate industry for a long time. However, the construction of a 130 000 MT/year capacity tin-plate factory by TINAH (state-owned tin mining company) will encourage a rapid development of the canning industry.

Local tuna canning companies complain about an insufficient supply of raw material as Indonesian producers prefer to export frozen tuna to canneries abroad where better prices are obtained, and payment is in foreign currency.

6.6 Transport

In addition to the limited access to ice, coldstorage and freezing facilities, small-scale producers and traders are also confronted by an inadequate transport infrastructure. This not only limits the radius of fish sales, but also affects the quality, particularly of fresh and frozen fish. The large number of collection centres hampers the setting up of an adequate transport network.

7. Industry organisation

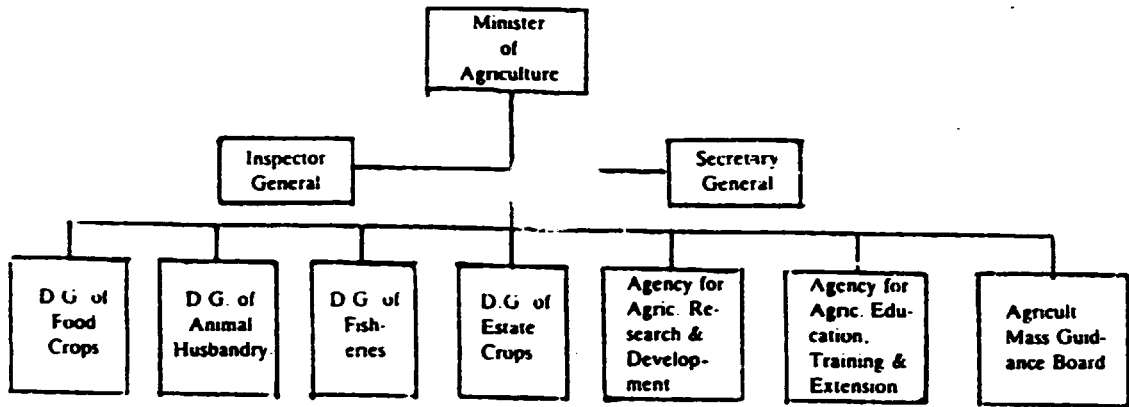
At the central Government level, fisheries falls under the Department of Agriculture. Under the law governing the local Government administration, certain aspects of fisheries administration are delegated to the provincial Governments, with policy and technical guidance from the central Government through the Minister of Agriculture. These aspects include the issue of fishing licences to Indonesian citizens; extension services; training and education of local fisheries officers, fishermen and fishfarmers; collecting fisheries statistics; conducting fish-auction; and organising fisheries associations and cooperatives.

Activities not delegated to the local Governments remain under the central Government, including the licensing of undertakings in fisheries using foreign capital or foreign personnel, and of fisheries research and development.

In carrying out its tasks in the field, the Directorate General of Fisheries utilises several technical executing establishments, namely the Development Centre for Marine Fishing; the Development Centre for Brackishwater Culture; the Development Centre for Freshwater Culture, the Development Centre for Post Harvest Technology and Quality Control; five Marine Fisheries Training Centres; twenty-one Coastal Fisheries Ports; two interinsular fishing ports, and one deep-sea fishing port.

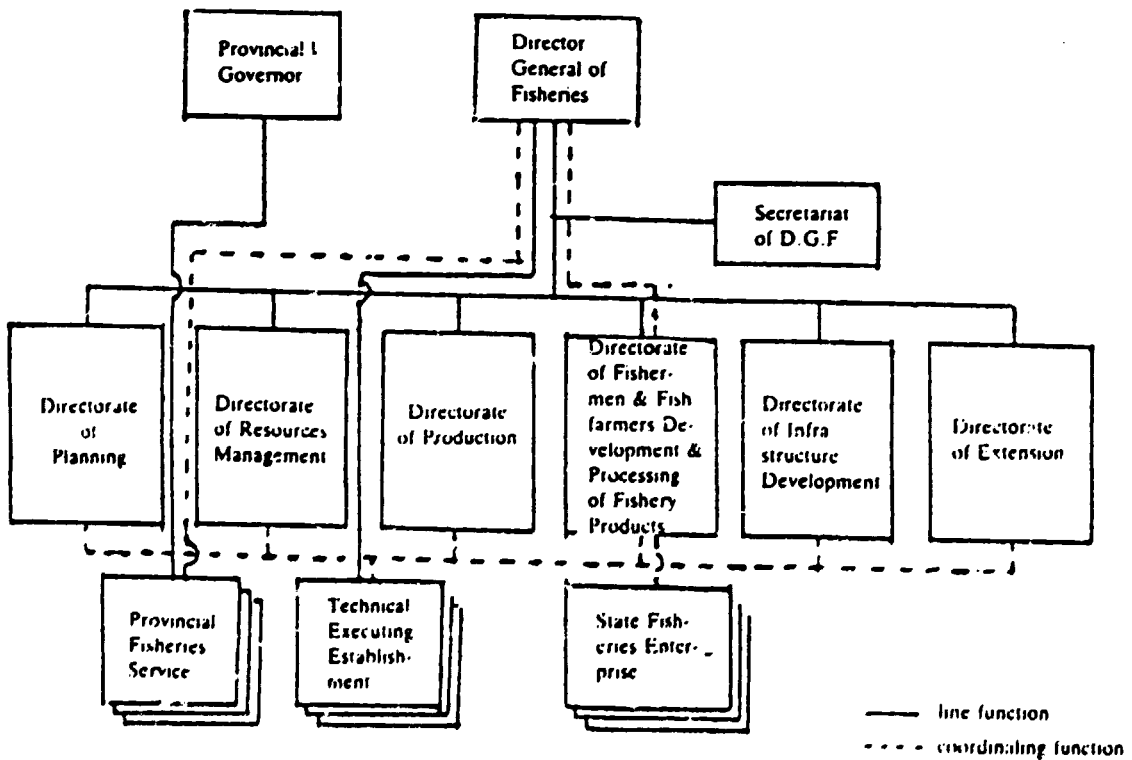
To pioneer the establishment of a modern fishery and at the same time to act as development agents for the local fisheries, the Government established State Fisheries Enterprises. These are directly responsible to the Minister of Agriculture but function under the technical guidance of the Directorate General of Fisheries.

Figure 2: Organisational set-up of the Department of Agriculture



•) D G = Directorate General

Figure 3: Organisational set-up of the Directorate General of Fisheries



In the provinces, implementation of fisheries development is carried out by the Provincial Fisheries Services. These are instruments of the local Governments.

Cooperatives are assigned an important place in the economic and social development of Indonesia. Village cooperative units (KUD) are to become the main organisation for rural economic activities.

The development of cooperatives is divided into three stages:

- a) the officialisation stage where the Government is involved.
- b) the de-officialisation stage when development is handed over to the cooperative movement; and
- c) the self-reliant stage when the cooperatives become fully independent.

Fisheries cooperatives are established at three levels:

1. The primary Village Fisheries Cooperative Units (KUD Mina). There are some 500 of these cooperative units throughout the country. Their primary role is in fish production, and through them fishermen are able to obtain inputs, credit and services. Occasionally, they are also involved in fish marketing.
2. The second tier cooperative units (PUSKUD) at provincial level. These assist the KUD Mina, especially in fish marketing.
3. National Associations of Fishermen's Cooperatives. These are meant to channel Government assistance to the lower level cooperatives.

The success of the fisheries cooperatives varies considerably between the various provinces.

Within the Department of Agriculture, fisheries education and training come under the auspices of the Agency for Agricultural Education, Training and Extension (AAETE). AAETE operates a Fisheries Academy and four Senior High Schools.

Outside the Department of Agriculture, fisheries education and training is provided by local Governments, and higher education by the Department of Education through faculties in universities and institutes.

Expertise especially in technology, quality control and new product development is insufficient for the industry. This is foremost felt in the tuna and shrimp sector. Being relatively young industries, each is in a position to employ modern techniques in all facets of their operations, from harvesting to processing, quality control and marketing.

7.1 Research and development

The Agency for Agriculture Research and Development (AARD) has under its auspices the Central Research Institute for Fisheries (CRIFI). CRIFI consists of three research institutes, namely: the Research Institute for Marine Fisheries, the Research Institute for Freshwater Fisheries, and the Research Institute for Coastal Aquaculture.

7.2 Credit facilities

Until the end of 1973 there was virtually no short and medium credit available to small-scale fishermen in Indonesia. The only source of credit for them was from moneylenders or fish traders. Even now, many small-scale fishermen are deeply indebted to them but the creation of institutional credit has made it possible for a large number of fishermen to obtain loans at low interest.

At present, the credit granted to small-scale fishermen and fish farmers is normally financed through three sources: a) institutional (Government funds allocated from development budgets, including credit extended by external funding agencies); b) non-institutional (private domestic capital); and c) foreign private capital.

Government policy is oriented toward expanding credit for small-scale producers. This becomes clear from the development objectives of the fishery sector during the Third and Fourth Five-year Development Plan, covering the period 1979 to 1988. These are directed to overcoming problems and constraints in a) the limited technical and managerial know-how; b) the bargaining position of the fishermen in marketing their catches; c) the limited financial resources available; and d) an increasingly severe limitation in resource availability.

Credit has been selected as one of the crucial development instruments to stimulate artisanal fisheries, including aquaculture.

Financial assistance is given in the form of loans or indirectly in the form of subsidies. For the small-scale fishermen, special loans are provided, for example

a) BIMAS (Mass Guidance) Credit, or Fishermen and Fishfarmers' Credit

This credit is extended to small-scale fishermen and fishfarmers for improvement of fishing vessels and gear and intensification of fish ponds. It does not require any collateral and has an interest of 12% per year. This credit scheme was introduced to balance the effects of the trawl ban, particularly its impact on small-scale operations.

The maximum loan is equivalent to the value of a 10 GRT vessel and gear or for the operation of a 2-ha fishpond.

b) Working Capital Credit

This credit is intended to supplement the small investment credit with the needed working capital. It is possible to apply for working capital credit only. The maximum loan is Rp. 10 million at 12% interest.

c) Mini-Credit

The loan ranges from Rp. 10 000 to Rp. 200 000 for both investment and working capital, and is provided by state banks at the village level.

d) Midi-Credit

The loan ranges from Rp. 200 000 to Rp. 500 000 and is intended for the same purpose as the Mini-Credit and is provided by state banks at the district level.

Subsidies are given, among others, through subsidised prices of fuel, fishing materials, fertilisers and pesticides. Due to communication and distribution constraints, however, subsidised prices are not always felt throughout the country.

In order to stimulate investments, foreign and domestic investors can obtain various concessions and exemptions such as a reduction of import duties on machinery, spare parts, exemption of transfer fee on the deed of the registration of the vessels, and so on.

8. Government policy

In order to stimulate development in the fisheries industry, the Government introduced its first Five-year Plan (REPELITA I) in 1969. From the onset, the Government has placed major emphasis on the well-being and progress of the small-scale fisheries sector.

In 1984, the Fourth Five-year Plan (REPELITA IV) was launched, in which is included the following paragraph:

"To support the fishery development programmes, the provision of fish marketing facilities, port facilities and irrigation networks for inland fisheries will be stepped up.

The provision of fishery infrastructure will be implemented to support fish production and marketing activities of the fishermen and fish farmers. The programme of upgrading and developing fishery harbours during REPELITA IV calls for the construction of several harbours, with the aim of both developing the infrastructure of coastal villages as well as stepping up the effective utilisation of the 200-mile Exclusive Economic Zones. The fishery cultivation efforts (brackishwater and freshwater pond fisheries) include, among others, the construction and rehabilitation of irrigation canals for brackishwater and freshwater pond undertakings. Fishery guidance, which basically is an extension programme, is mainly aimed at assisting fish farmers and fishing companies to obtain improved technical as well as economic knowledge for the benefit of their undertakings."

Fisheries development during the Fourth Five-year Plan has the following objectives:

1. to raise the income of fishermen and fishfarmers;
2. to increase the productivity of individual fish producers and raise fish production at national level;
3. to extend productive employment opportunities in fisheries;
4. to increase fish consumption;
5. to increase exports of fishery products as a source of foreign exchange; and
6. to promote resource management and achieve better control of resource utilisation throughout the country.

Fish production is projected to increase by 5.8% per year to reach 2.8 million MT in 1988, the end of REPELITA IV. Marine fisheries would contribute 73% of total production and reach 2.1 million MT in 1988. Per capita fish consumption is projected to increase by 3.0% per year to reach an average of 15.2 kg in 1988. Exports of fishery products are projected to increase by 17.7% per year by volume and 25.4% by value to reach 187 800 MT and US\$ 726 million, respectively, in 1988.

More rational utilisation of marine fish resources will be aimed at with the objective of increasing fishermen's productivity and income. This will be carried out inter alia by limiting the number of inshore fishermen in heavily exploited areas and diverting surplus fishermen to other inshore fishing areas with good potential (transmigration), or through the development of off-shore and deepsea fisheries. Seafarming will be encouraged, focusing on the culture of finfish, shellfish and seaweed with the aim of generating productive job opportunities, for men and women, and with the objective of providing additional income to fishermen families. Fish marketing will be directed towards benefitting both producers and consumers with a fair margin for the marketing agents. To achieve this goal, the role of state-owned fishery enterprises in stabilising fish prices will be enhanced through the nucleus estate smallholder system.

Long-term policies and investment projects in all sectors are directed towards the creation of maximum employment. The annual growth rate in the fishery sector is expected to be 2.4% between 1984/85 and 1988/89.

Table 30: Total fish production in Indonesia (1981-85) and REPELITA IV production targets (1984-88), (in 1 000 MT)

	1981	1982	1983	1984	1985	1986	1987	1988
1. Marine fishery	1 408	1 490	1 600	1 657	1 749	1 845	1 948	2 058
2. Inland waters	506	530	520	520	290	658	700	753
2.1 Open water	265	268	266	278	284	289	296	302
2.2 Culture	241	262	254	312	337	368	405	450
- Brackishwater pond	113	122	136	143	156	171	188	207
- Freshwater pond	78	84	70	93	98	104	110	117
- Paddy field	49	55	47	61	64	68	73	79
- Cages		1	1	1	1	1	1	1
- Others				14	18	24	33	46
Total	1 914	2 020	2 120	2 247	2 370	2 505	2 648	2 811

Source: Directorate General of Fisheries, Indonesia

Table 31: Government export and import targets for the fisheries sector in 1988 under REPELITA IV

	Quantity (MT - Net weight)	Value (US\$ million)
Export total	187 800	726.0
Shrimp exports	44 700	527.3
Skipjack/tuna exports	69 500	99.0
Other exports	73 600	99.7
Import total	137 600	96.3
Edible fish products	2 100	5.5
Non-edible fish products	135 500	90.8

Source: Directorate General of Fisheries, Indonesia

9. Foreign participation

In order to stimulate fisheries sector development in line with the Government's role, functions and objectives, foreign assistance is particularly directed at the following:

- assessment of fishery resources;
- development of appropriate technology;
- training of skilled manpower;

- establishment of extension services;
- identification and preparation of projects;
- pilot or pioneering fishing operations; and
- financing of commercial operations.

In addition to multi- and bi-lateral assistance, there are the various foreign funded fishing and processing joint ventures. Exact figures on their capital lay-out and investments are not available.

10. Conclusion

In view of the Government's commitment to the small-scale fisheries industry, any plans and projects for future development should be directed towards this sector.

As fish forms the most important source of animal protein, emphasis should be placed on the increase of production and productivity to augment per capita consumption. This will be particularly difficult because of the state of the resource in those areas of major concentrations of fishermen and because of the rapidly growing population. Opening up of new fishing areas by way of transmigration of fishermen or introduction of adequate vessels and gear seem to be the best solutions. Also, post harvest losses, now running at about 20%, could be reduced by improving the existing infrastructure or by creating new facilities. Particularly in the area of preservation and transport, major improvements are necessary.

In order to increase the income of the small-scale fishermen and assist in the transformation from small and medium-scale to large-scale entrepreneurs, it is necessary that the former get involved in the export-oriented industry. Currently, exports are dominated by shrimp and tuna; further product diversification appears necessary.

Annex I: Major marine and inland open water species landed

Inland open water speciesFISHERS

<u>Local name</u>	<u>English name</u>
Ukan mas	Common carp
Jelawat	Sulthan fish
Lampau	Thunfoi barbuis
Tsawas	Puntius
Mujair	Tilapia
Jambul	Catfishes
Cabus, Toman	Snakehead
Laris	Catfishes
Sepet	Sepat siam
Tarbakau	Kisising gouramy
Belida	Peatherback
Kebutu	Cely
Sidet	Bals

Marine water speciesFISHERS

<u>Local name</u>	<u>English name</u>
Ukan sebelah	Indian halibut
Toman lidiah	Bombay sole
Toman nomei	Pary fish
Maruyung	Marine catfish
Beloso	Lizard fish
Hi ji nangka	Coat fish
Gerut-gerut	Grunter/Sweetlip
Toman merah	Red snapper
Kerapu	Grouper
Lencam	Emperor
Kakap	Barramundi
Kerisi	Threadfin bream
Swanggi	Bilgrye
Ekor kuning	Yellowtail/Flauller
Gulameh/Thgsawaja	Croaker, Drum
Quart	Shark
Pari	Ray
Bawal hitam	Black pomfret
Bawal putih	Silver pomfret
Alu-alu	Barracuda
Layang layang	Sead
Selar	Therally
Kume	Jack Therally
Netengkek	Harttail scad
Dam bambu	Queen fish
Sunglir	Rainbow runner
Dam terbang	Flying fish
Belanak	Mullet
Kuro/Senangiu	Threaddfin
Julang-julang	Cerfish and Half-beak
Neri	Anchorv
Jepuh	Sardine
Temberis	Fringecale sardinalia
Lemuru	Indian oil sardinalia

CRUSTACEANS

<u>Local name</u>	<u>English name</u>
Ulang galah	Free-swimmer giant shrimp
Ulang tawar	Free-swimmer shrimp
Ulang grego	Athyrids

MOLLUSCS

<u>Local name</u>	<u>English name</u>
Siput	Snails
Pennis	Clam (Mussels)

OTHER AQUATIC ANIMALS

<u>Local name</u>	<u>English name</u>
Kodok	Frogs
Kura-kura	Turtles
Baya	Crocodiles

CRUSTACEANS

<u>Local name</u>	<u>English name</u>
Rejungan	Swimming crab
Keputing	Mangrove crab
Ulang bering	Spiny lobster
Ulang wirih	Tiger shrimp
Ulang putih	Beanna shrimp
Ulang dongol	Endeavour shrimp

MOLLUSCS

<u>Local name</u>	<u>English name</u>
Tiram	Cupped oysters
Silang	Scallops
Bendis	Clams
Kerang derah	Blood cockles
Cumi-cumi	Common squid
Sotong	Cuttlefish
Qurita	Octopus

OTHER AQUATIC ANIMALS

<u>Local name</u>	<u>English name</u>
Pergu	Marine turtles
Teripang	Sea cucumbers
Ubur-ubur	Jellyfish
Lalinya	Others

AQUATIC PLANTS

<u>Local name</u>	<u>English name</u>
Rumput Laut	Seaweed

Golok-golok	Wolf herring
Terubuk	Toli shad
Kembung	Chub mackerel
Tenggiri	Spanish mackerel
Layur	Hairtail
Tuna	Tuna
Cakalang	Skipjack
Tongkrok	Eastern little tuna

Annex II: The state of marine fish resources and exploitation in the archipelagic and territorial waters, 1982

	<u>MSY</u> <u>MT/year</u>	<u>Catch in 1982</u> <u>(MT)</u>	<u>Exploitation level</u>
<u>West of Sumatra</u>			
- Pelagic	243 500	46 109	Underexploited
- Demersal	169 100	25 318	Underexploited
- Tuna	12 800	2 468	Underexploited
- Skipjack	6 100	5 875	Reaching maximum level
- Shrimp	900	1 138	Overexploited
<u>South of Java</u>			
- Pelagic	159 000	38 289	Still possible for further development
- Demersal	112 700	21 778	Underutilised
- Tuna	12 800	2 468	Underutilised
- Skipjack	2 300	1 757	Reaching maximum level
- Shrimp	5 500	590	Underutilised
<u>Malacca Strait</u>			
- Pelagic	126 500	69 409	Still possible for development in offshore waters
- Demersal	78 300	75 749	Inshore fishing grounds are overexploited; Waters deeper than 40 m are lightly exploited
- Tuna	4 800	1 413	Underexploited
- Skipjack	2 300	1 172	At maximum level
- Shrimp	20 000	14 525	Underexploited
<u>East of Sumatra</u>			
- Pelagic	413 500	109 567	Underexploited
- Demersal	78 300	83 474	At maximum level
- Shrimp	4 000	1 621	Underexploited
<u>North of Java</u>			
- Pelagic	363 500	211 170	Inshore fishing grounds highly exploited; possible expansion offshore
- Demersal	322 900	122 288	Possible expansion offshore
- Shrimp	12 000	6 274	Underexploited
<u>Bali-Nusa Tenggara</u>			
<u>East Timur</u>			
- Pelagic	244 900	64 805	Underexploited
- Demersal	215 700	16 055	Underexploited
- Oil sardine	35 000	35 000	Overexploited
- Tuna	9 600	4 379	Underexploited
- Skipjack	4 600	4 111	Reaching maximum level
- Shrimp	500	146	Underexploited
<u>Southwest of Kalimantan</u>			
- Pelagic	156 000	37 576	Underexploited
- Demersal	245 200	47 136	Underexploited
- Shrimp	3 200	3 850	Overexploited
<u>East of Kalimantan</u>			
- Pelagic	127 400	56 640	Underexploited
- Demersal	199 500	39 326	Underexploited
- Tuna	7 900	133	Underexploited
- Skipjack	19 000	2 713	Underexploited
- Shrimp	5 000	3 959	Reaching maximum level

South of Sulawesi

- Pelagic	90 400	87 072	At maximum level
- Demersal	69 000	61 321	Reaching maximum level
- Tuna	15 300	8 101	Underexploited
- Skipjack	49 400	20 242	Underexploited
- Shrimp	NA	5 327	Further assessment needed

North of Sulawesi

- Pelagic	308 800	43 601	Underexploited
- Demersal	80 500	18 795	Underutilised
- Tuna	21 600	7 516	Underutilised
- Skipjack	37 700	11 440	Underexploited
- Shrimp	NA	473	Developing

Moluccas and Irian Jaya

- Pelagic	1 286 500	62 184	Underexploited
- Demersal	470 900	32 645	Underexploited
- Tuna	89 500	2 735	Underexploited
- Skipjack	154 000	13 267	Underexploited
- Shrimp	18 000	2 843	Underexploited

Annex III: Number of marine fishermen by category and province, 1982

	Full time	Part time (major)	Part time (minor)	Total	%
Aceh	30 761	6 365	2 555	39 681	3.3
North Sumatera	86 977	24 185	2 184	113 346	9.7
West Sumatera	14 255	2 439	1 763	18 457	1.6
Riau	27 750	6 392	3 193	37 335	3.2
Jambi	2 134	2 028	793	4 955	0.4
Bengkulu	3 730	470	140	4 340	0.4
South Sumatera	12 649	10 135	4 241	27 025	2.3
Lampung	1 329	155	184	1 668	0.1
Jakarta	10 476	1 408	681	12 565	1.1
West Java	58 084	16 868	1 649	76 601	6.5
Central Java	26 282	36 928	13 907	77 117	6.6
Yogyakarta	1 194	1 526	175	2 895	0.2
East Java	120 754	46 655	19 832	187 241	16.0
West Kalimantan	9 416	9 645	3 790	22 851	2.0
Central Kalimantan	4 540	5 045	2 131	11 716	1.0
South Kalimantan	8 316	9 201	3 657	21 174	1.8
East Kalimantan	19 086	19 758	8 791	47 635	4.1
North Sulawesi	27 948	31 342	21 138	80 428	6.9
Central Sulawesi	12 742	13 817	6 007	32 566	2.8
South Sulawesi	18 901	89 452	12 473	120 826	10.3
South-east Sulawesi	12 011	12 876	5 352	30 239	2.6
Bali	9 360	5 265	3 235	17 860	1.5
West Nusa Tenggara	13 578	13 372	5 475	32 425	2.8
East Nusa Tenggara	12 728	18 063	6 503	37 294	3.2
East Timor	NA	NA	NA	NA	-
Moluccas	27 808	29 120	11 977	68 905	5.9
Irian Jaya	9 531	11 416	5 501	26 448	2.6
Total	585 746	433 575	151 545	1 170 866	100.0

Source: Fisheries Statistics of Indonesia, 1982

Annex IV: External assistance to the fishery sector

	<u>Status</u>	<u>Amount</u> (US\$1 000)
A. Multilateral sources		
AID		
Loans		
1. Riau Fisheries Development Project (Loan No 94-INO(SF))	Completed	2 500
2. Irian Jaya Fisheries Development Project (Loan No. 154 (SF) & 155-INO)	Completed	7 900
3. Java Fisheries Development Project (Loan No 216-INO)	Ongoing	13 200
4. Sumatra Fisheries Development Project (Loan No. 474-INO)	Ongoing	14 000
5. Second Irian Jaya Fisheries Development Project (Loan No. 566-INO)	Ongoing	34 000
6. Brackishwater Aquaculture Development Project	Ongoing	23 000
Grants		
1. Sumatra Fisheries Development Project (T.A. No 236-INO for Project Preparation)	Completed	98
2. Sumatra Fisheries Development Project (T.A. No 368-INO for Advisory & Operational)	Ongoing	200
3. Second Irian Jaya Fisheries Development Project (T.A. No 395-INO for Project Preparation)	Completed	150
4. Brackishwater Aquaculture Development Project (T.A. No 415 for Project Preparation)	Completed	100
5. Java Fisheries Development Project (T.A. No 422-INO for Advisory & Operational)	Ongoing	180
6. Fisheries Sector Study (T.A. No 464)	Completed	50
IDA (Loans)		
1. First Fisheries Project (Credit 211-INO)	Completed	3 500
2. Fisheries Credit Project (Credit 480-INO)	Completed	6 500
3. Fisheries Component Under Rural Credit Project (Credit 827-INO)	Ongoing	14 500
4. Fisheries Component Under Rural, Credit Project 1979-84	Completed	14 500
UNDP/FAO (Grants)		
1. Naval Architects (Fishing Boats), 1970	Completed	10
2. Training Centre on Improved Fishing, 1971-73	Completed	125
3. Fish Preservation (Madura), 1972	Completed	23
4. Brackishwater Shrimp and Milkfish Culture Research and Training, 1972-81	Completed	1 587
5. Training Centre (Flores), 1973	Completed	385
6. Fisheries Development Training, 1973	Completed	1 051
7. Marine Fisheries Development (Irian Jaya), 1977	Completed	1 669
8. Inland Fisheries Development (Irian Jaya), 1977	Completed	165
9. Sumatra Fisheries Development Project (Cost-sharing with ADB), 1978	Completed	87
10. Marine Fisheries Training, 1979	Completed	3 491
11. Fisheries Management and Development, 1979	Completed	2 209
12. Subproject of the Indian Ocean Fishery Survey and Development Programme "Joint Eastern Fishery Survey", 1979-81	Ongoing	400
13. Fisheries Extension Services, 1979-83	Ongoing	2 921
14. South China Sea Fisheries Development Programme, 1980-84	Ongoing	3 560
15. Brackishwater Aquaculture Development Project (Cost-sharing with ADB), 1981	Completed	88

16. Site Selection for Shrimp Culture Development, 1981	Completed	81
17. Seafarming Project, 1982-85	Ongoing	1 800
B. Bilateral sources		67 836
Canada (Grants)		
1. Research on Fish Parasites in Fish Culture, 1979	Completed	124
2. Study on the Development of the Sea Fish, 1980-82	Ongoing	1 010
3. Feasibility Study for Development of Fisheries in Kepulauan Tujuh and Sengihi (TA 176), 1980-82	Ongoing	811
United Kingdom (Grants)		
1. Assistance to Institute of Fisheries Technology Jakarta, 1976-79	Completed	238
2. Post Harvest Fish Research, 1977-79	Completed	210
France (Grants)		
1. Laka Research and Development, Jatiluhur, 1967-74	Completed	177
Federal Republic of Germany (Grants)		
1. Demersal Fisheries Research, 1975	Completed	1 256
2. Regional Surveys on Fish Resources (with FAO), 1979-82	Ongoing	2 750
3. Advisory Assistance in the Development of Small-scale fishing in Bali, Lombok and Surrounding Waters	Ongoing	600 000
Italy (Grants)		
1. Study on Fresh Fish Marketing in East Java (with EEC)	Ongoing	3 037
Japan (Loans)		
1. Tuna Fishery Development Project	Completed	3 037
2. Jakarta Fishing Port (Grants)	Completed	37 867
1. Study on Fishing Port in Pelabuhan Ratu, 1979	Completed	100
2. Jakarta Fishing Port/Market Development OECF	Completed	2 100
3. Fishery Advisory Team (ATA-40), 1972-80	Completed	1 929
4. Strengthening of Academy of Fisheries, 1977-80	Completed	2 000
New Zealand (Grants)		
1. Fresh Fish Marketing Pilot Project, 1976	Completed	432
2. Supply of Fish Trawlers for Marine Fisheries Training and Development, 1976	Completed	285
3. Fisheries Cold Storage, Padang, 1976-78	Completed	600
4. Feasibility Study for Fish Port, Ujung Pandang, 1977	Completed	5
5. Fish Marketing Pilot Project in West Sumatra 1975-76	Completed	500 000
United States of America (Grants)		
1. Small-scale Fisheries Development	Ongoing	3 000
2. Tambak Irrigation Study	Completed	477
3. Brackishwater Aquaculture	Completed	805
4. Fisheries Production, 1976	Completed	388
5. Fishery Research & Education Programme, Jakarta, 1969-72	Completed	270
6. Fishery Research and Education Programme, Ambon, 1969-74	Completed	108

Annex V: Summary of identified investment programmes suitable for external support under REPELITA IV, by sub-sector

I INFRASTRUCTURE

- A. Fishing Ports and Landing Sites Project
 - 1) 10 units, small fishing ports
 - 2) 100 sites, fish landings
- B. Fish Marketing Facilities
 - 1) 60 units, private facilities
 - 2) Expansion, state enterprises
- C. Shore Facilities, State Projects
 - 1) Ambon Project
 - 2) Aertembaga Project
 - 3) Samudra Besar Project
 - 4) Java Project
 - 5) Handline Fisheries Shore Facilities
- D. Artisanal Fishery Project
 - 1) Fishing Village Infrastructure

II AQUACULTURE

- A. Freshwater Culture
 - 1) Pond intensification
 - 2) Pond extensification
 - 3) Paddy-cum-fish culture
 - 4) Hatcheries, new and improved
- B. Brackishwater Culture
 - 1) Pond intensification
 - 2) Pond extensification
 - 3) Canal rehabilitation
 - 4) New canals
 - 5) Hatcheries
 - 6) Pumps

III MARINE FISHERIES-ARTISANAL

- A. Artisanal Fisheries Development
 - 1) Improved fishing gear
 - 2) Vessel mechanisation
- B. Artisanal Tuna Handline Project
 - 1) 3 500 mechanised boats (5-7 GRT)
 - 2) 10 collection vessels/ice boats

IV MARINE FISHERIES, INDUSTRIAL VESSELS PROGRAMMES

- A. Industrial Tuna/Skipjack Credit Project
 - 1) 20 longline vessels
 - 2) 21 skipjack purse-seiners
- B. Development of Private Fishery Sector Under State Enterprises Programme
 - 1) 400 pole-and-line vessels (15-40 GRT)

V MARINE FISHERIES, STATE ENTERPRISE VESSEL PROGRAMME

- A. Pole-and-line vessels
 - 1) 9 units skipjack purse-seiners
 - 2) 20 units skipjack pole-and-line vessels

VI INSTITUTIONAL BUILDING

- A. Education, training, research, resource assessment and management
- B. Technical assistance for project preparation and project implementation

MALAYSIA

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MALAYSIA

1. Introduction

Malaysia has a population of 15.3 million (1983), a coastline of 3 400 km and an EEZ encompassing 480 000 sq km. The Malaysian fishing industry is a minor but important sector of the national economy. In 1985, fish accounted for 10% of total protein consumed and 50% of the total animal protein consumed in the country. Fisheries accounted for 6.76% of the GNP and 30.68% of the agricultural GNP in 1983. The industry provides employment to some 110 000 fishermen or 2.0% of the national labour force.

The fisheries may be divided into 4 regions: the west coast of Peninsular Malaysia, the east coast of Peninsular Malaysia, Sabah and Sarawak. The latter two are also referred to as East Malaysia. The west coast of Peninsular Malaysia is the most developed region with the most intensely fished waters in the country. The east coast of Peninsular Malaysia is relatively less developed and less intensely fished. In contrast, Sabah and Sarawak are the least developed with relatively under-developed fisheries.

2. Fishery resources

The combined Maximum Sustainable Yield (MSY) of Peninsular Malaysia's marine resources is estimated at 782 900 MT. The resource potential for Sarawak is estimated at 289 000 MT, while for Sabah the MSY is put at 119 000 MT. Landings in 1985 totalled 639 000 MT; this is a continuation of the declining trend which began in 1981. The west coast of Peninsular Malaysia accounts for about 60% of the total catch, the east coast of Peninsular Malaysia for 23%, Sabah for 7% and Sarawak for 10%. In all regions, the majority of the harvest consists of trashfish followed by Indian mackerel, shrimp, selar-scad and anchovy. Also caught are sardine, round scad, jolly fish, narrow-barred king mackerel, threadfin bream, cuttlefish Eastern little tuna, molluscs and crustaceans among which shrimp is the most important.

The traditional fishing grounds lie inshore within 12 miles off the coast. Resources on the west coast of Peninsular Malaysia are considered to be already overexploited; landings here have shown a declining trend. Inshore waters off the east coast of Peninsular Malaysia, Sabah and Sarawak are reaching their maximum sustainable level but there appear to exist good and relatively untouched resources offshore.

Offshore waters beyond 12 miles off the Malaysian coast are still underexploited. This has been attributed in part to a lack of skill and technology as well as the absence of adequate information on the availability of commercially viable resources there. There are, however, the bottom-set portable trap fishery for snappers off the west coast of Peninsular Malaysia and a troll-line fishery for little tuna, tongol and spanish mackerel off the east coast of Peninsular Malaysia. It is generally thought that the commercial potential for offshore fishing is good off the east coast of Peninsular Malaysia and off East Malaysia.

3. Exploitation

Marine landings in Malaysia showed a sharp drop in 1984. Total landings just exceeded 600 000 MT, a 1.7% drop from 1983. The decline

can be largely attributed to the drop in landings in Peninsular Malaysia. In 1985, landings reportedly recovered to 639 000 MT, still significantly below the last 5 year's average.

Table 1: Landings from marine operations, 1979-84 (in MT):

	1979	1980	1981	1982	1983	1984
Sabah	41 900	34 500	40 000	42 000	48 000	50 200
Sarawak	82 293	77 069	68 043	69 339	70 438	68 632
Peninsular Malaysia						
West Coast	432 347	493 495	433 371	433 986	442 173	347 743
East Coast	138 558	130 403	215 944	133 337	166 883	133 897
Total	695 098	734 467	757 358	678 662	727 499	600 472

In 1984, total marine landings in Peninsular Malaysia amounted to 600 473 MT valued at M\$1 359 million. Of this, the west coast of Peninsular Malaysia accounted for 347 743 MT, or 58% of the total volume. This was the first year that the catch fell below the MSY of 365 900 MT.

The east coast of Peninsular Malaysia accounted for 133 897 MT or 22.3% of the total 1984 landings. The MSY for this region is estimated at 417 000 MT.

Table 2: Marine landings in Peninsular Malaysia by major species, 1980-84 (in MT)

Local name	Species	Common name	1981	1980	1981	1984	1983
cincaru,		scad	75 847	51 261	46 267	65 510	65 960
bilis		anchovy	33 457	30 222	34 667	34 746	22 658
tamban		sardine	17 507	14 769	22 792	22 655	13 297
kembong		Indian mackerel	80421	74 826	69 967	90 064	85 184
tonggol		tuna	17 725	11 087	14 603	18 838	17 723
ikan baja		trash fish	170 137	152 959	150 860	157 648	119 197
udang		shrimp	70 948	65 417	60 179	64 001	576 471
sotong		squid	15 251	14 199	11 760	13 308	13 058
others			142 605	234 576	166 229	142 285	85 916
Total			623 838	649 315	587 323	609 055	481 640

Marine landings in Sarawak during 1984 amounted to 68 632 MT while Sabah contributed 50 200 MT.

Marine landings in Sarawak amounted to 68 632 MT, of which 44.1% was contributed by otter trawls and 18.4% by drift/gillnets. In Sabah most of the catch is caught by otter trawls, drift/gillnets and fishing stakes.

The 1984 marine landings in Peninsular Malaysia showed a 15.6% reduction compared to 1983. There was also a reduction of 17.7% in the wholesale value of the landings to M\$1.1 billion (about USD435 million).

The reduced landings are attributed to a smaller catch by trawlers and purse seiners. The landings of demersal and pelagic fish decreased by 19.1% and 13.3% to 178 024 MT and 224 472 MT, respectively.

The drop in wholesale value of the catch can be largely attributed to a drop in the catch of high value species. Landings of grade A fish was reduced from some 60 000 MT in 1983 to 40 000 MT in 1984.

The 1984, Sarawak marine landings declined by 2.6% to 68 632 MT compared to 1983. The preliminary 1985 landings of 63 900 MT showed a continuation of the declining trend. Still, landings are well below the MSY of 289 000 MT. This can be attributed to the fact that the fish effort is primarily directed towards the catching of shrimp.

Also for Sabah, the 1984 landings show a drop of 11% compared to 1984. However, 1983 was a peak year for landings. Sabah landings are also well below the estimated MSY of 119 000 MT.

The Malaysian fisheries are in a state of transition, with traditional inshore activities giving way to more efficient and sophisticated methods of fishing, notably trawling.

4. Disposition of catch

More than 60% of the fish landed in Peninsular Malaysia between 1971 and 1983 were consumed fresh. During this period, approximately 6-18% of the catch was processed or preserved, mainly by small-scale traditional methods, into products for human consumption, while about 5-25% were processed into fishmeal and manure.

In 1983, some 76 137 MT of the marine fish landed was used for drying, salting or smoking. This represented 12.5% of the total landing for the year. A total of 10 063 MT of the dried salted or smoked product was prepared in Peninsular Malaysia by establishments mainly located in the States of Kedah, Perak, Selangor and Trengganu.

About 36% of fish landings is processed into fishmeal and fish sauce. The other major processed products are dried/salted fish, fish crackers, frozen shrimp, prepacked wet fish, canned and dried anchovy.

Annual domestic consumption of fish is approximately 36 kg per capita of which 2.2 kg consists of canned fish.

Exports from Malaysia amounted to 136 808 MT in 1984. Of this total, Peninsular Malaysia took a 93% share, while Sabah and Sarawak accounted for 5% and 2%, respectively. However, in terms of export value, Sabah and Sarawak accounted for 29% and 9%, respectively.

In 1985, exports from Peninsular Malaysia totalled 159 224 MT valued at M\$192 million. This was a 25% increase in volume and a 3% increase in value compared to 1984.

Table 3: Disposition of marine landings in Peninsular Malaysia, 1980-84 (in MT)

	West Coast			East Coast			Total Peninsular Malaysia				
	1982	1983	1984	1982	1983	1984	1980	1981	1982	1983	1984
Fresh	287 434	209 239	159 208	106 160	144 232	91 560	377 169	417 220	393 594	353 471	250 768
Freezing	-	-	-	-	-	-	-	-	-	-	469
Canned	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cured:											
Dried/salted/smoked	59 477	72 749	69 591	3 379	3 388	7 578	77 240	69 830	62 856	76 137	77 169
steamed/boiled	1 391	7 206	14 625	45	431	353	7 993	2 244	1 437	7 637	14 977
fermented	5 977	7 721	7 900	420	791	5 143	8 922	6 173	6 397	8 512	13 043
others	308	71	106	3 093	4 057	9 396	1 029	2 405	3 401	4 129	9 501
Reduced	70 990	132 414	88 537	12 813	11 538	19 850	131 928	143 952	83 803	143 952	108 397
Others	8 410	12 772	7 321	7 426	2 445	5	19 617	15 217	15 836	15 217	7 327

5. Exports and imports

Peninsular Malaysia is a net importer of fishery produce. Total imports in 1985 totalled 218 616 MT valued at M\$ 277 million. This was balanced by exports of 159 224 MT valued at M\$ 192 million (see table 6).

Table 4: Peninsular Malaysia imports of fishery commodities, 1980-84, (in MT)

Origin	1980	1981	1982	1983	1984
Thailand	107 476	114 855	128 150	122 221	163 982
Japan	20 943	14 442	14 500	12 949	17 399
Indonesia	3 628	4 037	12 516	15 869	15 963
Peru	*	22	3 518	222	7 207
India	*	126	504	932	2 554
Chile	*	168	1 936	1 312	1 679
Singapore	2 966	1 419	2 387	1 964	2 663
Bangladesh	*	52	114	209	1 248
Rep Korea	*	417	640	841	596
Others	4 806	5 342	5 440	4 833	4 663
Total	139 819	141 848	169 2291	162 050	216 710

* included under others

Table 5: Peninsular Malaysia exports of fishery commodities, 1980-84, (in MT)

Origin	1980	1981	1982	1983	1984
Singapore	58 792	59 445	85 507	67 518	81 688
Sarawak	*	4 249	4 090	3 822	6 170
Australia	*	2 956	2 542	3 105	3 895
USA	924	924	1 011	2 876	2 583
Sabah	*	3 651	2 032	2 130	2 307
Japan	2 914	5 905	3 173	4 323	1 839
Canada	*	373	644	1 588	1 258
The Netherlands	*	4 086	2 236	2 599	1 068
United Kingdom	4 223	3 365	2 573	1 556	680
Others	48 353	38 476	28 011	27 817	25 634
Total	115 206	123 430	131 819	117 335	127 122

* included under others

Malaysia imports mainly from Thailand. In 1984, some 75% of the total imports volume was of Thai origin, making up some 50% of the total import value. Imports from India, Bangladesh and Burma consist primarily of frozen pomfret (black, white and chinese), frozen hilsa, frozen Indian mackerel and frozen shrimp (for reprocessing). Most of the frozen imported fish is defrosted before being offered for sale at retail level.

In 1983, Malaysia imported some 4 332 MT of dried, salted or smoked product mainly from Thailand and Indonesia valued at M\$5.2 million and in the same period, Malaysia exported 4 374 MT of the same product valued at M\$5.8 million mainly to Singapore.

Table 6: Peninsular Malaysia imports and exports of fishery commodities, 1985 (in MT and Malaysian Ringgit)

Commodity	Imports		Exports	
	Quantity	M\$	Quantity	M\$
Fish				
- fresh, chilled, frozen	108 830.23	109 574 318	77 106	27 798 106
- dried, salted, brined,	3 513	6 365 371	3 079	6 044 274
- canned	16 885	43 924 426	7 101	34 274 817
crustaceans and molluscs				
- fresh, chilled, frozen	23 150	29 070 787	31 457	29 801 525
- dried, salted, brined	2 910	10 158 180	8 766	8 205 369
- canned	2 125	10 759 183	6 561	36 009 012
Fats and oils	558	867 719	1	6 828
Flours, meal	56 340	48 116 639	11 379	1 374 734
Miscellaneous	4 300	13 246 050	13 770	48 871 463
Total	218 616	277 082 673	159 223	142 386 128

The export trade concentrates on Singapore for fresh, chilled fish; and Japan, Europe and Australia for fresh and frozen shrimp. Also Thailand is an important importer from Malaysia (about 21 000 MT in 1983), mainly consisting of finfish. For import and export by preservation and product form, refer Annex IV and V.

The import and export figures in Sabah and Sarawak show a surplus in terms of volume but in value terms the situation is much more encouraging, particularly in the case of Sabah.

Imports by Sabah and Sarawak consists primarily of canned goods while exports are almost exclusively fresh and frozen shrimp.

In Sabah, the total 1984 exports of 6868 MT consisted of 4 073 MT of shrimp, 552 MT of salted/dried fish, 947 MT of various fresh and frozen finfish species and 1 296 MT of other products. This pattern has been similar for the past 10 years.

Table 7: Sabah imports and exports of fish and fisheries products 1970-84 (in MT and Malaysian Ringgit)

Year	Imports		Exports	
	Quantity/MT	Value/MAL.Ringgit	Quantity/MT	Value/MAL.Ringgit
1970	3 049	4 494 787	2 367	8 703 229
1975	4 148	8 400 596	2 699	14 880 057
1980	11 136	21 966 287	3 588	35 127 434
1981	7 574	21 429 732	4 040	46 872 846
1982	7 709	22 375 152	4 219	56 657 408
1983	9 369	24 005 473	5 899	85 914 149
1984	10 263	25 149 913	6 869	87 629 192

In Sarawak the situation is very much the same with fresh and frozen shrimp accounting for some 41% of the total export of 2 817 MT and for 45% of the total export value. Another major export product was jellyfish.

Table 8: Sarawak imports and exports of fish and fishery products, 1965-84 (in MT and Malaysian Ringgit):

Year	Imports		Exports ^a	
	Quantity/MT	Value C.I.F./MAL.Ringgit	Quantity/MT	Value C.I.F./MAL.Ringgit
1965	4 617.90	6 179 568.00	97.24	179 875.00
1970	5 044.03	6 416 785.00	276.38	609 475.00
1975	4 912.73	9 553 139.00	1 292.25	5 770 850.00
1980	8 295.65	20 067 755.00	2 902.88	20 996 636.00
1981	9 426.81	24 458 926.00	2 573.45	24 224 788.00
1982	8 821.75	28 734 873.00	2 498.97	25 288 755.00
1983	7 422.21	25 211 348.00	3 176.54	29 303 270.00
1984	10 369.65	31 773 602.00	2 817.14	25 957 858.00

6. Fishing fleet and gears

The fishing fleet is basically made up of relatively small boats with engines of low power. About 60% of the vessels in use are to be found in Peninsular Malaysia. The fleet comprises vessels of various sizes and types, about 90% being mechanised (the majority with inboard motors). There were 41 079 licensed fishing boats in Malaysia 1984, an increase of 2.3% over the previous year. The distribution was as follows: 25 673 (62.5%) in Peninsular Malaysia, 6 500 (15.8%) in Sabah and 8 906 (21.7%) Sarawak. The increases were from Sarawak (9%) and Sabah (3.2%), while Peninsular Malaysia showed a slight decline in the number of vessels (refer Annex I, II and III).

Driftnets are the predominant gear used (40%) followed by trawlers (17%), the remainder being seine nets, stake-nets, gillnets, liftnets, bagnets and lines.

The main fishing gears used on the west coast of Peninsular Malaysia and their contribution to the 1984 catch are:

trawls	45.5%
purse-seines	30.3%
drift/gillnets	9.2%
other seines	5.2%
bagnets	4.3%

At the East Coast of Peninsular Malaysia main fishing gears used and their contribution to the 1984 production are:

purse-seines	40.6%
trawls	23.9%
hook and line	11.9%
drift/gillnets	9.4%

Table 9: Marine landings by gear group in Peninsular Malaysia, 1984
(in MT)

Gear Group	West Coast	East Coast	Gear Group	West Coast	East Coast
Trawl nets	158 269.63	31 936.69	Lines	5 785.17	15 978.40
Seine nets			Bagnets	15 104.57	3 970.39
- purse seine fish	86 344.90	84 536.99	Barriernets	983.40	-
- purse seine anchovy	19 083.00	5 777.39	Rush/scoop nets	2 218.16	-
- other seines	17 997.47	13.07	Shellfish collection	4 332.56	-
Drift/gillnets	31 842.30	12 652.25	Miscellaneous	892.22	751.56
Lift nets	75.44	8 479.32			
Traps					
- stationary	3 293.28	338.98			
- portable	1 521.76	5 536.11	Total	347 743.86	133 896.61

7. Employment

In 1984, there were 109 087 fishermen in the fishing sector, an increase of about 1.7% over the previous year. Out of the total, 70.0% were residing in Peninsular Malaysia, 11.8% in Sarawak and 18.2% in Sabah.

The largest increase (8.8%) was in Sarawak (8.8%). In Peninsular Malaysia, on the other hand, the number has decreased by a small proportion (0.1%). In Sabah the number remained constant. There were less fishermen in Peninsular Malaysia because of the steps taken by the Government to reduce the number of surplus fishing boats and thus the number of fishermen.

In terms of ethnic distributions, there were some 48 616 fishermen (or 63.7%) of Malay origin, 25 077 (32.8%) of Chinese origins and 2 675 (3.5%) of Indian, Thai and other origins. Some 55.7% of the Malay fishermen were found on the east coast of Peninsular Malaysia, while 92.3% of the Chinese fishermen were found on the west coast of Peninsular Malaysia.

A large proportion of the fishermen in Peninsular Malaysia worked on driftnet boats (39.6%), trawl boats (18.3%) and purse-seine boats (13.7%). For details on the number of fishermen, refer to annex I, II and III.

8. Aquaculture

Aquaculture in Malaysia is still in its infancy. Production comprises about 11.7% of the total fisheries harvest. The main species cultured is cockle (Anadara granosa) which comprises 80% of total aquaculture production. Other species cultured are Chinese carp, giant Malaysian shrimp (Macrobrachium rosenbergii), tiger shrimp (Penaeus Monodon), banana shrimp (Penaeus merguensis), seaperch (Lates calcarifer) and grouper (Epinephelus tauvina). The four main aquaculture systems are: pond, raft, cage and bottom culture.

The estimated potential for coastal and freshwater aquaculture in Peninsular Malaysia is:

- 28 500 ha for marine shrimp culture;
- 3 600 ha for marine cage culture;
- 7 500 ha for cockle culture; and
- 100 ha for mussel culture.

The potential acreage available in both Sabah and Sarawak is estimated to be at least equal to the acreage in Peninsular Malaysia. In addition, Sabah and Sarawak are often preferred by potential investors in view of the cheaper land, less population pressure and absence of pollution.

Whilst freshwater aquaculture is an important source of fish supply in East Malaysia, it is relatively insignificant in Peninsular Malaysia. However, there is potential in the upgrading of 2 500 ha of existing fish ponds, 2 200 ha of disused mining pools and 80 000 ha of lakes and water bodies. At present, major problems are the large-scale production of feed and fries for the industry. Nevertheless, aquaculture promises to be the solution to a shrinking inshore fishery production, and increasing domestic demand. By many, Malaysia is considered an ideal location for aquaculture operations due to climate, geographical, investment and other considerations.

In 1984, there were 18 342 units of ponds and old mining pools used for aquaculture purposes, with a total area of 4 950 ha. The figure shows an increase of 2.4% in total units and a reduction of 8.0% in total area. There were also 5 558 units of cages with a total water area of 51 572 sq meter, which was an increase of 7.3% and 17.3% in total units and area, respectively. There were 160 units of cockle farms, occupying a total area of 3 699 ha. Although there was an increase in the total units of ponds and cages under operation, the number of aquaculturists was reduced by 2% to 13 218 persons. This reflected the trend in the management of aquaculture practice towards one of commercial scale with optimisation of inputs and labour.

In 1984, there was significant increase in the aquaculture production. The total production was estimated at 57 482 MT. The increase was largely due to a greater contribution of brackishwater production, especially cockles, from 38 530 MT in 1983 to 63 582 MT in 1984. However, freshwater fish production was reduced by 67.3% to 3 912 MT.

Table 10: Estimate of aquaculture production in Peninsular Malaysia, 1983-84 (in MT)

Types	Production		Increase %	
	1983	1984	1983	1984
Freshwater	11,950	3 913	-15.4	-67.3
Brackishwater:	39 490	63 748	-23.1	+61.4
Total	51 440	67 661	+2.5	+31.5

There were several factors contributing to the reduction in the freshwater productions. Primarily, it was the shortage of fry, while at the same time, some 448 man-made up ponds and 785 ha of old mining pools ceased operations in 1984.

Table 11: Peninsular Malaysia estimated production by culture system (excluding cocles), 1982-84 (in MT):

	pond	Freshwater		Brackishwater			Total
		cages	sub-total	pond	cages	sub-total	
1982	14 098	28	14 126	326	413	739	14 865
1983	11 940	10	11 950	414	546	960	12 910
1984	3 910	4	3 914	64	103	167	4 081

9. Handling and processing

Fishing trips of small inshore fishing vessels normally last only between 8 to 20 hours. There are still a large number of vessels without proper fish storage holds; fish is either placed below deck or stored in wooden boxes/bamboo baskets on deck. Vessels operating purse seines, trawls and gillnets generally have fishholds but they are usually not insulated. Currently, more trawlers are being fitted with insulated fishholds. The use of polystyrene (EPS) insulated boxes is becoming increasingly more common. RSW systems are being introduced in bigger boats particular on the West coast of Peninsular Malaysia. The few available deep-sea vessels have adequate preservation facilities.

Fish handling practices on board vessels are generally poor with the exception of shrimp and other high priced species. Rough handling and poor icing are common while stepping on fish in the fish holds while applying ice is common.

Ice is mainly available in block form. Flake ice is very limited in use. Availability of ice to fishermen can be a serious problem in certain areas. There are a large number of remote artisanal fishing villages where no ice is available because they are situated too far from the ice plant and catch obtained is generally small.

There are 75 ice factories, mainly privately owned, with a total production exceeding 3 000 MT per day. Most are situated on the west coast of Peninsular Malaysia. Total ice storage capacity is 8 000 MT while total cold storage facility for fish is estimated at 10 000 MT.

9.1 Handling at landing centres

There are 33 designated fishery districts, accounting for over 300 landing centres. During the last 15 years the Fisheries Development Authority of Malaysia (LKIM) has attempted to concentrate landings in nine sophisticated complexes, most of which are equipped with ice-making equipment; handling apparatus; cold storage rooms, grading and packing facilities, an auction hall and so on.

Although attempts by LKIM to concentrate fish landings at a few official landing places is meeting with increasing success, the nine complexes handle only 27 000 MT (1983) of edible fish. The remaining 94% of the national catch is handled by privately owned mini complexes, or jetties which possess only rudimentary or no facilities to allow for proper handling. Fish are landed at almost all the fishing villages along the coast. The packing and transportation of fish from points of landing to large market centres is fairly well organised, although packing is sometimes delayed for two to five hours after the fish is landed depending on the value of the fish and the volume landed.

Fish is packed in boxes which are mostly made of wood. The boxes are of varying size, with capacities ranging from 120 to 240 kg. The boxes are often lined with heavy grade polythene sheets which has as disadvantage that melted ice cannot drain out of the box. Fish are mostly mixed with crushed ice before being boxed.

Pilot projects by the Asean Food Handling Bureau at a few selected fish landing complexes throughout the country, using returnable High Density Polyethylene (HDPE) containers have proven successful and encouraging.

Proper storage facilities at most landing centres are either very inadequate or entirely lacking. The general practice is for fish to be consigned directly to market centres to meet the strong local demand for fresh fish. When storage becomes necessary, fish are kept in coldrooms wherever possible.

9.2 Transportation of fish between landing and market centres

Fish are mainly transported in boxes on open lorries. The boxes are stacked and normally covered with tarpaulin. If the trip takes more than a certain number of hours the boxes are opened and re-iced en route. Hardly any refrigeration is involved in transporting fresh fish unlike fish imported from Thailand, which are more often conveyed in insulated trucks.

It is anticipated that the Malaysian authorities will soon insist that all fresh fish imported from Thailand has to be done by refrigerated truck. Currently, the Malaysian authorities are carrying out a survey on the use of small refrigerated lorries for domestic transport of fresh fish from points of landing to major market centres.

9.3 Handling at wholesale and retail markets

There are few holding facilities in the wholesale and retail markets, mainly because final consumers prefer fresh fish as opposed to frozen fish. On an average day, the major part of a particular consignment of fish will have been cleared at the wholesale markets by day-break and by the evening of the same day at the retail level. However, the remainder is frozen and offered for sale the next day in defrosted form which often leads to very low quality fish being offered.

At the wholesale level, very little re-icing is done if the fish are to be immediately disposed of to retailers; re-icing is only done if the fish are to be re-packed for dispatch to other markets. Retailers do generally not re-ice fish, especially when on display.

The Government policy to introduce dry fish markets will hopefully see fish in prepacked form, or fresh on ice in refrigerated display units.

Public health and hygiene on all levels of fish handling are very low, but there has been significant progress especially in LKIM fish handling complexes and new wholesale and retail markets. Nevertheless, the overall standard of fish handling and presentation is still unsatisfactory and a significant proportion (approx. 20%) of the national catch is lost in post-harvest activities.

10. Processing sector

Fish preservation has been practised in Malaysia for a long time, the simplest methods employed are drying, salting and fermentation.

Traditional processing is an important source of employment and of considerable economic value. The products are a cheap and nutritive source of protein to the people. However, in general the hygienic standard is low. Proper packaging and standardization of quality is often lacking. Locally manufactured equipment is widely available, but not often at affordable prices.

Mechanisation is often employed eg: for the production of keropok (deboning, mixing and mincing machines) and belacan (mincing machines), resulting in increased output and higher quality.

The fish drying industry is limited in size and traditional in character, mostly not surpassing the phase of cottage industry. There are about 1 000 dried fish processors, 100 processors of fermented fish products and 30 minced fish manufacturers.

10.1 Dried salted fish

Drying with or without salting is still the most important fish preservation technique in Malaysia. This product is more often made from surplus fish or fish unlikely to fetch a good price in the fresh fish market. Previously it was the staple diet of fishermen. However, with the increasing standard of living today, these products have found their way to retail outlets in the urban areas and are commanding good prices.

Since most dried salted fish processors are fishermen, the types of fish that are salted and dried are of numerous species depending on the day's catch.

The technique of salting and drying is a very simple one. The salted fish is dried on bamboo platforms, cemented drying yards lined with heavy grade paper, woven mats, netting or planks. The sun is the sole source of energy presently used for drying. The dried fish are collected into woven baskets or other containers, cut into cutlets (if desired), and packed or put aside until the time of sale.

The drying of fish is exclusively performed during the non-monsoon period.

Commercial fish drying is especially practised with anchovy ('ikan bilis'). It is a high-value product enjoying a continuously strong market demand. On the west coast and in some east coast States, anchovy is immediately cooked after catch on board specially equipped boats to maintain taste and arrest spoilage.

Fish crackers, locally known as 'keropok ikan' is a popular high protein snack in Malaysia and in neighbouring countries. During the year 1983, some 2 649 MT of fish crackers were produced in the States of Trengganu, Johore, Pahang, Kedah and Kelantan. Trengganu is the main producer, accounting for more than 80% of the production.

A majority of the factories involved in this activity usually have only the minimum equipment comprising a mixer, cooking vat and a platform for drying. Lately, however, some innovations have been made and there are now a few plants using bone/meat separators and slicers.

10.2 Fermented fishery products

Another popular method of preservation is fermentation. Fermented products are popular and differ greatly from one area to another. These products are produced by small-scale processing plants located close to sites where raw material is easily available. The technology employed is simple and the products are relatively cheap and nutritious, although salty. The main fermented fishery products in Malaysia are fish sauce ('budu'), shrimp paste ('belacan'), shrimp sauce ('cencalok') and hecko ('petis' or 'otak udang').

10.3 Freezing and cold storage

There are 47 freezing plants in Malaysia with a total production capacity of 58 000 MT. Fish freezing is not a large scale industry as fish is basically consumed fresh or chilled, and is available year-round. Freezing is mainly used for export products (esp. shrimp), using plate and blast freezers. Quite a few shrimp processing plants process IQF cooked and peeled prawns for export to Europe and Australia.

10.4 Canning

This sector of the fish processing industry is small. There are 14 canning plants in Malaysia. Initially, the canning industry seemed to develop favourably, but encountered major problems over the past years as the raw material supply became insufficient; the canneries could not cope with the increasing competition on the world market and stricter quality requirements by major importing countries could not be met.

Potential lies in new raw materials such as cockles, squid, cuttlefish, locally obtained and imported small pelagic fish and possibly, freshwater fish.

10.5 Fishmeal

Trashfish is utilised as raw material for fishmeal production in Malaysia. There is some fear that overfishing could lead to reduced availability of trashfish in the future.

Altogether, there are 14 fishmeal plants with a combined production capacity of 35 000 MT. Production facilities are of three basic types. The first category, of which there are only five factories, comprises modern, well-equipped factories, where good quality meal with a protein content of 65-68% can be produced. The second category comprises mechanised but rather 'old fashioned' factories, where extraction of oil from the fish is less efficient and the meal is therefore of a lower protein content (50-55%). The third category is the largest, and consists of simple, manually operated plants where the fish is dried on metal sheets over fires, with no attempt to recover oil, yielding a finished product with protein content of less than 50%. These factories sell to local pig and poultry farmers, who are often unaware of the poor nutritional value of the meal they are buying. The production of these factories is not monitored, and accounts for the discrepancies in reported fishmeal production levels.

Table 12: Major fisheries industry products

Dried/salted products	Fermented products	Minced products	Reduction products	Others
Dried salted fish of various species including anchovies and jellyfish	Fish sauce ('budi')	Fish balls	Fish meal	Canned products
	Shrimp paste ('belacan')	Fish cake	Fish manure	Fish rolls ('keropok lekor')
Dried salted shrimp	Hecko ('petis' or otak udang')			Frozen prawn
Dried cuttlefish				Frozen whole fish and fillet
Fish crackers	Fermented freshwater fish ('pekasam')			Steamed/boiled fish
Prawn crackers				
Cuttlefish crackers				
Fish satay				
Fish floss				

11 Training

In Malaysia, the aim of training is to upgrade the knowledge and skills of the fishermen, to enhance productivity to enable them to exploit resources in offshore areas; and to impart the knowledge and technical know-how on culture practices to fishfarmers.

Processors are provided with training through MARDI, under Entrepreneur Development Programmes. LKIM provides training in simple accounting and useful skills for fishermen's communities including for women and school drop-outs.

Training to fishermen and fishfarmers is provided by the Fisheries Department, Ministry of Agriculture, through training institutes. There are 2 marine fisheries training centres in Malaysia to upgrade the skills of traditional fishermen. Education programmes on proper handling of fish for persons involved in harvesting, handling and processing is also implemented by the Fisheries Department through its extension services. This activity includes introduction of high density polyethylene containers and insulated polyethylene fish boxes, and also the introduction of RSW systems for larger boats.

The provision of technical advice and know-how in fishing operations, engine and gear maintenance, post-harvest operation and fish farming is done by means such as:

- (a) publications, demonstrations and communications;
- (b) setting up of marine and aquaculture extension centres complete with adequate facilities and necessary equipment such as available at the Inland Fisheries and Aquaculture Branch Production and Training Centre at Batu Lintang.

- (c) Upgrading of facilities at existing hatcheries in order to accelerate and improve production techniques of fish and shrimp fry.

Training is provided to fishermen and fish farmers in order to increase their productivity. It is done through:

- (a) upgrading of facilities at existing institutions;
- (b) setting up of a new training centre in brackishwater aquaculture at the Brackishwater Aquaculture Research Station, Gelang Patah, Johore (Fisheries Department);
- (c) provision of allowances for fishermen and fish farmers to be trained in fishing and aquaculture and to enable the fishermen to be trained in other vocations as a means of encouraging the resettlement of surplus labour.

11.1 Research institutions

Fisheries Research Institutes come under the Fisheries Department. Research centres include the Fisheries Research Centre, Likas, Sabah, the Fisheries Research Institute, Glugor, Penang; the Freshwater Fisheries Research Centre, Malacca; and the earlier mentioned Research Station in the State of Johore.

Fisheries research activities are being intensified in order to assess and monitor resources, to develop or adopt technologies for the mass production of fish seed; and to improve or develop culture technologies and practices. Research activities include:

- (a) monitoring and assessing the inshore and offshore fishery resources;
- (b) identifying new cockle beds and rehabilitating old ones.
- (c) upgrading of research facilities;
- (d) accelerating aquaculture research with respect to breeding, feed formulation, culture methods and fish diseases; and
- (e) carrying out research on post-harvest aspects of fisheries.

Ongoing research in marine fish spoilage and related post-harvest losses in Peninsular Malaysia is mostly being conducted. A corresponding effort on socio-economic aspects is being taken care of by ICLARM, IDRC, Ford Foundation and the ASEAN Food Handling Bureau. The scale of research effort into post-harvest fish handling---especially with regard to socio-economic aspects---falls short of matching the size of the problems.

Among a small group of scientists, there is considerable interest in fish quality and wastage. MARDI and the Universiti Pertanian Malaysia (UPM) have conducted research in post-harvest handling, processing, product diversification and storage studies, freshwater fish utilisation, fermentation and cured products and packaging.

Market and socio-economic research is mainly carried out by UPM. The Fisheries Department and LKIM are taking practical supportive steps in the field of extension services.

12. Fish inspection and quality control

A number of Government institutions in Malaysia are involved in the inspection and quality control of fish and fishery products. They are:

- (i) the Food Quality Control Unit of the Ministry of Health;
- (ii) the Food Technology Division of MARDI
- (iii) the Standards and Industrial Research Institute of Malaysia (SIRIM);
- (iv) the International Trade Division of the Ministry of Trade and Industry;
- (v) the Institute for Medical Research;
- (vi) the District Health Officers and
- (vii) the Local Councils.

Implementation of fish inspection and quality control lies mainly with the Ministry of Health assisted by other Government institutions. The Governing Act is the Sale of Foods and Drugs Ordinance and Regulations which has provisions for the appointment of inspectors and officers who have the power to enter and inspect premises where food is processed and stored. Food processing premises cannot be registered unless they comply with the requirements of the Code of Practice for Food Hygiene.

Fish inspection and quality control programmes are basically directed towards the main export trade i.e. frozen, cooked and peeled shrimp.

The Code of Practice for the export of frozen, cooked and peeled shrimp is the reference document for the inspection and quality control programme. It is a very comprehensive document covering handling of shrimp at sea, during marketing and distribution and in processing plants. Inspectors from state, district or local health authorities carry out inspection. All export consignments must receive a Health Certificate issued by the Food Quality Control Unit of the Ministry of Health. Routine test analysis is provided by accredited private laboratories. Results are forwarded to the Ministry of Health which issues the Health Certificate which is presented to the Customs before an export license is issued.

There are 2 serious deficiencies in the quality control assurance programme, the qualitative and quantitative lack of manpower and laboratory facilities.

A number of plants have a quality control programme, however the nature and efficiency of these programmes vary considerably from plant to plant. Large companies catering for foreign markets incorporate good quality control practices in their product lines while others depend on private laboratories to assess if products meet specifications.

Other standards for processed foods created by SIRIM cover various fish products mainly directed at the local market, such as dried fish (including dried anchovy, dried shrimp) shrimp paste, canned fish in tomato sauce, shrimp canned in brine, fishmeal, and fresh fish. Nevertheless, most products for the local market undergo very little inspection or none at all.

13. International cooperation

Malaysia participates actively in international and regional programmes including those organised by FAO, the SCSP, the BOBP, SEAFDEC and receives assistance in the form of bilateral technical cooperation projects under the country's UNDP/IPF fund, as well as under Canadian, French and British technical cooperation programmes. There are also bilateral technical cooperation and agreements with Thailand and Indonesia.

Among the projects under international cooperation aid have been the ADB's feasibility study for fisheries development for Sabah and Sarawak; FAO/TCP project of pelagic acoustic survey; FAO's mission to identify and recommend programmes for the development and management of the EEZ; various consultancy inputs from SCSP/FAO; the Aquaculture Development and Research Project under UNDP/IPF sponsorship in Gelang Patah, Johor.

Malaysia also has bilateral technical cooperation projects with the United Kingdom for the training of extension workers; a pilot integrated fisheries community development project at Kuala Besut funded by the CIDA; and a crustaceans aquaculture project with the French Government. Under the bilateral agreements with Thailand and Indonesia, there are provisions for exchange of exports, materials, training and cooperative research.

SEADPEC provides essential training for Malaysians in fisheries technology and aquaculture, whilst projects under ASEAN are now gaining momentum with the implementation of a post harvest handling project assisted by Australia. Another post-harvest technology project with assistance from Canada is about to be implemented.

The USFDA together with MARDI have cooperated in training in quality control in the food processing industry.

14. Marketing and distribution

Marine fish marketing in Malaysia is generally characterised by extreme price fluctuations, varying trade profit margins between trade participants but mostly very much in favour of the middlemen; an unnecessarily long marketing chain; and a high rate of wastage.

Much of the Government intervention in fish marketing has tended to focus on the alleviation of the exploitation problem of small-scale fishermen and the provision of subsidies for the purchase of inputs such as fishing boats, fuel, gears, and other equipment. There are indications, however, that marine fish marketing is assuming a more modern outlook with an increasing proportion of the catch being frozen or refrigerated, and sold direct from landing centres to large retail, hotel, catering groups, and institutions.

Essentially, marketing activities are carried out by the private sector. Fishermen sell their catch either directly to the consumer, the retailer or to a wholesaler/agent (who may operate individually or as a cooperative). Generally, wholesalers dominate fishery trade in Malaysia;

they sell the fish to terminal markets or consign for export. The catch for the domestic market is mostly distributed as whole, wet fish; hardly any gutting or filleting takes place. The wide variety of species handled are classified basically into grades A, B and C.

15. Government policy

The National Agricultural Policy was announced in early 1984. This policy provides guidelines for the development of specific sectors including fisheries. Development strategy for the fisheries sector can be summarised as follows:

- a) There will be a modernisation of methods so as to fully exploit the country's fisheries resources;
- b) Off-shore fishing will be intensified;
- c) Aquaculture will be intensified to increase local supply of fish and to participate as an export earner.

For the marine fisheries sector, the overall plans are:

- (i) to intensify conservation and protection of inshore fisheries in order to attain an optional level of production;
- (ii) to rehabilitate the inshore fisheries resources;
- (iii) to reduce the overall fishing effort to a level that the resources can sustain;
- (iv) to channel under-employed fishermen to other more productive sectors of the economy;
- (v) to extend resource management and conservation to the offshore fisheries; and
- (vi) to provide adequate fisheries support services for both in-shore and off-shore fisheries in terms of fisheries research, training, marketing, institutional set-up and credit facilities.

For the aquaculture sector, the overall plans are:

- (i) to encourage the culture of commercially attractive species;
- (ii) to make available more land for fish culture;
- (iii) to improve existing culture practices;
- (iv) to provide adequate support services.

Basic needs of small scale fisheries communities are being met by on-going Government programmes with the provision of ancillary facilities: landing jetties, packing sheds, coldrooms, shipyards and so on.

These facilities have relieved some of the hardships of fishing, reduced wastage due to delays in handling, lack of cold storage facilities and minimising the cost of repair and maintenance of fishing boats.

Fishermen are in urgent need of cold storage facilities, enabling them to store fish. The existing facilities are not operational because of management problems. LKIM has tried, through various projects, to offer services provided by local towkays to local fishermen, but up to now not very successfully.

LKIM has established Fishermen's Associations in order to organise the fishermen and to provide them with facilities and inputs required for modernising the fishing industry.

16. Conclusion

The main issues facing the Malaysian fishing industry may be summarised as follows:

- (i) overfishing of the inshore waters of Peninsular Malaysia;
- (ii) management of Malaysian EEZ;
- (iii) expansion of the off-shore resource utilization through deep-sea fishing;
- (iv) development of aquaculture.

Annex I: Number of licensed fishing boats and number of fishermen operating licensed boats, in Peninsular Malaysia, 1970-84

Year	Fishing boats				Fishermen				
	Inboard	Outboard	Non-powered	Total	Malay	Chinese	Indian	Others	Total
1970	12 865	2 164	5 277	20 306	36 472	31 078	253	351	68 154
1975	16 031	2 138	3 928	22 147	40 335	31 992	452	525	73 304
1980	18 433	6 585	5 502	30 502	55 008	31 802	410	1 752	88 972
1981	18 565	7 368	4 437	30 390	54 538	30 084	609	1 694	86 925
1982	17 875	7 246	2 620	27 741	49 232	28 306	739	1 960	80 237
1983	16 285	7 202	2 208	25 695	47 322	25 238	534	2 496	75 590
1984	16 533	7 458	1 682	25 673	48 616	25 077	564	2 111	76 368

Annex II: Number of fishing vessels and fishermen in Sarawak, 1975-84

Year	Fishing boats				Fishermen	
	Non-powered	Outboard-powered	Inboard-powered	Total	Full time	Part time
1975	1 961	1 530	1 593	5 084	NA	NA
1980	1 671	2 171	3 330	7 172	8 752	2 918
1981	1 812	2 095	4 438	8 305	9 234	3 295
1982	1 339	1 603	4 764	7 706	8 871	3 272
1983	1 270	1 668	5 235	8 173	7 927	3 856
1984	1 456	1 855	5 595	8 906	9 009	3 810

Annex III: Number of fishing vessels and fishermen in Sabah, 1975-84:

Year	Fishing boats				Fishermen	
	Non-powered	Outboard-powered	Inboard-powered	Total	Full time	Part time
1975	400	2 705	1 131	4 236	8 300	2 900
1980	900	2 670	2 230	5 800	15 400	2 600
1981	800	2 800	2 300	5 900	15 450	3 000
1982	650	3 000	2 400	6 050	16 850	3 000
1983	600	3 150	2 550	6 300	16 900	3 000
1984	600	3 300	2 600	6 500	16 900	3 000

Annex IV: Peninsular Malaysia - Annual series of fishery commodity imports by type, quantity and value, 1980-85 (in MT and in 1000 Malaysian Ringgit)

Description of Commodity	1980		1981		1982		1983		1984		1985	
	Quantity	Value M\$	Quantity	Value M\$	Quantity	Value M\$	Quantity	Value M\$	Quantity	Value M\$	Quantity	Value M\$
Fish, Fresh, Chilled or Frozen (excluding fillets)	50 977.30	34 226	62 603.31	39 335	76 877.53	59 237	72 166.47	68 073	108 398.69	95 123	108 830.33	109 574
Fish, Dried, Salted, in Brine or Smoked	3 429.65	5 710	4 859.79	8 559	6 324.12	10 175	5 040.50	9 267	4 535.24	8 050	3 513.26	6 365
Crustaceans and Molluscs, Fresh Chilled, Frozen, Dried, Salted, in Brine or Simply Boiled	31 264.63	23 792	30 249.74	43 261	25 554.82	47 240	24 799.04	48 048	21 701.69	37 073	26 061.61	39 228
Prepared or Preserved Fish in Airtight Containers	21 053.66	44 259	15 198.08	42 388	16 344.77	44 516	16 913.64	41 803	18 480.81	46 980	16 885.96	48 924
Prepared or Preserved Fish not in Airtight Containers	69.87	316	160.04	457	354.39	806	640.43	1 554	960.51	2 233	NA	NA
Prepared or Preserved Crustaceans and Molluscs in Airtight Containers	572.98	2 887	590.44	3 478	1 888.07	10 675	2 660.58	14 842	5 574.30	12 307	2 125.71	10 759
Prepared or Preserved Crustaceans and Molluscs not in Airtight Containers	1 390.57	3 274	1 269.81	4 798	992.57	1 639	1 064.52	2 365	691.43	4 266	NA	NA
Fats and Oils, of Fish and Marine Mammals	174.10	129	32.60	69	256.67	532	449.37	848	1 489.88	2 346	558.63	867
Flours and Meals, of Fish, Crustaceans or Molluscs Unfit For Human Consumption	30 224.24	14 722	26 364.04	12 161	38 861.84	20 812	35 871.53	17 656	52 496.74	19 240	56 340.78	46 116
Miscellaneous	662.46	899	518.89	869	1 836.40	1 138	2 464.17	1 427	2 380.66	2 074	4 300.00	13 246
Total	139 819.46	130 218	141 847.64	155 380	169 291.18	196 774	162 050.25	205 888	216 709.95	259 697	218 616.20	277 082

Source: Department of Fisheries, Malaysia

Annex V: Peninsular Malaysia - Annual series of fishery commodity exports by type, quantity and value, 1980-85 (in MT and in 1000 Malaysian Ringgit)

Description of Commodity	1980		1981		1982		1983		1984		1985	
	Quantity	Value M\$	Quantity	Value M\$	Quantity	Value M\$	Quantity	Value M\$	Quantity	Value M\$	Quantity	Value M\$
Fish, Fresh, Chilled or Frozen (excluding fillets)	30 242.65	18 820	34 180.78	21 387	48 612.02	23 779	27 516.47	17 416	44 399.25	20 715	77 106.21	27 798
Fish, Dried, Salted, in Brine or Smoked	4 512.97	7 347	6 043.05	8 095	9 738.43	7 953	4 891.01	7 003	3 192.47	6 506	3 079.04	6 044
Crustaceans and Molluscs, Fresh Chilled, Frozen, Dried, Salted, in Brine or Simply Boiled	39 208.95	103 967	41 805.20	65 045	34 556.17	64 431	41 490.82	86 971	41 210.23	43 771	40 223.42	38 006
Prepared or Preserved Fish in Airtight Containers	7 769.92	33 330	9 074.01	36 096	6 378.34	28 545	6 699.36	30 714	6 258.35	26 492	7 101.65	34 274
Prepared or Preserved Fish not in Airtight Containers	321.25	575	335.40	707	365.99	949	450.63	1 083	669.09	1 939	NA	NA
Prepared or Preserved Crustaceans and Molluscs in Airtight Containers	4 537.31	20 885	5 214.92	18 974	3 790.11	21 352	5 323.11	31 536	6 936.81	36 041	6 561.57	36 009
Prepared or Preserved Crustaceans and Molluscs not in Airtight Containers	6 953.51	54 787	11 605.50	100 714	8 100.84	74 366	7 101.61	63 180	4 342.50	46 030	NA	NA
Fats and Oils, of Fish and Marine Mammals	0.91	2	3.87	9	5.34	14	1.96	6	2.97	18	1.98	6
Flours and Meals, of Fish, Crustaceans or Molluscs Unfit For Human Consumption	2 231.84	580	2 16.26	605	11 881.60	775	13 467.05	1 367	10 650.26	1 003	11 379.57	1 374
Miscellaneous	19 426.80	3 063	13 007.08	2 876	8 390.62	2 707	10 393.13	3 532	9 459.62	3 929	13 770.30	48 871
Total	115 206.11	243 362	123 430.07	254 513	131 819.46	224 876	117 335.15	242 811	127 121.55	286 448	159 223.74	192 386

Source: Department of Fisheries, Malaysia

Thailand

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Thailand

1. Introduction

Thailand's population was estimated at 15.7 million in 1984. Its GNP in 1983 was US\$39.3 billion, with the agriculture sector contributing almost 22.5% of the total. Per capita income was US\$794.2 in the same year.

Thailand is traditionally a fishing nation. Virtually 90% of its total aquatic production comes from marine fisheries.

With an annual production of 2.2 million MT of aquatic products, Thailand's fishing industry stands as the fifth largest in Asia after Japan, China, India and Korea Rep. During the period 1960 to 1977, the Thai fishery sector showed an average growth rate of 15% per annum and its contribution to the national income reached US\$611 million or 3.2% of the total GNP by 1977.

Despite the fact that fish landings have shown a declining trend since 1977, exports continued to be one of the largest foreign exchange earners, with US\$516.8 million in 1982 and US\$551.1 million in 1983. The country enjoys a positive trade balance in fishery products, both in quantity and value.

2. Resources

2.1 Marine resources

Thailand has a coastline of about 2,600 km bordered by the Gulf of Thailand (1,850 km) and the Andaman Sea (750 km). The total maximum sustainable yield (MSY) for the entire Thai Exclusive Economic Zone (EEZ) is estimated at 1.4 million MT (including crustaceans) by the Department of Fisheries. The MSY for the Gulf of Thailand is estimated at about 910,000 MT, of which about 770,000 MT are demersal and 140,000 MT pelagic species. Thailand's Andaman Sea area is estimated to have a MSY of about 290,000 MT, comprising 200,000 MT of demersal and 90,000 MT of pelagic species.

There are approximately 850 marine species found in Thai waters. Some of the most common and commercially important pelagic species are Indo-Pacific mackerel (Rastrelliger brachysoma), Indian mackerel (Rastrelliger kanagurta), scad (Decapterus spp.), Spanish mackerel (Scomberomorus commersoni), longtail tuna (Thunnus tonggol), sardine (Sardinella gibbosa), anchovy (Stolephorus heterolobus) and carangids (Selar crumenophthalmus, Selaroides leptolepis, Atule mate).

The more important demersal fish include: snappers (Lutjanus spp.), groupers (Epinephelus spp.), threadfin bream (Nemipterus spp.), monocle bream (Scolopis spp.), lizard fish (Saurida spp.), barracuda (Sphyraena spp.), croaker (Sciaenidae spp.), trevally (Caranx spp.) and slipmouth (Leiognathus spp.).

Other commercially important marine species are shrimp, spiny lobster, crab, squid and cuttlefish, and molluscs. The most important Penaeid shrimp species are P. merguensis, P. indicus and P. monodon. Various Metapenaeus species are also landed.

Squid species caught comprise Loligo and Sepioteuthis spp. Major cuttlefish species are Sepia and Sepiella spp. The most important molluscs are green mussel (Mytilus viridis), horse mussel (Musculus senhousenii), cockle (Arca granulosa), baby clam (Paphia undulate), hard clam (Meretrix meretrix) and oysters (Crassostrea commercialis, C. belcheri, C. lugubris). Three species of crabs are economically important. They are swimming crab (Portunus pelagicus), musk crab (Charybdis cruciata) and mud crab (Scylla serrata) (See Annex I)

2.2 Inland water resources

The combined length of Thailand's many major rivers is about 20 000 km. Besides these rivers, an area of 18 000 sq km of flood-plains and reservoirs is available for inland fisheries culture.

The country's total surface area of natural lakes is estimated to be around 300 000 ha. These usually refer to natural swamps or marshy lakes. There are approximately 8 000 swamps and marshy depressions and most of them are flooded during the rainy season.

Besides rivers and natural lakes, there are approximately 2 000 man-made lakes (reservoirs, irrigation tanks and community ponds) with an estimated total surface area of around 230 000 ha and a further 31 000 sq km of irrigated rice fields.

Approximately, 560 freshwater fish species are available in Thailand, the most important being carp, catfish, gouramy, tilapia and freshwater shrimp (See Annex I).

3. Resource exploitation

Thailand's total aquatic production increased from 213 000 MT in 1960 to 2.2 million MT in 1977, reflecting an average annual growth rate of 15% thereafter. Marine fish landings experienced a gradual decline during 1978-80 when landings dropped to 1.8 million MT. This decline was attributed to a combination of oil price increases, declaration of the 200-mile Exclusive Economic Zone (EEZ) by neighbouring countries, and over-exploitation of fishery resources in the Gulf of Thailand. However, by 1983, landings recovered to 2.29 million MT, largely because of increased fishing efforts coupled with the use of improved fishing techniques and gears; decline in the real cost of fuel; increasing fishing activities in the EEZ of third countries, under licence or joint venture; development of the Andaman Sea fishing grounds; and an increase in cultured fish production.

Table 1 Fisheries production by sub-sector 1974-85 (in MT)

Year	Total	Marine capture		Inland capture fisheries	INLAND AQUACULTURE				
		fisheries	Mariculture ^a		Brackishwater ponds ^b	Ponds	Freshwater Cages	Ditches	Paddy
1974	1 510 466	1 315 926	33 889	152 876 ^c	1 775	NA	NA	NA	NA
1975	1 555 300	1 303 816	88 254	130 856	2 538	14 770	227	214	14 625
1976	1 699 086	1 389 282	159 987	114 936	2 523	13 292	201	291	18 574
1977	2 189 907	1 954 266	130 101	89 233	3 166	16 051	477	279	16 334
1978	2 099 281	1 849 769	98 101	102 129	9 915	17 695	111	243	21 318
1979	1 946 334	1 812 585	89 914	103 714	10 659	15 653	334	273	13 202
1980	1 792 948	1 581 677	54 458	110 490	11 818	18 394	403	371	15 337
1981	1 989 025	1 723 774	87 091	116 558	13 579	28 568	1 005	1 218	17 232
1982	2 120 133	1 860 994	112 735	87 732	12 842	26 527	324	642	18 337
1983	2 255 415	2 002 076	83 828	102 820	14 064	—	52 627	—	—

a Mariculture production comprises cultured cockle green mussel oyster and horse mussel.

b Brackishwater pond production includes all shrimp species plus crab and fish. However, for 1974-76 only shrimp species are included.

c Includes freshwater aquaculture.

Source : Department of Fisheries, Thailand

Table 2 Total fishery production 1960-84 (in MT)

Year	Total	Freshwater	Marine
1960	219 045	72 574	146 471
1961	305 605	72 330	233 275
1962	339 788	70 079	269 709
1963	418 685	95 311	323 274
1964	576 986	82 790	494 196
1965	615 120	85 637	529 483
1966	720 282	85 117	635 165
1967	847 443	85 225	762 188
1968	1 089 303	85 245	1 004 058
1969	1 270 034	90 439	1 179 595
1970	1 448 404	112 714	1 335 690
1971	1 587 077	116 788	1 470 289
1972	1 679 540	131 383	1 543 157
1973	1 678 901	140 865	1 538 016
1974	1 510 466	158 876	1 351 590
1975	1 555 300	160 692	1 394 608
1976	1 699 086	147 294	1 551 792
1977	2 189 907	122 374	2 067 533
1978	2 099 281	141 496	1 957 785
1979	1 946 334	133 176	1 813 158
1980	1 792 948	144 995	1 647 953
1981	1 989 025	164 581	1 824 444
1982	2 120 133	133 562	1 986 571
1983	2 255 415	155 447	2 099 968
1984	2 134 838	161 819	1 973 019

Source : Department of Fisheries, Thailand

In general, it is obvious that the territorial and the EEZ waters are over-fished. The per unit catch which averaged 231.9 kg/hour in 1963 declined to 38.9 kg/hour by 1980. Overfishing, inappropriate gear, excessive fishing effort and illegal fishing methods are primarily responsible for the depletion of resources. Declining domestic marine resources force Thai fishermen to encroach into the waters of neighbouring nations, causing serious diplomatic problems.

With the introduction of the EEZ by neighbouring countries, Thai fishermen lost around 300 000 sq km of traditional fishing grounds, representing between 400 000 - 600 000 MT of fish annually.

3.1 Marine fishing

Thailand's marine capture fisheries contributes about 90% of total landings, nearly one-third of which is caught outside of Thailand's territorial waters. An analysis of the current exploitation levels of fisheries resources within the territorial and EEZ waters of Thailand indicates overfishing of most stocks and it is noted that a similar level of production could be achieved with much less effort. In 1984, marine catches consisted of 65% foodfish and 35% trashfish. The former includes fish (27%), shellfish (7%), squid and cuttlefish (6%), Indo-Pacific mackerel (6%) and others (35%), while the latter comprises mostly juveniles of valuable fish and shrimp species.

Marine fisheries in Thailand can broadly be classified into two categories namely: (a) the industrial fishery; and (b) the small-scale fishery. In the industrial fishery, trawl, purse-seine and castnets are the major gears used, whereas in the small-scale fishery less mobile gears are used, such as bamboo stake traps and pushnets. The catch of the small-scale fishery estimated at less than 500 MT a year plays a minor role in the Thai marine fishery. The catch from industrial otter-board trawl vessels accounted for 50.5% of the total catch in terms of volume and for 49.1% in terms of value, followed by (in terms of volume) purse-seiners (24.5%), pair trawlers (10.8%), anchovy purse-seiners (5.3%) and mackerel encircling gillnetters (3.6%).

Table 3: Landings of major marine species, 1980-84 (in 1 000 MT)

<u>Species</u>	<u>1980</u>	<u>1981</u>	<u>1983</u>	<u>1984</u>
<u>Fish</u>				
Indo-Pacific mackerel	53.4	71.0	79.8	129.0
Indian mackerel	27.9	20.5	53.2	33.4
King mackerel	11.3	13.7	9.2	10.3
Spotted tuna	8.7	11.6	53.8	44.3
Scad	30.9	37.3	34.1	44.2
Hardtail scad	11.1	4.4	21.9	11.2
Trevally	23.4	19.2	23.3	20.3
Sardinella	105.4	139.8	124.9	367.2
Anchovy	20.3	14.4	40.6	90.0
Big-eyed scad	15.7	26.7	23.3	25.2
Bonito	5.0	10.6	32.0	32.4
Mullet	4.9	7.4	5.5	4.6
Croaker	11.2	13.4	10.8	11.5

Threadfin bream	18.0	20.3	16.2	15.0
Lizard fish	10.2	8.7	9.4	9.7
Snapper	5.1	4.9	5.0	4.2
Big-eye	16.4	15.4	10.9	10.0
Conger eel	2.6	2.8	1.8	1.5
<u>Crustaceans</u>				
Banana shrimp	19.1	23.1	18.0	19.8
Jumbo tiger shrimp and tiger shrimp	2.5	2.1	2.2	1.9
King shrimp	1.9	1.8	1.8	1.5
School shrimp	13.1	16.4	14.1	13.5
Other shrimp	81.6	89.1	102.8	80.4
Sergestid shrimp	14.9	14.8	21.1	18.8
Swimming crab	29.3	28.4	24.9	22.3
Mud crab	4.5	4.5	3.4	4.3
<u>Molluscs</u>				
Squid	39.8	48.0	76.4	66.3
Cuttlefish	26.7	27.2	47.3	56.3
Octopus	5.7	5.5	8.2	6.5
Blood cockle	17.7	23.3	16.5	16.5
Green mussel	31.3	36.7	43.1	62.2
Oyster	6.0	8.4	5.3	5.7
Horse mussel	9.0	18.5	13.1	14.2
Short-necked clam	35.1	62.2	31.8	50.5
Trash fish	786.9	796.7	803.3	757.6
Other foodfish	138.2	145.7	536.9	585.8
Other products	3.2	29.2	-	-
Total	1 648.0	1 824.4	2 099.9	1973.0

Source: Department of Fisheries, Thailand

Table 4: Catch of marine fish by major fishing methods, 1983-84 (in MT)

Type of fishing method	1983	1984
Otter-board trawl	908 268	835 304
Pair trawl	171 979	178 686
Beam trawl	8 681	2 647
Purse-seine	400 267	406 058
Chinese purse-seine	29 208	23 052
Anchovy purse-seine	40 000	87 824
King mackerel gillnet	18 733	24 674
Mackerel encircling gillnet	33 259	59 996
Pushnet	32 193	23 082
Bamboo stake trap	9 294	11 943
Total	1 651 882	1 653 266

Source: Department of Fisheries, Thailand

Thailand's commercial fishing fleet consists primarily of larger fishing vessels of more than 14 m in length and averaging 250 GRT. Fishing vessels are mostly owned and operated by the private sector. (The number of registered fishing vessels, by size and type in 1984 are listed in Annex II).

Fishing methods and practices in Thailand can be divided into three main zones:

- a. Coastal fisheries This area is restricted to off-shore operations involving small and medium sized trawlers. Also under the same category fall marine hatching and breeding farms - which consists primarily of shrimp and oyster farms. Gears and equipment used for this type of fisheries include purse-seines, pole-and-line, gillnets, squid and shrimp nets, and bamboo stake traps.
- b. Off-shore fisheries: This type of fishing operation involves vessels of 10 to 100 GRT - most of which are the popular otter trawlers, with a small number of pair and beam trawlers. The main area of operations are along the continental waters of the Gulf of Thailand and the Andaman Sea. Apart from trawl nets, a variety of purse-seines, gillnets and encircling gillnets are in use.
- c. Deepsea fisheries: These are operated by large ocean-going trawlers equipped with radio communications, sonar and fish scanner systems, and refrigerated holds. These distant water trawlers mostly undertake fishing trips of 30 days or more. The vessels are commonly used in overseas joint fishing ventures.

The number of shipyards in Thailand has increased from 74 in 1970 to 168 in 1984. However, boatbuilding technology has advanced little since mid-1960s and it remains basically a labour-intensive industry. The use of plant and power tools is minimal and almost every master technician builds "by eye". The Department of Fisheries reports that only one yard in Thailand builds steel fishing vessels. The building of wooden vessels is a profession handed down from one generation to the next, and is traditionally a village industry. The annual total building capacity is estimated at 652 vessels. Five basic hull shapes are constructed, although only one predominates for both trawlers and seiners.

Boatbuilding costs are rising, with a reported increase of over 130% in the last three years. In 1979, the price of a 12.5 m fishing vessel was approximately Baht 0.9 million (US\$46 000) and a 25 m stern trawler, about Baht 5.0 million (US\$260 000). New or reconditioned truck engines are normally used in boats of up to 18 m in length and marine diesels in larger vessels.

3.2 Inland fisheries

In 1983, the inland fishery sector landings accounted for about 5% of Thailand's total fish production. Although this sector's contribution to the total aquatic production of the country is small, it provides a livelihood for some 13 500 families, wholly or mainly dependent on inland fishing.

The top five contributing species in 1983 were tilapia (25.3%), sepat Siam (19.1%), catfish (14.8%), local carp (10.6%) and snakehead (10.6%).

3.3 Aquaculture

Aquaculture comprises a number of activities, such as (i) culture of fish and shrimp in brackishwater ponds; (ii) bivalve mariculture in coastal waters; and (iii) freshwater culture in ponds, paddy fields, ditches and cages. Brackishwater culture and mariculture together contribute around 8% of total fishery production. The main species are

shrimp, cockles, green mussels, oysters and sea bass. The sector's shellfish production accounts for more than 50% of the country's total domestic shellfish production.

The aquaculture sub-sector has shown pronounced fluctuations in production since 1975, peaking at 195 000 MT in 1976 but dropping to a low of 100 000 MT in 1980. These fluctuations have been mainly due to wide variations in mariculture production of bivalve molluscs, of which only 30% of the weight is edible. Aquaculture production from sources other than mariculture rose fairly steadily from 1975 through 1983 in a linear fashion, increasing at an average annual rate of about 3 600 MT. Although production data are not available, the marine cage culture is probably the fastest growing sub-sector in the aquaculture fisheries, although it currently contributes only a small portion of total aquaculture production.

Table 5: Inland freshwater aquaculture production, 1977-83 (in MT)

Year	Mariculture	Inland freshwater aquaculture			
	brackishwater	Ponds	Cages	Ditches	Paddy
1977	130 101	16 051	477	279	16 334
1978	98 101	17 695	111	243	21 318
1979	89 914	15 653	334	273	13 202
1980	54 458	18 394	403	371	15 337
1981	87 091	28 568	1 005	1 218	17 232
1982	112 735	26 527	324	642	18 337
1983	83 828				
				52 627	

Source: Department of Fisheries, Thailand

4. Disposition of landings

Statistics show that marine fish utilisation in Thailand increased by 19.7% in 1984 compared to 1980. Fish utilisation showed an increasing trend in almost all sectors except for dried/salted fish products. The canned fish sector registered a remarkable increase of more than 400% from 4 241 MT in 1980 to 18 326 MT in 1984.

During 1984, 42.8% of the marine catch was used as raw material for fishmeal, 22.4% consumed fresh, 10.2% frozen, 9.2% canned, 4.9% dried-salted, and the remainder used as raw material for steamed or smoked fish and for the production of shrimp paste. The main species for fresh consumption was foodfish, shellfish and Indo-Pacific mackerel. Frozen fish, shellfish and cephalopods are mostly for export purposes.

Table 6: Apparent consumption of fish, 1970-84 (in 1000 MT)

Year	Fish production (+)		(-)	Trade ^b		Total available for domestic human consumption
	Marine landings	Freshwater landings	Trash and foodfish used for fishmeal ^a	(+) Imports	(-) Exports	
1970	1 336	113	487	14	35	921
1971	1 470	117	661	16	50	892
1972	1 548	131	721	15	77	896
1973	1 538	141	811	19	120	767
1974	1 352	159	702	20	111	717
1975	1 394	1	648	17	104	820
1976	1 552	141	642	25	128	954
1977	2 067	122	879	18	164	1 164
1978	1 958	141	905	29	211	1 012
1979	1 813	133	808	79	239	978
1980	1 648	144	813	43	232	790
1981	1 824	165	826	47	292	918
1982	1 987	134	833	46	398	930
1983	2 100	155	860	59	433	1 021
1984	1 973	162	844	119	516	894
Average	1 704	142	763	209	219	912

^a Up to 15 000 MT of shellfish are used as fertiliser or for fishmeal.

^b Adjusted to whole fish equivalent basis.

Source: Department of Fisheries, Thailand

Table 7: Utilisation of marine fish by product form, 1980-84 (in MT)

Year	Fresh consump- tion	Frozen	Dried and salted	Steamed or smoked	Shrimp paste	Dried shrimp	Fishmeal	Fish sauce	Canned fish	Others	Total
1980	427 989	123 873	116 320	20 844	15 099	17 497	822 834	75 024	26 818	1 655	1 647 953
1981	505 464	122 369	126 403	28 015	16 850	52 303	840 974	90 130	41 241	743	1 824 444
1982	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1983	482 115	155 573	271 684	20 581	21 376	75 449	859 958	92 290	116 283	4 677	2 099 986
1984	443 298	200 958	79 732	21 579	19 001	97 526	843 446	80 671	181 326	5 482	1 973 019

Note: Frozen for export

Source: Department of Fisheries, Thailand

Freshwater fish are mostly used for fresh consumption (72.8%), followed by dried and salted (12.9%), fermented (8.0%), steamed or smoked (3.7%) and others including fish sauce, shrimp paste, dried shrimp, fish meal and fertiliser (2.5%). Of the top five freshwater species (tilapia, snakehead, local carp, sepat Siam and catfish), only sepat Siam is used mainly for dried and salted production.

Table 8: Utilisation of freshwater fish by product form, 1980-84 (in MT)

Year	Fresh consumption	Dried and salted	Steamed or smoked	Fermented	Shrimp paste	Dried shrimp	Animal feed and fertiliser	Fish sauce	Others	Total
1980	91 556	27 050	5 455	15 175	313	156	585	3 744	961	144 995
1981	113 478	23 712	6 089	15 656	407	155	508	3 931	645	164 581
1982	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1983	108 288	24 286	5 666	12 268	423	83	2 776	601	1 056	155 447
1984	117 555	21 022	5 669	13 455	212	166	2 583	135	1 022	161 819

Source : Department of Fisheries, Thailand

4.1 Domestic consumption

In Thailand, fish is mostly consumed in fresh form. In 1984, the average annual per capita consumption of fish was 21 kg. Per capita consumption in the northern and north-east regions of the country is only 7.8 kg, compared to 35 kg in Bangkok and coastal areas, where 56% of the population reside. The reasons for this disparity are assumed to be the higher income level, accessibility, traditional preferences and weaknesses in the distribution system

Table 9: Per capita fish consumption, 1970-84

Year	kg	Year	kg
1970	25.7	1978	22.4
1971	24.2	1979	21.2
1972	23.4	1980	16.8
1973	19.4	1981	19.3
1974	17.4	1982	19.2
1975	19.3	1983	20.6
1976	22.1	1984	17.7
1977	26.3		

Source: Department of Fisheries, Thailand

Fish distribution and marketing are handled mostly by the private sector. Fish traders are categorised into registered traders with the Fish Market Organisation (FMO) and non-registered traders. In the case of the reportedly large number of non-registered fish traders, trading is by bargaining. Freshwater fish is mostly sold to local traders and collectors, who channel the fish to wholesale and retail outlets.

Government institutions directly dealing with fish marketing are the FMO and the Cold Storage Organisation (CSO). FMO handles the landing and marketing of its 12 stations, where daily auctions are held by registered fish agents. CSO buys fish for freezing and distribution in the north-eastern and northern regions.

4.2 International trade

The Thai fish processing industry is a fast growing one, typical of the developing world. In fact, since its 'big boom' some years ago, it has made admirable progress, placing Thailand among the top ten seafood exporters of the world. The total volume of exports was 466 219 MT in 1985 compared to 406 990 MT in 1984 and 344 681 MT in 1983. Exports of fishery products accounted for 7% of the country's total export earnings in 1982.

Table 10: Total fishery product exports, 1970-85

Year	MT	Year	MT
1970	44 956	1978	235 386
1971	55 111	1979	277 896
1972	82 381	1980	252 568
1973	104 133	1981	300 036
1974	88 221	1982	295 900
1975	97 994	1983	344 681
1976	133 454	1984	406 990
1977	180 331	1985	466 219

Source : Department of Fisheries, Thailand

The Thai seafood export industry produces a wide range of products. Major products exported are frozen shrimp, frozen fish, canned seafood, dried and frozen squid and cuttlefish, and fishmeal. Table 11 shows that while the other product groups showed limited growth or even declines in exports, there has been, over the years, a steady rise in exports of canned seafood. The export volume of canned products has increased by 280% from 1981 to 1984, with canned tuna being the major contributor to this increase.

In 1984, the highest export value by category was achieved by fresh/chilled/frozen shrimp which was mainly exported to Japan, followed by canned tuna exported mostly to the USA and Europe, chilled/frozen cuttlefish exported to Japan, Italy and France and fresh/chilled/frozen fish exported to Japan, Malaysia and the USA. Fishmeal was primarily exported to Malaysia, Singapore, Indonesia, Hong Kong and Taiwan Province of China.

Fresh/chilled/frozen shrimp and canned tuna continued to register the highest export values in 1985 as well.

Table 11: Fish and fishery product exports, 1981-84, (in MT and million Baht)

	1981		1982		1983		1984	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
Frozen shrimp	19 699	2 081	22 647	2 764	20 211	3 165	19 430	2 798
Frozen cephalopod	39 000	1 248	42 656	1 784	39 301	1 637	42 820	NA
Fishmeal	111 042	968	83 074	701	92 751	784	85 490	743
Crustacean and mollusc meal	20 289	327	20 713	377	NA	NA	NA	NA
Frozen fish	49 000	530	53 116	688	53 75	685	75 250	1 017
Dried cephalopod	2 900	450	3 565	607	3 457	630	NA	NA
Dried shrimp	1 976	180	2 217	216	2 013	197	NA	NA
Canned seafood	40 848	2 092	65 770	3 186	71 570	3 821	114 460	6 212

Source : Ministry of Commerce and MOAC, Thailand

Table 12. Fishery exports by product 1985 (in MT and 1 000 Baht)

<u>Product</u>	<u>Quantity</u>	<u>Value</u>
Live fish	155	11 774
Fish; live for aquarium	306	29 200
Fish; fresh chilled frozen	96 444	1 376 777
Shark fins	22	17 552
Fish; dried salted or smoked	4 812	128 049
Cuttlefish; salted in brine/dried	1 686	390 729
Squids salted in brine/dried	2 633	647 696
Octopus; salted in brine/dried	67	6 121
Mussels salted in brine/dried	115	3 446
Asari; salted in brine/dried	-	3
Jellyfish: fresh, frozen, dried, salted	2 662	34 691
Shrimp, lobster; salted in brine/ dried or boiled	5 925	531 694
Crabs; in shell, simply boiled	62	8 193
Other crustaceans molluscs salted in brine/ dried or boiled	5 242	179 819
Cuttlefish: fresh chilled, frozen	25 709	1 507 242
Squid; fresh, chilled, frozen	11 168	464 898
Octopus fresh chilled frozen	9 412	149 042
Mussels; fresh, chilled, frozen	14	2 781
Asari fresh chilled, frozen	240	10 075
Arkshell; fresh, chilled, frozen	147	4 437
Shrimp lobster fresh chilled, frozen	24 041	3 439 461
Crabs/Crabmeat fresh, chilled, frozen	159	9 348
Other crustaceans molluscs fresh chilled frozen	407	31 503
Shrimp paste	80	3 827
Sea-cucumber; frozen, dried, salted	1	76
Fish waste	19	112
Tortoise-shell; unworked	176	10 288
Coral and similar unworked and natural sponges	-	596
Fish liver oil	-	-
Fish fat and other oil of fish	-	-
Sardine in airtight containers	3 012	91 738
Tuna in airtight containers	87 134	4 619 876
Fish maws roes in airtight containers	-	-
Fish preserved in airtight containers	12 798	492 282
Cuttlefish in airtight containers	1 102	47 315
Asari in airtight containers	8 462	305 132
Crabmeat in airtight containers	6 378	700 194
Shrimp, prawns, lobsters in airtight containers	12 231	1 028 74
Other crustaceans molluscs prepared in airtight containers	60 747	1369
Fish maws, roes not in airtight containers	3	827
Other fish preserved, not in airtight containers	1 548	48 073
Cuttlefish not in airtight containers	2 686	334 723
Asari preserved, not in airtight containers	15	879
Other crustaceans molluscs prepared not in airtight containers	38	2 960
Fish sauce	9 109	145 713
Oyster sauce	53	2 792
Fish meal	74 791	605 122
Flour & meals of crustaceans or molluscs	53 673	1 000 168
Total	466 219	18 527 660

Imports have increased from 47 174 MT in 1981 to 152 170 MT in 1985. The main fishery products imported into Thailand are frozen tuna (mostly skipjack) for canning purposes. The other significant imports are cockles and shrimp paste. Most of the imported fish, crustaceans and cephalopods are re-exported in value-added form.

Table 13: Total fishery product imports, 1970-85

<u>Year</u>	<u>MT</u>	<u>Year</u>	<u>MT</u>
1970	14 229	1978	28 703
1971	15 934	1979	79 967
1972	15 140	1980	43 569
1973	19 542	1981	47 174
1974	19 965	1982	46 215
1975	19 682	1983	59 172
1976	24 931	1984	119 064
1977	18 634	1985	152 707

Source: Department of Fisheries, Thailand

5. Handling and processing

5.1 Handling on board and at landing sites

Fish handling practices onboard Thai fishing vessels vary considerably depending on the size and kind of vessel and the fish species involved, as well as the distance from the fishing grounds.

Most of the fish caught by otterboard trawlers in Thailand is classified as trash fish or by-catch. Official estimates indicate that 800 000 MT of by-catch are landed annually, i.e. about 43.7% of the total catch. The quality of the by-catch is generally low because of poor onboard handling and lack of preservation facilities. The catch is stored in bulk in the holds without ice. Hence, the quality of the latest catch of the day is generally better.

In 1983, approximately 94.6% of the by-catch in Thailand was used as raw material for fishmeal and the remainder utilised as raw animal feed or fertiliser.

Small pelagic catches are obtained mainly from purse-seine operations using light attraction devices. Fishing vessels used are generally small (12-15m) to medium size (16-19m), made of wood, and with an average crew of more than 20. Depending on the season, home port and type of vessel, the fishing trip may take from 10-12 hours to 4-6 days. Crushed block ice seems to be the only type of ice available and is used by most of the purse-seine fishing fleet. Salt is used instead of ice by boats whose catch is generally used for fish sauce and/or salted/dried fish production. A few bigger-sized boats (up to 20m) are equipped with refrigerated fish holds. Fish are normally bulk-iced. Fish holds are insulated and wooden surfaced with a total capacity of 2-4 MT each. The vessel's capacity is between 20-50 MT. Fish holds usually have no drainage systems.

Fish on-board fish are brailled from the net directly to the fish hold. Four to six buckets of ice are added to each scoop of brailled fish. The ratio of fish to ice is around 3-4:1. Catch consists of many different species and sizes but are not sorted before storage, with the exception of big-sized fish.

High commercial value species caught by trawlers are generally sorted and box-iced on board before landing. Wooden, plastic or metallic boxes are used, but they are usually too small in size and of inadequate design.

Because of improper handling and storage on board, significant loss in fish quality is observed during landings, particularly in the case of longer trips and big catches. Small pelagic fish from purse-seiners fishing close to their bases, and landed only a few hours after catching (6-12 hours) are generally of good quality.

During unloading and handling at landing places, fish become warmed up, bruised and contaminated, further damaging its quality and commercial value. Unloading is generally done by adding harbour water to fish holds and brailing out the fish into bamboo baskets. Fish are then dropped onto the pier floor, washed with harbour water and sorted by species and size by many people. Sorted fish are again packed into bamboo baskets, which are, unfortunately, often left uniced and exposed.

Chub mackerel, Indian mackerel and other species which are highly priced in fresh fish markets receive better treatment after sorting and 'basketing' in landing places. They are dealt with first by packing them in ice into large inner-lined wooden boxes. These boxes and baskets are transported by insulated or open trucks covered by canvas to major fresh fish markets in Thailand and Malaysia.

Sardines used for canning are simply bulk-iced and transported in open trucks covered by canvas to the canneries which are generally located some 800 to 1 000 km away from the landing sites. Sardines used for fishmeal production are, of course, not iced.

Larger and small-scale fishing units operate mostly out of 19 major ports in Thailand. These ports handle almost 77% of the total marine landings in the country. A total number of 13 landing and marketing facilities, operated by the PMO in ports on the Gulf of Thailand and on the Andaman Sea Coast, account for almost one-third of the total catch. A significant volume is also handled by facilities belonging to the private sector. Catch unloading facilities appear to be poor: fish are often washed with dirty water pumped directly out of the harbour by vessels alongside the wharf. Furthermore, fish are stored in baskets and wooden boxes which are difficult to keep clean.

5.2 Fish processing and utilisation

Side by side with modern facilities such as cold storages and canning factories, there is a widespread small-scale seafood preservation and processing industry in coastal towns and villages. The most common methods involved are sun-drying, salting, pickling, smoking and fermentation. Most of the top quality and high-value marine products are processed through freezing plants and canning factories for subsequent export. The remainder goes toward local consumption in various preserved and product forms. A large number of processing facilities can be found in Thailand.

Table 14: Number of selected fishery industry facilities in Thailand, 1984

<u>Type of plants</u>	<u>Total</u>	<u>Type of plants</u>	<u>Total</u>
Shipyard	168	Dried shrimp	284
Ice-plant	155	Dried squid	865
Cold-storage	78	Dried mussel	776
Canned fish	38	Steamed fish	138
Fish sauce	113	Smoked fish	184
Fishmeal	95	Fish shrimp crackers	78
Shrimp paste	2 860	Fish ball	64
Salt fish	800	Nam pla	37

5.2.1 Freezing, ice plants and cold stores

The freezing industry is the largest and best developed of the Thai seafood processing industries. Fish, cuttlefish and shrimp form the bulk of the products which are frozen.

It is also important to note that Thai cold storage plants have many 'sister' companies involved in refrigerated transport, ice-making plants and deep-sea fishery fleets.

The industry comprises 44 freezing plants authorised to export frozen fishery products. Many of these are of a high technical standard and make increasing use of food technologists for the supervision of hygiene and product quality. However, the standard varies, and an important challenge to the country is to transfer knowledge of good processing practices to the less developed parts of the industry.

Needless to say, the Thai seafood industry has come a long way in just a decade. It was mainly the efforts of the private sector, strongly encouraged by the Government, that made this success possible. Although dependent on importing machinery, technology and know-how, it was primarily their business-like spirit which made this possible.

The main problem of the frozen fish industry is the quality and shortage of domestic raw material, on which they have very little influence. Increasing imports and domestic aquaculture production of high-value species appear to be the best solutions at the moment.

5.2.2 Canning

At present, canned products mostly comprise tuna, mackerel, crab, shrimp and petfood. Others include baby clam meat, crab meat, shrimp, squid and seafood cocktail. Vegetables (green beans) and fruits (pineapple) are also sometimes handled by fish canneries. There are about 30 seafood canneries in Thailand producing in excess of 65 000 MT of canned products per year. Currently, there is a strong tendency to diversify production by introducing new can sizes, sauces and so on, in accordance with market demand.

Production of canned tuna, in particular, has increased during the past few years. Only about 100 000 cases were produced in the early seventies. In 1985, more than 100 000 MT of tuna raw material were processed in the tuna canneries, over 65 000 MT of which was imported, the rest coming from domestic production.

The canneries suffer the same problem as the frozen food sector - the lack and doubtful quality of raw material. Initial processing is often carried out in peeling sheds, market floors, houses, or any available open space, where shrimp are peeled, crabmeat is picked, cephalopods are cleaned, and fish are filleted. These facilities and operations are under no form of control and conditions are quite inadequate.

5.2.3 Fishmeal

Production of fishmeal is carried out by around 120 factories, a figure that immediately indicates a problem of excessive capacity. About 800 000 MT of trash fish is annually converted into nearly 200 000 MT of fishmeal, of which roughly 50% is exported, mainly to Asian countries.

Despite the fact that raw material contains a mixture of oily and lean fish, the production technology used by the factories is the same - a straightforward cooking/sterilising and drying process, after which the meal is ground and packed.

This meal has a low protein content (55-60%), which can be attributed to the fact that no effort is made to extract oil from the fish. The sand content of Thai fishmeal is normally over 20% and sometimes as high as 30%. This is because the raw material (trash fish) are caught by bottom trawls, and since raw material prices are high, fishermen have no incentive to clean the fish. The problems of low protein content and high sand levels explain why Thai meal has not been exported to Europe or to Japan in any significant quantity.

Generally speaking, the Thai fishmeal industry is in an unhealthy situation, characterised by low market prices, over-capacity, shortage of raw material, inefficient equipment and poor quality product.

5.2.4 Fish sauce ("nam pla")

Of the traditional Thai industries, the "nam pla" industry deserves special mention. The annual export has increased from 1 003 MT in 1973 to 7 534 MT in 1982, at a value of Baht 112 million. The market is largely represented by Asiatic groups overseas. Annually, about 30 000 MT of fish is used for the production of a similar quantity of "nam pla". Production is carried out in 96 registered plants, generally

presenting the picture of a home industry, although some of them are of considerable size and turn out products of high quality.

Fish sauce plants use anchovies, sardines and mackerel as raw material. Anchovies are preferred indicating that it gives a better quality final product.

5.2.5 Other traditional products

It was reported that in 1982, there were 5 950 plants producing prepared and preserved seafood products by traditional methods. This is about 97% of all the processing plants, but they only account for 13% of all raw material processed, or about 150 000 MT annually. Besides fish sauce, this category comprises products such as salted, dried, steamed, and smoked fish, dried shrimp, squid and mussels, fish and shrimp paste, fish and shrimp crackers, and fish balls. The products are generally sold in the domestic market.

The facilities for the processing of traditional products are usually labour-intensive. The preservation of this industry has, therefore, a significant social aspect. However, the conditions leave much to be desired and call for improvement. Salting and particularly drying as well as routine preparatory processing are mostly done anywhere around fish landing places or fishing villages under critically poor hygienic conditions.

The quality of dried products varies very much with the size and fat content of the species utilised. They are generally packed in bamboo baskets.

Some 11% of marine landings and 22% of freshwater production are processed into dried, salted and smoked fish products. Boiled-dried shrimp, and dried squid and cuttlefish represent 90% of the dried fish industry exports. The total export value is about US\$30 million. Dried Indo-Pacific and Indian mackerel, croaker, anchovy and gourami are mainly destined for domestic consumption.

5.3 Quality control and existing standards

Fish inspection and quality control activities in Thailand are rather unsatisfactory, particularly considering the nature, volume, value and socio-economic importance of the Thai fishery industry.

Existing legislation is confusing and incomplete. A number of Government institutions are involved in food control like the Agriculture Regulator Division of the Agriculture Department, the Fisheries Technological Development Division of the Fisheries Department, the Public Health Ministry's Food and Drug Administration, the Industry Ministry's Thai Industrial Standards Institute (TSI), the Commerce Ministry's Office of Commodities, and the Fisheries Technology Development Division (FTDD).

FTDD, in practice, is the only department exercising fish inspection and quality control activities, though it has no legal ordinance for doing so.

Control is exercised only on freezing plants and cannery factories exporting their products abroad. No attention is given to the control of

fishing vessels, landing places, fish markets and fish processing plants and their products sold for local consumption.

Government fish inspection and quality control activities concentrate on end-product analysis. Plant quality control also focus on end-product analysis. Standards followed are those enforced by the leading importing countries.

Thailand is anxiously looking for possibilities to increase exports and, thus, improve foreign exchange. This calls for new initiative and efforts in the area of product development and improvement of existing exported goods. Thai exporters of fishery products have had serious warnings in the form of complaints and rejection of shipments. There is an urgent need to up-grade the image of Thai fish products in the international market.

Numerous reports unanimously conclude that the root of the quality problems is to be found at the early stages of fish handling, in the boats, at the landing places, and when local operators prepare raw material for the factories, under unacceptable conditions.

6. Government policy

Under the 6th National Economic and Social plan (NESP) covering the period 1987-91, the Government of Thailand focuses on two major policies:

1. to develop the national fishery resources; and
2. product development

Under this programme, the Government plans to

1. maintain the current level of fish production;
2. maintain the present level of exports;
3. provide adequate animal protein under the poverty eradication scheme; and
4. maintain the domestic consumption level.

In order to realise these targets, the Government has planned a 3% increase in fish production per annum. Special emphasis has been put on the increase of aquaculture and mariculture production. Joint ventures in deepsea fishing with other countries will be encouraged. Under the 6th NESP, the Government has also established a policy to maintain the present fish production level in Thailand.

To make the Thai fisheries industry what it is today, a considerable amount of time and hard work has been expended by Government officials of various departments and agencies including aid and assistance from competent officials and technicians of international organisations.

Playing the lead role in the promotion and development of the industry is the Department of Fisheries of the Ministry of Agriculture and Cooperatives. Apart from this institution, there are a number of other state enterprises sharing various fields of responsibilities.

In the case of the PMO, for example, other duties not often mentioned include the task of promoting the welfare of fishermen and their families, the development of fishing villages, and encouraging

collective activities such as fishing cooperative societies and associations.

Not to be overlooked for their enduring efforts and hard work and notable contribution to the success of the fisheries industry are the Foreign Trade Department of the Ministry of Commerce and the Board of Trade (BOT), as evidenced by their ceaseless efforts in seeking new overseas markets for Thai products. On the financial side, the Board of Investment (BOI) provides help by granting BOI privileges to all sectors of the seafood industry.

7. Research institutions

Most research in both the marine capture and fresh and brackishwater culture sectors is undertaken by the Department of Fisheries (DOF). Kasetsart and Chulalongkorn Universities maintain research laboratories on the eastern coast and undertake field research.

Marine capture fisheries research and development are under two DOF Divisions, Exploratory Fishing Division (EFD) and Marine Fisheries Division (MFD), each of which operates research vessels. EFD and MFD are primarily responsible for assessing fish stocks in Thai waters. The assessment of prospects for joint-venture fishing agreements is also done by EFD.

Fisheries stations are established in order to serve as technical arms of the DOF. At present, there are 34 fisheries stations providing necessary technical know-how, extension services, fish/shrimp seeds and appropriate management schemes to farmers.

Through external assistance, four research centres were established. They are:

1. the marine fisheries laboratory established in 1965, with the technical assistance of the Federal Republic of Germany Government;
2. Phuket Marine Biological Centre established in 1967, with the technical assistance of the Canadian Government;
3. National Inland Fisheries Institute established in 1972, with the technical assistance of the Canadian Government; and
4. National Institute of Coastal Aquaculture established in 1981, with the assistance of the Government of Japan.

These institutes periodically conduct training courses in various fields for both Thai and foreign participants. In addition, three inland fisheries centres in Ayuthya, Surat Thani and Trang Provinces were established in 1984 by grant aid from the Japanese Government with the main objective of being the regional centres for freshwater fisheries development.

In the field of fish utilisation technology particularly fish as food aspects, two main research groups are well identified, namely the FTDD, Department of Fisheries, Ministry of Agriculture, Bangkok, and the Institute of Food Research and Product Development (IFRPD), Kasetsart University, Bangkok.

The FTDD has been particularly active and successful in the areas related to the small-scale processor, consumer education, trash fish utilisation, minced fish processing, quality control and fish sauces. Among equipment developed by the FTDD, there are two models of a

mechanical fish drier, two models of a smoke kiln, a fish scaling machine, a fish cracker slicer, a sausage press, and an insulated fish container. Some of these have been transferred to and successfully used by some processors.

The impact of FTDD on the modern processing industry is mainly due to the activities of the quality control section. This constitutes a valuable link to the commercial sector and contributes greatly to the identification of problems and formulation of worthwhile projects.

8. International cooperation

Thailand participates actively in regional and international activities such as the Southeast Asian Fisheries Development Centre (SEAFDEC), the Indo-Pacific Fisheries Council (IPFC) and the Indian Ocean Fishery Commission (IOFC). The IPFC and the IOFC are forums for bilateral discussions upon which policies and decisions are made concerning fishery matters between member countries.

Thailand has consistently received assistance, including training courses, from international organisations such as the Food and Agriculture Organization of the United Nations (FAO), provided under the umbrella of the United Nations Development Programme (UNDP). Since 1978, external loan and grant assistance to the fisheries sector has amounted to approximately US\$108 million of which multilateral sources have contributed US\$45 million. These included US\$24 million loans from ADB for the Fisheries Development Project (involving loans for fishing vessels purchase and cold storage/ice-plant construction) and Aquaculture Development Project which is concentrating on developing brackishwater shrimp, and freshwater pond and cage culture.

Bilateral aid has contributed a total of US\$63 million to the fisheries sector since 1978 through 20 grants (US\$29 million) and two major loans (US\$34 million) from OEFC, Japan. The major bilateral donors have been Canada, Japan, the Netherlands, Denmark, Australia and the USA, with lesser commitments from the UK and Sweden. Bilateral assistance has concentrated on fish and shrimp culture research and development, training and post-harvest handling and technology.

9. Conclusion

Thailand's fishery sector is over-capitalised. This should be seen in the light of the over-exploitation of most resources, which has led to a decreasing number of vessels and increasing illegal fishing in the waters of Third World countries.

With the over-exploitation of most species, catch composition is also tending towards smaller and juvenile fish. Thailand's trash fish landings have been estimated at almost 40% of total landings.

Thailand has experienced a steady growth in its fishery export sector. But this sector is facing major problems in procuring enough raw material for the local processing industries, and instead, has to rely increasingly on (more expensive) imports.

Freshwater and marine aquaculture are seen as areas with the best potential to increase domestic production in the short and long term. Its output will be of vital importance to domestic requirements as well

as a major source of raw material for its export-oriented industry.

Foodfish supplies may also be increased through better onboard and onshore handling and by improving the existing marketing structure.

Conservation of marine resources in Thailand's own waters can only be achieved through strict enforcement of effort and gear restrictions, while protection of spawning grounds and checking pollution levels are other areas that need urgent attention.

One way to reduce fishing effort in the domestic waters is by increasing the number of joint fishing vessels in the waters of Third World countries. Overseas joint ventures are presently taking place with Australia, Indonesia and Saudi Arabia. The government to government joint-venture agreement with Bangladesh (since 1973) remains valid, but the fishing licences have not been renewed due to various technical problems faced by both parties. Most of the joint ventures are on a private company basis, but are clearly supported by the Government.

Annex I: Most important marine and freshwater species landed

<u>Thai name</u>	<u>English name</u>	<u>Scientific name</u>
Pla Too	Indo-pacific mackerel	<u>Rastrelliger brachysoma</u>
Pla Lang	Indian mackerel	<u>Rastrelliger kanagurta</u>
Pla In-see	King mackerel	<u>Scomberomorus commersonii</u>
Pla Dab-Lao	Wolf-herring	<u>Chirocentrus spp.</u>
Pla O	Little tunny	<u>Euthynnus spp.</u>
Pla Too Kaek	Scad	<u>Decapterus spp.</u>
Pla Kaengkai	Hardtail scad	<u>Megalaspis cordyla</u>
Pla Si-kul	Trevally	<u>Caranx spp.</u>
Pla Ku-rao	Theadfin	<u>Polynemus spp.</u>
Pla Lang Kiew	Sardinella	<u>Sardinella spp.</u>
Pla Ka-tak	Anchovy	<u>Stolephorus spp.</u>
Pla Klaboak	Mullet	<u>Mugil spp.</u>
Pla Chalamed-dum	Black pomfret	<u>Formio niger</u>
Pla Chalamed-kao	Silver pomfret	<u>Pampus argentus</u>
Pla Bai-kha-nun	False trevally	<u>Lactarius lactarius</u>
Pla Num-dok-mai	Barracuda	<u>Sphyaena spp.</u>
Pla Chuad	Croaker	<u>Sciaena spp.</u>
Pla Sai-daeng	Threadfin bream	<u>Nemipterus spp.</u>
Pla Sai-kao	Monocle bream	<u>Scolopis spp.</u>
Pla Pak-kom	Lizard fish	<u>Saurida spp.</u>
Pla Dab-ngoen	Hairtail	<u>Trichiurus spp.</u>
Pla Kapong	Snapper	<u>Lutjanus spp.</u>
Pla Soy-nok-kao	Sweetlip	<u>Plectorhynchus spp.</u>
Pla Tato	Big-eye	<u>Priacanthus spp.</u>
Pla Hed-knon	Shad whiting	<u>Silage spp.</u>
Pla Duk-Talae	Barble eel	<u>Plotosus spp.</u>
Pla Kod-Talae	Marine catfish	<u>Tachysurus spp.</u>
Pla Kaben	Ray	<u>Dasyatis spp.</u>
Pla Chalarn	Shark	<u>Aetobatus spp.</u>
Pla Lin-mah	Flat fish	<u>Carcharhinu spp</u>
Pla Jak-phan	Indian halibut	<u>Cynoglossus spp.</u>
Pla Yodjak	Conger eel	<u>Psettodes erumei</u>
Kung Chae-bauy	Banana shrimp	<u>Muraenesox spp.</u>
Kung Kula-dam	Jumbo tiger shrimp	<u>Penaeus merguensis</u>
Kung Kula-lai	Tiger shrimp	<u>P. monodon</u>
Kung Luang	King shrimp	<u>P. semisulcatus</u>
Kung O-kak	School shrimp	<u>P. latisulcatus</u>
Kung Kradan	Flathead lobster	<u>Metapenaeus spp.</u>
Kung Takataen Kang		<u>Thenus orientalis</u>
Kai	Mantis shrimp	<u>Squilla spp.</u>
Kaew	Sergestid shrimp	<u>Acetes spp.</u>
Pu Ma	Swimming crab	<u>Portunus pelagicus</u>
Pu Talae	Mud crab	<u>Scylla serrata</u>
Plamuek Kluai	Squid	<u>Loligo spp.</u>
Plamuek Kradong	Cuttlefish	<u>Sepia spp.</u>
Plamuek Sai	Octopus	<u>Octopus spp.</u>
Hoy Klaeng	Cockle	<u>Arca granulosa</u>
Hoy Malangpoo	Green mussel	<u>Mytilus spp.</u>
Hoy Nang-rom	Oyster	<u>Crassostrea spp.</u>
Hoy Kapong	Horse mussel	<u>Modiola sensousia</u>
Hoy Lai	Short-necked clam	<u>Paphia undulata</u>
Mang Ka-prun	Jellyfish	<u>Rhopilema spp.</u>

Kai Tao-talae	Turtle eggs	-
Sarai Tale	Seaweed	-
Pling Talae	Sea-cucumber	-

Cultured freshwater species

Pla Nai	Common carp	<u>Cyprinus carpio</u>
Pla Tapie Kao	Local carp	<u>Puntius gonionotus</u>
Pla Lin	Silver carp	<u>Hypophthalmichthys molitrix</u>
Pla Chao	Grass carp	<u>Ctenopharyngodon idellus</u>
Pla Song	Big head carp	<u>Aristichthys nobilis</u>
Pla Ta Kok	Soldier river barb	<u>Cyclocheilichthys enoplus</u>
Pla Yeesokthek	Indian major carp	<u>Labeo rohita</u>
Pla Kahoo	Giant carp	<u>Catlacarpio siamensis</u>
Pla Nil	Nile tilapia	<u>Tilapia nilotica</u>
Pla Duk Dan	Freshwater catfish	<u>Clarias batrachus</u>
Pla Sawai	Striped catfish	<u>Pangasius sutchi</u>
Pla Tephoo	Catfish	<u>Pangasius larnaudii</u>
Pla Tepha	Giant catfish	<u>Pangasius sanitwongsei</u>
Pla Salid	Snakeskin gouramy, sepat Siam	<u>Trichogaster pectoralis</u>
Pla Rad	Giant gouramy	<u>Osphronemus gourami</u>
Pla Mortan	Kissing gouramy	<u>Helostoma temmincki</u>
Pla Mor	Climbing perch	<u>Anabas testudineus</u>
Pla Chon	Snakehead	<u>Ophiocephalus striatus and other Ophiocephalus spp</u>
Pla Grai	Featherback	<u>Notopterus chitala</u>
Pla Busai	Marbled sleepy goby,	<u>Oxyeleotris marmoratus</u>
Pla Suatoo	Siamese tiger fish	<u>Datnidos micropelis</u>
Pla Yeesok	Jullien's golden- price carp	<u>Probarbus julieni</u>
Pla Gadum	Black shark	<u>Morulus chrysophekadion</u>
Pla Lai	Swamp eel	<u>Fluta alba</u>
Pla Toona	True eel	<u>Anguilla australis</u>
Sung Kam Kram	Giant freshwater shrimp	<u>Macrobrachium rosenbergii</u>
Khob	Frogs	<u>Rana spp.</u>
Tao	Turtle	<u>Tryonix spp.</u>

Cultured brackishwater and marine species

Pla Kabok	Grey mullet	<u>Liza viagiensis</u>
Pla Kapong Kao	Giant seaperch, Seabass	<u>Lates calcarifer</u>
Pla Salidhin	Spinefoot, Rabbit-fish	<u>Siganus canaliculatus and Siganus javus</u>
Pla Kawjud	Grouper	<u>Epinephelus tauvina</u>
Kung Kuladam	Jumbo tiger shrimp	<u>Penaeus monodon</u>
Kung Chair Bua	White shrimp	<u>Penaeus merguensis</u>
Kung Kula Lai	Tiger shrimp	<u>Penaeus semisulcatus</u>
Kung Takard	Pink shrimp	<u>Metapenaeus spp.</u>
Pu Tale	Mud crab, Swimming crab	<u>Scylla serrata</u>
Hoy Mangpu	Green mussel	<u>Mytilus smaragdinus</u>
Hoy Gapong	Horse mussel	<u>Modiolus senhousenii</u>
Hoy Krang	Cockle	<u>Arca granulosa</u>
Hoy Mang rom	Oyster	<u>Crassostrea commercialis</u>
Hoy Ta-grom	Oyster	<u>Crassostrea lugubrius</u>
Hoy Muk Jan	Gold lipped pearl oyster	<u>Pinctada maxime</u>
Hoy Kala Fangha	Black lipped pearl oyster	<u>Pinctada margaritifera</u>

Annex II: Number of registered fishing boats by size and type of fishing method, 1984

<u>Type of fishing method</u>	<u>Total</u>	<u><14m</u>	<u>14-18m</u>	<u>18-25m</u>	<u>>25m</u>
Otter-board trawl	7 769	3 906	2 135	1 545	183
Pair trawl	1 166	41	484	635	6
Beam trawl	196	190	6	-	-
Thai purse-seine	469	34	150	282	3
Chinese purse-seine	16	1	9	6	-
Anchovy purse-seine	155	81	48	26	-
Luring purse-seine	321	25	45	245	6
King mackerel gillnet	265	65	123	76	1
Pomfret gillnet	21	11	8	2	-
Mackerel encircling gillnet	245	165	40	40	-
Other gillnets	418	397	11	10	-
Mackerel gillnet	71	67	2	2	-
Crab gillnet	879	865	14	-	-
Sardinella gillnet	31	31	-	-	-
Mullet gillnet	17	17	-	-	-
Threadfin gillnet	13	13	-	-	-
Push net	960	931	28	1	-
Shrimp gillnet	2 052	2 044	8	-	-
Other nets	364	265	52	44	3
Long line	46	15	25	5	1
Squid cast-net	532	477	48	7	-
Total	16 006	9 641	3 236	2 926	203

Source: Department of Fisheries, Thailand

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