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FISHERY INDUSTRY PROFILES

Background document*

Prepared by

INFOFISH**

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CHINA

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1. INTRODUCTION

China has a total area of approximately 9.6 million square kilometers and is the third largest country in the world after the USSR and Canada. With a total annual fisheries production of 10.36 million mt in 1988 and an estimated 10.8 million mt in 1989, she is the world's third largest fishing nation after Japan and the USSR. Her annual increase in production from aquatic resources over the last ten years had contributed to some 20% of the global increase in such products. Covering most of the eastern half of Asia and bordered by the north-west Pacific including Yellow sea, Pohai and East and South China Seas the country spans some 40 latitudes stretching from the tropical through the temperate zones. Length of the coastlines of the mainland and more than 5,000 islands are 18,400 kms and 14,200 kms respectively.

China's population of 1,093 million (1989) with an annual growth rate of 2% is nearly one fifth of the global population. While her average annual growth rate of GDP during the period from 1981-89 was 9.4%, the GNP is estimated at US$ 359 billion and per capita GNP US$ 330 in 1988. However, the rate of growth of real GNP in 1989 is estimated at 4%, a substantial decline from the 1988 level of 10.9%. Comparatively the agricultural sector that includes fisheries had a better growth of 4.5% in 1989.

2. RESOURCES

Fishery resources can be divided into capture fisheries from marine and inland areas as well as marine aquaculture and freshwater fish culture. While the country is yet to make a formal declaration of her EEZ, most of her fishing effort is confined to some 4.73 million sq. kms of territorial waters. The marine capture fishery has been rapidly expanding lately covering not only her own fishing grounds but the international waters and national EEZ's of several other maritime States as well. The long and tortuous coastline provides a large number of excellent bays and creeks as well as shallow brackishwaters rich in fishery resources. The continental shelf of 200 metre isobath encompasses some 1.5 million sq. km of fishing area. Of this 1.3 million ha are shallow water and mud-flats ideal for extensive mariculture operations. In the sea areas to the east and south, differences in water temperatures caused by the south bound cold current and the northbound warm current create ideal niche for a large number of fish and plankton, enabling cold and warmwater species of fish and shellfish to thrive. Several rivers including the Yangtze, Yellow river and Pearl river that discharge into the territorial seas also provide excellent conditions for high level of primary productivity, stimulating the growth and propagation of a wide range of aquatic animals and plants.

It is estimated that there are more than 1,500 kinds of marine and over 500 varieties of freshwater fish and shellfish - both warm water and cold

water species - constituting China's aquatic resources in the seas and inland respectively. These include a large number of fishes, crustaceans and molluscs such as pomfrets, large head hairtails, chub mackerel, Japanese spanish mackerel various freshwater carps and catfishes like common carp, grass carp and silver carp as well as shrimps, Cephalopods and jelly fish.

Diversified collaboration agreements have been established with foreign enterprises through joint ventures, co-production and labour service cooperation. At the same time efforts to expand domestic marine fisheries production base are also being continued. China's Yellow Sea Research Institute - using Norwegian research vessels has recently established the presence of a 3 million ton anchovy resource in the yellow sea. This stock is estimated to sustain 500,000 tons per annum though the current exploitation is only one fifth of this.

3. PRODUCTION

Total fish production in China has increased by more than a million tons every year from 1985-87. As per estimates, the figure for 1989 is 10.8 million. Species wise fish landings data from 1984-88 are given in Table 1, Page 3.

Fisheries production comprises both capture and culture production respectively from marine and freshwater sources. Geographically and ecologically, production areas in marine fishery sector can be divided into five catagories namely a) South China Sea fishery, b) the East China Sea fishery, c) Yellow Sea fishery, d) The Pohai fishery and e) the distant water fishery. Though latest data on production under these five areas are not readily available, Table 2 gives details of production from different sources for the past 38 years.

Table 2. Fisheries Production Source-wise (1950-1988)

	Total	Marine		Freshwater	
Year	Yield	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	184	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
1986	8 235	3 896	858	530	2 951
1987	9 553	4 381	1 101	587	3 484
1988	10 609	4 633	1 425	654	3 897

Source: Bureau of Aquatic Product, PR China

TABLE 1. CHINA: NOMINAL CATCHES (METRIC TONS)

		1984	1985	1986	1987	1988
Common carp	Cyprinus carpio	181100	237900	354200	522600	584600
Crucian carp	Carassius carassius	54300	71400	88500	104500	11[illegible]00
Mud carp	Cirrhinus mulitorella	36200	47600	57000	69700	[illegible]900
Grass carp (= White amur)	Ctenopharyngodon idella	271700	356900	442700	522600	5[illegible],600
Silver carp	Hypophthalmichthys molitrix	760700	999300	1180600	1324000	1481000
Bighead carp	Hypophthalmichthys nobilis	362200	475800	590300	627100	701500
White amur bream	Parabramis pekinensis	90600	119000	147600	174200	194900
Nile tilapia	Oreochromis(Tilapia)niloticus	18100	23800	29500	34800	39000
Freshwater fishes nei	Osteichthyes	393049	433222	473102	558370	627758
Elongate ilisha	Ilisha elongata	16613	17302	19937	12494	14680
Alaska pollack(Walleye pollock)	Theragra chalcogramma	-	-	-	20000	20000
Greater yellow croaker	Pseudosciaena crocea	40733	26101	17243	17239	18083
Lesser yellow croaker	Pseudosciaena polyactis	19623	30628	19806	20143	23954
Croakers, drums nei	Sciaenidae	-	-	-	700	700
Porgies, seabreams, etc nei	Sparidae	-	-	-	564	564
Filefishes	Cantherines(=Navodon)spp	324245	272674	426918	407210	263294
Scads	Decapterus spp	199908	233883	238079	344753	251170
Pomfrets, nei	Pampus spp	55475	66741	71374	91250	64141
Pacific herring	Clupea pallasii	9444	3228	6445	12971	...
Japanese Spanish mackerel	Scomberomorus niphonius	74937	90623	94218	99006	124810
Largehead hairtail	Trichiurus lepturus	450030	458723	406403	393606	365730
Chub mackerel	Scomber japonicus	123933	92573	132196	166039	240699
Marine fishes nei	Osteichthyes	1209044	1263439	1495065	1673215	1977437
Freshwater crustaceans nei	Crustacea	51928	55411	62021	80626	84740
Marine crabs nei	Reptantia	344282	339476	328337	413196	449851
Subtropical spiny lobsters nei	Palinurus spp	-	-	-	233	233
Fleshy prawn	Penaeus chinensis	34835	73188	112232	187058	253895
Penaeus shrimps nei	Penaeus spp	26202	84649	139156	108032	139101
Akiami paste shrimp	Acetes japonicus	188445	209120	175207	162366	190589
Natantian decapods nei	Natantia	-	-	-	7	7
Freshwater molluscs nei	Mollusca	29830	33982	56220	53010	59016
Pacific cupped oyster	Crassostrea gigas	40688	50872	54994	65543	73954
Sea mussels nei	Mytilidae	136582	128860	210657	312680	429675
Japanese scallop	Pecten yessoensis	3813	8312	23686	43640	121991
Blood cockle	Anadara granosa	14907	16686	24173	33386	33986
Razor clams	Solen spp	110006	125717	126175	133597	140673
Clams nei	Bivalvia	147569	193438	284448	365648	417998
Cuttlefishes, bobtail squids	Sepiidae, Sepiolidae	-	-	-	2067	2067
Octopuses	Octopodidae	-	-	-	318	318
Squids nei	Loliginidae, Ommastrephidae	54030	53102	50374	60175	73531
Marine molluscs nei	Mollusca	15281	24261	41592	68902	81505
Sea-urchins	Strongylocentrotus spp	...	...	225	194	30
Jellyfishes	Rhopilema spp	36461	60908	19380	58484	32098
Total		5926793	6778819	8000063	9346222	10358678

Source: FAO

Sector-wise average annual growth in fish production during the past five years is presented in Table 3.

Table 3. Fish Production 1984-88 ('000mt)

	1984	1985	1986	1987	1988	Average rate of annual increase %
Capture fisheries						
Marine	3,305	3,485	3,896	4,381	4,633	8.8%
Inland	439	475	530	587	654	10.5%
Culture fisheries						
Coastal	639	712	858	1,101	1,425	22.2%
Freshwater	1,810	2,379	2,951	3,484	3,897	21.2%
Total	6,193	7,052	8,235	9,553	10,609	14.4%

Source: Bureau of Aquatic Products, PR China

3.1 Marine Fisheries

The traditional fishing grounds within the 100 meter isobath had become overfished by mid eighties when fishing beyond continental shelf was found to be uneconomical. Consequently China made all-out efforts to extend fishing operations to distant waters as well. Presently, marine fishing has developed into a large scale and substantially integrated industrial system employing over a million people. The industrial fishing in national and distant waters has led to substantial increase in marine fish production. Annual catch increased continuously for six years from some 3 million tons in 1983 to 4.63 million tons in 1988. Nearly half of the total fish production is from marine capture fisheries that includes some 100,000 mt from deep sea fishing.

The principal species of marine fishes caught are fishes like Yellow croaker (*Pseudosciaena polyactis*), Groupers (*Serranidae*), Scads (*Decapterus*), Pomfrets (*Pampus spp.*) and so forth; crustaceans such as shrimps (*Penaeus chinensis*, *P. orientalis*, *Acetes japonicus*) and molluscans like bivalves and cephalopods including *Mytilidae*, *Anadera spp.*, *Bivalvia*, *Sepiidae*, *Sepiolidae*, *Octopodidae* as well as jelly fishes (*Rhopilema spp.*). (Table 1).

3.1.1 Shrimp landings

According to government sources, the estimated annual sustainable yield of the shrimp stock is 30,000 - 35,000 mt (Table 4). To maintain this stock position catch is controlled by the government and allowed between

September and December. Trawling is prohibited. Small vessels catch shrimp with gill-nets. Fishing for shrimp takes place in the Gulf of Bo Hai and the Yellow Sea area. Artificial stocking is also regularly practiced to maintain shrimp stocks. Shrimp species like Acetes and Trachypenaeus curvirostris are consumed locally in fresh or dried form.

Table 4. China: Production of Captured Shrimp, 1980-87 (000 mt)

Year	P. Orientalis	Others a/	Total
1980	32.9	3.5	36.4
1981	21.5	4.0	25.5
1982	7.4	2.0	9.4
1983	15.4	4.6	20.0
1984	8.0	7.5	15.5
1985	20.7	11.8	32.5
1986	16.6	12.8	29.4
1987	9.9	23.8	33.8

a/ Includes: P. japonicus, Solonocera spp., P. merguiensis and P. monodon
Source: BAP, China, PR

3.1.2 Distant water fishing

Ever since the first distant water fishing fleet of modern China set sail for West Africa in 1985 under the aegies of the newly launched China National Fisheries Corporation (CNFC), this country has vastly expanded her overseas fishery activities. She has lately made fishery agreements with several maritime nations in the world including Argentina, Uruguay, USA, Spain, Morocco, Nigeria, Senegal, Guinea Bissau, Guinea, Sierra Leone, Mauritius and the USSR. From 1985 onwards, fifty Chinese deep sea vessels are engaged in bottom trawling in West African waters. Since 1989, four vessels are carrying out mid water trawling in Argentine waters while there are 9 tuna longliners and 3 pole-and-line vessels catching sashimi grade tuna in the South Pacific for Japanese markets. By the end of 1988 nearly a hundred fishing vessels from 16 Chinese enterprises were operating in the fishing grounds adjoining 16 countries and regions of West Africa, North and South America, Middle East, and the South Pacific. Total fish production from these operations is estimated at 100,000 tons.

3.2 Inland Fisheries

Just as the country is quite vast and rich in flora and fauna, the inland water resources are also substantial. Inland water fish production - including production from freshwater fish culture as per FAO estimates has gone up from 1.24 million tons in 1980 to 4.55 million mt in 1988 recording nearly four-fold increase in just eight years. Of these the share of inland capture fisheries is only about 17%. The rest is entirely from culture.

The inland fishing area of rivers and lakes put together comes to some 14 million ha. Several commercially important fish and shrimp species thrive in the nutrient rich Yangtze, Pearl, Yellow-Rivers and the lakes of Taihee, Hongze, Chaohu, Boyang, Honghu, Dongtiu and Weishan. The species caught comprises the various kinds of carps such as common carp (Cyprinus carpio), grass carp (Ctenopharyngodon idella), silver carp (Hypophthalmichtys molitrix), big-head (Hypophthalmichthys nobilis), etc., as also, breams, sturgeon, hilsa, herring, mandarin fish, salmon, eel, turtle, crab and shrimps. With the introduction of improved fishery management practices including resource conservation measures and enhancement of wild population through artificial stocking, the yield from inland water capture fishery has substantially increased in recent years.

4. FISHING BOATS AND GEAR

Chinese fishing fleet comprises some 218,000 mechanised boats with total 7.573 million hp. in the marine sector. These are either wooden or steel hulled. Further, nearly 43,000 inland water fishing vessels of 17 hp. or so and more than 100 deep sea fishing boats of sizes varying from 300 GRT to 3,000 GRT are also in operation. The 300 GRT boats are fitted with 600-900 hp. engines.

Since the 70s, extensive trawler and purse-seiner construction programmes were initiated to strengthen China's short and medium distance fleet. Consequently large scale production of 600 hp. trawlers and some purse seiners have gradually changed the fleet composition. FRP boats are also being constructed for fishing at present.

Bottom trawling is the most common fishing operation in China especially as pair trawlers. Stern trawling is more popular with the overseas operations. Trawlers are 30-40 mts OAL with a crew of about 20, owned by state-run enterprises or collective fishery operatives as well as private owners. However, traditional wooden hulled fishing junks as also the small-scale artisanal fishing sector as a group is not common in modern Chinese fishery field.

4.1 Fishing Gear and Equipments

China is not only self sufficient in fishing gear and equipments required by her fleet, but also export many such items to various countries in the world. Monofilament nets, lines, ropes, floats and nooks as well as marine diesel engines are locally manufactured. While Dongfeng Plastics Factory produces monofilament fishing nets, Guang Lai and Rong Cheng Fishery Wire-rope factories manufacture all sort of multipurpose wires in a wide range of specifications and models.

Wenzhou Fishery Machinery Factory is engaged in the production of fish processing, ice making, freezing and feed manufacturing equipments. On the other hand Nantong Marine Diesel Engine plant and Zibo Marine Diesel Engine Factory established in early 1970's have been meeting the domestic needs of the industry and also exporting diesel engines to Australia, Honduras and Pakistan.

4.2 Fishing Harbours and Landing Centres

There are more than 700 large and small fishing ports scattered along the coast, half of them equipped with adequate fish handling facilities. Equipments and facilities provided at these harbours include cold storages, warehouses, sheltered fish landing areas, transportation, and weather forecasting and communication facilities. Moreover, amenities such as clinics and schools are also provided at fishing centres.

The State-owned National Fisheries Corporation through its Guangzhou Harbour Engineering Company (GHEC) set up in 1958 has been playing a significant role in establishing fishery harbours in the country. GHEC is the first grade port engineering enterprise in the country that undertakes various related activities as well.

5. AQUACULTURE

China is the cradle of aquaculture where fish culture began about 4,000 years ago. Her inland waters comprise roughly 27 million ha of which 5.64 million ha can be used for aquaculture purposes. Added to this is some 17.66 million ha of cultivable water stretches and mud-flats adjoining the coastline. Her total production from aquaculture in 1988 reached 5.32 million mt, accounting for 50.2% of total fish and fishery production from all sources.

5.1 Freshwater Aquaculture

Over 50% of the total aquaculture production of 5.32 million tonnes in 1988 was contributed by freshwater aquaculture with the rest from mariculture and brackishwater culture. As per data for 1987, of the total freshwater production of 3.48 million tons, some 2.617 million tons were obtained from pond culture 207,000 ton from lakes, 378,000 tons from reservoirs, 219,000 tons from rivers and small water ways, 106,000 tons from paddy field and 53,000 tons from other sources.

The main cultured fishes include ten freshwater species namely the Chinese carps (grass, silver and bighead), wuchang fish (Megalobrama amblyocephala), black carp (Mylopharyngodon piceus), mud carp (Cirrhina molitorella), common carp (Cyprinus carpio) and tilapia (Oreochromis mossambicus, O. niloticus, and O. aureus). These are reared in polyculture ponds yielding 1.3 to 7.5 ton/ha/year production in semi-intensive and intensive systems. Chinese carps and tilapia polyculture integrated with animal husbandry and crop farming is also common in China. About 75% of China's freshwater aquaculture production is obtained from pond culture, 90% of which is linked with crops and animals. Yields exceeding 13 t/ha/yr are obtained by using up to nine species of fish in a single pond simultaneously.

About 25% of the freshwater fish production in China originate from pens and cages in lakes, reservoirs, rivers and paddy fields. Fish are also produced in lakes and reservoirs by cove culture wherein fry are first released into netted - off areas of coves and when they grow up to fingerlings released to the surrounding waters where they grow to some 15 cm length. Use of floating cages without supplimental feeding is also common.

Freshwater shrimp (Macrobrachium rosenbergii) has been getting popular as a culture species in freshwater ponds in China lately, due to its export importance. Freshwater eel is another species of growing popularity from export angle.

The total area utilized for freshwater aquaculture in China is over 3.94 million ha of ponds, 646,000 ha of lakes, 1.43 million ha of reservoirs, 324,667 ha of small waterways, 80,000 ha of paddy fields and 64,000 ha of other areas.

China has about 22,000 townships and village-operated fish farms with a total of 340,000 people and 1,200 State-operated fish farms with 10,000 personnel. Out of the State-owned farms 1,000 are freshwater fish farms and the rest marine.

5.2 Mariculture

Marine aquaculture is well developed in coastal provinces. While the total mariculture area was nearly 300,000 ha in 1985, the corresponding figure in 1988 has gone up to 420,000 ha. Accordingly the total yield has also increased from 712,000 mt in 1985 to 1,425,000 mt in 1988. This remarkable increase in production puts China at the top among the world maricultural nations.

Crustaceans, molluscs, fish and seaweeds are cultured in brackishwater ponds. Jellyfish and sea cucumber, considered gourmet food in China are also produced from mariculture.

5.2.1 Shrimp Farming

Among crustaceans, prawn farming has made remarkable progress increasing by almost 79% during the past six years covering 150,000 ha. The total production of cultured prawns had gone up to 200,000 tons valued at 3.4 billion yuan (RMB) or US$ 1.7 billion approximately by 1988 and 1989. The predominant species cultured is white Taisho (Penaeus orientalis). Small volumes of Black tiger (P. monodon), banana prawns (P. merguensis) and (P. penicillatus), kuruma ebi (P. japonicus) and (Solenocera spp.) are also cultured. Production details for 1980-87 are given in Table 5.

Table 5. China: Culture Shrimp Area, Production and Average 1980-87

Year	Area (000 ha)	Production (000 tons)	Average Yield (kg/ha)
1980	9.3	2.6	280
1981	13.7	3.7	270
1982	16.5	7.1	430
1983	19.9	9.0	452
1984	33.4	19.3	578
1985	59.6	40.7	683
1986	85.1	82.8	973
1987	131.3	153.2	1,167
Average Annual Growth Rate (%)	46	79	23

Source: BAP, China, PR

Shrimp culture in China is seasonal due to long winters that bring in continuous cold spells in the culture areas except in the Southern most part of the country. As such culture operations are mainly confined to some 4-5 months in summer. Gravid spawners are collected from the wild during April-May months for the so-called seeding factories or hatcheries. Grow-out period is from 4-5 months followed by harvest mostly at 25-30 gr size which usually gives 31/40 (pieces/lb) and below counts in headless form.

Nearly 80% of the Chinese cultured shrimps are produced by the five northern coastal provinces. Average production from the ponds is 1.5 mt/ha. Mostly intensive and semi-intensive culture is practised with very high stocking densities.

5.2.2 Mariculture of other species

Apart from shrimps, mariculture of several other species of aquatic animals and plants is quite common in China. Seaweeds (kelp and laver) of species Laminaria and Porphyra, molluscs such as scallops, mussels, abalone and oyster, finfish like mullet, milk fish, giant sea-perch and red seabream are items commonly used in mariculture. (Table 6). As of 1987, seaweeds accounted for about 23.7% of the marine harvest. So also in 1986, approximately 230,000 tons of scallops and 100,000 tons of mussels were farmed. Sea-cucumber is another item cultured.

While the juveniles of most of the maricultured species are collected from the wild, two fish species namely Mugil soiny and seabream (Pagrus major) have been successfully propagated using artificial breeding.

Table 6.

Category	English name	Scientific name
Fin fish	Mullet	Mugil spp.
	Milkfish	Chanos chanos
	Giant sea-perch	Lates calcarifer
	Red seabream	Pagrus spp.
Molluscs	Blue mussel	Mytilus edulis
	Razor clam	Sinonovacula constructa
	Oyster	Ostrea plicatula, Crassostrea gigas, and C. talienwhanensis.
	Abalone	Haliotis discus hannai
	Scallop	Chlamys ferreri, Patinopecten yoessenis, and Argopecten irradians.
Halothurians	Sea-cucumber	Stichopus spp.

5.2.3 Seeds, Feed and Sea Ranching

As of 1986, China had a total of 1,204 State-operated marine and freshwater fish hatcheries and nurseries manned by more than 30,000 personnel. Additionally there were also over 3,000 collective and privately operated hatcheries and nurseries. With the increasing production from intensive shrimp culture as well as the expansion of area under culture, there has been a growing need for both seeds and feeds needed for aquaculture. Feed being the main cost factor involved in shrimp aquaculture 60-70% of the total cost is on account of feeds. Fish feeds are mostly domestically produced. China National Fisheries Corporation is operating a number of prawn farms, juvenile fish farms, fish feed factories as well as processing and marketing agencies for fishery products including aquaculture products.

Chinese sea-ranching programme is mainly aimed at propagation of shrimp stock in the coastal waters. Every year, millions of shrimp fry produced in the hatcheries are released into the sea. During the period 1984-89, altogether some 10 billion shrimp fry have been released off Hainan, Guanxi and Guandong (Canton) provinces.

6. HANDLING AND PROCESSING

Fish handling practices on board fishing vessels and at farmgates in China vary extensively depending on the kind of vessel, species involved and marketing methods. The majority of fishing vessels are below 60 hp and those above 200 hp as on 1986 are about 1600. The number of modern vessels especially those operated by the State fishing enterprises has been rapidly

increasing through the concerted efforts for modernisation at national level. However, still there are vessels owned by the communes that are often old and due for replacement. In such cases the handling and preservation practices are very poor, leading to low quality of the catch landed and wastage of fish. Nevertheless, highly priced species of fish and shell fish receive careful treatment being usually covered with ice on landing and well preserved.

On the other hand, production from aquaculture is handled with varying degrees of competence ranging from keeping fish and shellfish in live condition to excessive spoilage in summer months. The consumer preference in China being for freshwater fish against marine fish and that too freshwater species in live form, fish sold in live condition fetches invariably a premium price. Around the Central and Southern provinces of eastern China, with some of the most productive freshwater culture farms, live fish are transported either to local markets or exported to HongKong by trucks equipped with water tanks and aerators. In major prefefectual markets there are large tanks suitable for keeping fish and shell fish in live condition. However, despite the various modernisation measures that have improved the condition considerably, during the beginning of the '80s loss of fish due to inadequate handling and transport especially in the northern provinces was estimated at 20-50%.

6.1 Fish Processing

Common methods of fish processing in China before the 1950's were rather simple such as salting, drying, wine-pickling and smoking. Subsequently large scale industrial processing and freezing was introduced gradually. By the mid-1980's there were 430 processing plants including 240 State-owned factories employing more than 50,000 workers all over the country. Against this the total number of processing and freezing plants by 1988 has gone up to 1,400. Approximately 2 million mt of aquatic products are processed per annum now. More than 3,000 kinds of seafood products, industrial articles and medications are thus produced. Fish and shell fish are processed into frozen, dried or canned products, using modern equipments - as well as old fashioned ones. Especially dried/salted and canned products very often do not meet international standards. Poor processing facilitiees are the main hurdles in improving quality. However, modern freezing equipments -mostly - plate-freezers are common for export products like shrimps, fish fillets or wholed fish.

6.2 Freezing and Cold Storage

Shrimps are frozen in various product forms such as headon, headless, PUD (peeled undeveined), PUD tail-on and P&D (peeled and diveined) tail-on. These are block frozen with very little production of individually quick frozen (IQF) shrimps. Small quantities of IQF shrimps produced are frozen in blast freezers with practically little IQF facility albeit growing interest in acquiring IQF equipments.

Freezing of fish and fish fillets is done either by plate or blast freezers. Though the general consumer preference is for fresh fish, it

is a common practice to store even freshwater and aquaculture products after harvesting to be partly kept apart for freezing and storage for the winter months. But with the improvements in quality of life and the consequent increase in home refrigeration frozen products in small retail packages are getting more and more popular.

The total cold storage capacity available has considerably increased, more than doubling during the past five years from 250,000 mt in 1985 to 600,000 tons in 1990. Correspondingly the total number of cold storages has also increased from 370 to 1,200 during this period.

6.3 Canning

Canning industry in China is still in the process of modernisation in tune with the changing times. Though the quantity canned has nearly doubled during the past one decade, even now the quality standards are not up to the international levels. So much so whatever canned are still aimed at the ethnic Chinese in the export markets abroad as well as the local markets. Some of the canned fishery products of China registered with the United States Food and Drug Administration are mostly typical Chinese delicacies and specialities such as, fried carp, fried dace, fried long tail, anchovy, sardines, mackerel, marine eel, clams and cuttlefish. There are also fried spiced fish, fish with fermented soya beans etc, largely packed in glass jars for domestic markets as well as three piece cans for exports. Retortable pouch are also not uncommon. Canned crab meat and eels are two other items of export interest, produced in increasing quantities.

6.4 Drying

As per an earlier estimate (1986) about 50% of the total marine catch is dried or dry/salted in China. Dried and dried/salted products are to a great extend processed in the traditional way either by air or sun-drying or both. However, in the State-owned major fish processing plants artificial drying through heated chambers or tunnel drying is quite common. Some of the dried products from such plants have met with good response from foreign markets like Japan paving the way for increased exports.

6.5 Others

Various industrial products from seaweeds as well as fish meal and fish oil, their derivatives like tablets and capsules, fish protein concentrates (FPC) and peptons culture media used in culture of antibodies etc., are some of the wide range of fishery products that are increasingly being processed in China.

7. MARKETING

Domestic and international marketing are handled in different ways by separate agencies and organisations in the centrally planned economy of China. Till recently marketing and distribution of fish and fishery products were not regulated by supply and demand forces. However, with

the formulation of new policies by the government during mid-1980's that included liberalisation of regulations related to monopoly procurement and distribution by the State, the situation has changed radically. The fishermen and fish farmers are now allowed to directly sell their products in free markets. However, major market outlets are still the large and modern State-owned markets that handle nearly 90% of the total amount of fish distributed. The remaining 10% or so is channelled through the small and not very well maintained free markets or rural trade fairs with rather poor facilities.

Anyway, there are no complex marketing systems or network of distribution channels. In most cases the fish arrives at the market by trucks or carts early in the morning. Early arrivals especially before 5 am sometimes get a premium price of 15 to 23 per cent more than the market price as an incentive. Fish are brought in from the fish purchasing centres where the boats bring the fish from the producing areas or directly from the fish pond areas. Fish on arrival in the market are bulk weighed, sorted and sold at prefixed prices or at the ruling price. Institutional customers like restaurants and hospitals obtain their requirements either through on-the-spot purchase from the market or on longterm contract basis.

7.1 Pricing System

In general, China maintains a double-track price system in which planned output is sold at state-fixed prices while goods produced in excess of planned production are traded at negotiated or market prices. Prior to the promulgation of the new policy for fishery development in the mid-1980's, there used to have a common system of dual pricing for fish in such a way that the fish from State purchase quotas was sold at a subsidised rate of 33% while privately sold fish did not have a controlled price. But with the new policy, State purchase quotas are abolished for all fish and other aquatic produce and prices are allowed to float at free market rates. With the exception of a certain amount of fish which will be provided to the municipalities of Beijing, Tianjin and Shanghai for special purposes at controlled prices, all other sales are at negotiated prices. However, in the event of too high or too low prices the State steps in to regulate prices by controlling supply through its own purchase or sales as the case may be.

7.2 International Trade

Among the developing countries of Asia, China is the third largest exporter of fish and fishery products excluding Taiwan P.C. - after Rep. Korea and Thailand. So also she is the fourth largest importer of such products next to Thailand, Rep. Korea and Malaysia, in that order. As per official figures the total value and quantity of exports have gone up by 2.7 and 2 times respectively during the decade till 1988. At the same time imports have increased from US$ 6.4 million in 1978 ato US$297.066 million in 1988, as per FAO estimates (Table 7).

TABLE 7. CHINA: IMPORTS & EXPORTS OF FISHERY PRODUCTS

		Imports				Exports			
		1985	1986	1987	1988	1985	1986	1987	1988
Total Value	V	71046	76312	113373	297066	366920	645813	912476	1362316
Fish, fresh, chilled or frozen	Q	935	352	1326	3730	59371	66383	86467	93176
	V	1700	984	2809	6021	120441	135873	194312	258041
Fish, dried, salted or smoked	Q	491	796	1044	1550	2858	3289	3026	2743
	V	3075	4083	8062	13734	15897	19073	21673	19323
Crustaceans and molluscs	Q	5696	6367	7678	8615	57992	98219	123983	195486
	V	9471	8172	9844	16773	206349	445573	619497	983525
Fish, canned	Q	15	26	88	99	3009	5432	7811	7802
	V	46	87	207	253	8102	17981	33899	49483
Crustaceans and molluscs, canned	Q	49	16	37	42	9162	11952	14992	14512
	V	597	161	273	398	16012	26818	42311	49767
Oils	Q	0	0	667	1029	-	16	31	19
	V	1	0	462	756	-	145	291	200
Meals	Q	198552	193600	235182	471839	464	947	2332	6053
	V	56156	62825	91716	259131	119	350	493	1977

Source: FAO estimates V = Value in '000 US$ Q = Quantity in MT

7.2.1 Exports

Exports are in all major product forms such as live, fresh, frozen, dried as well as small quantities in canned form. Shrimps, yellow croakers, squid/cuttlefish (from joint venture operation in West Africa), freshwater fish, jellyfish, seaweed and so forth are the main items exported. Of these the most important item is of course shrimps that has recorded remarkable increase in quantity and value during the past five years as a result of the aquaculture boom.

The major markets for Chinese fishery products are Japan, USA and HongKong in that order. Japan buys mostly frozen shrimp, bivalves, live eel, dried molluscs and dried seaweeds (Table 8). Shrimp is the main exportable item for U.S. market as well. (Table 9). HongKong is China's important trade outlet for live fish, fresh fish, frozen and canned products (Table 10). Mackerel, dace and Chinese herring are the canned seafood products exported to HongKong. HongKong also plays an important role as a re-exporter of Chinese fishery products (Table 11). Many US and European buyers import Chinese shrimp via HongKong through back to back letters of credit.

Prior to the launching of export trade liberalisation policy, exports were allowed only through national trading corperations like the China National Oil, Cereal, Export-Import Corporation and the China National Fisheries Corporation. But now the provinces are allowed to set-up their own trading houses to handle direct exports. Still private packers or communes have to route their exports through the public sector trading houses.

7.2.2 Imports

Nearly 90% of the imports in terms of value are on account of fish meal that is being used in increasing quantity for compounding fish feed to meet the country's growing aquaculture need (Table 12). Other items are fresh frozen and dried fish, canned products and fish oil in small quantities. Frozen and dried cuttlefish and squid and some dried molluscs are such items. Most of these are imported through HongKong. As per FAO estimates, imports have gone up from some 20,222 mt and US 10.654 million in 1980 to 486,904 mt and US$ 297.066 million respectively in 1988.

7.2.3 Export Inspection

The inspection and quality standards of import and export commodities are controlled by a new regulation promulgated by the Chinese State Council on 28th January 1984, replacing the earlier provisional regulations of 1954. In July 1984, the provisions of sanitation of food for export were also promulgated according to which all food stuff including processed fish and raw material for human consumption are subject to strict sanitary and quarantine inspection. Such inspections are carried out by the Import and Export Commodity Inspection Bureau (CIB) and its sub-offices. Processing plants and storage premises are to be approved by the CIB for export production.

TABLE 8. CHINA: EXPORTS OF FISHERIES PRODUCTS TO JAPAN 1985-89 (Q = MT, V = MILLION USD)

	1985		1986		1987		1988		1989	
	Q	V	Q	V	Q	V	Q	V	Q	V
Eel, live,	1012	5	863	8	2507	25	5575	54	3967	38
Fish, live, n.e.s. (1)	282	1	317	2	358	2	447	3	664	6
Fish, fresh, n.e.s.	247	1	309	2	1411	5	836	4	1722	8
Spanish mackerel, frozen	905	1	1477	2	7134	14	6067	14	7237	17
Fish, frozen, n.e.s.	4168	10	4915	12	4979	12	6690	18	7635	23
Cod, pollack, herring roes, prepared or preserved	648	9	1081	14	1213	12	1495	12	1217	10
Shrimps, fresh, or frozen	10664	83	18723	173	27898	254	8120	318	37516	290
Crab, live, fresh, or frozen	7376	18	11009	28	8210	22	9366	30	12657	37
Hard clam, live, fresh, or frozen	10752	9	14276	15	13291	15	20765	28	21164	26
Crustaceans and molluscs fresh, or frozen, n.e.s. (2)	2211	1	1817	1	4828	8	-	-	-	-
Molluscs and aquatic invertebrates, frozen	-	-	-	-	-	-	1979	13	4367	50
Jelly fish dried, salted or in brine (3)	1825	7	2838	11	2872	17	2279	18	2651	26
Wakame (Undaria)	2515	2	2894	3	5537	5	4255	4	6583	7
Edible seaweeds, n.e.s.	506	1	571	1	1080	3	1402	4	1455	4
Eel preparations	125	1	431	5	596	10	1536	25	2269	33
Fish, preparations	694	2	1266	3	1390	5	496	2	857	4
Molluscs, prepared or preserved (4)	8014	12	9356	17	10137	22	8119	18	12294	24
Pearls (5)	22	13	13	12	6	7	10	8	8	6
Others	4598	18	5905	17	7832	20	13346	48	27861	90
Total	56564	194	78061	326	101279	456	122650	618	152124	699

Note: (1) n.e.s. - not elsewhere stated.
(2) In 1988 the classification has been changed, thus the corresponding figures are not found.
(3) This statistics up to 1987 includes beche-de-mer, also.
(4) This statistics up to 1987 includes prepared/preserved crustaceans.
(5) This contains all types of pearl products, cultured or natural, freshwater or seawater, and worked or unworked.

Source: Japan Marine Products Importers Association

Table 9. USA: Monthly Imports of Shrimp (All Types) from China (Against Monthly Total), 1986-1989 in 1000 LBS

	1986	1987	1988	1989
Jan		(29723)	(35741)	(55805)
		3625	4613	19593
Feb	(22329)	(39224)	(31254)	(36968)
		4694	3148	8785
Mar	(26027)	27367	(37335)	(31870)
		2414	6981	3829
Apr	(29558)	(30411)	(41795)	(31646)
	3354	3354	14297	5821
May	(31946)	(35390)	(42554)	(42554)
	881	4186	11864	11864
Jun	(31529)	(41330)	(36742)	(39851)
	1540	4250	6846	6609
Jul	(37534)	(40766)	37951	(40447)
	2080	3566	6034	5543
Aug	(32937)	(39433)	38816	(74897)
	1146	3511	5068	5928
Sep	(37533)	(43820)	(39005)	(36140)
	1250	2405	3472	2433
Oct	(35538)	(50582)	(39942)	(53378)
	2962	2022	3166	18585
Nov	(45119)	(45005)	(53678)	(57632)
	2865	3913	14428	17071
Dec	(27409)	(54765)	(67078)	(46131)
	1772	4527	24359	13044
Total Jan-Dec	(400130)	(478306)	(503878)	(502967)
	20661	42417	104316	102988

Source: US NMFS

Table 10. Hong Kong: Imports From China (Q=mt, V='000 HKD)

	1985		1986		1987		1988		1989	
	Q	V	Q	V	Q	V	Q	V	Q	V
	-	-	-	-	-	-	-	-	-	-
Red snapper, fresh	4	78	4	43	15	168	11	108	3	43
Conger pike eel, fresh	768	10548	1059	12132	1619	30333	1219	58133	1487	95280
Marine water fish, fresh	4449	61097	5600	74697	12993	149549	13276	141325	13008	131395
Fresh water fish, fresh	36623	380990	41072	427632	37683	417273	36198	482408	32905	411852
Fish fry	-	143423	-	176501	-	180630	-	161317	-	78954
Aquarium fish, fresh water	-	3297	-	3813	-	1785	-	1806	-	1452
Aquarium fish, marine water	-	-	-	-	-	21	-	53	-	12
Red snapper frozen	-	-	-	-	-	-	-	-	15	494
Conger pike eel frozen	19	284	8	60	8	92	46	405	141	1928
Marine water fish, frozen	4889	57765	6586	67766	7105	93520	9388	116781	8313	106524
Fresh water fish, frozen	132	1376	69	630	172	1750	1383	28275	1852	37990
Fish fillets, fresh	32	302	-	-	636	8937	2533	29569	2483	27843
Fish fillets, frozen	476	4498	467	5272	-	-	1430	14103	1679	13028
Conger pike eels dried/salted	-	-	-	-	-	-	1	27	-	-
Marine water fish, dried/salted	1898	38608	2439	55724	2289	84092	1843	60191	1014	42746
Fresh water fish, dried/salted	1	28	-	-	7	293	120	4806	105	4099
Seche-de-mer, dried/salted	108	1474	127	734	269	4294	99	1951	117	3368
Sharkfin, dried/salted	35	5889	91	10001	235	33155	373	58452	440	75916
Sharkfin, boiled in water	-	-	-	-	-	14	90	9876	123	12995
Fish smoked	-	1	-	5	-	11	-	-	-	-
Shrimp fresh/frozen	7340	307170	18464	732045	23649	924088	44697	1774423	35546	1101358
Oyster fresh/frozen	482	3726	258	1969	174	1424	101	1077	28	491
Abalone fresh/frozen	5	505	47	2469	17	1955	50	5774	51	6074
Cuttlefish fresh/frozen	984	9203	1863	21646	2325	37184	2601	44860	3904	70716
Squid fresh/frozen	173	1689	454	6748	897	13188	1945	28479	2272	29827
Octopus fresh/frozen	-	48	22	265	7	93	23	344	-	-
Other crustaceans fresh/frozen	2455	57147	3357	90825	4104	104516	5215	135289	4403	108172
Molluscs fresh/frozen	2007	12968	3643	24902	7270	72702	4500	48626	3874	39448
Shrimp dried/salted	143	2817	1407	21335	1365	17470	2611	32595	1479	20889
Oyster dried/salted	18	714	46	3358	84	6617	42	4518	104	9230
Abalone dried/salted	-	-	2	877	-	693	2	489	-	61
Cuttlefish dried/salted	19	504	31	829	22	271	33	964	19	623
Squid dried/salted	2	70	103	3566	40	1997	168	6651	260	14679
Octopus dried/salted	1	29	25	761	51	1763	45	1465	107	4990
Crustaceans dried/salted	115	1884	3	33	30	729	147	2586	258	5421
Total	63,182	1,108,132	87,232	1,745,628	103,066	2,190,501	130,190	3,257,726	115,990	2,468,898

Source: INFOFISH

Table 11. Hong Kong: Re-Exports of Shrimp and Cephalopods to China (Q = mt, V = '000 HKD)

	1985		1986		1987		1988		1989	
	Q	V	Q	V	Q	V	Q	V	Q	V
Shrimp fresh/frozen	54	1433	314	10209	313	8757	769	32141	713	31057
Cuttlefish fresh/frozen	33	206	36	254	69	623	48	674	419	3876
Squid fresh/frozen	537	4183	1726	11915	1998	17429	3229	30291	5372	43502
Octopus fresh/frozen	-	9	2	87	15	365	9	493	14	704
Other crustaceans fresh/frozen	19	614	24	819	43	1314	7	941	5	677
Shrimp dried/salted	124	1970	33	388	105	716	181	1182	77	871
Cuttlefish dried/salted	3	32	6	141	23	426	38	917	43	972
Squid dried/salted	298	7321	234	2729	678	10525	1424	25321	1299	29787
Octopus dried/salted	2	76	2	57	1	33	11	194	2	122
Other crustaceans dried/salted	5	443	-	33	3	161	3	146	1	39
Crustaceans/molluscs prepared	5	235	4	123	25	724	11	508	3106	227
Crustaceans/molluscs canned	4	211	3	188	3	217	19	585	16	710

Source: INFOFISH

Table 12. China: Imports of Fishmeal, 1980-89, (Q = mt, V = US$1000)

	1980	1981	1982	1983	1984	1985	1986	1987	1988
				"Fishmeal"					
Q	18800	13500	67300	52600	101400	192000	180000	226000	448000
V	9475	6318	23757	23828	37822	53760	57600	86558	243712

Source: FAO/Oil World

Export must meet the veterinary and sanitary requirement set forth by the importing countries. For this the plants and storages are required to establish quality control systems and to be responsible for the sanitary quality of exports. A list of fish and fishery commodities subject to inspection by the CIB is given in Table 13.

Table 13 List of Fishery Commodities Subject to Inspection

Note: With the development of China's foreign trade, the kinds of import-export commodities subject to inspection may change. Information on changes is released from time to time.

Aquatic products

a) Fish
   Frozen fish (including frozen fish, frozen fish in cutting pieces and frozen fish fillets)
   Salt-water fish

b) Prawns and shrimp
   Frozen prawns
   Frozen shrimp
   Frozen shrimp, peeled

c) Shellfish (including without shell or shelled, but not including dried products)
   Periwinkle (mud-snail)
   Ark shell
   Clam
   Marine mollusc
   Razor clam

d) Other aquatic products
   Jelly fish
   Frozen cuttle fish
   Frozen cuttle fish fillets
   Chum salmon roe
   Salted herring roe

Inspection of export commodities is generally conducted on finished products. But China National Import and Export Commodities Inspection Corporation set up in 1980 with its headquarters in Beijing and branches in 29 provinces, municipalities and autonomos regions, may also send their specialists on request to ascertain the quality and sanitation condition of the import and export commodities.

As per the relevant regulations; sanitary inspection and quarantine of imported food stuff are undertaken by the Institute of Food Sanitary Supervision and Inspection.

7.2.4 Disposition and Consumption

As per the available data, about 20% of the total fish landing is presently used for various kinds of processing that produces some 3,000 kinds of seafoods, industrial articles and pharmaceutical products. About fifty percent of the rest is estimated to be used for drying and curing. As mentioned earlier freshwater fish is always preferred in China where most expensive product form is live fish.

Per capita fish supply as per 1984-86 average is 6.1 kg against 4.9 kg some five years before. Despite the rapid growth in fishery production Chinese per capita fish consumption is comparatively low. This is mainly attributed to an expanding population. Nevertheless, with the increasing per capita income and improving living standards there is every possibility of further increase in fish consumption in the coming years. As such demand is expected to increase steadily over the next decade. Considering the consumption pattern in the neighbouring countires with similar ethnic preferences, it is also likely that the food habits will change in China with more intake of fish and dairy products and a corresponding fall in consumption of grains.

8. FISHERY ADMINISTRATION

Fishery administration is carried out by the Ministry of Agriculture (MOA) formerly called the Ministry of Agriculture, Animal Husbandry and Fisheries (MAAF). Under this ministry the Bureau of Aquatic Products (BAP) and Bureau of Fisheries Management and Fishing Boat Superintendence (BFM) share between themselves the primary responsibility of the fishery industry. The BAP is responsible for fisheries development activities while the BFM administers marine fisheries regulations; port operations; as well as marine communication and safety. Apart from these Bureaus, special agencies are also established to handle marketing and investment, fishery management, fishery education and training as well as fishery research as shown in the chart on Page 22.

In addition to the Central Government agencies, several autonomous fisheries corporations and trading houses are lately being established by the municipal and provincial governments. These are meant for providing essential technical, marketing and commercial services to the fish producers on a commercial basis. These services also include feed and fingerling supplies, provision of cold storage, and transport, equipment procurement, construction engineering services as well as marketing and exports.

8.1 China National Fisheries Corporation (CNFC)

CNFC is the largest national enterprise of its kind engaged in almost all aspects of fishery industry both at home and abroad. CNFC was founded in 1985 with the merger of the erstwhile China National Marine Fisheries Corperation, China National Aquatic Products Supplying and Marketing Corperation and China National Aquaculture Corperation. Presently engaging some 40,000 employees this corporation has set up 16 subordinate enterprises and nearly 200 joint ventures in China. It has also established 11 enterprises or sole proprietorship or joint ventures scattered in 9 countries.

Fishing, aquaculture, processing of aquatic products, building of fishing boats, fabricating nets and equipments, formation of international fisheries corporations and several such allied fields are covered by the CNFC. Its annual turn over is over one billion RMB.

The overseas ventures in fisheries promoted and controlled by the CNFC are of different kinds and in many forms. They include countries like Guinea Bissau, Senegal, Spain, USA, Palau, Argentina, Morocco, Nigeria, Uruguay, USSR, Sierra Leone and so on. The joint activities carried out are fishing for pelagic species, cephalopods and tuna, processing and marketing of marine products, as well as transportation, storage, etc. The distant water fishing fleet of CNFC formed during the five years from 1985-90 comprises more than 50 deep sea fishing vessels including 300 GRT boats with 600-900 hp as well as 3,000 GRT factory vessels and 5 reefer ships.

8.2 Research Activities

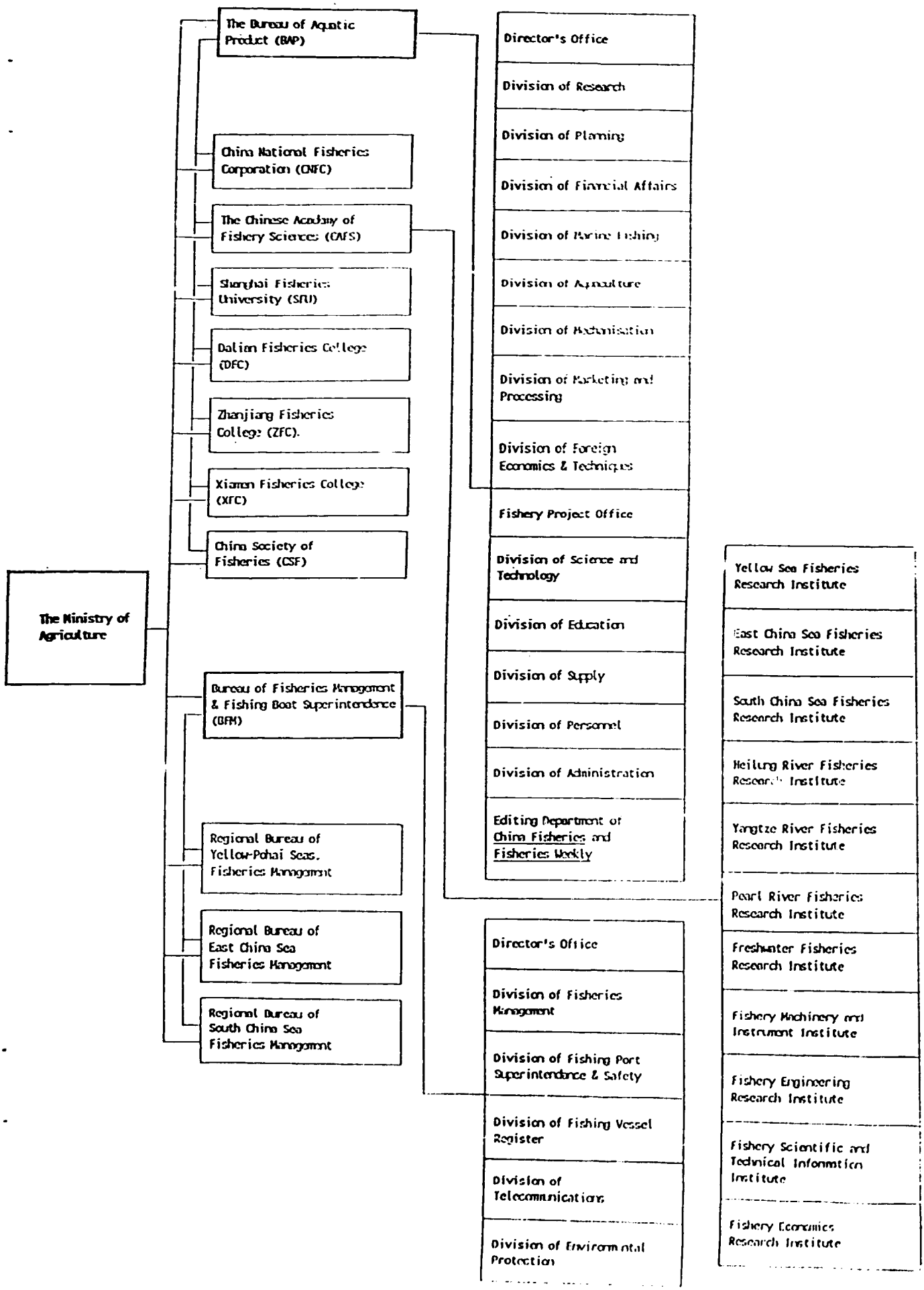
Under the Chinese Academy of Fishery Sciences of the Ministry of Agriculture there are nine fisheries research institutes engaged in various fishery related research. Three of these namely the Yellow Sea Fisheries Research Institute, the East China Sea Fisheries Research Institute and the South China Sea Fisheries Research Institute, are involved in marine fishery research. There are four freshwater fishery research institutions viz Heidongjiang, Chanjiang, Pearl River - Fishery Research Institutes and the Wuxi Freshwater Fisheries Research Centre. Finally, there are also the Fishery Machinery and Instrument Research Institute and the Fishery Engineering Research Institute. All these are coordinated by the MOA through the Scientific and Technology Department of the Bureau of Aquatic Products. Apart from these, there are three separate research institutes supervised by the Chinese Academy of Sciences mostly concerned with basic research in zoology, hydrobiology, limnology, fish pathology, oceanography and marine biology. These are located in Beijing, Wuihan and Quingdao respectively.

Major provinces and cities in China have their own fisheries research institutes conducting applied research in fishery sciences. They are supervised by the provincial or city Bureau of Aquatic Products. They cover a wide range of topics of immediate application for the development of local fishery industry and have contributed enormously to the progress achieved by China in these years.

8.3 Manpower Training

It is estimated that a total of about 500,000 persons are involved in fishery activities under the State. While about one third of them are from technical secondary schools, nearly 10 per cent are university graduates with an equal number of those college educated. There are also post-graduates among the staff. The prominent fishery educational institutes such as Shanghai Fisheries University, as well as Xiamen, Zhanjiang and Daliam fisheries colleges are managed by the MOA whereas some Universities with fisheries departments are under the Ministry of Education.

Fisheries Administration under MOA



9. GOVERNMENT POLICY

It was in 1979 that China's National Conference on Fisheries stated a policy for rational utilization and management of water and land resources. Since then various new approaches were formulated redirecting emphasis on reforms and opening to the outside world as also development of marine and freshwater aquaculture. Provision of substantial inputs in the form of financial, material and technical support to ensure the attainment of production targets was the mainstay of the policy enunciated during the 1980's. Accordingly the government has liberalised production, marketing and price controls.

The legislation entitled 'The Fishery Law of the People's Republic of China' adopted by the 14th session of the 6th NPC in January 1986 and effective from July same year has clearly expressed the attitude of the government to fisheries development. It contains a range of regulations which are designed to protect the fisheries at environmental level and to encourage conservation. Further, establishing a fishery license system for domestic operations, promotion of far-seas fishery operations and permit requirements for foreign fleets operating in Chinese waters are also incorporated into the policy that was ratified by the State Council in Oct., 1987. The other salient features of the Government policy are as follows:

* 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.
* 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.
* 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.
* All levels of Government are to give attention and effort to exploiting water resources.
* Fish breeding and upgrading fish catching and processing will be accorded top priority to achieve the growth objectives.
* Efforts must be intensified to guarantee sufficient fish supplies for big and medium-sized municipalities within three to five years.
* 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.
* 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.
* Fuller exploitation of water bodies available for farming is seen as a way of helping urban areas to produce enough for themselves.
* 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.

* 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.
* 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.
* 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.
* 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.
* 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.

9.2 International Cooperation

In her fishery development activities China has been actively assisted by the various international and regional agencies like the Food and Agricultural Organisation (FAO), the United Nations Development Programme (UNDP), World Bank (WB), International Development Association (IDA), International Fund for Agricultural Development (IFAD), Asian Development Bank (ADB), and the Economic and Social Commission for Asia and the Pacific (ESCAP). She has received both financial and technical assistance from such sources, especially in her aquaculture activities.

In fact, China has the most projects and the largest capital assistance from multilateral funding among the East Asian countires for fishery development as capital assistance projects. These include a US$ 40 billion World Bank loan coupled with a US$ 60 million concessionary credit facility from the IDA for the conversion of site for mariculture of shrimps and seaweeds. Another WB US$ 60 million loan is extended for construction of 11,100 ha of fishponds and the improvement of 6,100 ha of existing ponds. Special Drawing Rights (SDR) of US$ 10.15 million from IFAD for the development of 2,000 ha for intensive carp farming is another item. There are also six projects aided by the World Food Programme (WFP) at a total of US$ 91 million for the construction of 8,000 ha of fish ponds and associated infra-structure. With these sorts of assistance China is expected to add 62,000 ha of ponds for intensive culture of fish and shellfish and to modernise fishing equipments, feed processing plants, and to establish cold storage facilities for fishery products.

Foreign investment in fishery sector to the extend of US$ 100 million in about 130 joint ventures has also been absorbed at all levels to speed up fishery development process. As per provisional figures, China has traded and has become involved in cooperation with more than 60 countries,

regions and international organisations in fisheries activities. She has also set up bilateral scientific and technological relations with over 10 of these countries and economic ties with an additional 20 countries and regions.

10. CONCLUSION

China has made remarkable progress in production, processing and marketing of marine products especially during the past decade. The key factor in this has been the policy of reform and opening to the outside world persued by the government as enunciated through the fishery law of the 1986. Concerted efforts initiated during the decade have resulted in unprecedented advancement on all areas related to fisheries in this country. The policy incorperates rewards for those who make a special contribution to the industry and a series of regulations aimed at environmental protection and conservation in the context of fisheries, two vital areas for a country like China teeming with its millions of people. Pollution regulations are also tightened up and a national monitoring system is being set up.

With regard to the hitherto unexploited resources in the capture and culture fields, suitable measure are envisaged in the government policy. Approximately 350,000 sq km of the sea off Chinese coast are being surveyed to assess stocks for which the State Bureau of Oceanography has 15,000 scientists at its disposal. Telemetering sensor buoys offshore are being used together with oceanographic vessels to improve oceanographic and weather forecasting broadcasts to the fishermen and offshore workers.

Considering the measures introduced for the modernisation of the industry, an area still in need of added efforts is fish handling and quality control. Most of the processing plants are old fashioned. There is obvious scope for strengthening the existing quality control and inspection systems mainly confined to the finished products. As there are no institutionalised systems for enforcing implant or inprocess quality control, often the importers from HongKong have to provide the required knowhow and training. The importers' representatives also carry out inspection of products especially shrimps before shipment.

Nevertheless there are reasons to assume that the fishery industry in China is on its growth path, tackling one by one the problems confronting its progress. There are already plans for the establishment of an appropriate body for fish quality control. Coupled with this, the organisation of adequate extension services and fish processor training facilities in the country will go a long way in improving the image of Chinese seafood products. Even now China has succeeded in its efforts to such an extend that the total fish production attained in 1988 at 10.36 million mt was far higher than the 9 million mt target fixed for 1990 at double the quantity of 4.5 million mt landed in 1980. As such it is to be expected that her target of 18 million mt fish production by the end of the century together with tripling per capita fish capita fish consumption will easily be attained.

INDIA

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1. INTRODUCTION

Embraced by the Arabian Sea in the West and the Bay of Bengal in the East, India is strategically located to harvest the rich fishery resources in the Indian Ocean. The Indian territory extends to the Lakshadweep group and the Andaman - Nicobar group of islands off the West and East coasts respectively of the Peninsular mainland that tapers off into the Indian Ocean. The coastline is 7 517 kms long with a Continental Shelf area of 0.45 million sq kms and 2.02 million sq kms of Exclusive Economic Zone (EEZ). The extend of the continental shelf of up to 200m depth varies from 32 km off the coast of Andhra Pardesh to 177 km off Maharashtra state. The inland fishery resources consist of 4.5 million ha of natural and manmade water bodies and some 29 000 km of rivers and channels. Both catching and processing sectors in Indian fishing can be considered as yet to be fully developed, despite the remarkable progress made over the past years. However, the Government and private industry have lately been showing keen interest to further develop and upgrade these activities.

The population of India as estimated in February 1990 is 821.9 million, and the annual growth rate is 2.1%. Out of the nations total fishermen population of 7.14 million, the inland sector provides employment to 4.86 million. The real GNP growth rate was 1.8% in 1983, but went up to an average 5.2% for the seventh five year plan period from 1985 - 90. GDP per capita was Rs 3365 in 1986-87. As per the latest estimates made in 1990, per capita GNP is U$320 and the GDP growth rate is 4.5%. Current account deficit is U$6700 million and the foreign debt amounts to U$62.8 billion. Inflation based on CPI is 10.1%.

2. FISHERY RESOURCES

Fish production is predominantly artisanal and in the small scale sector with limited number of industrial vessels. There is no uniform pattern in the socio-economic organisation of fishery activities. Many small-scale fishermen also perform other economic activities like boat-building and salt-making. However, there appears to be a progressive shift from individual operations into joint ventures with other fishermen, money lenders and village level groupings.

The overall income situation of fishermen in 1985 has 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 couprises 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 1988. The inland fishery sector showed an even more dramatic growth from 260 000 MT in 1961 to 783 800 MT in 1975 and 1.4 million tonnes in 1988-89.

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

2.1 Marine resources

Out of a total 2.02 million sq kms of the EEZ, the major share of 42.6% is in the West Coast and 27.7% in the East Coast region. The remaining 29.7% of the EEZ is around Andaman - Nicoban group of Islands.

The marine resources are catagorised into three sectors namely inshore resources - up to 50 metre depth, offshore - 50-200 metre depth and deep sea - beyond 200 metre depth. The estimated potential of Indian EEZ is 4.47 million MT, of which only 40% or 1.8 million tons are caught in 1988.

Nearly 51% of the potential yield (2.26 million) has to be harvested from the inshore waters of 0-50 m zone. However, bulk of the unexploited potential (2.21 million tonnes) is to be harvested from 50-200 m depth zone - roughly to the extent of 1.71 million tonnes - and the remainder 0.50 million is expected from deep sea zone of beyond 200 m depth.

The offshore resources that are still under-exploited 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, W.Bengal, Maharashtra, Tamil Nadu, Andhra Pradesh and Kerala. Demersal stocks and shrimp resources are moderately to heavily exploited.

Table 1: Major marine species found in Indian waters

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

Source: MPEDA,India

2.2 Inland resources

The inland fishery resources comprise rivers and canals of a total length of about 29 000 kms, reservoirs of about 1.45 million hectares, tanks and ponds of about 0.75 million hectares, Beels, lakes and derelict water areas of about 1 million hectares and brackishwater and mangrove swamps of about 0.9 million hectares. The production potential of these areas, when fully developed, is estimated at 4.5 million tones.

The Ministry of Agriculture, in close collaboration with the various State Government Fisheries Departments has set up about 200 Fish Farmer's Development Agencies to bring these areas under fresh water fish culture. About 180 000 hectares have been brought under culture and 220 000 tonnes of fish was produced till 1987, under this system. About 35 hatcheries were set up to produce nearly 10 billion seeds for fresh water fish culture till 1987-88. The species of fresh water fishes under culture are given in Table 2, below :

Table 2: List of Important Indian Fresh Water Fish And Shell Fish Species

FRESH WATER FISHES

MAJOR CARPS

Catla catla
Labeo rohita
Labeo calbasu
Cirrhinus mrigala

OTHER SPECIES

Tilapia species
Cyprinus carpio (Common carp)
Hypophthalmichtys molitrix (Silver carp)

COLD-WATER FISHES

Tor schizothorax (Snow trout)
Heteropneustes fossilis
Anabas testudineus
Channa maralius
Channa striatus
Channa puntatus

CAT FISHES

Mystus aor
Mystus seenghala
Wallago attu
Pangasius pangasius

FRESH-WATER PRAWN

Macrobrachium rosenbergii
Macrobrachium malcomsonii

Source: MPEDA, India

3. PRODUCTION

Total fishery production in 1988 was 2.96 million MT. Of this, about 60% is from the marine sector and the remainder from the inland fisheries sector.

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

October - December is the major marine fishing season in India especially in the West coast. 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.

The present level of exploitation is only about 35% of the estimated potential of Indian EEZ. The fishing effort is mostly concentrated in the 0-50 m depth zone, getting nearly 99% of the present production.

Fish landings in India in recent years present a fluctuating pattern with the peak production in 1988 as indicated below:

Table 3 :Fish landings in India

Year	Total	Marine	Inland
1978	2220	1404	816
1979	2236	1388	848
1980	2442	1555	887
1981	2444	1445	999
1982	2367	1427	940
1983	2507	1519	987
1984	2862	1779	1083
1985	2824	1734	1090
1986	2922	1708	1274
1987	2907	1648	1259
1988	3145	1775	1370

Source: MPEDA, India

The major items caught are Bombay duck, Sciaenids, oil sardines, Penaeid prawns, perches, cat fishes, etc. Details are as given in the table below :

TABLE 4 : MARINE FISH LANDINGS IN INDIA 1988
1983 - 1988

Species	1983	1984	1985	1986	1987	1988
1. Elasmobranchii	70,046	57,757	52,804	49,627	67,552	56,773
2. Cat Fishes	60,764	57,415	44,500	64,258	60,036	69,853
3. Bombay Duck	100,950	117,742	112,454	104,019	103,202	112,568
4. Perches	56,141	72,241	71,813	39,547	34,751	43,170
5. Polynemids	5,947	7,603	9,059	5,151	7,412	5,558
6. Sciaenids	100,755	109,852	101,078	149,446	174,763	157,391
7. Silver Belly	91,733	57,122	52,725	41,669	38,830	44,033
8. Pomfrets	54,290	49,979	32,974	37,443	40,942	47,091
9. Oil Sardines	183,706	188,832	120,587	177,443	165,850	184,962
10. Lesser sardines	77,010	67,594	60,556	93,577	64,482	74,624
11. Anchoviella	109,797	99,612	82,048	66,880	55,604	75,947
12. Other clupeids	33,695	38,001	34,283	52,049	35,307	40,371
13. Ribbon Fish	39,071	53,085	84,403	63,853	61,134	53,923
14. Carangids	53,769	68,745	54,703	30,603	25,999	34,615
15. Mackerel	31,227	42,648	61,860	60,297	61,631	71,630
16. Seer Fish	35,615	36,651	34,078	31,384	37,038	34,510
17. Tunnies	16,959	20,354	31,261	22,392	23,095	30,693
18. Penaeid prawn	118,203	130,051	121,958	138,631	140,483	152,240
19. Non penaeid prawn	48,750	61,961	67,084	73,487	59,081	72,242
20. Other crustaceans	42,431	60,783	57,537	18,927	22,623	16,268
21. Cephalopods	19,748	20,964	31,642	22,403	23,393	22,931
22. Others	197,868	211,686	249,969	394,059	367,275	373,617
Total	1,548,475	1,630,678	1,569,376	1,739,145	1,670,483	1,775,010

Source: MPEDA, India

3.1 Inland fish production

Inland fish production in India has increased from 0.94 million tonnes in 1982 to 1.4 million tonnes in 1988. But the increase has not kept pace with the increase in the domestic demand for fish. A demand-supply gap arose as a consequence, and the prices of fish in the domestic market increased more rapidly than the prices of other commodities. Possibilities of increased supply from the marine sector for domestic marketing being limited due to greater emphasis being given for its export-oriented future development, major contribution to the additional supply to the domestic market should necessarily come from fresh water culture fisheries in ponds and tanks and through stocking-cum-capture fisheries in reservoirs. This is more so because emphasis on exploitation of the potential of brackishwater areas will be on shrimp production for augmenting supply for export marketing.

According to the targets set by the Government, an additional area of 0.4 million hectares is proposed to be brought under culture activities to step up production to 1.45 million tonnes by 1990. The strategy for increasing production also envisages upgradation of technology to a semi-intensive level to improve productivity.

4. FISHING FLEET AND GEARS

Presently the number of fishing boats aggregate to 206 301 of which traditional crafts - both mechanised and non-mechanised boats put together are 183 395. The motorised traditional crafts are 15 292 and mechanised boats are of 22 906. There are 17 principal types of traditional fishing crafts all of which are indigenously evolved to suit the local conditions in the different fishing regions. The traditional crafts using out-board motors number 8 723. All except mechanised ones use oars or sails for propulsion. The principal gears used are gill nets, bag nets, boat seines as well as beach seines, hook and line, etc. Several mechanical fishing accessories, ancillary fishing equipments and electronic equipments of practical value in fishing operations have been introduced recently improving efficiency.

In addition to the non-mechanised and mechanised traditional carfts, small mechanised fishing vessels of 7.6 m to 15.2 m O A L, numbering 22 906, comprising trawlers, gill netters, bag netters, and purse-seiners are in operation in the in-shore region. In the off-shore and deep-sea regions, 166 vessels of 20 m O A L and above, mostly designed for out-rigger trawling for shrimps are in operation.

It is estimated that the artisanal sector contributes to about 25% of the present production. The mechanised small boats

operating in the in-shore waters account for about 74%. The balance of about one percent only is the share of the comparatively small number of deep-sea fishing vessels now in operation.

5. AQUACULTURE

Though aquaculture has been in vogue for quite sometime now, markedly increased productivity from the same is more of a recent development. Production from brackishwater culture increased from 12 376 tonnes in 1983 to 20 581 tonnes in 1987 - an increase of 66% over a five year period. The area under cultivation has also increased from 30 700 ha to 50 800 ha showing an increase of 65%. The major species cultured were Tiger (Penaeus monodon) - 11 634 tonnes (57%). White (Penaeus indicus) 5 033 tonnes (24%) and Brown (Metapenaeus dobsoni) 3 914 tonnes (19%). Freshwater shrimp (Macrobrachium rosenbergii) is also produced on a limited scale.

6. HANDLING AND PROCESSING

Most of the mechanised boat operators have started taking ice to preserve fish caught particularly the exportable varieties. However, indigenous fishing crafts do not carry ice for preserving catch. After landing, catches 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. 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.

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 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) of India. MPEDA is directing efforts toward making all catamarans carry ice. However, further improvement is desirable.

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. Peeling sheds are all 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 eg. 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.

6.1 Processing sector

Drying, freezing and canning are the three different type of processing prevalent in India. Drying is the age old form of preservation; now resorted to only when there are bumper landings. Sun-drying is done in whole form and also as gutted particularly for bigger fishes. Salt is added on drying fishes.

Freezing is the most prominant and modernised sector for fish processing in India. There are altogether 225 freezing plants with a total capacity of 2 184 tonnes per day. Most of them are equipped with horizontal plate freezers for block freezing of shrimp. Some freezing plants have tunnel freezers too. The individual quick freezing (IQF) is of a recent addition to the freezing area: 24 IQF plants with a production capacity of 120 tonnes per day have been set up so far. Most of them are assisted by the MPEDA. Some of the IQF plants set up have sophisticated machinery for automatic in-line processing and packaging of IQF shrimp in raw, cooked and breaded form. Main items thus frozen are shrimp, squid, cuttlefish, lobster and certain fishes like pomfrets, seerfish etc, almost exclusively for export.

Cold storage rooms are mostly small, less than 50 MT capacity 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 the MPEDA. There is clearly a need for assistance in design and construction of cold storages. There are proposals to set up cold storages in other major export centres.

Canning capacity available in India as on date is around 84.55 tonnes per day and the number of plants are only 25. These plants were established to can shrimp for export. However, with the decline of canned shrimp export, most of the canning plants are idling. Some of the canning plants are used for canning tuna, sardine, mackerel etc in a very limited way mainly for domestic market.

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 cost of the finished product.

6.1.1 Fishmeal

Though there are only very few fishmeal plants that too scattered at different parts of the country, none of them is working at full capacity due to the lack of adequate raw material supply. When these plants were established, their economy was based on trash fish. But the demand and prices for trash fish have increased so drastically within the country that it has been found unworkable to use it to feed the fishmeal plants. The number of fishmeal plants is around 24 with a limited capacity of 419 tonnes per day.

6.1.2 Miscellaneous

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), etc. Many of these are exported to different parts of the world.

6.1.3 Fish processing equipments

Machinery for grading, washing, splitting and beheading are being inducted into a few of the existing processing plants. However, the new processing plants being established have got fully automated systems for various processes.

The seafood processing industry in India is almost entirely geared to the handling of shrimp. In some of the plants having modern equipment for grading, washing, packing, etc. The capacity utilization is only at 20%. With the projected expansion of shrimp production through aquaculture, capacity utilization is expected to reach 50%. The anticipated expansion of facilities in shrimp processing is only meant for promoting individual quick freezing, freeze drying, etc. Part of the idle capacity could be utilized for processing cephalopod, tuna, mussels, etc.

6.2 Product development

6.2.1 Head-on shrimp

Processing and marketing of head-on shrimp was developed with technical assistance from ITC. Export of head-on shrimp is not uncommon particularly to continental markets, although in

limited quantities. The poor landings of suitable grades of whole shrimp is the major limiting factor for the development of head-on shrimp export.

6.2.2 Accelerated freeze-dried shrimp

This is one of the recent developments in the processing sector in India. Although there is only one plant in India so far, efforts are underway to start similar plants. Most of the products find their way to Japan, United States and Continental markets.

6.2.3 Squid

Squid has emerged the distant second item of importance among the fishery products from India, particularly with the growing demand from Spain as a leading buyer. Squid is processed in different ways such as whole, frozen, squid tube, battered squid and dried squid.

6.2.4 Cuttlefish

Cuttlefish is also processed in the whole form and fillets mainly to cater to Japanese and European markets.

6.2.5 Cooked whole lobster

Deviating from the traditional way of processing which was conformed to lobster tails for US market, lobster is processed in whole after cooking. The major outlet for this item is Japan.

6.2.6 Isinglass

This is comparatively a new product in India derived from fish maws. There is one plant so far in operation catering to European buyers especially from Ireland.

6.2.7 Chitin/chitosan

Along with shrimp, squilla with a high chitin content is caught. This is an excellent raw material for Commercial production of chitosan that 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 bactopeptone for microbiological work.

6.3 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 fishery products 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.

6.4 Infrastructure

Despite strenuous efforts by the Government to upgrade and develop infrastructure since the First Five-Year Plan, in the Fiftees, 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 an uneven regional distribution of fish for 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 sector, the export oriented processing industry is rather well equipped, although there remains much room for improvement. The structure of the industry varies from place to place. A large number of small, often family-controlled, enterprises make up a large share of the industry.

In view of the Government's policy to restrict imports of machinery so as to check the outflow of foreign exchange, the introduction of up-to-date processing equipments has been slow. However, lately the Government has been encouraging import of equipments particularly faster (liquid-nitrogen) freezers and IQF machinery.

6.5 Quality control and hygienic 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 in inspection and quality control related to 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 various 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 comprehensive inspection and quality control programme covers almost all marine products and certainly all important marine export products.

Mandatory 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 intending to export 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 referred to as the Modified In-Process Quality Control (MIPQC) scheme was introduced. Under this programme, the firms concerned 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 now, most of the shrimp processing plants had qualified for licences to operate under the MIPQC scheme.

7. MARKETING

7.1 Domestic market

India has a well developed domestic market for fish and fishery products; although the per capita consumption data indicate a different version. The low per capita consumption is mainly due to the fact that more than 50% of the population do not consume fish because of their inaccessibility or socio-religious considerations. Nearly 90-95% of the marine landings are consumed in the coastal states mainly due to the absence of adequate marketing infrastructure facilities and partly due to the unfamiliarity of people residing in interior areas with the marine fish.

The inland fish production is almost entirely consumed locally with the sole exception of brackishwater shrimps.

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

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 distribution of fish are limited and, due to this and the distance involved, fish has an uneven distribution and is generally of low quality.

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. Extension of loans by auctioneers, wholesalers and purchase commission agents is quite common in all the States. Abouth 43.5% of fresh fish is sold through auction by fishermen. Direct sales are at pre-fixed prices. Fisherman'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.

7.2 International trade

The international trade in fish and fishery products is confined to only export as import of these items is not generally allowed. Export of fish and fish products from India has registered a growth of over 10% in volume and 50% in value during the last five years as shown below.

Table 5 : Export of fish and fishery products from India, Quantity and Value

	Quantity (tonnes)	Value (Rs million)
1984	89 912	3 855
1985	80 588	3 756
1986	89 288	4 627
1987	89 125	4 896
1988	99 306	5 833

Source: MPEDA, India

The lion's share of export consists of frozen products with the remainder being mostly dried items. Export of canned products is negligible for the present.

Among the frozen marine products, shrimp accounts for the dominant share of over 56% in volume and 79% in value of export from India. The share of other items like squid, cuttlefish and lobster are on a gradual rise representing an increasing share on export list. The details are given in Table 6.

TABLE 6

INDIA: EXPORTS OF MARINE PRODUCTS Q = MT, V = MILLION RS

FINANCIAL YEAR		1979-80	1980-81	1981-82	1982-83	1983-84	1984-85	1985-86	1986-87	1987-88	1988-89
Frozen shrimp	Q:	51 068	51 358	52 180	55 002	54 444	55 398	50 349	49 203	55 736	56 835
	V:	2112.5	2017.8	2479.5	3161.5	3148.1	3296.9	3298.2	3779.3	4257.8	4703.3
Frozen froglegs	Q:	2 926	3 452	4 065	1 896	2 428	2 778	1 746	453	.	.
	V:	63.4	84.1	112.0	47.2	66.8	77.7	74.3	23.6	.	.
Frozen lobster/ lobster tails	Q:	560	610	694	749	648	1 082	1 650	1 132	1 863	1 663
	V:	40.6	34.8	51.5	68.6	51.5	78.9	144.5	143.1	247.3	236.0
Frozen cuttlefish/ fillets	Q:	1 551	1 220	1 819	2 305	1 526	1 966	5 010	4 694	9 195	8 262
	V:	42.8	19.4	41.2	62.7	33.8	51.0	108.0	139.7	223.1	234.4
Frozen squids	Q	2 244	1 705	1 387	1 222	2 050	1 663	4 619	9 739	7 621	16 374
	V:	29.6	19.7	17.4	20.1	26.9	30.0	55.2	172.7	137.3	380.9
Fresh/frozen fish	Q:	22 629	8 769	6 760	12 847	22 573	9 091	10 561	13 138	14 904	11 234
	V:	133.2	82.4	96.2	188.7	291.0	144.0	171.5	222.9	302.3	284.5
Canned shrimp	Q:	231	281	82	65	41	29	12	1	2	13
	V:	11.3	11.3	4.2	4.3	2.4	2.0	0.6	0.1	0.1	0.5
Dried fish	Q:	3 357	3 887	1 022	2 597	6 492	11 828	8 151	5 368	5 220	3 633
	V:	15.6	24.4	7.4	21.0	53.5	100.0	76.1	67.4	66.4	44.3
Dried shrimp	Q:	19	1 13	55	90	28	80	73	19	34	59
	V:	0.2	1.2	0.8	0.7	0.5	1.1	0.6	0.2	0.5	1.3
Shark fins/fish maws	Q:	341	390	358	156	250	249	231	237	273	315
	V:	26.8	36.4	37.3	19.9	32.7	33.9	31.2	37.3	48.2	58.3
Miscellaneous items	Q:	1 475	3 806	1 683	1 246	2 211	2 023	1 249	1 859	2 331	1 389
	V:	12.2	16.9	12.6	18.9	23.0	27.4	19.8	20.6	29.0	35.0
Total	Q:	86 401	75 591	70 105	78 175	92 691	86 187	83 651	85 843	97 179	99 777
	V:	2 488.2	2 348.4	2 860.1	3 613.6	3 730.2	3 842.9	3 980.0	4 606.7	5 312.0	5 978.5

Note: A financial year spans April - March

Source: The Marine Products Export Development Authority, India

Among the major markets for Indian fishery products, Japan has been the number one ever since 1973. However, the predominance of Japan is gradually being eroded with the increasing off take by W. European countries like UK, Spain, etc. USA is the second leading market for quite some time now. The performance of the various markets is given in Table 7.

TABLE 7

INDIA: EXPORTS OF MARINE PRODUCTS BY COUNTRY Q = MT, V = MILLION RS

	Financial Year	1984-85	1985-86	1986-87	1987-88	1988-89
Japan	Q:	41 536	40 327	37 287	38 738	35 811
	V:	2603.6	2777.1	3105.8	3261.8	3568.4
USA	Q:	13 647	9 519	11 374	14 444	13 531
	V:	565.4	460.6	563.0	751.5	701.2
UK	Q:	4 146	4 818	4 217	5 554	6 883
	V:	204.2	226.7	243.1	341.6	428.4
Spain	Q:	236	2 229	5 323	6 969	10 808
	V:	372.4	33.0	93.0	156.2	288.0
Singapore	Q:	1 209	1 284	6 240	6 720	6 329
	V:	39.5	44.7	116.9	148.2	170.3
France	Q:	1 471	3 135	4 455	5 155	4 768
	V:	33.6	74.6	123.4	159.5	144.1
Greece	Q:	318	2 025	1 913	2 362	3 302
	V:	6.2	20.5	23.5	30.1	61.5
Netherlands	Q:	1 224	528	820	532	1 200
	V:	52.2	34.6	72.9	45.0	86.4
Italy	Q:	135	284	85	594	4 116
	V:	2.5	5.2	3.2	23.4	151.0
UAE	Q:	1 870	1 292	635	1 073	997
	V:	42.4	42.4	33.1	45.8	48.0
Kuwait	Q:	1 391	1 826	891	2 058	1 458
	V:	27.3	35.5	22.1	54.5	47.0
Sri Lanka	Q:	11 387	7 897	5 572	5 034	3 603
	V:	92.7	72.2	70.1	62.4	41.9
Belgium	Q:	1 272	982	742	1 144	1 270
	V:	41.4	32.8	26.2	70.0	38.1
Others	Q:	6 345	7 505	6 289	6 802	5 701
	V:	128.3	120.0	110.5	161.9	204.2
Total	Q:	86 187	83 651	85 843	97 179	99 777
	V:	3 842.9	3 980.0	4 606.7	5312.0	5 978.5

Source : MPEDA, Indi

The over-all growth of marine products export from India is given in Table 8 below :

TABLE 8

INDIA: EXPORT GROWTH OF MARINE PRODUCTS Q = MT, V = MILLION RS

FINANCIAL YEAR	Q	V	Rs/kg	ANNUAL GROWTH RATE (%) Q	V
1961-62	15 732	39.2	2.49	- 21.30	- 15.52
1962-63	11 161	42.0	3.76	- 29.06	+ 7.15
1963-64	19 057	60.9	3.19	+ 70.04	+ 44.96
1964-65	21 122	71.4	3.38	+ 10.84	+ 17.44
1965-66	15 295	70.6	4.62	- 27.59	- 1.20
1966-67	21 116	173.7	8.23	+ 38.06	+145.90
1967-68	21 907	197.2	9.00	+ 3.74	+ 13.53
1968-69	26 811	247.0	9.21	+ 22.39	+ 25.26
1969-70	31 695	334.6	10.56	+ 18.22	+ 35.47
1970-71	35 883	350.7	9.77	+ 13.21	+ 4.83
1971-72	35 523	445.5	12.54	- 1.00	+ 27.03
1972-73	38 903	597.2	15.35	+ 9.52	+ 34.08
1973-74	52 279	895.1	17.12	+ 34.38	+ 49.88
1974-75	45 099	684.1	15.17	- 13.73	- 23.57
1975-76	54 463	1245.3	22.86	+ 20.76	+ 82.03
1976-77	66 750	1891.2	28.33	+ 22.56	+ 5.87
1977-78	65 967	1809.5	27.43	- 1.17	- 4.32
1978-79	86 894	2346.2	27.00	+ 31.72	+ 29.66
1979-80	86 401	2488.2	28.80	- 0.57	+ 6.05
1980-81	75 591	2348.4	31.07	- 12.51	- 5.62
1981-82	70 105	2860.1	40.80	- 7.26	+ 21.79
1982-83	78 175	3613.6	46.22	+ 11.51	+ 26.35
1983-84	92 691	3730.2	40.24	+ 18.57	+ 3.23
1984-85	86 187	3842.9	44.59	- 7.02	+ 3.02
1985-86	83 651	3980.0	47.58	- 2.94	+ 3.57
1986-87	85 843	4606.7	53.66	+ 2.62	+ 15.75
1987-88	97 179	5312.0	54.66	+ 13.21	+ 15.31
1988-89	99 777	5978.5	59.92	+ 2.67	+ 12.55

Source : MPEDA, India

7.3 Disposition of catch

Of the total catch of 2.8 million tonnes from both capture and culture in marine and inland resources during 1988, nearly 67% that comes to 1.96 million tonnes - was consumed locally. The consumption in processed and preserved form aggregated to 23.35% (i.e nearly 0.68 million tonnes). The export of fish and fish products account for 11.1% of the landings - nearly 0.99 million tonnes in 1988.

8. 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 organsations, promoting bilateral and multilateral cooperation and collection and maintenance of relevant statistics. It assists State Governments in the formulation of policy, plans and projects, 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 and the Ministry of Food Processing also look after certain functions concerning fisheries. These relate to export promotion, developing the production base and quality control. The Marine Products Export Development Authority (MPEDA) a statutory national Agency under the commerce Ministry is responsible for the development of Seafood industry with emphasis on export production and export promotion.

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 universitites. 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 coastal States mostly concentrate on marine fisheries, undetaking activitis 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 and supplementary functions are expected to be undertaken by primary cooperatives in collaboration with other concerned agencies. In practice, however, primary fisheries 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.

8.1 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 that 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. Central Institute of Fisheries Technology (CIFT) Cochin, is engaged in resource and extension activities related to fishing process and quality control. It also investigates into the various aspects of fishing and fish processing methodology and equipments. Training of personnel required by the fishing industry is the primary task of Central Institute of Fisheries Nautical and Engineering Training (IFNET),Cochin. Central Institute of Coastal Engineering for Fishery (CICEF) located in Bangalore and several other agencies are involved in Fishery related research and development.

The Central Inland Capture Fisheries Research Institutes Barrackpore and Central Institute of Freshwater Aquaculture Bhubaneswar cover scientific research on inland fishery resources, development of suitable methods for management and conversation 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 the Integrated Fisheries Project, Cochin; the Central Food Technological Research Institute, Mysore; and the National Institute of Oceanography.

9. 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 overall objective is to achieve a substantial increase in foreign exchange earnings by the end of the 8th Plan in 1995 by following a 5-pronged strategy:

(i) Stepping-up export production by the development of capture fisheries;
(ii) Stepping-up production from culture fisheries by:
  (a) increasing the per-hectare yield from shrimp farms;
  (b) bringing more area under export production of shrimp by culture; and
  (c) developing culture production of other exportable items
(iii) Induction of new technology and value addition;
(iv) Modernisation of processing facilities, quality upgradation and reduction in waste; and
(v) Aggresive market promotion measures.

9.1 Incentives

9.1.1 Credit facilities

Most of the nationalised banks extend financial assistance to seafood business mainly the export marketing. The financing pattern changes from bank to bank also varies from party to party depending up on their stake with business credit worthness, amount involved, etc.

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

The type of advances given to the export sector are mainly of the following types:
(i) packing - credit
(ii) term loan for machinary and plant
(iii) over-draft against hypothecation of finished goods; and
(iv) foreign bills discounting facilities.

Incentives/assistance are also rendered by Government for further expansion of the export-based fishery industry particularly in the following areas.

9.1.2 Deep-sea fishing

The main thrust area of the strategy for increasing fish production is development of deep-sea fishing. Although steps were initiated by the Government from the early seventies to facilitate acquisition of deep-sea fishing vessels by Private Sector Companies and Public Sector Corporations engaged in

fishing and fish marketing, the progress was very slow. Therefore, from time to time, the Government policy for promoting deep-sea fishing was modified in the light of experience gained. Under the present policy of the Government, deep-sea fishing vessels can be imported (1) under the terms of General Import Policy, (2) under the 100% Export-Oriented Unit Scheme and (3) under Joint Ventures with foreign technical/financial collaboration. Further, relaxations recently announced include permision for import of even second-hand vessels, not more than 8 years old, as well as waiver of the existing 'pari passu' condition of acquiring one indigenous vessel for every two imported vessels, in the case of import of second-hand vessels as well as in the case of import of vessels under the 100% Export Oriented Unit Scheme.

To promote the formation of new deep-sea fishing companies, the MPEDA has a scheme to participate in the equity capital of export-oriented deep-sea fishing companies to the extent of 11% of the equity capital.

Chartering of foreign vessels is allowed under certain terms and conditions. Some of the other concessions granted are:

(i) Fishing vessels have been exempted from payment of import duty;
(ii) Joint Venture Companies are permitted to acquire vessels on long lease;
(iii) For an initial period, engagement of foreign crew, even upto 50% is permitted;
(iv) Term loan facility upto 80% of the cost of vessels at a concessional interest rate of 7.5% per annum is provided by specialised lending institutions;
(v) Availing of loans from foreign financing institutions is permitted, subject to certain terms and conditions;
(vi) Foreign equity upto 40% is permitted in Joint Ventures;
(vii) Technical fee etc are permitted to be paid, if included in the Joint Venture Agreement
(viii) A subsidy of 33% of the construction cost of the fishing vessels is given by the Government in respect of vessels acquired from Ship-Building Yards in India.

9.1.3 Brackishwater shrimp farming

Apart from the technical assistance and training facilities provided by the MPEDA and other Governmental agencies engaged in the promotion of brackishwater shrimp farming, the MPEDA is extending the under mentioned direct incentives:

(I) Development of New Farms

Development of new areas for shrimp farming is subsidised to the extent of 15% of the capital

cost, subject to a financial ceiling of Rs7 500 per hectare. The area limit and financial ceiling for assistance to a single unit or an individual is presently 10 hectares and Rs75 000.

(II) Establishment of Hatchery

To promote the setting up of shrimp hatcheries, the capital cost is subsidised to the extent of 50% in respect of State Governments (maximum Rs 0.5 million), 25% to Corporate Sectors (maximum Rs 0.25 million) and 15% to individual entrepreneurs (maximum Rs 0.15 million).

(III) Establishment of Seed Banks

To encourage the rational utilisation of naturally occuring shrimp seed, 50% of the capital cost on equipments for setting up seed banks, subject to a ceiling of Rs20 000 per unit, is subsidised.

(IV) Equity Participation in New Companies

To promote semi-intensive and intensive shrimp farming, the MPEDA has a scheme to participate in the Equity Capital of new enterprises for such ventures upto 11% of the Equity Capital.

9.1.4 Fish processing industry

The organised sector of the fish processing industry in India is engaged almost entirely in export roduction. The MPEDA, which is the Government agency responsible for developing the export sector of the fishing and seafood industry and for promoting the export of fishery products, is administering several assistance schemes to modernise the industry and to generate the flow of value-added products in the export stream. Assistance is also given for the setting up of Quality Control Laboratories with qualified technologists in processing plants. The subsidy assistance given by the MPEDA under these schemes ranges from 15% to 50% of the cost of machinery within the prescribed financial ceiling in individual cases.

For promoting value addition to export products, the Government have also authorised the MPEDA to be a co-promoter of new industrial enterprises for the production and export of seafoods in value-added forms like IQF shrimp, freeze dried shrimp, surimi products etc and to participate in the equity capital of such companies to the extent of 11%.

Training in processing, quality control, product development etc are given to personnel sponsored by the industrial units free of charge or at nominal cost by Government institutions

in the Country. Cost of overseas training of quality control personnel is also subsidised.

In India, high import duties are generally levied on machinery and other items that are required for the domestic sector and they are as high as 240% of the value in some cases. Industrial units engaged in the production of fishery products for export are allowed to import the eligible items of machinery etc at a concessional rate of import duty of is only 40% in most cases. Even the concessional rate of duty is as high as 147.25% in respect of some items. The industry feels that if the desired rate of progress in the export sector is to be achieved duty-free import of the required machinery and other items should be permitted.

9.2 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 vessels construction, strengthening of facilities at Goa Shipyard and a small area development project at Balashore (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 has India started drawing from the Asian Development Bank and consequently more funding from that source for projects can be expected. In the private sector, foreign investments have recently increased, particularly in the deepsea fishing sector, but also in infrastructural works like harbour facilities and shipbuilding.

10. CONCLUSION

Though fisheries in India have developed considerably with the Five-year Plans and subsequent allocation of funds for development, it still require a lot more to be done in the area of production, processing and marketing. The resources in the off-shore, deepsea and to a large extent the inland resources are yet to be exploited effectively. Despite various attempts, the out come seems to be not commensurate with the resources. Processing is principally geared for export marketing alone. The domestic market is still left to the unorganised sector. Much improvement can be brought into this area which will result in better transportation and distribution of a wide range of protein rich seafoods in the country. Currently the transport and warehousing facilities for this highly perishable commodity are very limited which are the major barriers for developing the domestic marketing in India. Though research and training facilities are not wanting its impact is hardly felt, particularly in view of the magnitude of Indian requirements.

With the concerted attempts both by the Central and State Governments, and also allocation of enhanced resources for development, hopefully advancement in the fisheries sector will be more and more visible in the years to come.

INDONESIA

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1. INTRODUCTION

Indonesia consists of 13,667 islands of which Java, Sumatra, Kalimantan, Sulawesi and Irian Jaya are the major ones. The coastline is 36,600 km long. The potential marine fishing area extends to some 5.8 million sq km comprising 3.1 million sq kms of territorial waters and 2.7 million sq kms of Exclusive Economic Zone. Approximately 775,000 sq km of productive shelf area of less than 200 m depth is the main scene of current fishery activities.

The archipelago has a land area of 1.92 million square km and a population of 175.6 million (1988) with an annual population growth rate of 2.3%. Most of the population is concentrated in a few islands like Java, Bali, Madura and Lombok which together account for nearly two third of the population. The gross domestic product of Indonesia aggregated to $58 511 million in 1986 while GDP from Fisheries sector was $590 million. The annual per capita income was $510 in 1983 reflecting a real growth of 4.2%. The average real growth of the GNP during the period 1979-84 was 5%. The growth rate of fishery sector was 2.4% during 1985-89 while the overall agriculture sector accounted for 3% growth during this period. As per the latest estimates made in 1990 per capita GNP is U$520 and the GDP growth rate is 6.5%. Current account deficit is U$2.2 billion and the foreign debt amount to U$53.1 billion. Inflation based on CPI is 6.4%.

Fish and Fishery products play a key role in the day to day life of Indonesians providing about 62% of animal protein supplies. The per capita fish consumption is around 14.67 kg. However fish consumption is not evenly distributed. In some areas of Java, consumption is only around 4 kg per head. Fishery sector provides employment to more than 5% of the national labour force and it comprises small, medium, and industrial sub-sectors. The total number of people employed in the fishery sector aggregates to 1.37 million. The majority of fishermen are found in the most densely populated coastal areas that are being over-exploited. This is largely because the Indonesian fishery sector is basically artisanal and small-scale in nature. In fact, small scale fisheries provide about 95% of the total fish production and also account for nearly 97% of the employment in fisheries sector.

2. FISHERY RESOURCES

2.1 Marine Fisheries

With several areas of generally high rates of primary productivity and upwellings that influence fish production, Indonesian waters are estimated to support a maximum sustainable yield (MSY) of 6.6 million tons. This is more than double the quantity currently exploited. The extensive shelf area of the Java Sea, Karimata and Malacca Straits are highly productive and their demersal resources are still under-exploited. However, pelagic

resources in these areas are already heavily exploited. In Eastern Indonesia, both pelagic and demersal resources offer scope for further increase in production. Skipjack and yellowfin tuna resources are also considered to offer potential for increased exploitation in eastern and southern Indonesian waters.

The maximum sustainable yield from the territorial waters is estimated at 4.5 million and that from the EEZ at 2.1 million tons. Of these the pelagic species excluding tuna and skipjack within the territorial waters hold a potential of 2.2 million tons. The potential of demersal species, excluding shrimps is 1.9 million, limited to a maximum depth of 200 metres. The pelagic and demersal species in the EEZ are estimated to hold a potential of 1.3 million tons and 0.6 million tons respectively. The resource estimates are still continuing and a final picture is yet to emerge.

The resource potential for tuna and skipjack estimated particularly in the deep-sea waters of eastern Indonesia, the Indian Ocean and Pacific Ocean is 0.441 million tons. So also, some 69,000 tons of shrimps in the coastal areas of the shallow Sundra Shelf and Sahul Shelf and about 48,000 tons of coral fish are said to be available, in Indonesian waters.

Eastern little tuna, anchovies, Indo-pacific mackerel, Fringe scale sardine, scad, oil sardine, skipjack and tuna are the most abundant pelagic species present. Among the demersal species, slipmouths, shrimps, catfish, redsnapper and sharks are predominant.

As the marine fishing grounds are quite vast the resources are characterised by multispecies fishery involving relatively less shoals, typical of tropical seas. More than two hundred commercially important species have been identified in Indonesian waters. Of these not less than 23 pelagic fish species, and five shrimp species are common in the landings. Fishing is seasonal, varying from one region to another depending on the location and climatic conditions.

2.2 Inland water resources

Both capture and culture fishery resources are included in this category. Potential resources comprise some 4,900 km of riverine stretches, 17 million ha. of lakes, 27,000 ha. of reservoirs and 2.39 million ha. of freshwater ponds, 24,900 ha. of brackishwater ponds and 135,000 ha. of paddy fields.

Production from inland capture fishery has been declining lately. Shrinking areas of open waters, competition in water usage, population increase, pollution and such environmental factors have been responsible for this situation. Natural rivers are few and short, offering limited scope for fish production.

Nevertheless, yield from aquaculture is estimated to grow substantially through the introduction of modern culture methods. Traditional practices and extensive culture with low productivity still common in many parts of the archipelago have to be replaced with semi-intensive and intensive

production systems under scientific management. The potential for aquaculture production is estimated to the tune of 0.76 to 1.155 million tons.

3. FISH PRODUCTION

Production has consistently increased from 2 261 619 tonnes in 1984 to 2 880 000 tonnes in 1988 - an increase of 27% over five year period (Table 1). The marine sector contributes nearly 75% of the total production and the rest from the inland waters. However growth rate in inland sector at 30% is higher than that in marine sector.

Fish production from various sources over the five years period from 1983-87 indicate the highest increase of 91% was in cage culture though the actual production is only 1,879 tonnes in 1987. Paddy field culture production presents the next higher growth at 68% followed by brackishwater culture at 43%. The growth rate in marine and inland fishery is rather similar at 20%. Freshwater capture fishery has recorded the lowest growth of 4% over the five years period.

Table 1

Fish Production 1983-88

Year	Total	Marine Fishery	Inland Fishery
1983	2 214 476	1 682 014	532 462
1984	2 252 989	1 712 804	540 185
1985	2 375 470	1 810 000	564 470
1986	2 529 899	1 922 781	607 118
1987	2 670 413	2 017 350	653 063
1988	2 880 000	2 165 500	714 500

Inland fishery production accounts for nearly 25% of the total fish production in Indonesia. It includes capture fishery from open inland waters, as well as aquaculture production from brackishwater culture, freshwater culture, cage culture and paddy field culture.

3.1 Marine Fisheries

The major regions of marine fish production are South Sulawesi, North Sumatra, Central Java, East Java, and Riau together accounting for nearly half of the total marine fish production. Fish landings have recorded an increase of 55% over eight year period beginning 1980. The number of marine fishing units have increased from 425,263 in 1984 to 493,079 in 1987. The marine fishery sector is dominated by artisanal fishery. Apart from a wide range of finfish species, crustaceans like banana prawns and molluscs including cuttlefish and squids are caught off Indonesia. Sea weeds, jelly fishes, sea cucumbers etc are items of export value along with shrimps and

tuna. The catch details by species are given in Table 2.

Table 2

Marine Fisheries Production by Major Species 1981-87

(Tonnes)

Species	1981	1982	1983	1984	1985	1986	1987
Total	1,408,272	1,490,719	1,682,019	1,712,804	1,821,725	1,922,781	2,017,350
FIN FISHES	1,206,983	1,326,447	1,467,824	1,529,553	1,591,231	1,664,022	1,731,084
-Tuna	25,239	28,080	26,088	30,697	33,672	39,563	40,405
-Skipjack	57,430	61,577	76,790	80,658	87,448	85,188	102,559
-Eastern little tuna	87,731	106,012	103,878	103,179	111,630	114,234	122,675
-Narrow barred king mackerel	37,382	42,727	47,289	42,293	40,691	45,177	44,805
-Indian mackerel	85,747	99,311	95,738	114,281	124,988	124,166	121,265
-Scads	65,637	77,366	91,937	135,253	172,534	163,404	145,304
-Indian oil sardinella	44,172	56,987	90,908	79,365	54,058	51,387	61,531
-Black pomfret	8,142	6,508	7,970	8,554	11,081	9,752	11,040
-Silver pomfret	8,469	9,746	15,467	9,111	9,848	11,879	10,927
-Yellow tails	7,835	8,156	10,572	11,039	13,219	15,944	17,201
-Trevalies	48,189	52,394	64,737	55,811	64,430	70,365	72,977
-Fringescale sardinella	108,714	98,980	104,617	109,393	106,543	120,646	118,297
-Giant sea perch/ Barramundi	9,845	9,697	14,158	12,609	13,881	16,654	17,488
-Mullets	15,390	15,943	19,289	16,771	17,509	20,183	20,705
-Hairtails, cutlass fishes	10,735	15,846	18,364	20,515	16,728	16,893	19,872
-Croackers, Drums	18,641	18,636	19,578	20,751	18,853	22,923	26,512
-Anchovies	99,681	104,575	104,690	109,299	106,887	107,977	117,995
-Others	468,004	513,906	555,754	569,974	587,231	627,687	659,526
CRUSTACEANS	140,042	108,499	120,704	109,463	116,723	126,519	140,932
-Giant tiger prawn	9,100	10,068	10,726	14,209	10,481	14,097	10,720
-Banana prawn	22,196	30,693	37,380	26,128	29,610	32,887	35,766
-Metapenaeus shrimp	12,095	15,961	15,865	14,105	13,338	16,479	17,588
-Panulirid Spiny Lobster	996	562	763	473	448	1,257	965
-Other shrimps	66,957	43,206	46,650	46,513	53,313	52,987	66,868
-Mud crab	1,684	1,930	1,958	1,894	2,987	3,332	2,824
-Others	27,014	6,079	7,362	6,144	6,546	5,480	6,177
MOLLUSCS	50,947	45,200	59,310	63,297	46,339	45,849	50,686
OTHER AQUATIC ANIMALS	3,049	3,094	24,574	1,404	4,458	13,586	9,232
SEAWEED	7,251	7,479	9,607	9,087	62,974	72,805	85,416

Source: Fisheries Statistics of Indonesia

Shrimp production

Overall shrimp landings have witnessed an increase of 33% over a period of five years (1983-1987). While shrimp landings from marine fishery sector maintained a growth rate 18% the aquaculture shrimp production has more than doubled during this period.

Table 3

Shrimp Production (tons)

	1983	1984	1985	1986	1987
Marine fishery	111 384	100 955	106 742	116 450	130 942
Inland open water fishery	6 924	6 717	7 374	6 684	7 949
Aquaculture	27 754	31 989	37 399	40 888	55 967
Total	**146 062**	**139 661**	**151 515**	**164 022**	**194 858**

Tuna Fishery

Tuna is the second largest fishery after shrimp in the case of both production and export. The production growth over the last six years (1983-88) is maintained around 19% as shown below.

Table 4

Tuna Landings (tons)

1983	261 110
1984	262 927
1985	285 881
1986	281 802
1987	295 405
1988	310 176

3.2 Inland Fisheries

The Inland fishery production comprises landings from capture and production from aquaculture. The catch from inland capture recorded only a marginal growth while aquaculture production has witnessed a growth rate of around 40% over the five year period as indicated below.

Table 5

Inland water fish production:

Year	Openwaters	Brackishwater	Fresh water culture	Cage culture	Paddy field culture	Total
1983	265 562	134 072	79 681	982	52 165	266 900
1984	269 321	142 404	76 528	1 052	50 880	286 334
1985	266 590	150 100	82 430	1 100	65 250	298 880
1986	273 012	170 310	88 743	557	74 496	334 106
1987	276 291	192 123	95 353	1 879	87 417	376 772

Though data for the recent years are not available, it is estimated that production from aquaculture has steadily increased in 1988 and 1989 as well, with similar trend in 1990.

The inland capture fishery has been almost stagnating due to over exploitation and poor management.

Sea weeds

Indonesian waters have rich resources of a wide range of seaweeds comprising different species of commercial importance. Some of the most common species presently being exploited are as follows :-

1. Eucheuma spinosum: found in Molucas, Sulawesi, Nusa Tenggara, Irian Jaya and Riau Islands.

2. Gelidium spp: distributed along the coastal region of Indonesian sea and Riau Islands.

3. Gracilaria: found in West Nusa Tenggara, Bali Straits, South Coast of Java, Lampang and West Coast of Sumatra.

Hypnea is commonly harvested together with Gelidium and Gracilaria.

The existing seaweed processing industries are mainly under small scale processors. The final product consists of agar-agar while dried seaweed is also destined for export. The seaweed processing industry needs to be further developed to meet the domestic demand as well as to fully utilise the available raw material for processing to industrial and food products.

The seaweed production has increased from 5,945 ton in 1979 to 85,416 tons in 1987 over a period of nine years; representing a growth rate of 1438% over this period.

4. FISHING CRAFTS AND GEAR

Total number of fishing boats in Indonesia during 1987 was 467,794 against 300,549 in 1982. Of these, more than 76% are non-mechanised. The fishing crafts operating in marine waters aggregated to 334,072. Among these nearly 33% were powered boats and the rest belonged to non-powered category. The details of fishing boats are given below:-

Table 6

Details of Fishing Boats in operation (1983-87)

	Powered			Non-Powered		
	Inland	Marine	S.Total	Inland	Marine	S.Total
1983	5 577	86 351	91 928	132 659	220 706	353 365
1984	5 631	93 711	99 342	128 358	219 929	348 287
1985	5 983	95 623	105 533	130 554	220 323	351 377
1986	6 568	98 965	105 533	132 244	219 130	351 374
1987	N/A	N/A	111 839	133 722	222 233	355 955

During the year 1989, altogether 871 foreign fishing vessels were operating in Indonesian waters under licence and Indonesian flag. These are from Thailand, Taiwan and Japan.

Fishing gear are mainly divided into two groups - pelagic and demersal. Gillnets and traditional seines are the most commonly used pelagic fishing gear. These are mainly meant for catching small pelagic Clupeid, Carangoid and Scomboroid fishes. The traditional seines, which have different local names, are usually provided with a bag (cod-end). The operation of the seine is often assisted by the use of fish lures, to aggregate fish shoals and thus substantially increase the catch.

Modern purse seines were introduced in 1968 and became popular among the medium-scale fishermen, especially those fishing in the Java Sea. Rastrelliger is one of the main species caught with this gear. Troll-lines are used almost everywhere for catching large pelagic species, even from traditional fishing craft powered by sail. Pole and line fishing for skipjack is exclusively carried out in the eastern part of Indonesia. Live-bait is used to attract skipjack schools around the craft. More recently, purse seines are also being used for catching skipjack in that area. Tuna long-lining is a relatively new introduction. Commercial operations started in 1972 with the Indian Ocean and the Banda Sea in the eastern part of Indonesia as the main fishing grounds.

Demersal fishing gear consist of beach seines, traps, gillnets and trawls. Among the traps, tidal traps are popular along shores and river-mouths where the tidal range is high, especially in the Malacca Strait and Kalimantan. Traps for catching coral fish (Caesio spp., etc) are popular in certain coral reef areas, mostly in the western part of the country. Bottom gillnets are mainly used for catching shrimp, though other fish are netted as by-catch. Bottom trawls, mainly otter trawls, were introduced commercially in 1967 when the Foreign Capital Investment Law was promulgated. Trawling for shrimp developed tremendously since then and became a threat to the traditional fishermen along the shores of the main islands facing the Sunda Shelf. Consequently, trawl fishing has been almost entirely banned in the waters of Indonesia. Only in the Arafura Sea in the most easterly part of the country, is trawling permitted with the proviso that a by-catch excluder device should be attached before the codend of each trawl.

4.1 Boat Building Facilities

There are 26 shipyards to build steel hulled vessels and a large number of small boatyards to construct wooden vessels. Of the shipyards, 14 are capable of building 1,000 GT class vessels and three yards can build vessels over 10,000 GT. These are mainly freight carrying and work boats. Some shipyards have constructed shipjack pole and line vessels up to 100 GT class - the largest fishing vessels built in the country. Shipbuilders at Jakarta, Ujung Pandang and Tanjung Pinang have some experience in construction of fibre glass reinforced plastic (FRP) hulls for small boats up to the 10 metre class.

Wooden hulled vessels are constructed throughout the country by artisans. They are located around most major port cities. The vessels are roughly constructed, but are generally strong and serviceable.

4.2 Infrastructure facilities

- Fishing Ports and Fish Landing Centres

The increasing number of fishing crafts have necessitated the provision of suitable landing and berthing facilities. Open beaches which were more or less sufficient for the country crafts did not provide safety and security for powered fishing boats. Realizing the apparent necessity for adequate landing and berthing facilities the Government of Indonesia, has taken steps to upgrade and rehabilitate the existing fish landing centres all over the country. The fish landing centres which were under the jurisdiction of the local/provincial governments were provided with additional facilities like landing jetties, marketing/auction halls, water supply and electricity.

Alongwith such programmes the Government also started development of new fishing ports involving either a substantial upgrading of the existing fishing centres at strategic locations or establishment of ports at completely new locations amidst or close to potential fishing grounds. These new fishing ports are generally provided with standard facilities including landing jetties, fish marketing/auction halls, ice plants, cold rooms, slipways and repair shops, fuel supply, water supply, electricity, navigation aids, and net repairing/drying yards.

Fishing ports come under the jurisdiction of the Central Government. According to their role in supporting the growth of national fisheries development and the volume of fish landed, fishing ports are classified into Coastal Fishing Ports, Inter-insular Fishing Ports, and Deep-sea or Ocean-going Fishing Ports. The Deep-sea Fishing Port located in Jakarta has, besides the standard facilities, which are of larger dimension, cold storage and freezing facilities, and land for the development of fishery-based industries.

5. AQUACULTURE

Aquaculture has a long tradition in Indonesia, starting from the 14th century. Presently traditional aquaculture practices are popular in most of the coastal and inland areas of the archipelago. However, the leading provinces are Java, South Sulawesi and Aceh. Total aquaculture production is estimated to range between 382,000 and 400,000 at present.

Freshwater fish culture mainly utilizes common carp (Cyprinus carpio), tilapia (Oreochromis mossambicus) and Java carp (Puntius javanicus) apart from the giant freshwater prawn (Macrobrachium rosenbergii). As for brackishwater culture, common species used are milkfish (Chanos chanos), mullets (Mugil cephalus), tilapias and sea bass (Lates calcarifer).

Shrimp aquaculture has been gaining momentum lately with the extensive, semi-intensive and intensive culture of P. monodon. While about 96% of the aquaculture production is consumed locally, the rest, mostly shrimp is exported to Singapore and Japan.

Currently the total area of brackishwater culture ponds (tambak) available in Indonesia is around 258,000 ha. Aquaculture production of shrimp has almost doubled during the 5 years from 1982-87 reaching 56,000 tons in 1987. Mixed farming of P. monodon and milkfish is a common practice in Indonesia. The total number of fish farmers is estimated to have increased at a rate of almost 10% per annum between 1977 and 1984 reaching from 600,000 to 1,150,000. By 1985, the aquaculture industry had employed some 1.3 million people in the following farming categories :

tambak	-	134,000
freshwater ponds	-	839,577
paddy fields	-	302,486
cage culture	-	5,132

Culture systems practiced in Indonesia are mostly extensive and semi-intensive for fish and shrimps with a shift towards enhancing production through intensive culture for prawns, as well as cage culture and running water culture for carps.

The development of brackishwater culture in Indonesia, particularly the technical aspects is supervised by Brackishwater Aquaculture Development Centre (BADC) at Jepara, Central Java, a development centre under the Directorate General of Fisheries. The major activities of BADC are studies on shrimp nutrition, feed formulation, natural food development, diseases, pest control, water quality control and management, general hatchery management, site selection, pond construction as also - training programme for fisheries personnel, extension workers and pond operators.

The availability of extensive tambak areas currently under-utilized, hold great potential for intensifying shrimp culture activities in Indonesia. A considerable part of this can be upgraded from the existing low production level of shrimp to moderate to high yields according to the level of technology applied i.e semi-intensive or intensive farming. With the intensification, Indonesia will emerge as a leading producer of shrimp. However additional inputs like fry, fertilizer, pesticides and supplemental feeds are the most important requirements for the increased output.

6. FISH HANDLING AND PROCESSING

6.1 Handling

A major share of the fish caught in Indonesia is by artisanal fishermen who fish from small fishing vessels that do not generally carry ice. Though they are mainly engaged in one-day fishing, fish handling practices need to be improved. Ice is expensive and is taken on board in the case of powered fishing boats engaged in longer fishing operations. Block ice is preferred

which is crushed at sea. The fish caught after each haul, is stored in the holds in layers of crushed ice. Sorting of fish is done only in the case of selected species; like shrimp, tuna, pomfrets etc. The bigger boats such as double-rig trawlers, tuna longliners, skipjack purse seiners and carrier vessels have refrigerated holds and in some cases freezers. The double-rig shrimp trawlers dump most of the by-catch back into the sea. Some high value fish is retained for crew consumption. The shrimp is frozen whole and kept in cold storage for further processing and packing on shore. The same process holds good for skipjack, but tuna is usually eviscerated before freezing and storage.

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 to replace the traditional baskets at some pilot landing places. Sorting, according to species and quality, is done simultaneously at this stage. The fish is then sold to buyers - either traders or processors - at the landing site. The fish sold is re-packed in ice for further forwarding to distant markets, or transported un-iced to local processing plants and markets. In the bigger cities all the fish marketed is usually iced. Trucks or pick-ups are the vehicles most used for fish transport. Insulated and refrigerated vans are gradually becoming common in the big cities.

Nearly 55% of the fish caught in Indonesian waters is consumed fresh and the rest is processed or preserved in different forms. The most popular processing method is drying and nearly 30% of the fish landed is salted and dried. Other popular methods are boiling, smoking, freezing etc.

6.2 Processing

Drying

Fish salting and drying are almost entirely done by traditional methods. Both pelagic and demersal fish are used as raw materials. When trawling was still allowed in the western part of the country, some of the trash fish component of the shrimp by-catch was either salted and dried or processed into fishmeal. Boiling in a salt solution is very popular for short-term preservation of pelagic fish species such as Rastrelliger, skipjack and little tuna. Smoking is done either as a drying process or as a flavoring process. The dried product has a long shelf life; the relatively wet product which is a delicacy is rather perishable. Skipjack is the most popular raw material in North Sulawesi and Moluccas where skipjack fishing is dominant. Milk fish is the most preferred item in Java, where it is cultured in brackish water ponds.

Salted and dried fish constitute a common item of people's diet, mainly because it is comparatively economical. Boiled and smoked fish are also relatively cheap.

Freezing and Cold Storage

With the development of export markets for various items of processed fish and shellfish especially shrimps, the number and capacity of freezing have gone up considerably during the past decade. While there were about 40 freezing plants with a production capacity of around 300 tons in 1980, the provisional data available for 1990 shows nearly four-fold increase in the figures with the corresponding increase in utilization to the level of more than 400 tons/ day. Similarly the cold storage capacity has also gone up from 14,245 tons in 1980 to more than 24,000 tons in 1990. (Table 7 and 8).

Table 7

The number and capacity of freezing plants (1980)

	Region	No. of plants	Capacity (tonnes/day)
(1)	Sumatra	9	38
(2)	Java	13	99
(3)	Bali and Nusa Tenggara	1	10
(4)	Kalimantan	5	20
(5)	Sulawesi	7	57
(6)	Moluccas and Irian Jaya	13	60
	Total	**38**	**284**

Table 8 **Freezing and Cold Storage Capacity, (1990)**

Regions	Freezing Capacity (M.T.)		Cold Storage Capacity (M.T.)
	Installed/day	Actual/day	
Sumatra* & Riau	184	91	5,000
Java	366	202	9,590
Bali* & Nusa Tenggara	45	10.5	1,020
Sulawesi	126	46.5	2,630
Kalimantan	45	21.7	2,870
Moluccas* & West Irian*	126	44.5	2,960
Total	892	416.2	24,070

* Data incomplete or provisional.
Source: Directorate General of Fisheries

Ice making

There are nearly 400 ice plants with a production capacity of 7,000 tonnes per day. Ice plants are largely concentrated in urban areas, much of it devoted to non-fishery uses leaving very little to be used by fishermen. Ice making and ice storage facilities are provided at the existing fishing

ports and in the new port premises. The number and capacity of ice plants and cold storage facilities by region as per 1980 data are given below.

Table 9

Iceplant/Cold Storage Facilities (1980)

		Ice Plant No.	Capacity	Cold Storage No.	Capacity
(1)	Sumatra	97	1 121	18	3 420
(2)	Java	140	2 799	15	4 685
(3)	Bali and Nusa Tenggara	18	64	1	900
(4)	Kalimantan	64	1,681	9	1 100
(5)	Sulawesi	32	1 283	5	1 240
(6)	Moluccas and Irian Jaya	14	71	10	2 900
	Total	**365**	**7 019**	**58**	**14 245**

Canning

Fish canning industry almost entirely utilizes pelagic fish, particularly oil sardines and lately tunas. Canning plants are therefore concentrated in Bali Straits where this kind of fish are abundant. The tuna canning industry has developed since the early 1980s mostly through US and French joint ventures. The current production in 1990 is estimated to be more than 30,000 M.T., recording rapid growth from about 8,500 M.T. in 1988. There are two vertically integrated companies, one at Denpasar and the other at Biak. The Denpasar plant is owned by Mantrust - Bali Raya group and has two canneries with a total capacity of 30,000 M.T. The one at Biak has 7,000 M.T. capacity as it is a French joint venture of PT Multi-Transpeche.

With an assured supply of tuna raw material, an expanding domestic fishing industry, extremely low labour cost, all point to the imminent take off of Indonesian tuna canning industry. Additional canning capacity being built up at present is a clear indication of the expansion in the offing.
Fish meal processing is carried out invariably in conjunction with the existing fish canning plants especially when the raw material availability is adequate.

6.3 Quality Control

There are three Ministries responsible for product standardization and quality control in Indonesia. They are the Ministries of Agriculture, Trade and Health. The Ministry of Agriculture is responsible for raw materials, Ministry of Trade for final products, and Ministry of Health for all health requirements of raw material and final products. The Ministries of Health and Agriculture in agreement over the jurisdiction of quality control of fish and fishery products and in-plant sanitary conditions have issued joint

regulations no. 31/KTPS/UM/I/1975 - 32/I/KAB/BU/75 on the quality improvement of fishery products that divide the responsibilities as follows:-

1) Matters concerning health - the provisions set forth in this regulation shall be implemented by the Directorate of Food and Drug Control on behalf of the Ministry of Health.

2) Matters concerning fishery technics - the provisions set forth in this regulations shall be implemented by the Director General of Fisheries on behalf of the Ministry of Agriculture.

Technical responsibility for quality control and inspection falls on the Directorate of Fisheries, Ministry of Agriculture. The joint regulations impose several important issues:-

1) Every processing unit producing for domestic or export markets shall obtain 'Good Manufacturing Certificate' (article 9.1).

2) Every processing unit shall employ at least one person holding 'the Fish Processor Certificate' issued by the Director General of Fisheries (article 8).

3) Processing units are subject to official inspection and the 'Good Manufacturing Certificate' will be withdrawn if the unit fails to comply with the regulations (Article 17.1). Consequently, the unit would be forbidden to operate (Article 17.3).

4) The processing unit shall be equipped with a quality control laboratory (Article 4.3).

5) All products for export should receive the 'Export quality certificate' (Article 14).

6) All new end products before being introduced into market should receive the 'Examination Certificate' and be registered by the Ministry of Health (Article 17.5).

A net work of quality control and inspection laboratories called Provincial Fish Quality Control and Inspection Laboratories (PFQCIL) have been setup all over the country. There are 22 PFQCIL in 19 provinces which form part of the provincial fishing service to carry out fish quality control and inspection within provinces. The main task of laboratories is to carry product certification especially for frozen shrimp and froglegs for export. Organoleptic and microbiological tests are carried out. Department of Fisheries has set up Central Institute of Fisheries for quality control development with a view to coordinating the functioning of provincial laboratories. Thus the improvement of fish quality control receives the highest attention of the Department of Fisheries.

However there are certain obstacles which lay beyond the control of Department of Fisheries and also of fish processors like insufficient clean

water supply, imperfect road system, open sewerage systems in close vicinity to processing plants etc. that has led to the chronic problem of inconsistent quality. Despite the good reputation enjoyed by several processors Indonesia is still in the 'Block list' of USFDA requiring mandatory inspection of shrimps imported into the U.S. before it is released at the port of entry. Only three firms have been taken off the 'block list' as on 1990 beginning. A mandatory compliance programme has been initiated by the Government to overcome such problems and some 150 processors have been brought under this.

7. MARKETING

7.1 Distribution in the domestic market

The fish marketing system is dominated by the flow of fish and fishery products to Java from outer islands. With nearly two-third of the national population, Java is the primary domestic market for fish. However fish catch in Java is only 30% of the sales there and the bulk has to be brought in from other islands. The fishermen have access to a wide range of buyers including consumers, traders in auction halls, wholesalers who distribute fresh fish to urban areas and local buyers to whom they are financially indebted.

For fresh fish there is no large wholesale market and most of the fish traded is in small quantities. But there is a large wholesale market in Jakarta for dried and salted fish which are consigned to agents at this market from outside Java. No direct sales to consumers are however made in this market. Most of the fish is sold to local distributors or retailers who come from West Java and Central Java. The annual turnover of this market is nearly 50,000 - 70,000 tonnes.

Fresh fish presented in ice is mostly sold by local fish dealers operating fixed-location shops or stalls inside large market places where other food and household goods are also sold. But many who sell salted fish have their own small shops in the vicinity of their clients' homes. Fish peddlers operate on a limited scale, often in an unorganized 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 fish and smoked fish. Supermarkets are found only in the larger towns, but the number is increasing every year. These markets are generally well-organized and sell many kinds of canned fish products both locally produced and imported from other countries, salted fish and smoked fish of high quality, as well as locally made speciality products such as fish paste, shrimp crackers, etc.

The government has established nearly 200 fish auction halls in various fish landing centres. The auction halls in Jakarta and Perkalongan are provided with ice plants and cold storage facilities. The annual turnover of the auction markets varies considerably depending on the size and intensity of fishing activities ranging from over 20 tonnes at Painan, West

Sumatera to nearly 55 000 tonnes at Perkalongan, Central Java.

7.2 International Trade in Fisheries

Indonesia is an exporter as well as importer of fish and fishery products with export far exceeding import in both volume and value.

Export

Export of fish and fishery products has increased in a fairly large proportion over the last few years. The increase over the past seven years (1983-1989) was nearly 257% in volume from 88,728 tonnes in 1983 to 228,658 tonnes in 1989. The growth of export value during the same period has also been equally matched by a growth of over 324% - from US$257 million in 1983 to US$833 million in 1989, as shown below.

Table 10

Export of fish and fishery products from Indonesia (1983-87)

Year	Quantity in MT	Value in US$MILLION
1983	88 728	257
1984	76 020	248
1985	84 811	259
1986	107 868	374
1987	140 880	467
1988	181 218	712
1989	228 658	833

Shrimp is the major item accounting for about one third of the export in volume and three forth of the export earnings, followed by tuna/skipjack. The other items include jelly fish, seaweed, crabs, etc.

Japan, U.S., Singapore, EEC, Hongkong, Malaysia, Thailand, Canada and Australia are the major export markets for Indonesian marine products.

The details of items of fish, shrimp and other fishery products exported from Indonesia are given in Table 11 and 12 and 13.

Table 11

EXPORT VALUE OF FISHERY PRODUCTS (1988 - 1989)

COMMODITY	YEAR		INCREASE	
	1988	1989	QUANTITY	PERCENT
Value (US$ million)	712.199	832.712	120.513	16,92
- PRAWN :	500.312	556.662	56.350	11,26
- Fresh	10.773	6.461	(4.312)	(40,03)
- Frozen	489.067	547.725	58.658	11,99
- Canned	472	2476	2.004	424,58
- TUNA, SKIPJACK, BILLFISH	73.619	102.668	29.049	39,46
- Fresh	14.822	26.668	11.846	79,92
- Frozen	38.091	36.668	(1.423)	(3,74)
- Canned	20.706	39.332	18.626	89,95
- OTHERS	39.583	63.081	23.498	59,36
- Fresh	18.797	27.932	9.135	48,60
- Frozen	6.612	13.874	7.262	109,83
- Dried/Salted	14.038	20.868	6.830	48,65
- Canned	136	407	271	199,26
CRAB :	5.831	10.126	4.295	73,66
- Fresh	2.817	2.060	(757)	(26,87)
- Frozen	543	2.293	1.750	322,28
- Canned	2.471	5.773	3.302	133,63
- FROG LEGS	17.995	16.723	(1.272)	(7,07)
- JELLY FISH	16.453	8.669	(7.784)	(47,31)
- SEAWEED	3.782	5.704	1.922	50,82
- CORRAL	13.900	14.461	561	4,04
- FISH OIL	2.840	3.700	860	30,28
- ORNAMENTAL FISH	4.905	9.971	5.066	103,28
- SNAIL	4.486	3.648	(838)	(18,68)
- PEARL	6.132	8.247	2.115	34,49
- OTHERS	28.493	37.299	8.806	30,91

Note: Figure in brackets show fall in value
Source: Directorate of Fisheries, Indonesia

Table 12

Export in volume and value of penaeid shrimp, 1984 - 1989

Year	VOLUME				VALUE			
	Total export (ton)	%	Shrimp (ton)	%	Total export US $1,000	%	Shrimp US $1,000	%
1984	75695	100	28025	37.0	248063	100	195552	78.8
1985	84497	100	30980	36.7	259444	100	202729	78.1
1986	107445	100	36114	33.6	376117	100	284875	76.1
1987	140378	100	44238	31.5	475523	100	352435	74.1
1988	181218	100	56794	31.3	712199	100	500312	70.2
1989	228658	100	77123	33.7	832712	100	556662	66.8

Table 13

Export of Tuna/Skipjack
Volume and Value 1984-89

Description/ Product Form	1984	1985	1986	1987	1988	1989	Average Annual Increase(%) (1984-88)	% Increase/ Decrease 1988-89)
1. Quantity (tonne)	16,092	19,105	26,059	38,269	49,260	58,677	31.25	+19.12
-Frozen	14,655	16,953	21,867	31,684	36,020	27,426	25.81	-23.85
-Fresh	47	936	2,369	2,311	4,735	8,629	536.76	+82.2
-Canned	2,200	1,216	1,823	4,274	8,505	20,621	59.66	+242.46
2. Value (US$1,000)	15,081	16,018	21,678	39,254	73,618	102,668	52.54	+39.46
-Frozen	10,485	12,795	15,868	25,822	38,091	36,668	39.97	-3.73
-Fresh	190	975	2,261	5,139	14,821	26,668	215.19	+79.93
-Canned	4,406	2,248	3,549	8,293	20,706	39,332	73.06	+89.95

Imports

Import of fish and fishery products has recorded a negative growth over the last four years - 1983-1987 both in volume and value. The import volume which was 57,878 tonnes in 1983 has declined to 57,426 tonnes in 1986 thus recording a negative growth of 0.8% over this period. Similarly import value has also declined by 18% during this period from US$34 million in 1983 to US$28 million in 1987. However import volume for 1987 with 65,371 tonnes has recorded an increase of 13% over 1983 data though value at $27.83 million has not made much difference.

The major items imported are fish meal, canned fish, agar agar, fish oil and fish feeds. The details of import are given in table 14.

The import of fishery products are mainly derived from Peru, Thailand, Chile and Japan.

Table 14

Import of Fishery Products (1989)

Commodity			Increase	
	1988	1989	Quantity	%
Volume (tonne)	37,861	56,754	18,893	49.90
-Fish Meal	19,705	38,797	19,092	96.89
-Other Meal	4,271	1,608	(2663)	-62.35
-Feed Fish	150	646	496	330.67
-Canned Fish	461	508	47	10.20
-Seaweed	324	369	45	13.89
-Fish Oils	7,126	9,629	2,503	35.12
-Frozen/Fresh Fish	4,607	3,407	(1200)	-26.05
-Others	1,217	1,790	573	47.08
Value (1000 US$)	20,704	33,032	12,328	59.54
-Fish Meal	10,700	20,906	10,206	95.38
-Other Meal	983	1,794	811	82.50
-Feed Fish	156	697	541	346.79
-Canned Fish	1,226	1,072	(154)	-12.56
-Seaweed	935	1,092	157	16.79
-Fish Oils	3,176	2,981	(195)	-6.14
-Frozen/Fresh Fish	2,488	1,714	(774)	-31.11
-Others	1,040	2,776	1,736	166.92
Average (US$ per Kg)	0.55	0.58	0.04	6.43
-Fish Meal	0.54	0.54	(0.00)	-0.76
-Other Meal	0.23	1.12	0.89	384.74
-Feed Fish	1.04	1.08	0.04	3.74
-Canned Fish	2.66	2.11	(0.55)	-20.65
-Seaweed	2.89	2.96	0.07	2.55
-Fish Oils	0.45	0.31	(0.14)	-30.54
-Frozen/Fresh Fish	0.54	0.50	(0.04)	-6.84
-Others	0.85	1.55	0.70	81.48

7.3 Disposition of catch

Bulk of Indonesian fish catch is disposed off in fresh form followed by dried/salted. The other major forms of disposition are freezing, smoking, fermenting, etc. Reduction into fish meal has declined over the years while canning has maintained a steady increase. The most significant increase has been recorded in the case of boiling, smoking and fresh form. The details of disposition for last five years are as below:-

Table 15

Disposition of marine catch

	1983	1984	1985	1986	1987
Fresh	781 718	853 647	878 607	928 944	1 061 060
Dried	539 789	561 493	636 556	665 298	626 887
Boiled	104 170	121 210	121 599	125 248	119 554
Fermented	51 626	43 806	50 934	55 068	54 973
Smoked	77 438	44 531	44 294	52 867	54 998
Others	60 442	46 183	58 573	66 851	65 163
Canning	17 299	16 504	7 722	5 587	13 015
Fishmeal	14 285	9 317	6 001	3 350	4 288
Total	**1 682 019**	**1 712 804**	**1 821 725**	**1 922 781**	**2 017 350**

Inland water fishes are also disposed off rather similarly with the bulk being fresh followed by dried/salted, boiled, fermented etc as shown below.

Table 16

Disposition Inland Water Fishes (MT)

	1983	1984	1985	1986	1987
Fresh	176 516	178 873	185 318	182 891	188 007
Dried	71 948	76 020	79 524	77 142	73 705
Boiled	477	473	596	587	655
Fermentation					
Blachan	1 293	1 463	825	864	1 030
Fish Peda	137	146	86	51	97
Fish Sauce	6	-	-	-	-
Smoked	10 666	8 872	8 739	8 175	9 449
Other process	4 338	3 059	1 896	2 560	2 476
Freezing	179	409	282	742	872
Total	**265 560**	**269 315**	**269 266**	**273 012**	**276 291**

7.4 Fish consumption:

Fish products play an important role in the Indonesian diet providing over 60% of the national animal protein supplies. Domestic demand for fish is expected to increase over the years as a result of increase in population and income.

The per capita fish consumption rose at an average rate of about 2.6% per annum bringing about a steady growth from 11.36 kg in 1978 to 14.67 kg in 1986, as shown below:-

Table 17

Per Capita Consumption of Fish

Year	1978	1979	1981	1984	1986
kg/year	11.36	11.84	12.40	13.76	14.67

The targeted per capita consumption is 18 kg per annum, by the year 1994.

8. FISHERIES ADMINISTRATION

The subject 'Fisheries' comes under the Department of Agriculture in the Central Government. However certain aspects of fisheries administration like the issue of fishing licenses to Indonesian citizens, extension services, training and education of local fisheries officers, fishermen and fish farmers, collecting fishery statistics, conducting fish auctions, organising fisheries associations and cooperatives etc are delegated to the local governments with the policy and technical guidance from the central government through Ministry of Agriculture.

Activities not delegated to the local governments remain under the purview of the central government, including the licensing of undertakings in fisheries using foreign capital or foreign personnel; and conducting of fisheries research and development.

Within the Department of Agriculture, the Minister of Agriculture is assisted by three Junior State Ministers. The Junior Minister for the Development of Animal Husbandry and Fisheries Production is in charge of fisheries development. The Department of Agriculture is further divided into 4 Directorates General including one for fisheries.

The Directorate General of Fisheries (DGF) comprises 6 Technical Directorates and an Administrative Secretariat. The DG directs the implementation of fisheries development throughout the country on the basis of the policies of the central government.

In carrying out its tasks in the field, the DGF utilizes the service of several technical establishments, namely the different Development Centers - for Marine Fishing; Brackishwater Culture; Freshwater Culture, and Post Harvest Technology and Quality Control respectively as well as five Marine Fisheries Training Centers; twenty-one Coastal Fisheries Ports; two Interinsular Fishing Ports, and a Deep-sea Fishing Port.

For pioneering 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. They are directly responsible to the Minister of Agriculture but function under the technical guidance of

the DGF.

In the provinces, implementation of fisheries development is carried out by the Provincial Fisheries Services. They are instruments of the local governments and implement the decisions of the latter on the basis of guidance provided by the Department of Agriculture through the Directorate General of Fisheries. The Provincial Fisheries Services have branch offices in the Regencies and technical staff in lower administrative units.

8.1 Research and Development

The Agency for Agricultural Research and Development (AARD) has under its auspices the Central Research Institute for Fisheries (CRIFI). CRIFI consists of three research institutes, for Marine Fisheries, for Freshwater Fisheries, and for Coastal Aquaculture respectively. The Research Institute for Fish Technology which was formerly a separate institution is now integrated into the Research Institute for Marine Fisheries, that deals with research relating to both marine and freshwater fisheries.

Coordination between AARD and the Directorate General of Fisheries and other Directorates General is maintained through a Research Board chaired by the Minister of Agriculture. Operational linkages exist between the Research Institutes and their respective partners among the technical executing establishments of the Directorate General of Fisheries, where research results are field tested and prepared for extension.

8.2 Industry Organizations

Fisheries Corporations:

Fisheries Corporations include both private Indonesian and joint venture fishing as well as state owned fishing enterprises. Production from this sub sector is primarily export oriented and consists mostly of shrimp from double rig shrimp trawlers, tuna from long-liners and skipjack from pole and line fishing. These corporations have invested heavily in large fishing vessels or fleets of small vessels and well integrated shore based support facilities.

State owned Fishing enterprises:

The State owned fishing enterprises have been set up to exploit resources which had not attracted private (joint venture and domestic) investment. Three of such state enterprises are involved in skipjack pole and line fishing and are based in Ambon (Moluccas), Artembaga (North Sulawesi) and Sorong (Irian Jaya). One state enterprise engaged in long-lining is based in Bali and another based in Riau Province is engaged primarily in exporting fish to Singapore. Another state enterprise is located in Perkalongan and is engaged primarily in transporting and marketing in Java.

Fisheries Cooperative Societies:

The Government has been encouraging cooperative movement in fishery sector to provide better services to fishermen in the development process. With the Presidential Decree of 973, monolithic character of cooperatives was transformed to multi-purpose cooperatives called Village Economic Units and Village Unit Cooperatives.

A Village Unit Cooperative consists of an administrative management, in charge of formulating policy and supervising the activities of the managing directors, and an operative management looking after and pursuing day-to-day matters.

The involvement of fisheries cooperatives in fishery credit, was greatly enhanced when the Mass Guidance fishery credit was initiated in 1980, in terms of which only cooperatives were entitled to obtain credit. This arrangement helped substantially to strengthen the cooperative movement by encouraging fishermen to seek cooperative membership and by discouraging them from seeking loans from money-lenders.

The funds for credit programme come from government banks, notably the People's Bank of Indonesia, and are generally disbursed to Village Unit Cooperative members upon the recommendation of the Village Unit Cooperative's staff. The loans are repaid from the proceeds of the catch auctioned at government landing places.

Recently, a new activity has been included in the fisheries cooperatives, i.e. management and administration of auctions in facilities constructed with fund from the Directorate General of Fisheries. Some cooperatives have earned a substantial income from these activities.

9. THE GOVERNMENT POLICY

Economic development aimed at establishing a balanced structure with a well developed industry sector and a strong agriculture has been the first priority in the national development. Five year development plans have been drawn since 1969 with a view to achieving this long term objective in stages. The just completed fourth five year plan had the following objectives in the fisheries sector :-

(a) To raise the income of fishermen and fish farmers.

(b) To increase the productivity of individual fish producers at national level.

(c) To extend productive employment opportunities in fisheries.

(d) To increase fish consumption.

(e) To increase export of fishery products as a source of foreign exchange.

(f) To promote resource management and achieve better control of resource utilization throughout the country.

Under the Fourth Five Year Plan priority is given to securing self-sufficiency in food and achieving capability in the manufacture of industrial machinery, with a view to achieving:

1) a more equitable distribution of development and its gains leading to the welfare of the entire population.

2) a sufficiently high economic growth, and

3) a sound and dynamic national stability.

Development of small-scale fisheries has been given priority in the overall fisheries development in Indonesia. This means that all development policies and programmes formulated should be directed towards encouraging the growth, and overcoming the short-comings and constraints of the small-scale fisheries. The role of the government is primarily directed towards the creation of a favourable climate for the economic forces within the community to forge ahead. Implementation is, by way of providing appropriate regulatory measures, research support, education, training and extension, public sector infrastructure and by pioneering work in certain fields which have not yet attracted private investment.

To protect the small-scale fishermen from unfair competition by large-scale operators, the government has introduced several regulatory measures. On the basis of geographical, and demographic factors, combined with socio-technological considerations, the shallow western part of the archipelagic waters of the Sunda Shelf in particular is reserved for the small-scale fisheries. In the offshore waters the medium and large-scale fisheries are temporarily still allowed to fish. The eastern deeper oceanic water and the remote Sahul Shelf are open for the development of industrial fisheries.

As further protection for the small-scale fisheries, the inshore waters are divided into fishing zones parallel to the coastline. Starting from the coast-line the fishing zones are respectively 3 miles, 4 miles and 5 miles wide, and are closed for inboard engine powered fishing boats of more than 5 GT, 25 GT and 100 GT respectively. The restriction also applies to certain fishing gears of certain sizes considered too effective for the respective zones. The zoning however, is limited to the heavily fished areas, mainly in the western part of the country.

Another regulatory measure was introduced for improved control of the allocation of the demersal resources, particularly among the trawl fisheries. This regulation divides the marine waters into four fishing areas, and a maximum number of fishing vessels is allocated to each area through licensing according to its estimated resources potential.

To overcome the problem of depletion of inshore resource, the government encourages the use of bigger boats capable of reaching offshore fishing grounds. To this end, the government is increasing the maximum limits of the

credit scheme to cover bigger boats, owned and operated by groups of fishermen. Infrastructure facilities, such as fishing ports have been constructed at several strategic points to support the fishing operations and the marketing of the catch.

The development of large-scale/industrial fisheries is mainly directed towards the production of export commodities, such as shrimp, tuna and skipjack and is carried out on an integrated basis, covering fishing, processing and marketing activities. It is in this background that the Government decided in June 1988 that for tuna fishing in Indonesian waters new licenses for foreign vessels will only be issued for line boats; all catches should be landed within Indonesia for marketing or processing; and a minimum 30% of the crew must be locals. The fishing areas allocated to large-scale fishing enterprises are separated from those allocated to small-scale fishermen, to prevent unfair competition. But they are encouraged to buy fish from small-scale fishermen when the need arises, thereby enabling the latter to get better prices for their catch.

9.1 Incentives and Credit facilities

Subsidies are extended to the fisheries sector for purchase of fishing boats and fishing gear, but these subsidies generally are in the form of concessional rate of interest on bank loans that include 'General Loans' and 'High Priority Loans':

The high priority loans are extended to economically under-privileged entrepreneurs and to support export-oriented activities, to be financed in large part by Bank Indonesia at relatively low interest rates. These loans consist of program loan, export loan, plantation loan and national contractor's loans.

These loans, have specific ceilings and are intended for economically underprivileged entrepreneurs either for investment or working capital. These loans support labour intensive projects as investments or as working capital, and are intended to effect a more equitable distribution of business opportunities. Working capital loans are also extended to national, economically underprivileged contractors who are working on government development projects while export loans are extended for working capital to exporters and designated suppliers to finance production and mobilization for export.

Besides, Bank Pembangunan Indonesia (BAPINDO) also extends credit facilities for fishing infrastructure, processing industry, fish farms, and production of fish and shrimp seed.

Sources of funds which can be used to finance the fisheries sub-sector, include banking and non-banking financial institutions. Non-bank financial institutions which provide medium and long term investment loans, working capital loans and equity investment, are quite popular in Indonesia. Other funding sources are, venture capital in the form of equity investment in project proposals, leasing companies, factoring as well as stock market.

The stock market is a long-term source of financing in which funds are obtained from the public in order to finance projects either as equity investment or bonds. Companies can utilize the stock market to raise long-term funds for project financing.

9.2 Support for Aquaculture and Export production.

The Government of Indonesia has taken several measures to support development of shrimp culture particularly for the small scale sector including tambak irrigation study conducted along the northern Java covering 26,000 ha. The Government has also supported the construction and rehabilitation of irrigation canals for tambak in different places in Indonesia. Other significant developments in this regard are as follows:-

a) The first Brackishwater Aquaculture Development Project supported by Asian Development Bank has rehabilitated and constructed 280 km of primary and secondary canals serving 14,000 farmers on 20,000 hectares of tambak in West, Central and East Java. The project also provided credit to support Small Scale Fisheries and pond operation in the targeted areas.

b) The World Bank Loan Project, called Fisheries support Services Project extended credit to invest in rehabilitating canals in Aceh and South Sulawesi and South East Sulawesi of 185 km and 415 km respectively. The components of this project also included the construction of a shrimp hatchery and feed factory establishment.

c) Another project called Shrimp and Fish Culture Development Project in Java, North and South Sumatera and South Sulawesi is now planning to rehabilitate canals, establish hatchery and intensive brackishwater pond and feed factory.

To accelerate the development of brackishwater aquaculture through intensification programme the Government of Indonesia has also implemented tambak intensification programme since 1984/1985 especially for development of small scale fish farmers.

To meet the participation of domestic as well as foreign investors in fisheries sector, the government has established an agency called "The investment coordinating Board (BKPM) alongwith "an easy one stop service procedure" set up.

Another facility provided is duty exemption for raw materials imported for use in production/processing of export goods/commodities such as fisheries export products. In this connection the government has also simplified the import procedure.

10. CONCLUSION

Aquaculture and tuna fishery are two potential growth areas in Indonesian fishery sector. While the first is labour intensive, tuna industry is capital intensive. In all such areas the small scale fishermen have to play a significant role. The major constraints and short-comings faced by the Indonesian fishermen especially in the small scale sector have been identified as follows :
i) Low technical and managerial know-how ii) Disadvantageous bargaining position in marketing iii) Low financial capability iv) Depletion of resources and v) Scarcity of economic and social infrastructure.

Schemes and programmes to assist the fishermen have been carried out by the Government since the First Five Year Plan and are constantly improved and intensified. Training and extension schemes are provided for both men and women in fishermen communities. The scheme for men include better fishing techniques, training for skippers/engine drivers etc. Women are trained in fish processing and other income generating activities to increase family income. Government also provides fish marketing facilities to improve the bargaining position of fishermen in marketing. Further, various credit schemes are being formulated to provide the capital needed by fishermen. The depletion of fishery resources are supplemented by effectively taking up culture practices, and cultured shrimp farms, that can supply a major part of shrimp exported from Indonesia.

With the various schemes and programmes being implemented, fishery export development in Indonesia seems to present a promising future ahead. But modernisation of production technology and quality upgradation is an urgent requirement to sustain the tempo of exports. Nevertheless, the development of the Indonesian tuna canning industry is worth watching as it holds very good potential for expansion. Unlike her neighbour Thailand, availability of raw material in her own waters and the prevailing low labour cost coupled with the inflow of international investment, offer excellent opportunity for growth. The recent purchase of Van Camp - the world's second largest tuna cannery in the U.S. - by an Indonesian firm Mantrust Corporation is an indication of future developments on this front.

MALAYSIA

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1. INTRODUCTION

Malaysia is a Federation of 13 States comprising 11 states on the mainland of Peninsular Malaysia and the States of Sabah and Sarawak in East Malaysia. The total population as per estimates made in February 1990 is 17.6 million and the per capita GNP is U$2,050 with a GDP growth of 8.5%. Current account deficit is U$148 million and foreign debt is estimated at U$16.4 billion. Inflation is quite low at 2.8% based on CPI. The coast line of Malaysia is about 3400 km long. With the declaration of the Exclusive Economic Zone (EEZ), Malaysian waters of economic importance increased from 47 000 to 160 000 sq nautical miles or 480,000 km^2. With this expansion fishery sector has come to form an important part of the national economy contributing about 2.3% to the Gross Domestic Product.

The fishery can 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 highest intensity of fishing 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.

The ficheries sector - both capture and culture - provide employment to 1.7% of the nation's manpower. Number of employment in marine sector aggregate to 88 963 while people employed in the culture sector amount to 15 860. There has been a decline by 2.6% in the number of people employed in Fisheries Sector in 1988 over the previous year.

2. RESOURCES

The Maximum Sustainable Yield (MSY) of Peninsular Malaysia is estimated to be around 782,900 MT. Resource potentials for Sarawak and Sabah are in the region of 289,000 MT and 109,000 MT respectively. Landings in 1988 totalled 825,631 MT out of which the west coast of Peninsular Malaysia accounted for 430,188 MT, east coast 264,261 MT, Sabah 48,000 MT, Sarawak 79,642 MT and Labuan 3,540 MT. Apart from trash fish, the major portion of the catch consisted of threadfin bream, round scad, anchovy, sardine, eastern little tuna, Indian mackerel, shrimp, cepalopods and jelly fish. Of the total landings in 1988 shrimp accounted for 68,158 MT, cephalopods 27,939 MT and tuna 26,641 MT.

Traditional fishing grounds lie inshore within 12 miles off the coast. Resources on the west coast of Peninsular Malaysia appear to have been over exploited because of the declining trend of landings in that region for the last few years except in 1987 when there was an unprecedented increase.

Inshore waters of the east coast of Peninsular Malaysia, Sabah, Sarawak have not yet reached their Maximum Sustainable Yield (MSY). Landings over the last few years appear to have stabilised around 68,000 - 69,000 MT for Sarawak and 45,000 - 48,000 MT for Sabah while landings off the East Coast of Peninsular Malaysia increased from 120,000 - 135,000 MT in 1984-86 to 240,000 - 260,000 MT in 1987-88.

Untouched and potentially rich resources are found in the offshore areas beyond the 12-mile region that are yet to be fully exploited. This has been attributed in part to lack of skill and technology as well as the absence of information on economically/commercially viable fishery resources there. There are, however, the bottom-set portable trap fishery for snappers of the west coast of Peninsular Malaysia and a troll-line fishery for little tuna and spanish mackerel off the east coast of Peninsular Malaysia. It is generally thought that the commercial potential for off-shore fishing is good off the east coast of Peninsular Malasia and off East Malaysia.

3. PRODUCTION

The declining trend in production set in Peninsular Malaysia since 1984 has more or less recoved in 1987. However, fish landings in the country as a whole has declined by 6.2% again in 1988 with a total of 694 449 tonnes over the previous year. The drop in catch was in the pelagic landings while demersal landings have recorded an increase of 19.3%. The highest rate of increase was in the prawn catch.

Table 1: Marine Fish Landings in Peninsular Malaysia (in MT)

	1987	1988
Pelagic	284 344	235 662
Demersal	151 926	181 213
Prawns	67 048	81 265
Trash fish	216 780	194 780
Mussels	20 467	1 529
Total	**740 565**	**694 449**

Source: Department of Fisheries

The decline in pelagic fish landing may be due to the migratory patterns. The tight enforcement of restriction on trawler operation has led to drop in trash fish landing while adverse climatic condition was the real cause for poor mussel

catch.

Bulk of the fish landings are from Peninsular Malaysia and the remaining catches are from Sabah and Sarawak. The state wise fish landings are given below.

Table 2: Fish landings in Malaysia, 1985-88 (in MT)

Year	Peninsular Malaysia		Sarawak	Sabah	Total
	East Coast	West Coast			
1985	462 861	327 124	62 893	51 500	**904 378**
1986	122 329	324 047	67 971	50 720	**565 067**
1987	240 703	499 862	69 443	49 000	**810 498**
1988	264 261	430 188	79 642	3 540*	**777 631**

* Total landings in Labuan only.
Source: Department of Fisheries

Nearby 25-30% of the fish catch is trash fish. Tuna catches amount to about 10% of the total pelagic catches. Indian mackerel is the largest single species caught. The development of the west coast fishery is a result of its proximity to the main metropolitan markets and is dominated by Chinese fishermen. The east coast fishery has been relatively isolated from the large urban centres and is dominated by Muslim Malays who have a different work ethic from that of the west coast fishermen. The traditional fishing activity on the east coast has been dominated by inshore artisanal fishing with trips limited to 1 to 2 days.

It is generally considered much of the fresh and chilled fish imported every year from Thailand is infact caught in Malaysian waters and in particular EEZ of South China Sea. But the total catch from these illegal fishing activities is unknown.

4. FISHING BOATS AND GEARS

The number of fishing boats licenced in Peninsular Malaysia during 1988 was 21 341 compared to 22 138 in 1987. Of this, trawlers aggregated to 4 200 in 1988 compared to 4 101 in 1987. However, the number of purse-seiners and traditional gears have declined over the previous year as shown below:

Table 3: Number of fishing boats by gear in Peninsular Malaysia

	1988	1987	1986
Trawlers	4 200	4 10	14 118
Purse-seiners	60	675	628
Traditional gear	16 481	17 362	17 730
Total	**21 341**	**22 138**	**22 476**

Source: Department of Fisheries

The number of fishing boats in Sabah and Sarawak has also gone down during 1988 as shown below:

Table 4: Fishing boats in Sabah and Sarawak

	1988	1987	1986
Sabah	9 247	9 026	8 900
Sarawak	6 939	7 842	8 856

Source: Department of Fisheries

4.1 Fishing fleet

The fishing fleet is mainly composed of small fishing boats with low power engines. However, an increasing trend in the case of trawlers and declining trend in the case of boats with traditional gears has been noticed. The total number of gears licensed in 1988 was 31 419 units - an increase of 5.7%. This increase was mainly due to the steep rise in the number of licences issued in Sarawak.

The number of fishing gears licensed in 1988 in Peninsular Malaysia dropped by 6.0% to 21 341 units. The break-down by gears are as follows: Trawlers 4 200 units (19.7%), Purse-seiners 660 units (3.1%) and others - mainly traditional gears - 16 481 units (77.2%).

4.2 Fishing efforts

Fishing efforts relate closely to the number of trips, number of days and number of hauls. The annual average fishing trips for trawlers and purse-seiners in Peninsular Malaysia was 240 trips and 163 trips respectively. The total number of fishing trips in the East Coast Peninsular Malaysia was lower than those in the west coast mainly because of the monsoon in the area. The number of fishing trips per year for trawlers and purse-seiners in the west coast were 252 and 165 as compared to 228 trips and 161 trips in the east coast respectively.

The average total number of fishing days by major gears in Peninsular Malaysia are as follows:

Trawlers 250 days, Purse-seiners 200 days and drift netters 250 days per annum. The average fishing days were more for the west coast Peninsular Malaysia as compared to the east coast also because of the monsoon period affecting the latter.

5. AQUACULTURE

Aquaculture is a rather recent development in Malaysia

compared to its neighbours in the Indo-Pacific region. There are 19 species of finfish, crustaceans and shellfish cultured in Malaysia. The major species are cockles (Anadara granosa), green mussel, Chinese carp, giant Malaysian shrimp (Macrobrachium rosenbergii), tiger shrimp (Penaeus monodon), banana shrimp (Penaeus merguiensis), seaperch (Lates calcarifer) and grouper (Epinephelus tauvina).

Malaysia has immense potential for developing aquaculture. Realising the resource potential, a series of programmes have been formulated for development of aquaculture. These are:

5.1 Culture of Tiger Prawn

Malaysia has over 570 000 ha of mangrove swamps - 113 000 ha in Peninsular Malaysia, 284 000 ha in Sabah and 173 000 ha in Sarawak. Government propose to develop 21 000 ha for tiger prawn culture by the year 2000. The total production is expected to be 80 000 tonnes by the turn of this century.

5.2 Culture of Seabass

The Government envisages establishment of 8 250 units of marine floating cages by the year 2000 to culture seabass. The annual production estimated is 5 500 tonnes.

5.3 Culture of Mussels

The suitable area estimated for mussel culture is about 500 ha which is capable of producing 157 500 m tons if fully utilised. It is expected that 6 500 culture rafts will bring in 200 000 tonnes of mussels.

5.4 Culture of Cockles

It is reported that there is still an area of 2000 ha coastal mud flats on which on-bottom culture can be practised. The total anticipated production is around 84 450 tonnes out of this area and also due to improvement in culture techniques in the existing areas.

5.5 Freshwater fish culture in ponds

An earlier survey indicated that about 8 000 ha of land are available for freshwater fish culture in ponds. Government propose to bring in 3 000 ha under culture with a production prospect of 3 000 tonnes.

5.6 Freshwater fish culture in mining pools

It is expected that 17 200 ha of abandoned mining pools would be available for culture. There are two methods for culturing

in mining pools small area - less than 5 ha -may be worked similar to excavated ponds and large area can support floating cages culture. It is expected that 2 000 ha of mining pools will be developed as ponds and 3 000 units of floating cages will be introduced in larger pools. A total production of 5 000 tonnes fish is expected out of this.

5.7 Freshwater fish culture in lakes

The cage culture in the man-made lakes is yet another potential area. It is expected that 206 000 ha of water area would be available for aquaculture out of irrigation and hydroelectric dams, which would add another 103 000 tonnes of fish even if as little as 1% of this area is used. According to a conservative estimate, 15 000 units of floating cages will be introduced and 15 000 tonnes of fish will be produced by the turn of this century.

6. HANDLING AND PROCESSING

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

6.1 Handling

Fish handling facilities and practices on board vessels are generally inadequate with the exception of shrimp and other high priced species.

Ice is mainly available in block form. Flake ice is quite limited in use. Non-availability of ice to fishermen can be a serious problem in certain areas. There are a large number of remote artisanal fishing villages where ice is not available because they are situated too far from the ice plants and catch obtained is generally small.

There are 100 ice factories, mainly privately owned, with a total production of around 7 870 MT per day. These are mainly situated on the west coast of Peninsular Malaysia. Total ice storage capacity is 6 000 MT while total cold storage facility for fish is estimated at 9 000 MT.

6.1.1 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 sophisticated complexes, most of which are equipped with landing facilities; handling apparatus; cold storage rooms, grading and packing facilities, an auction hall and so on. The number of complexes and quantity of fish handled are as below:

Table 5

Year	No of complexes	Fish handled (MT)
1986	9	35 736
1987	10	44 426
1988	11	45 198
1989	13	47 621

Source: Department of Fisheries

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.

Storage facilities at most landing centres are still inadequate. 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 ice packed and kept in chillrooms wherever possible.

6.1.2 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 the fish is cleared at the wholesale markets by day-break. However, the remainder is ice packed and kept in coldrooms and offered for sale the next day which often leads to deterioration of quality.

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 despatch to other markets. Retailers generally do not re-ice fish, especially when on display.

The Government proposal 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 landing 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.

6.1.3 Transportation

Fish are mainly transported in wooden boxes in open lorries. The boxes are stacked and normally covered with tarpaulin. 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 would make it compulsory that all fresh fish imported from Thailand should be brought by refrigerated truck. Currently, the Malaysian authorities are carrying out a survey on the use of small refrigated lorries coupled with plastic containers for domestic transport of fresh fish from points of landing to major market centres.

6.2 Processing sector

Fish preservation has been practised in Malaysia for a long time, the simplest methods employed being 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.

Major fishery products common in Malaysia are as given in the table below:

Table 6: Major fishery industry products

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

6.2.1 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 majority of dried salted fish processors are fishemen, 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, [illegible]mented 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 continously strong market demand. On the west coast and in some east coast States, anchovy is immediately cooked after catch on board especially equiped boats to maintain taste and arrest spoilage. Drying of anchovy is mainly done by mechanical process.

Fish crackers, locally known as 'keropok ikan' is a popular high protein snack in Malaysia and in neighbouring countries. There are about 383 Keropok processors with total capacity of 600 MT per year. Fish crackers are produced in the States of Trengganu, Johore, Pahang, Kedah and Kelantan. Trengganu is the main producer, accounting for more than 50% of the production.

A majority of the productin centres involved in this activity usually have only the minimum equipments comprising a mincer, 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.

6.2.2 Fermented fishery products

Another popular method of preservation is fermentation. Fermented products are popular and differ greatly from one area to another. These are produced by small-scale processing outlets 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'), hecko ('petis' or 'otak udang') and fermented fish ('ikan jerok/pekasam').

6.2.3 Freezing and cold storage

There are 55 processing plants/cold storages in Malaysia with a total daily production capacity of 6 000 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. Some of the shrimp processing plants process IQF cooked and peeled for export to Europe, USA and Australia.

6.2.4 Canning

This sector of the fish processing industry is small. There are 33 canning plants in Malaysia. Majority are of smaller size and only a few plants, employ modern machineries. 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 for canning such as cockles, squid, cuttlefish, locally obtained and imported small pelagic fish and possibly, freshwater fish.

6.2.5 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 44 fishmeal plants with a combined daily production capacity of 500 MT. Production facilities are of two 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 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.

6.3 Fish inspection and quality control

A number of Government institutions in Malaysia are involved in the inspection and quality control of fish and fisheries 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 ie. frozen, cooked and peeled shrimp and canned products.

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 permit is issued.

There are 2 serious deficiencies in the quality control assurance programme, namely the qualitative and quantitative shortage 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.

Standards for processed foods created by SIRIM also 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.

7. MARKETING

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 on consignment basis. 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 grade A, B and C and according to sizes big, medium and small.

7.1 Import and Export

Malaysia has turned as a net exporter of fish and fish products in terms of the exchange earnings. Though export by volume had declined to 170 000 tonnes in 1988 from 184 350 tonnes in 1986, there was a quantum jump in value realisation from $353.7 million in 1986 to $507 million in 1987. Imports, however, increased both in volume and value in 1987 to 245 217 tonnes valued $353.0 million from 238 989 tonnes valued $328.2 million in 1986. The distribution of import and export of fish and fish products is given below.

Table 7: Malaysian Import and Export of Fish/Fish Products

	1985		1986		1987	
Export	Q	V	Q	V	Q	V
P.M'sia	151 753	170.0	174 126	235.8	155 433	320.5
Sarawak	3 046	28.6	3 138	29.3	3 82	143.6
Sabah	2 064	21.9	5 960	74.8	7 559	80.9
Total	**156 863**	**220.5**	**183 224**	**339.9**	**166 513**	**445.0**
Import						
P.Msia	218 003	273.4	229 907	303.7	237 872	332.6
Sarawak	4 519	13.3	3 802	11.8	3 507	9.8
Sabah	7 787	22.9	5 280	12.7	3 838	10.8
Total	**230 309**	**309.6**	**238 989**	**328.2**	**245 217**	**353.0**

Q: Quantity in Metric tonne V: Value in M$ million
Source: Department of Fisheries

7.1.1 Major Items

The major items of export are fresh chilled frozen fish and crustaceans/molluscs in terms of volume while in value terms crustaceans/molluscs both frozen and canned, fresh/frozen fish and canned fish are the major items. The details are as follows :

Table 8: Export of Fishery Commodities, 1986 & 1987

	1986		1987	
	(M.tons)	($ 000's)	(M.tons)	($ 000's)
Fish				
Fresh chilled frozen	82 064	36 348	60 938	41 101
Dried salted/smoked	2 937	6 555	2 943	10 827
Canned	7 712	42 377	7 664	44 067
Crustaceans/Molluscs				
Fresh chilled frozen	57 623	65 904	59 037	103 764
Dried	904	4 383	1 414	7 727
Canned	7 534	47 473	9 461	71 877
Fats and oil	4	16	62	61
Flours and meals	9 953	1 093	5 956	1 362
Miscellaneous	14 983	56 869	18 595	69 453
Total	**183 514**	**261 016**	**166 070**	**350 238**

Source: Department of Fisheries

In the case of imports, fresh frozen fish account for 60% in volume and 45% in value. The other items of significance are fish, crustaceans/molluscs, meal not for human consumption, canned fish etc. Details are given in Table below.

Table 9: Import of Fishery Commodities 1986 & 1987

	1986		1987	
	(M. tons)	($ 000's)	(M. tons)	($ 000's)
Fish				
Fresh chilled frozen	125 201	130 916	143 839	155 568
Dried salted/smoked	4 537	6 603	6 492	9 110
Canned	25 354	50 624	12 828	43 759
Crustaceans/Molluscs				
Fresh chilled frozen	23 215	32 349	21 220	40 399
Dried	2 332	6 223	2 322	5 480
Canned	4 192	23 611	5 118	33 035
Fats and oil	325	541	310	551
Flours and meals	52 377	46 742	43 852	42 221
Miscellaneous	3 559	13 146	3 597	12 833
Total	**231 092**	**310 756**	**239 578**	**342 957**

Source: Department of Fisheries

Major markets and resources of export and imports of fish and fish products for Malaysia are as follows:

Table 10: Major Export and Import Markets, (M. tons)

Export	1987	1986	Import	1987	1986
Singapore	98 073	12 373	Thailand	184 315	174 684
Australia	4 014	3 390	Indonesia	19 744	13 736
USA	5 807	5 085	Japan	10 316	7 920
Japan	3 750	1 947	Chile	9 500	13 120
Canada	3 954	3 826	India	3 179	2 724
Netherlands	1 647	1 449	Hong Kong	1 637	2 115
UK	163	217	Singapore	776	759
Thailand	32 542	29 917	Taiwan	2 000	2 733
Germany, FR	1 120	719	Korea, Rep	1 258	594
Others	15 000	13 211	Bangladesh	1 553	1 704
Total	**166 070**	**183 514**	Others	5 300	11 004
			Total	**239 578**	**231 093**

Source: Department of Fisheries

7.2 Disposition of catch

Consumption in fresh form for the domestic usage aggregate to nearly 60% of the total landings. The freezing sector was hardly in existence until 1983. However, the quantity of fish frozen in 1988 was 11 780 tonnes - roughly 2% of the total landings. The dried/salted/smoked form is the third largest form of consumption aggregating to around 10% of the total catch, after the fish meal production which account for 25% of the fish landings. The disposition of catch in different forms is given in the table below.

Table 11: Disposition of Marine Fish Landings (in MT)

	1988	1987	1986	1985
Fresh	395 346	445 069	281 804	289 118
Frozen	11 780	11 386	11 396	9 394
Dried/salted/Smoked	69 391	63 937	39 162	42 157
Steamed/boiled	942	5 335	2 803	9 181
Fermented	14 657	13 694	12 757	13 617
Others	16 331	16 373	2 360	8 435
Reduced	176 038	174 480	91 669	87 468
Others	9 964	10 291	4 423	3 492
Total	**694 449**	**740 565**	**446 376**	**462 861**

Note: Data for Canned and Cured products not available.
Source: Department of Fisheries

8. FISHERY ADMINISTRATION

The Department of Fisheries under the Ministry of Agriculture is vested with the responsibility to maintain, manage, conserve, protect and develop the fishing sector in Malaysia. The Department has branch offices in each state and also several research and training institutions such as the Fisheries Training Institute of Malaysia providing training for fishermen in engineering, navigation, gear technology and fish handling.

Fisheries Research Institute, Gelugor, Penang that coordinates and conducts research on various aspects of fisheries, National Prawn Fry Production and Research Centre, Kedah conducting research into penaeid and freshwater prawn seed production and providing training in feed production technology are also under this department. Brackishwater Aquaculture Research Centre, Gelang Patah, Johor, and Freshwater Fisheries Training Centre, Enggor, Perak are the other two institutions engaged in training and extension activities in brackishwater and freshwater fisheries, including aquaculture.

8.1 Research activities

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 is mostly being conducted in marine fish spoilage and related post-harvest losses in Peninsular Malaysia. 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 Malaysian (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.

8.2 Fisheries Development Authority of Malaysia

The Fisheries Development Authority was set up in 1971 to upgrade the socio-economic status of fishermen and to develop and improve the nation's fishing industry. It registers and supervises fishermen's societies and also participates in fishery enterprises for the benefit of the fishing industry. It has offices in all the states, except Sabah.

8.3 Other agencies

Food Technology Division of the Malaysian Agricultural Research and Development Institute (MARDI), Sabah Fishery and Fishermen Development Corporation (KO-NELAYAN), and the Faculty of Fisheries and Marine Science & Faculty of Food Science and Biotechnology, University Pertanian Malaysia, are some of the other agencies providing research, development and education in fisheries, marine sciences, aquaculture and food sciences.

8.4 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 import the knowledge and technical know-how on culture practices to fish farmers.

Processors are provided with training through the Malaysian Agricultural Research & Development Institute (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 through Majlis Amanah Rakyat (MARA), National Productivity Centre (NPC) and private consultants.

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 situated at Batu Maung, Penang on the West Coast of Peninsular Malaysia and at Kuala Trengganu on the East Coast of Peninsular Malaysia. 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 maintenence, post-harvest operation and fish farming is done by various means such as:

(a) publications, demonstrations and communications;

(b) setting up of marine and aquaculture extension centres complete with adequate facilities and necessary equipments such as available at the Inland Fisheries and Aquaculture Branch Production and Training Centre at Bukit Tinggi, Pahang and Enggor, Perak;

(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;

(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.

8.5 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 coopertaion 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, Johore.

Malaysia also has bilateral technical cooperation projects with the United Kingdom for the training of extension workers; a pilot integrated fisheires 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 experts, materials, training and cooperative research.

SEAFDEC 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.

9. 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; and

(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 optimal 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 traditional fishermen to other more productive sectors of the economy especially deep-sea fishing;

(v) to extend resource management and conservation to the offshore fisheries; and

(vi) to provide adequate fisheries support services for both inshore and offshore 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 the existing culture practices; and

(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, slipway and so on.

These facilities have relieved some of the hardships of fishermen, reduced wastage due to delays in handling as well as lack of cold storage facilities and minimised 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 similar to those provided by local 'towkays' or 'financier-middlemen' to local fishermen, but up to now not very successfully.

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

10. CONCLUSION

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

(i) overfishing of the in-shore waters of Peninsular Malaysia;

(ii) management of Malaysian EEZ;

(iii) expansion of the off-shore resource utilization through deepsea fishing; and

(iv) development of aquaculture.

PHILIPPINES

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1. INTRODUCTION

The Philippines is a collection of 7 100 islands, which can be divided into four island groups or regions: Luzon, Visayas, Mindanao and the Palawan and Sulu group. It has a total land area of 300 000 km^2 and territorial waters of 1.7 million km^2. The declaration of 200 mile exclusive economic zone added some 450 000 sq km of productive waters towards the South China Sea to the West and the Pacific ocean to the east and south. The coastline is approximately 17 410 km. Of the total population of 60.9 million as on February 1990 it is estimated that about 55% resides within Coastal zones. As per latest estimates made in 1990, the per capita GNP is U$727 with a GDP growth of 5.7%. Current account deficit in foreign trade is U$1,466 million and foreign debt is U$26.6 billion. Inflation based on CPI is 10.8%.

The per capita fish consumption in Philippines works out to 40.5 kg in 1988.

Fishery sector's significant contributions to income, employment, and export earnings lend to its potential as a major industry that could fuel economic development in the country. On an average it accounts for five percent of the gross domestic product (GDP), five percent of export earnings and five percent of the country's labour force.

The fish production both in quantity and value has been on a steady increase rising from 2.08 million in 1984 to 2.3 million MT in 1988.

The fishery sector employs over one million people, accounting for 31% of the national labour force. The capture fishery employs about 825 000 fishermen of whom, more than 770 000 are municipal and small scale fishermen. The municipal fisheries sector is composed of the fishermen residing in the coastal municipalities of the country, falling within the low income category comparable to the artisanal/traditional sector in other countries. The aquaculture sector employs about 250 000 people. Employment opportunities are expected to increase with the further development and exploitation of the Exclusive Economic Zone (EEZ).

2. FISHERY RESOURCES

The Philippines Fisheries can be classified into two major catagories - marine and inland. The marine fisheries comprises coastal and deep sea fishing. Inland waters consists of swamps, fish ponds, lakes, rivers, reservoirs etc. In the

Philippines, the inland fishery is more significant and growth oriented because of aquaculture development.

Though there is no comprehensive assessment of the potential resources within Philippine waters, there is an extensive continental shelf and a generally productive marine environment. The estimates of maximum sustainable yield (MSY) varies from 1.6 million to 3.7 million tons.

The traditional fishing grounds are coastal shelf areas within depths up to 200 meter from the coast. Coastal waters have an area of about 266 000 sq km most of which are coral reeves. Extensive continental shelves are found off Northern Luzon, the Luigayen Gulf, Manila Bay, the Bicol region, the Visayan islands, Palawan and North eastern and South-Western Mindanao.

Philippines oceanic waters are still under exploited by Commercial fishing. The area include the western Sulu Sea, part of South China Sea, the turtle islands, Balabac waters, Cagayan de Sulu, Bugsuk, Ursula Island, Brooke's Point and adjacent areas. Stocks of demersal fish on rough bottom grounds are yet to be fully exploited. The use of handlines and bottom longlines could be greatly expanded to improve catch of demersal fish.

2.1 Marine resources

Some of the most important species in terms of availability and potential for high returns on investment are as follows:

2.1.1 Yellowfin and Bigeye Tuna

These are part of a large stock extending to the Western Central Pacific. The actual total commercial and local catch of these species was recorded at 57,060 metric tons in 1988.

2.1.2 Skipjack

The Philippine skipjack is also part of a wide-ranging stock which is believed to be still underexploited. Total catch in 1988 was recorded at 55,940 MT.

2.1.3 Frigate Tuna

Total catch of frigate tuna was recorded at 105,436 MT in 1988. While fishing for this species, "incidental" catches of other fishes such as Spanish mackerel, dolphin fish, sergeant fish, barracuda and rainbow runners are also taken.

2.1.4 Roundscads

Roundscads are caught in greater quantity than any other species or species group. However, there is no evidence of overfishing for this particular stock. Even in the Visayan-Sibuyan Sea areas, it appears that the maximum sustainable yield for round-scad has not yet been reached. The total catch in 1988 was 178,687 MT.

2.1.5 Shrimps and Prawns

Large penaeid shrimps are usually associated with estuaries and bays, rivers and extensive mangrove areas. They are abundant in waters of up to about 2.5 meters deep. Habitat-wise, shrimps in the Visayan-Sibuyan Sea areas are not yet fully exploited while those in the Samar Sea tend to be overfished. The quantity caught in 1988 at 27,667 MT shows a decreasing trend over the previous year.

2.1.6 Squids

The quantity of squids caught in 1987 was 33,124 metric tons while in 1988 it was 28,835 MT. Considerable evidence show, however, that this is far less than the potential catch. There is still little organized fishing for squids, pointing to the need for more exploratory fishing to test the abundance and determine the catch rates of this species.

2.2 Inland Fishery Resources

The inland fishery resources consists of about 400 000 ha of mangrove forests - of which 205 000 ha have already been developed into fish ponds - about 200 000 ha of fresh water lakes, 126 000 ha of fresh water swamps - of which about 6 000 ha are presently developed- and 130 000 ha of reservoirs which are also utilised for fish production. Aquaculture is the highest growth oriented sector in the Philippines fishery. Initially fish production through aquaculture was primarily based on the brackish water pond culture of milk-fish (Chanos-chanos). Recently aquaculture production has however diversified ard expanded. In addition to milkfish, shrimp and sea bass are now produced in brackish water ponds; while tilapia and carps in fresh water ponds, pens and cages. Encouraging advances have been achieved in integrated fish-livestock farming and in rotational rice-fish culture. The production of oysters, mussels and seaweeds is presently

carried out in open-sea culture sites. There has also been a significant change in aquaculture production from the traditional extensive and low output practice to the highly intensive-high output systems. Due to its better profitablity, prawn farming is slowly replacing milkfish farming in brackish water ponds. The introduction of improved culture systems, highly productive strains, improved feed formulations, highly improved technique in the hatchery production of fry and the expansion of production areas have contributed significantly to the exceptionally fast growth rate of the aquaculture industry in the country. The implementation of both locally and externally supported technical and funding support programmes had also contributed to rapid development of aquaculture. Some of these locally funded programs are the KKK Aquamarine Programme, Biyayang Dagat Programme, the Taal Lake Development Project, and the Laguna Lake Cooperative Development Programme. The Laguna de Bay Fishpen Development Project (ADB) the Agro-Industrial Technology Transfer Programme (OECF) and the Agricultural Loan Fund (WB) are among the externally funded programmes which had enhanced the speed of development of the aquaculture industry.

3. PRODUCTION

The total fish production in the Philippine has recorded a growth of 4 .8% in 1988 over the previous year as seen from the table below.

Table 1

Fish Production - (1984-88)

Year	Quantity (MT)	Value (₱ Million)	Variation Qty	Variation Value
1984	2080439	25,650	1.41%	35.13%
1985	2052111	31,297	1.36%	22.02%
1986	2089484	37,331	1.82%	19.28%
1987	2213040	37,349	5.91%	0.05%
1988	2305506	38,176	4.18%	2.21%

Source: BFAR, Philippines

Fish production in all sectors viz Aquaculture Municpal and Commercial fishery have recorded increase over the previous years. The aquaculture sector has shown the highest growth rate of about 108% since 1980 while the growth rate of Municipal fisheries and commercial fisheries was only 22% and 25% respectively. Fish production by different sectors is given below:

Table 2

Fish Production by Sectors (MT):

Year	Aquaculture	Municipal	Commercial	Total
1988	602 030	1 094 332	609 144	2 305 506
1987	560 970	1 060 878	591 192	2 213 040
1986	6470 893	1 072 365	546 230	2 [illegible]39 484
1985	494 742	1 045 382	511 987	2 052 111
1984	477 887	1 089 044	513 506	2 080 439
1983	445 073	1 145 841	519 316	2 110 230
1982	392 348	978 362	526 273	1 896 983
1981	339 501	938 628	494 768	1 772 897
1980	289 166	894 610	488 478	1 672 254

Source: BFAR, Philippines

The Municipal territory comprises both marine and inland waters, the major share being marine fishing; as shown below:

Table 3

Municipal Fish Production from Marine and Inland Sources

Municipal Fishery Production (M Tons)

	Marine	Inland	Total
1988	845 976	248 356	1 094 332
1987	816 247	244 631	1 060 878
1986	807 275	265 086	1 072 361
1985	785 132	260 250	1 045 382
1984	789 975	299 071	1 089 046

Source: BFAR, Philippines

The municipal fishery forms the major single sector of the Philippines fishery accounting for over 47.1% of the total fish production.

3.1 Tuna landings

Tuna is the most important item caught in the Philippines waters and second largest export product after shrimp.Over the last decade, commercial tuna fishery has emerged as the most valuable in Philippines. This is mainly because of the introduction of the purse-seine method in combination with the fish aggregating devices to attract pelagic fish, particularly skipjack and small yellowfin tuna. Five basic types of gears are used for tuna fishing in the Philippines.

They are hook and line, gill net, lift nets, surrounding nets and trap nets. Barriers and fish aggregating device (PAYAW) are the two types of fishing aids commonly seen in the Philippines.

The transformation of the tuna fishing to an industrial-scale activity has its roots in the late sixties. The growth of the tuna fishery was further fuelled with the increased production by small purse-seine and driftnet operators fishing at night and using drifting bamboo rafts to attract live-bait. There are 17 joint-ventures - 10 between Filipino and Japanese companies, 3 Hong Kong companies, 2 Taiwanese companies and 2 companies registered in Panama, operating in the Philippine Tuna fishery.

Table 4

Philippines Tuna Catch from 1980 - 1988

Year	Qty in '000 MT
1980	79.2
1982	102.7
1984	103.6
1986	136.5
1988	115.4

Source: GLOBEFISH

Though marine fishing continues to be the most important sector contributing around 74% of the present total fish production, share of aquaculture is on a gradual and steady rise, increasing from 17% in 1980 to around 26% in 1988.

4. FISHING CRAFT AND GEAR

The commercial fishing boats range in size from 5 GT to 1 500 GT. Ninety one percentage of these are below 100 GT whereas 65% of the vessels are of 50 GT.

Table 5

Commercial Fishing Vessels

Number	Tonnage (class)
18	450 - above
58	200 - 449.9
153	100 - 199.9
292	50 - 99.9
2 099	below - 50

Source: BFAR, Philippines

There are three principal types of gear used in commercial fishing as specified below:

Table 6

Purse seine	34.14%
Otter trawl	30.66%
Bag net	21.67%
Others	13.53%
	100.00%

Source: BFAR, Philippines

Of these three, purse-seine is the most prominent accounting for over 40% of the fish production, followed by otter trawl. The share of production is as below:

Table 7

Type of gear	Qty (MT)	Percentage of Commercial catch
Purse-seine	246 940	40.54
Otter trawl	151 790	24.92
Bag net	95 220	15.63
Others	115 194	18.91
	609 144	100.00

Source: BFAR, Philippines

There are about 464 395 fishing vessels called 'bancas' catching fish along the municipal waters. Of these 42% ie 193,976 are motorised and 270,419 (58%) are non-motorised. The share of motorised boats is on the increase - during 1980 share of motorised boats was only 29%.

The numbers of bancas fishing in municipal waters are as below:

Table 8

Municipal Fishing Vessels (Bancas)

	Motorised	(Share)	Motorised	(Share)	Total
1980	105 090	(29%)	262 748	(71%)	367 838
1985	193 976	(42%)	270 419	(58%)	464 395

Source: BFAR, Philippines

5. AQUACULTURE

Aquaculture accounts for some 25% by Quantity and 31% by Value of the total fish production in the Philippines (1987). It contributes significantly to local food security. Of the total per capita consumption of fish/fishery products of 40.5 kg in

1988 nearly 20% was form aquaculture sector. Nearly 250 000 people are employed in this sector of which 90% are with brackish water fish ponds. It has been shown that aquaculture labour is more productive than in other comparable agriculture activities. It has also been indicated that income and profits generated from aquaculture are generally higher than those derived from other agricultural activities. Seaweed farming has been proven to be a more productive alternate source of livelihood. The artisanal fishermen have increased their income several folds by seaweed farming.

The livelihood of a large portion of the rural coastal population is directly dependent on the fishery resources. Most of the shallow water resources in the country have, however been over exploited. As such the introduction of aquaculture in many of these areas has generated employment opportunities and increased livelihood and income generation capacities which inturn, has contributed to the general improvement in their socio-economic conditions. The major species presently produced through aquaculture are given below:-

5.1 Milkfish (Chanos chanos)

This species is cultured in two culture systems - brackishwater ponds and freshwater fishpens. Production from these two systems put together amounted to 215 379 MT in 1987. A significant increase in the value of total production for this species was recorded in 1984-1985 notwithstanding the decrease in production - resulting from a shift in preference from milkfish to prawn. A significant portion of brackish water ponds have been converted to prawn ponds. The negative growth in fishpen production was primarily due to low productivity presently being experienced in Laguna de Bay and the removal of a significant hectarage of illegally constructed fishpens.

5.2. Prawn (Penaeus monodon)

The attractive pricing and high demand of this species in the international market has been responsible for its rapid growth among the aquaculture species. Production in brackishwater ponds had almost tripled in 1985 (29 thousand MT) over that in 1983 with a value of P 2 659 million. In 1987 the share of prawns/shrimps in total production from aquaculture was about 6.4% (quantity) with a total production of 35 470 tonnes).

The recent trend in prawn production points to a shift from the traditional extensive grow-out ponds to semi-intensive and intensive types where the stocking density is six to more than

10 times that of the traditional extensive type of culture. Other factors which favour the shift to intensive types are the readily available supply of hatchery-produced post larvae (PL 20), the introduction of high energy input technology, the availability of formulated complete feeds and highly improved pond design.

5.3 Tilapia

The increasing importance of this species in domestic markets is shown by the rapid growth rate in production. During 1987 production has increased to 65,885 tons - an increase of neraly 60% over the previous year. The average total production for this species represents 6.9% of the total aquaculture production during the same period.

5.4. Carp

Three species are presently being cultured in freshwater pens, ponds and cages, namely, the bighead carp (Aristichtys nobilis), silver carp (Hypophthalmichthys molitrix) and the common carp (Cyprinus carpio). Very little data are available on culture of carps in the Philippines. Induced spawning through hormone injections for the production of fry and the adoption of a polyculture system with Tilapia and milkfish have contributed substantially to enhance production recently.

5.5 Mariculture

Mariculture of molluscs and seaweeds has very good scope for development due to their high potential for expansion. The availability of extensive and ecologically favourable habitats and technologies for production are two important factors favouring the intensification of mariculture development. Now that most of the shallow water fishery resources on which the coastal sustenance fishing sector depends on are being depleted, the expansion of culture activities to those areas will serve as an important alternative avocation for this sector. Major species used for mariculture are as follows:

5.5.1 Oysters

Four species are available for culture but the slipper-shaped oyster, Crossostrea iredale and C. malabonensis are the species commonly cultured in the country. During 1987 oyster production aggregated to 10 361 MT.

The farming method for oyster culture is well-established. Present efforts in the expansion of the industry are primarily aimed at improving methods of spat collection and

introduction/experimentation in areas where oysters are not presently cultured. The main constraint in enhancing production at present is the limited local market and problems in distribution and marketing.

The channeling of production to the potential export markets, is hampered by the poor quality of the produce due to high bacterial counts. Many of the productive areas are highly polluted, eg, Bacoor Bay, and Manila Bay in general, and thus the quality improvement has to be addressed if the industry is to tap export markets.

Oysters are mainly consumed in fresh form. The lack of fast transport and distribution network to allow the produce to reach the local markets in fresh state as well as hygienic standards and handling methods are major problems hampering the expansion of production in areas far from the local markets. The bacterial contamination of oyster has also contributed to low local consumption together with its failure to penetrate the export market.

5.5.2. Mussels

Three species are being farmed namely, Perna viridis, the green mussel, Modiolus metcalfi and M. philippinarum the brown mussels. Green mussel is the most popular species and is widely farmed in the country. It is a fast growing species and its "meat" is soft and tender. Mussels recorded an annual production of 11 644 MT in 1987.

5.5.3. Seaweeds

The seaweed industry has shown a remarkable growth during the last decade. It ranks third among the fishery exports in terms of value during the last few years. The average annual production from seaweeds represents about 25% of the average annual production from aquaculture during this period. In the year 1987 the total production of seaweeds at 220,839 MT was valued at US$20.9 million.

Present production is dependent on the culture of three major species, namely, Eucheuma denticulatum (= E. spinosum), E. alvarezii (formerly called E. striatum or the "cottonii" of commerce) and Caulerpa lentillifera. A small fraction of the production comes from the harvesting of wild stocks of Sargassum for seaweed meal, several species of Gracilaria and Gelidiella acerosa for agar manufacture. About 90-95% of the total annual production consists of Eucheuma.

The major producing areas are Tawi-tawi, Sulu, Southern Palawan, and Central Visayas, several places in Mindanao, islands of Leyte, Cebu, Panay, Cuyo and Batangas in Luzon.

Pond culture of Caulerpa mainly centers in Mactan, Cebu although small open reef farms are now producing in Calatagan Batangas.

The major items produced from aquaculture for 1983 - 1987 are given below:-

Table 9

Aquaculture Production by Species, 1983 - 1988 (MT)

Species	1983	1984	1985	1986	1987	1988
	Quantity	Quantity	Quantity	Quantity	Quantity	Quantity
1 Milkfish	238,559	237,675	193,650	179,505	197,529	187,877
2 Tilapia	30,770	32,002	43,780	55,836	75,769	75,046
3 Shrimp and prawn	9,287	26,357	26,537	27,986	32,380	41,548
4 Oyster	11,310	14,617	15,268	16,465	10,361	12,445
5 Mussel	18,506	20,306	22,680	12,114	11,644	15,502
6 Seaweeds	132,204	142,088	182,946	168,868	220,839	256,405
7 Others	4,437	4,842	2,841	1,034	1,122	10,731
Total	445,073	477,887	487,702	461,808	549,644	599,554

Source: Bureau of Agricultural Statistics

6. FISH HANDLING AND PROCESSING

6.1 Handling

Due to lack of proper facilities for icing, transportation and cold storage, a considerable amount of fish landed gets spoiled during distribution. There are only 9 ice plants with a capacity of nearly 100 tons of ice production per day. It is estimated that up to 30% of the fish offered for auctioning are already spoiled during the time from catching till landing.

6.1.1 Handling on board

In most fishing areas, the degree of care exercised in the handling of fish on board the vessel and on-shore depends on the value of the species. High value species are better taken care of than low value ones and thus the intrinsic quality of these species is usually quite good. Low-value species are poorly iced and little protection from heat and contamination is provided. Hence, the quality on landing ranges from poor to rejects.

Some fishing vessels are not properly cleaned and sanitized. In addition to this, the widespread use of tubs, baskets, and wooden boxes as fish containers causes contamination during storage of fish resulting in poor quality, spoilage, off-ordours and reduced shelf-life.

6.1.2 Handling at Landing Site & Auction Halls

When fish are unloaded at the landing ports, the ice is often discarded. The fish are transferred to other containers for auction. More often, they are unloaded on floors under direct sunlight with little or no ice, thereby exposing them to further quality deterioration.

Water from the harbour is often used to wash the fish. Harbour water is usually contaminated, thus aggrevating spoilage of the fish.

6.2 Traditional Fish Processing Methods

The fish processing industry in the Philippines generally ranges from small to medium cottage industry level employing the traditional methods of salting, drying and smoking with the small units operating in strategic locations all over the country. The industry absorbs surplus fish catch during the peak season, offers a ready market at almost the same price as fresh fish during the lean months and provides storable protein diet items.

6.2.1 Drying

Drying is one of the oldest and simplest methods of preserving fish in the Philippines and in many tropical countries. This industry plays an important role in stabilizing the utilization, distribution and marketing of fish resources. The product is acceptable to all income groups and has high export potential.

Sun-drying as a method of preservation remains popular in the country because of its low-capital investment and other advantages. The techniques are usually simple and do not require high technology or expensive equipment. At present, approximately 38% of the total catch is processed into dried fish products. There are 658 drying plants in the country today, 415 of which are registered. The Philippines shows the highest per capita consumption of dried fish of 4.4 kg annually in Southeast Asia.

Fish drying activities in the country vary according to the availability and suitability of raw materials for drying. As the processors are generally small scale family establishments, most of them have limited capital and do not receive assistance provided by various government agencies and financing institutions. These factors coupled with the existing conditions in areas difficult to reach limit the development and improvement of the industry. Nevertheless, in some areas in Palawan and Cagayan, processors have realized the relative benefits of using artificial dryers for fish. In Cagayan, oven-type agro-waste dryers are used for drying tiny shrimps which are consumed locally or even exported to Japan. The use of these artificial dryers was introduced in the mid-seventies.

6.2.2 Salting and Fermenting

The manufacture of fish sauce (patis) and fish paste (bagoong) is a major industry in many parts of the country. Production peaks during the month of April and falls in October. By-catch market surpluses like tiny shrimps of Acetes sp., and other species of low-commercial value are also absorbed by this industry, thus preventing wastage of resources.

The technology employed by the processors is simple, which consists basically of mixing the salt and fish or shellfish and allowing it to ferment for a certain period of time, depending on whether fish sauce or fish paste or both are desired as end products. The containers used to stack the mixture vary from earthernware jars to plastic containers and concrete tubs.

To hasten the fermentation process, some processors have adopted techniques such as exposing the containers of salt-fish mixture to sunlight with the containers covered and burying the containers partly into the ground, on the principle that fermentation is faster at higher temperatures. Artificially produced enzymes, such as pepsin in powdered form is now manufactured and are used by some fish processors.

6.2.3 Smoking

Fish smoking is believed to be introduced into the Philippines by the Chinese. This method preserves the fish, enhances its flavour and improves its appearance. The method is simple and may not require expensive machinery. The raw materials are locally available and the products are widely accepted.

There are two kinds of smoking practised in the Philippines,namely hot and cold. Hot smoking is a slow broiling process, where the fish are placed close to the fire to cook as well as to be saturated in smoke, normally at a temperature of 150 to 190 deg F. This is sometimes called 'barbecure smoking'.

With cold smoking, temperature levels of 90 to 110 deg F is maintained, with the fish smoked over a period of days to a week. Charcoal may be used to provide the heat, with guava leaves or non-resinous sawdust thrown on to produce smoke that gives a certain flavour to the fish, as in the tinapa, a special process that gives the fish a rich golden colour and juicy taste.

Fish smoking is not practiced throughout the country and many coastal areas prefer to dry or ferment excess fish than to smoke them. Only six of the 12 regions of the country process smoked fish. Milkfish is smoked either whole, split, boneless and soft-boned and is sold locally while smoked-dried tuna (katsuobushi) is mainly for export to Japan.

Due to non-uniformity in the processing method, smoked fish show varying degrees of product quality, shelf-life and acceptability.

6.2.4 Fish Canning

Canning has grown to a certain degree. At present there are 30 fish canning plants in the country of which 21 are operating in Metro Manila while the rest are located in other provinces. However, operation still vary from excellent to poor; or from high degree of technological sophistication to primitive manual operations. The most commonly used species are those utilized by the fish curing industry such as milkfish, sardines and mackerel which poses a problem on the raw material supply during some parts of the year. Other raw materials like shrimps, squid and crabmeat still need to be tapped. The most common defects found in local canned sardines are:

(a) Mislabelling - contents are not the same as those stated

on the label
(b) Fish are not processed immediately after thawing, resulting in off odours and mushy texture of products
(c) Proportion of solids to sauce is not within the required proportion of 60/40
(d) Cans are defective. Fracture on can seams occurs due to too tight pressure on the rollers. Cans are sometimes dented.

Considerable attention should be given to this industry to improve product quality to enbale it to be more competitive in the export market and at the same time satisfying the demands of the local consumers.

6.2.5 Freezing

Freezing is a big help to the fish processing industry in two ways. It provides efficient preservation and storage of the catch for future processing and caters to the export of frozen fish such as tuna, shrimp and other products. The freezing capacity is limited and storage capacity is only around 140 tons per day.

A majority of Filipinos have strong preference for fresh fish to frozen ones because of the undesirable freezing procedures in some establishments resulting in sub-standard frozen products. Contact plate freezers are widely used while air blast freezers are employed only by a few exporters.

6.2.6 Minced Fish Products

Fish balls are the most popular among the minced fish products. It is prepared from white meat species seasoned with sugar, salt, monosodium glutamate and starches as thickening agents. However, most plants engaged in this industry lack training in proper sanitation and flies appear to be a major problem in the processing area. Products are sold locally. This industry may absorb trash fishes and market surpluses including fresh water species.

Studies are now being made to maximise the utilization of by-catch such as croakers, lizardfish and sharks into comminuted forms and extruded as breaded products. Fish balls are popular products and are now sold almost everywhere. Fish 'quekiam' and fish burger are now being promoted in the market. By-catch are also good raw materials for the manufacture of other fishery products like fish salami, fish noodles, keroepock, fish sticks and others. With appropriate processing technology, by-catch can become an important potential source of protein for human consumption.

6.2.7 Shellfish Processing

Processing of shellfish is confined mainly to the more popular crustaceans and molluscs. Shrimps and prawns, because of their high market value are mostly exported in fresh, frozen or chilled forms; similarly with lobster tail and crabmeat. Dried shrimp, crabmeat and tiny shrimps (Acetes sp) are also exported to Japan, USA and other countries. Molluscs like abalone, mudsnail, mussels, oysters, cuttlefish, squid, octopus and arkshell are also exported in live or processed forms such as dried, salted and frozen/chilled. Processing technologies for shellfishes have been developed but most of them are exported either because of high export demand and abundance in catch or because they have no local demand at all. However, considering the present availability of appropriate technologies, utilization or other potential species shows promising prospect.

6.2.8 Bangus (Milkfish) Deboning

The changing tastes of consumers and their demands for improved acceptability of millefish locally called bangus, a bony fish, gave rise to the milkfish deboning industry. This industry caters to the institutional markets such as hotels and restaurants which have gained popularity in their broiled fish products. It also caters to the demand of Filipino communities abroad who have marked preference for convenience food items. Today, this industry generates employment and adds to the foreign currency earnings through exports. The product is exported in frozen, marinated, dried and smoked forms.

6.2.9 Manufacture of Boiled Tuna (Sinaing na Tulingan)

This is a lucrative business in the Tagalog Region. It utilizes frigate tuna, bullet tuna and eastern little tuna. The process of boiling the fish with salt enables the fishermen/producers to sell the product to other areas where the demand is high without the risk of spoiling the fish as it keeps for 4-7 days at room temperature. The technology is now being promoted especially in areas where the catch is abundant. However, the product is consumed locally only.

6.2.10 Processing of Boiled-Dried Fish

This is a new product; the technology was introduced by the Japanese. Small species like slipmouth (*Leiognatnus* sp.) locally known as "sapsap", and anchovies (*Stolephorus commersonii*) are processed into boiled-dried products. The

fish are boiled in a concentrated brine solution and dried under the sun. This method preserves the product and enables the processors to market them in areas where they are in demand.

6.3 Other Fishery Products and By-Products

These are generally produced by small-scale factories, and the product are either consumed within the locality where the product is produced, or used in the export market, both for direct human consumption and for industrial purposes.

6.3.1 Fishmeal Processing

Fishmeal production also depends to some extent on by-catch in addition to offals and wastes in processing, particularly from the fish canning industry where such wastes constitute approximately 40% of the raw materials. In the frozen food industry, the waste materials constitute 80% of live crabs and 30% of shrimps. Rejects in dried and smoked fish and fish offals from filleting are also absorbed by the fishmeal industry. However, there is a need to improve the processing techniques in fishmeal production as its quality is believed to be inferior to imported meals. Nevertheless, importation of fishmeal has drastically reduced.

6.3.2 Shark Liver Oil Extraction

Shark fishing for squalene oil started in Cagayan in 1980. The extraction of oil from shark liver was practiced during this year when there was high demand of shark oil in Japan and France. The process is crude because of the unavailability of appropriate processing equipments.

6.4 Packaging and Trasportation

The dominant type of container used for fish handling and distribution is a conical steel tub known locally as "banera", having a capacity of approximately 70 kg used for transporting fish to some landing areas and retail markets. Other types of containers are also used, such as those made from rattan, bamboo, timber, styrofoam and plastic. These vary from one region to another although the banera still remains the most common.

The fish is iced in banera on board the vessels and transferred to auction halls in the same containers. The baneras are usually owned by resident brokers, some of whom also own fishing boats. Other boat owners market their fish through regular brokers who charge a 7-10% commission on

sales. Some brokers lease/rent baneras to their established wholesale and retail clients and charge a minimum deposit, while in certain cases buyers provide their own fish containers.

Fish for transportation to distant markets is repacked and iced in the banera and loaded into insulated trucks. Timber planks are placed between succesive layers of baneras to facilitate stacking but because the baneras are always overfilled, damage to fish at the bottom layers due to crushing becomes inevitable.

Large trucks, both insulated and open ones are commonly used for medium to long distance transportation. When open trucks are used, the fish are packed in styrofoam boxes with ice. The use of this type of containers is now becoming popular. To make them more durable, wooden frames are provided for support and protection against rough handling.

Fish for local distribution is noramlly transported either by privately-owned jeepneys or small pick-up trucks with a capacity of one ton or less.

The introduction of high density polyethylene plastic (HDPE) containers has improved the fish handling practices in the fishing industry. Trials have been successful in Iloilo and Bacolod and they have been found to be ideal for handling and distribution of milkfish from the production areas to the auction centers. These containers offer the following advantages: 1) ease of handling; 2) better presentation of produce at auction; and 3) better utilization of space in vessels.

6.5 Quality Control Programme

The Bureau of Fisheries and Aquatic Resources (BFAR) of the Ministry of Natural Resources and Bureau of Food and Drugs (BFAD) of the Ministry of Health are the two organisations involved in fish Quality Control and Inspection in the Philippines. Two national standards have been prepared and published by the Philippines Bureau and Standards. They are:

I. PTS 031.01.1969 Standardization of fresh, chilled and frozen fish.

II. PTS 031.03.1970 Standardization of live, fresh, chilled and frozen shrimp.

These two standards are of advisory nature and intended to serve as a guide to producers, distributors, and consumers in determining good quality products. The standard includes also basic requirements for packing, transport, marketing and

labelling as well as inspection and sampling procedure. The standard for live, fresh, chilled and frozen shrimp have been amended and published in the Fishery Administrative Order No. 117 together with the standard for frozen tuna as mandatory standards for exported products.

The quality of fresh fish and shrimp in the Philippines is good mainly due to :

(1) Rejections of exported product in the past which forced the producer to improve the quality of their products.

(2) The Government's action aimed for mandatory registration and inspection of establishments as well as standardisation of exported products.

(3) Consumer requirements for good quality products which was based on historical development rather than recent consumer education.

(4) Availability and wide acceptance of traditional methods for utilisation of low quality fish eg. production of fish sauce.

All fish processing plants are subject to the Government inspection and have to comply with the requirements described in the relevant legislative acts. The plant that fails to comply with these requirements will not receive permit to operate.

6.6 Problems Facing The Fish Processing Industry

The fish processing industry is bugged by many problems which are either industrial, socio-economic, institutional or political in nature. Nevertheless, inspite of them the industry continues to grow and it has gone a few steps ahead towards its full development. The various problems of the fish processing industry are summarized below:

6.6.1 Huge losses in value of fish and fishery products due to poor handling practices, sanitation and hygiene which results in inadequate supply of raw materials for processing and inferior quality of fishery products. This is also attributed to lack of adequate facilities necessary for handling, processing and distribution.

6.6.2 Poor hygiene and sanitation and non-standardized procedures encourage insect infestation on cured products and non-uniformity of product quality.

6.6.3 Slow transfer of new technologies and strong resistance to new techniques due to lack of proper education and training

on proper fish handling, processing and quality-consciousness among the fish processors. The lack of facilities and equipment needed for extension and technology dissemination also hinders technology transfer. Thus, the processors still cling to the traditional methods which are in most cases crude and sub-standard resulting in either poor quality or product rejects.

6.6.4 Lack of capital limits the processors' ability to expand their business and explore the utilization and processing of other fishery resources. Thus, most operations are confined mainly to traditional processing methods good for small to medium-scale operations.

6.6.5 Lack of proper coordination among agencies and other institutions involved in the fishery industry resulting in gaps and duplication of some functons while neglecting other important areas.

6.6.6 Lack of government funds to carry out effectively and efficiently the much needed extension service and other forms of technical assistance that the industry needs.

7. MARKETING

The fish and fishery products are one of the major exchange earners for the Philippines in the agriculture sector and maintains a favourable balance of trade as shown below:

Table 10

Foreign trade in fish and fishery products

(₱ Million)

	Export	Import	Balance of trade
1984	2178.7	50.0	2128.7
1985	3496.0	118.1	3377.9
1986	4863.0	385.6	4477.4
1987	6441.8	637.4	5804.4
1988	9600.6	1312.5	8288.1

Source: BFAR, Philippines

7.1 Export

Shrimp has of late, become the main export item accounting for nearly half of the export earnings from fish and fish products. The tuna is the next main item with a share of 22% followed by seaweeds 8.1%, shell craft articles 5%, cuttlefish/squids 3%, live fish 1%, and sea cucumber 1%, clam meat 1%, milk fish 1%, etc. Export details of major items and export growth for the last ten years are given below :-

Table 11

Export of Fish and Fishery Products, 1978 - 1987

Year	Quantity (MT)	% Variation	Value (PM)	% Variation
1978	48,438		532	
1979	64,890	35.4	782	47.2
1980	76,179	17.0	939	20.5
1981	83,236	9.2	1,251	33.0
1982	68,265	-18.1	1,120	-10.4
1983	75,588	11.8	1,592	42.0
1984	63,044	-17.1	2,129	34.0
1985	95,077	51.0	3,496	64.1
1986	101,449	6.3	4,863	39.1
1987	112,382	10.9	6,445	32.6
1988	128,903	15.2	9,599	48.9

Source: BFAR, Philippines

Table 12

Major Fisheries Export, 1987 - 1988

		Quantity (MT)	1988 Qty	1988 Val	Value (000)
1.	SHRIMP/PRAWN (Total)	15,550	24,128	5,266,862	3,187,354
	Frozen/Chilled	14,935	23,563	522,937	3,158,144
	Processed	615	592	37,825	29,210
2.	TUNA (Total)	37,311	47,37.	2,362,861	1,427,225
	Frozen/Chilled	11,250	10,242	451,747	371,687
	Canned	26,061	37,137	1,911,114	1,055,538
3.	SEAWEEDS (Total)	30,752	27,462	592,158	487,969
	Dried/Treated	25,511	26,651	563,813	458,622
	Others	5,241	811	28,345	29,347
4.	SHELLCRAFT ARTICLES	3,747	3,780	314,821	302,449
5.	CUTTLEFISH/SQUID	2,886	2,790	202,722	214,398
6.	FISH KEPT ALIVE FOR TRANSPORT	4,148	5,036	128,612	107,206
7.	CLAMSHELL (MEAT)	1,457	1,704	97,635	97,260
8.	BANGUS (Milkfish)	1,795	90	5,666	80,223
9.	CAPIZ SHELLS	4,066	5,393	99,975	63,556
10.	SEA CUCUMBER (Trepang)	2,195	2,062	49,393	51,648
11.	OTHERS	7,923	9,078	478,728	2,517
	GRAND TOTAL	111,830	128,902	9,599,433	6

Source: BFAR Fisheries Statistics of the Philippines/NCSO, 1987

7.1.1 Major Export Markets

Japan, USA, West Germany and U.K. are the major export markets for fish and fishery products from the Philippines, with Japan and USA as the major buyers of Philippines shrimp. The markets for fish and fish products from Philippines are as below :

Table 13

Major Countries of Destination of Philippine Export of Fish and Fishery Products, 1988

	Quantity (MT)	Value (000 Pesos)
Japan	33,505	5,038,184
USA	27,560	1,790,521
W. Germany	14,263	686,818
U.K.	6,773	364,309
Canada	5,084	308,554
HongKong	4,169	120,982
Denmark	7,749	112,153
Hawaii	1,223	102,487
France	5.260	95,345
Italy	1,079	46,748
Others	22,238	933,332
Total	128,903	9,599,433

Source: BFAR, Philippines

7.2 Import of fish and fishery products

Though import value has increased (from 230 million in 1978 to 637 million Peso in 1987) the growth has been much less compared to exports. Restrictions imposed on import of canned sardine and mackerel in 1983, has resulted in substantial fall in imports to mere P50 million in 1984. However, Government has brought out an import liberalisation programme in 1988, resulting in a substantial increase in import, particularly of fish for canning.

This trend is expected to continue as canneries have much excess capacity compared to the current fish supply especially during the lean season. The import details are as below :-

Table 14

Import of Fish and Fishery Products

Year	(M Tons)	₱ (Million)
1978	47,995	230
1979	45,873	207
1980	53,402	274
1981	46,850	288
1982	83,445	444
1983	23,038	111
1984	6097	50
1985	28,755	118
1986	69,084	386
1987	104,936	634
1988	164,575	1,312

Source: BFAR, Philippines

The major items imported are fish meal, a vital component of animal feeds, followed by frozen sardine/mackerels, frozen tuna, etc. as shown below :

Table 15

Major Items of Import

		1988		1987	
		Qty MT	Value ₱M	Qty MT	Value ₱M
a)	Frozen Sardine/ mackerels and other fishes	95,304	437	63,208	257
b)	Frozen Tuna	18,552	243	3,297	38
c)	Fish meal	47,784	574	34,473	315
d)	Others	2,935	58	3,894	24
	Total	164,575	1312	108,830	634

Source: BFAR, Philippines

7.2.1 Sources of Imports

Japan is the major source for fish and fish products imported into the Philippines followed by Peru, Chile, New Guines, Taiwan etc. in 1988 as shown below :

Table 16

Major Sources of Fishery Import - 1988

	M Tonnes	$ (Million)
Japan	118,563	856,586
Peru	25,803	208,079
Chile	5,178	66,677
New Guinea	2,851	39,333
Taiwan	4,429	38,740
USA	1,840	33,534
Indonesia	1,606	19,131
Singapore	846	12,354
Thailand	1,153	8,379
Hong Kong	481	7,752
Others	1,825	21,602
Total	164,575	1,312,467

Source: BFAR, Philippines

8. FISHERIES ADMINISTRATION

With the independence of Philippines by 1946, Bureau of Fisheries (BOF) was organised as per Republic Act no. 177 on July 1, 1947 in an enlarged manner. The expanded Bureau included the Philippine Institute of Fisheries Technology and Seven Secondary Fisheries schools. The educational functions of the Bureau was transferred to other offices in 1957. The Institute of Fisheries Technology was transferred to the University of the Philippines (UP) and became the UP College of Fisheries (UPCF). The Fisheries schools were transferred to the Bureau of Public Schools in the Department of Education. The Bureau of Fisheries was converted into the Philippines Fisheries Commission within the Department of Agriculture and Natural Resources, in 1963 and was reverted to old name of Bureau of Fisheries in 1972. With a shift from a presidential to a quasi-parliamentary government, various Cabinet rank departments were converted into Ministries, in 1974. Agriculture and Natural Resources was

divided into two ministries : Ministry of Agriculture (MOA) and Ministry of Natural Resources (MNR). The Bureau of Fisheries and Aquatic Resources (BFAR) under the Ministry of Natural Resources under a Minister responsible for fisheries policies. During the period fisheries office was at the division level, a section, variously named Fish Culture/Inland Fisheries/Fisheries Biology and Conservation, was responsible for aquaculture. By 1980, BFAR consisted of 14 divisions plus 13 regional fisheries offices. The divisions are: Administration, Finance, Planning and Management, Legal, Fisheries Training, Fisheries Conservation and Enforcement, Fisheries Utilization, Fisheries Economics and Information, Technological Services, Fisheries Licenses, Fish Propagation, Fisheries Research, Fisheries Extension, and Fisheries Engineering. Of these, the Fish Propagation Division has full involvement in aquaculture while Fisheries Training, Fisheries Economics and Information, Fisheries Research, and Fisheries Extension have partial responsibility for aquaculture. The different Fisheries Regional Offices are involved in aquaculture and may have specific units for aquaculture.

8.1 Programmes and Projects

The government through the Bureau of Fisheries and Aquatic Resources (BFAR) implements the Fish & Fishery Products Utilisation Project under the Expanded Fish Production Programme. This programme is implemented hand-in-hand with the other programmes and projects of other research and development institutions. The programmes primarily aims at promoting import substitution and expanding fishery exports. To realize these objectives, the following activities are being undertaken.

8.1.1 Research

To maximize the utilization of fish and fishery products, research studies directly concerned with converting the once non-utilized fish species and other minor sea products are being conducted. Studies on the improvement of handling and processing techniques of traditional products to suit consumers' demands are likewise being made.

8.1.2 Extension Service

Results of research studies in fish handling, processing and utilization are disseminated through lectures, demonstrations, seminar/workshops and technical information services in order to encourage the processors to adopt new technologies and the private investors to engage in fish processing industry. Such medium of technology transfer helps promote import substitution and develop export products and

at the same time upgrade the quality of fish and fishery products.

8.1.3 Product Development

Corollary to research activities, studies on producing new products that could be derived and developed from various fish and fishery products are being undertaken. Likewise, traditional processing methods are improved by applying appropriate technology and using suitable processing equipment. Available technologies and new ones are verified and pilot scale production of fishery products are being undertaken.

8.1.4 Training

Training courses and seminars/workshops are conducted for interested parties by the staff of the Fisheries Extension Division and the Fisheries Utilization Division of BFAR. The former conducts training courses on improved fisheries extension methodologies for trainers and extension officers while the latter conducts training on fish handling and processing for operators. A one-week training course on fish handling and processing is an on-going project of the BFAR through the Fisheries Utilization Divison where proper fish handling and processing methods are taught to housewives, processors, businessmen, students and industrialists. This serves as a medium of technology transfer to disseminate the technology to the industry. Training courses on fish handling and processing are given to upgrade the skills of the technologists and extension officers and make them more effective in their jobs. Other academic and research institutions implement similar trainings.

9. GOVERNMENT POLICY

Fisheries policies are formulated through the Fishery Industry Development Council, an agency under MNR. The Development Council, in consultation with the Office of the Minister and BFR, formulates the plans and programs of fishries development for the country, while BFAR is the implementing agency.

Fisheries programs are incorporated in the "National Economic Development Plan", which includes both a medium-term (5 year) and long-term plan. The National Economic Development Authority assembles the various programs of the different agencies of the government into a national economic program. It oversees and monitors the implementation of this program by the different government agencies. It also coordinates

all external inputs.

The 1981 Integrated Fisheries Development Plan (IFDIP) is a government attempt to optimize fishery resource management and rationalize production, distribution and marketing of aquatic products. The Philippine Fisheries Development Authority (PFDA), a government corporation, presents the National Fish Marketing Infrastructure Program (NFMIP) as its major strategy towards the attainment of the IFDP's objectives. The NFMIP's main components are the National Fishing Port of Navotas, the regional commercial ports, the municipal fishing ports, the ice plant and cold storage chain, and the fish transport system.

Hand in hand with strict law enforcement and sound resource management striking a healthy balance between fishery resource protection and exploitation, the government through the PFDA strives to catalyze industry development through on-shore and offshore infrastructure networks. Such networks are calculated to eventually ensure not only fishermen of the prompt disposal and obtainment of financial returns for their catch but also the common man of the availability and affordability of the commodity all over the country.

9.1 Agricultural Credit

It is estimated that about 373 000 fishing households representing 80% of people employed in the industry have incomes below the poverty line. Poverty is more prevalent among the municipal fishermen because of (1) population pressure in coastal areas (2) weather conditions that cannot be overcome by small and low-powered craft used by small scale fishermen (3) poor harvest handling (4) inefficient distribution system and (5) lack of alternate employment opportunities in the fishing villages. Realising the need for a helping hand, government of the Philippines introduced a two way credit policy: Firstly to direct banks to extend credit to the fishery sector and secondly to create credit programmes by budget allocations and foreign loans. Since the credit programmes introduced earlier were not effective in extending the required assistance, the government revised the credit policy in late 1986 with a different approach to address the development issues of the Agricultural and rural sectors. Credit is still considered an important poverty intervention mechanism, but it has to be provided in a way which does the least damage to the financial inter mediation process. The stress of the current credit policy is towards government intervention and greater role of market forces and private institutions in the allocation of financial resources.

The current credit programmes available to fisheries are (a) Agricultural Loan-Fund (b) Agro-Industrial Technology Transfer Programme (AITTP) (c) ADB Fisheries Loan Programme (under external funding) (d) Comprehensive Agricultural Loan Fund (CALF) and (e) Livelihood Enhancement for Agricultural Development (LEAD) under government funding.

9.2 Credit Policies

Salient features of the credit policy that affect fisheries sector are:

a. Presidential Decree (PD) 43 of 1972 which made it mandatory for government banks and financial institutions to grant loans to fishpond operations;

b. PD 704 of 1975 or the Fisheries Law which repealed PD 43 and declared fisheries as a preferred area of investment;

c. PD 717 of 1975 or the Agri-Agra Loan Quota which mandated financial institutions to allot 25 percent of their loanable funds to agriculture, fisheries and agrarian reform beneficiaries;

d. Central Bank Circulars which provided for rediscounting privileges, relaxation of collateral requirements and low interest rates to agriculture including fisheries loans;

e. Letter of Instructions which established (a) the Barrio Guarantee Fund and Barrio Savings Fund to guarantee all cooperative loans and (b) the National Commision on Countryside Credit and Collection to foster credit consciousness in the rural areas.

10. CONCLUSION

With the increasing demand for fishery products in the world markets and the eventual development of the Philippine EEZ, the outlook for fishery industry looks positive. However proper management of fishery resources is required in the light of the present problems that threaten the sector. Foremost are problems of over fishing or depletion of resources particularly in Coastal areas, destructive fishing activities, pollution and other forms of environmental degradation.

Keeping this is view the following recommendations are made for further development of the industry :

1. Implement an intensive educational information and technology dissemination programme nationwide designed to:

   a. effect technology transfer on product development and improvement.

   b. demonstrate proper handling, hygiene, sanitation and standard processing procedures.

   c. encourage quality-consciousness in fish processing. This may include print media, TV and radio programmes, training courses and workshops.

2. Provision of trained fish inspection staff to advise and provide quality control guidance in the regions.

3. Appropriation of sufficient funds for research and development projects to support the fish processing industry.

4. Expansion of fish inspection and quality control laboratories in the regions as a show-window to the industry where appropriate fish processing technologies may be demonstrated.

SRI LANKA

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1. INTRODUCTION

Sri Lanka is a tropical island located in the Indian ocean, South East of India with a total area of 65 610 km^2 and a coast line of 1 561 km. With the declaration of EEZ in 1978 Sri Lanka's fishing right extends to 230 000 sq km. Though Sri Lanka's continental shelf area spreads over 27 800 km^2, it is narrow, rarely exceeding 40 km in width.

The estimated population in Sri Lanka in 1988 was 16.59 million which indicated an increase of 1.4% over 1987 population. The fisheries sector provides full-time employment to nearly 96 000 while those who find part-time employment aggregate to nearly 10 000. The people who benefit from direct employment in the fishery industry is about 5 000.

The Gross Domestic Product of Sri Lanka in 1988 was Rs 119 050 million compared to Rs 115 922 million in 1987 representing a growth of 2.7%. Per capita GNP as per latest estimates made in 1990, is U$416 with a GDP growth of 2.5%. While the current account deficit is U$520 million, foreign debt amounts to U$5.3 billion and inflation based on CPI is 11.6%. The fishing industry contributed 1.9% of the GDP in 1988 compared to 1.8% in 1987.

2. FISHERY RESOURCES

The fishery resources of Sri Lanka comprises marine and inland waters. The marine resources account for 80% of the fish production and the rest is from inland waters.

The marine waters are catagorised into coastal zone - up to 40 km -offshore - 40 km to 100 km - and deep sea beyond 100 km. The annual sustainable yield is estimated at 250 000 tons consisting of 170 000 tons of pelagic and 80 000 ton of demersal and semi-demersal fish. The coastal zone is in fact, over-exploited and hence account for nearly 80% of the total fish production. The recent exploratory surveys indicate a potential yield of around 7-9,000 tons of migratory pelagic fish from the off-shore and deep sea areas within the exclusive economic zone of Sri Lanka.

The continental shelf is generally rocky, particularly between Colombo and Batticaloa. However, sandy bottom occurs even in the rocky areas. The northern part, particularly the Palk Bay area, is predominantly muddy or muddy-sandy. From Puttalam to Colombo, the shelf has extensive trawlable bottom but the south-west part has a rough and uneven bottom. The Hambantota area has a limited trawlable bottom. In the east, there is smooth bottom only in the inshore area south of Trincomalee

but north of it the bottom is very suitable for trawling. The slope begins abruptly in most areas except in the Palk Bay, Gulf of Mannar and Pedro Bank areas. The shelf widens gradually south of Puttalam and narrows on the east coast.

Large pelagic fishes such as tunas, tuna-like fishes, king mackerels, bill fishes and pelagic sharks contribute about 30 000 t/annum to the annual total production. The exploitation of these species around Sri Lanka is presently linked to the area within and up to a little beyond the edge of the continental shelf. The tunas, bill fishes and pelagic sharks are primarily oceanic species and are predominant well beyond the continental shelf and only the tuna-like species such as eastern little tuna, frigate tuna, and king mackerels tend to be concentrated in the shelf area.

Considering the species composition in the production of large pelagics, a significant increase in production of these varieties may be possible only by extending the fishery beyond the presently exploited range, well into the offshore ranges of the EEZ. This may help to increase the production by at least 20 000 t - skipjack 15 000 t, yellowfin (young) 1 000 t, yellowfin and bigeye (old) 2 000 t, billfishes 500 t and others (mainly sharks) 1 500 t - provided the economic viability of the fishing operations can be established. One encouraging feature is that there is a declining trend in the tuna fishing effort by foreign nations such as Japan, Korea and Taiwan in this part of the Indian Ocean - due to economic reasons and the new legal regime of the oceans.

Other commercially important resources consist mainly of prawns, lobsters, crabs, squids, cuttlefish, sea-cucumber, oysters and chanks. There are about 33 species of prawns but only about eight of them (P. indicus, P. semisulcatus, P. monodon, P. merguiensis, P. stylifera, Metapenaeus spp.) contribute significantly to the resource. About 4 500 t is exploited at present but potential yield is unknown. The catch trends do not show possibilities of substantial increase in production. The main concentrations are in the mud banks of the Palk Bay area, between Colombo and Udappu, off Mullaitivu and in Batticaloa.

About five species of lobsters are present around Sri Lanka and they contribute about 200-600 t/annum. These are found in coral banks, sandstone, rocks and even mud banks up to 25 m depth. Sea cucumber (Beche-de-mer) is found primarily in the muddy bottom off the shores of the northwest coast of Sri Lanka (Palk Bay, Gulf of Mannar and Kalpitiya). The main species is Holothuria scabra found in the 6-20 m depth range. Production is estimated to be about 100-150 t/annum. There is no information on the potential yield.

Oysters consist of edible oysters, window-pane oysters and pearl oysters. Little is known about the production and potential of the first variety; the second variety contributed to an important industry in the past, the main resource being present in Tamblegam Bay (Trincomalee). The pearl oysters are abundant in the pearl banks off the NW coast and contributed to a major fishery until about 25 years ago. In 1958, 4.5 million pearl oysters were fished out from a stock of about 258 million oysters while in 1983, 20-30 000 osyters were collected by divers.

About 100 t of chanks are collected and exported annually from the Palk Bay area. Little is known about their potential yield. The main production of squids and cuttlefish comes from the prawn grounds as incidental catch. There is no major fishery for these species of which the present production is around 1 000 t/annum. Two crab species of commercial value exist and the present production is in the region of 1 500 t/annum.

About 215 demersal species belonging to 55 families are represented in the catches by a variety of fishing gear but only a few families are common or predominant (>10%) such as - Lethrinidae (emperor fishes), Lutjanidae (snappers), Carangidae (jacks and trevallys), Serranidae (groupers), Pomadasyidae (grunts/sweet lips), Leiognathidae (pony fishes), Acanthuridae (surgeon fishes) and the cartilaginous fishes - Carcharinidae (requiem sharks), Myliobatidae (eagle rays), Rhinobatidae (guitar fishes) and Dasyatidae (sting rays).

The inland fishery resources comprise fresh water and brackish water. The share of inland waters consists of 20% of the total fish production in Sri Lanka.

3. PRODUCTION

The fish production in Sri Lanka has been fluctuating in the eighties as indicated in Table 1 below:

Table 1: Fish Production during 1981 - 88

Year	Fish Production (tons)
1981	206 843
1982	216 933
1983	220 806
1984	169 347
1985	175 409
1986	183 056
1987	190 002
1988	197 536

Source: MOH, Sri Lanka

fishing is carried out by small crafts such as Orus and Vallams, in all areas. Long lining and trolling are used by large Orus and 28'-32' boats to catch pelagic species like seer, mackerel, tuna, marlin, shark, skipjack etc. Trawling for bottom fish, especially prawns is practised in the Gulf of Mannar, Chilaw, Negombo and Jaffna areas by 28'-32' boats and large Orus with sails. Beach seining is done in Hambantota, Amparai, Mullaitivu, Trincomalee, Mannar, Puttalam and Jaffna districts using flat bottomed crafts, Parus, Pathais and Vallams. The catch consists mainly of anchovies, sardines and mackerel. Other methods in use are stake net fishing in lagoons and cast nets and traps in shallow waters to catch crabs. Gill nets are used in almost all inland tanks.

4.2.1 Tuna fishing

The most commonly used gear in Sri Lanka for tuna fishing is the drift gillnet. Tuna fishing is becoming, however, more and more a multi gear fishery with long line, troll line and hand line.

Landing of tuna by gear	
Drift gillnets	65%
Trolling line	15%
Purse-seine	10%
Pole and line	0.5%
Long line	0.5%

Fishing boats employed in tuna fishing are mostly 3.5 ton wood/glass reinforced plastic hulls (11 ton, 11.5 m in length) and less important
5.5 m outboard engine boats.

4.2.2 Cephalopod fishing

Cephalopods are caught mostly by scoop nets followed by purse-seines and beach seines. Gear wise landing areas follows:

Landings of Cephalopods	
Scooping	50%
Purse seine	30%
Beach seine	20%

5. AQUACULTURE

The inland fishery resources of Sri Lanka compri<es 380 000 ha water bodies including 260 000 ha fresh water and 120 000 ha of brackish water. The annual yield from inland water bodies is around 32 000 m ton. Development of inland fishery has been given high priority by the government in view of its employment potential particularly in the rural areas. Hence production target has been estimated at 50 000 tons by 1994.

3.1 Tuna

Tuna fishery though quite an old practice, has picked up recently and forms a high share of the total fish caught in Sri Lankan waters. Tuna landings for the last six years are as given below:-

Table 4: Tuna landings 1983 - 1988 (MT)

	total fish landings	tuna landings	share of tuna
1983	220 806	34 405	15.58%
1984	169 347	24 096	14.23%
1985	175 409	25 132	14.33%
1986	183 056	25 847	14.12%
1987	190 002	26 745	14.08%
1988	197 536	27 787	14.07%

Source: MOH, Sri Lanka

3.2 Sea weeds

Gracilaria seaweed is mainly collected from Puttalam district and Trincomalee Bay. Most of the seaweed collected is exported to Japan to manufacture Agar. 150 tons of dried seaweed was exported in 1986 of which 70 tonnes from Puttalam lagoon and 80 tonnes from Trincomalee. Since then harvest has declined considerably due to political unrest. Bay of Bengal Programme started an experimental Gracilaria farming project in Puttalam District in early 1988. The project has a research component in cooperation with the National Aquatic Resources Agency (NARA) and an extension component carried out in collaboration with Sarvodaya Shramadama Sangamanya, a non-governmental organisation. Sarvodaya has set up a village farm plot in Kunjimatotam. Gracilaria is being cultured using the vegetative propagation technique. Progress at both sites has so far been slow, mainly due to political unrest.

4. FISHING FLEET AND GEARS

There are about 27 806 fishing crafts operating in Sri Lankan waters of which 13 000 or 46.6% are motorised. Traditional motorised crafts are 3 491. FRP boats fitted with out board motors number 7 896. Three and a half ton boats with inboard motors are 3 289 and the boats over 3 1/2 ton with inboard motor are 184.

Besides there are 12 946 traditional non-mechanised crafts also. The large majority of the fishing crafts are owned by individual fishermen while cooperatives also own and operate fishing crafts.

4.1 Crafts

The operating craft are of two categories, namely introduced and traditonal craft. The introduced craft comprise the following four types:

1. 19-21 ft. FRP non-mechanised boats.
2. 17-23 ft. FRP open boats powered mostly with 6-15 h.p. out-board motors. Their operational range is about 10-15 miles from the coast.
3. 28-32 ft. timber/FRP, decked boats powered with 30-40 h.p. in-board engines, which normally operate mostly within 25 miles from the coast but sometimes beyond.
4. 34-38 ft. FRP, drift netters which operate in offshore areas.

The traditional craft are all made of timber and consist of three types, namely:

The Log rafts (Theppams and Kattumarams). These craft essentially consist of three to five wooden logs lashed together and operate in the inshore waters and lagoons. They are propelled by oars, sails or outboard motors.

The Dugouts (Orus and Vallams). The dugouts with a superstructure are called the Orus or Thonies and those without superstructure are Vallams. These craft some of which have outriggers are also propelled by oars, sails or outboard motors and operate in inshore waters and lagoons.

The Flat Bottomed Craft (Parus and Pathais). These are beach seine craft. Parus are used in the West and South Coasts and Pathais in the North and East Coasts. Some large Vallams are also used in the East Coast for beach seine operations.

Approximately 4 200 non-mechanised 15'-18' canoes operate in inland tanks.

4.2 Fishing techniques

The major fishing technique in general involves is the use of nylon gill nets. Since these nets are selective, catch depends on mesh sizes. The non-mechanised traditional craft and the outboard mechanised 17 1/2'-23' boats generally use nets of mesh sizes below 3 1/2 inches while the 28-32 ft. boats use nets of mesh sizes between 3 1/2 inches and 6 inches.

Drift netting accounts for about 70% of the total fish production in the coastal fisheries. Pole and line fishing using live bait is a popular method of fishing along the South West Coast, Trincomalee and batticaloa areas and is used to catch skipjack by large Orus and 28'-32' boats. Hand line

fishing is carried out by small crafts such as Orus and Vallams, in all areas. Long lining and trolling are used by large Orus and 28'-32' boats to catch pelagic species like seer, mackerel, tuna, marlin, shark, skipjack etc. Trawling for bottom fish, especially prawns is practised in the Gulf of Mannar, Chilaw, Negombo and Jaffna areas by 28'-32' boats and large Orus with sails. Beach seining is done in Hambantota, Amparai, Mullaitivu, Trincomalee, Mannar, Puttalam and Jaffna districts using flat bottomed crafts, Parus, Pathais and Vallams. The catch consists mainly of anchovies, sardines and mackerel. Other methods in use are stake net fishing in lagoons and cast nets and traps in shallow waters to catch crabs. Gill nets are used in almost all inland tanks.

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Major aquaculture systems:-

5.1 **Pond Culture:**

Seasonal estate tanks range in size from 1/2 acre to 10 acres, which retain monsoon rain water for 6 to 8 months or even longer. This water is exausted with releasing for Agriculture during dry season. Ministry of Fisheries undertakes several programmes to effectively utilise these ponds for fish culture. During 1988, Rs 1 million was disbursed for construction of fish ponds and about 9 million fingerlings were stocked in 148 seasonal tanks of altogether 941 ha area.

A pond fish culture programme has also been introduced in the Mahaweli area. 20 ponds have already been established. Ornamental fishes are also being reared in some of the ponds.

5.2 **Large and medium tanks:**

Large and medium tanks account for 90% of the inland fish production. Indian carps have been systematically stocked in these ponds as per stocking programme of the Ministry. Fishermen are supplied with fibre glass boats and fishing nets - gill nets - with a view to increasing fish production from reservoirs.

5.3 **Reservoir Fisheries in the Mahaweli Area:**

Reservoirs in Mahaweli area are being stocked with suitable fish species like Indian carp. A fisheries station has been set up in this area to produce 2 million fingerlings per annum. Two more similar stations are proposed at Victoria and Pinbarehewa - reservoirs.

5.4 **Cage/Pen Culture:**

This system involves enclosing water areas with netting and raising fish in the enclosures after being stocked with fingerlings. An extension programme to disseminate the technology developed for cage/pen culture with different species to local fishermen is being carried out.

5.5 **Coastal Aquaculture:**

A pilot project conducted with assistance from the Bay of Bengal Programme for the development of coastal aquaculture was completed in 1987. The project was to disseminate suitable basic techniques of brackish water shrimp culture by demonstration and culture of shrimp in farms.

5.6 Development Plans For Aquaculture

- Expanding the area under brackish water prawn culture. There are 45 estuaries and 40 lagoons along the coast of Sri Lanka.

- Establishment of small farms of 1-5 ha will be promoted on a cluster basis, within the framework of the poverty alleviation programme. Larger farms will be approved only if such farms agreed to help smaller ones.

- Provision of better scientific and research services for prevention of diseases.

- Reducing the cost of prawn feed by developing cost efficient feed.

- Providing better quality seed in sufficient quantities.

- Construction of shrimp hatchery to produce 20 million marine shrimp post larvae per annum.

- A number of commercial scale farms have been in operation since 1985. There was an export of 750 tons of cultured shrimps in 1987. An area of about 3 000 acres has been alloted to the private sector companies for shrimp culture.

6. HANDLING AND PROCESSING

The boats operating in the coastal fishery make one-day fishing trips and do not carry ice on board. However mechanised boats carry ice, the quantity depending up on the duration of the operation and the type of fishery. Larger boats and multi-days boats carry even up to 80 x 50 kg blocks of ice on board.

Fish is not generally iced immediately on catch nor is ice used for fish consumed in the vicinity of landing centres. Fish transported over longer distances from producing areas to consuming areas is packed with ice in wooden boxes with capacity to hold 23 to 27 kgs. Icing is generally done twice initially at the time of loading for transport. Fish is rarely iced on arrival at consuming point.

Fish is mainly transported in insulated trucks. However refrigerated carriers are generally used by exporters for transport of shrimp.

Fish is sun dried with or without salt, on the beaches and in backyards often under poor hygienic conditions. Fish that are dried are mainly carane sharks, skates, rock fish and some

small species of the 'shore seine varieties'. The dried fish producing districts are Jaffna (63%) Puttalam (14%) Mannar (12%) and the East Coast districts (11%). Reduction of fish into fish oil is solely done by the Ceylon Fisheries Corporation and few private sector enterpreneuers.

Freezing is generally done for exportable items like shrimp, lobsters, squids etc.

Sea-cucumber is caught and processed into Beche-de-mer in Jaffna, Mannar and Puttalam districts. There is no local market for this product and is only exported.

7. MARKETING

Fish marketing in Sri Lanka is mainly handled by private traders. Government policy is not to put control on fish marketing activities of the private traders, though fisheries cooperatives are encouraged to undertake marketing of fish. Government has also established Ceylon Fish Marketing Corporation; in order to play a key role as price stabilizer for both producer and consumer. However the extent of influence on fish price by CFC is hardly any at present, because of the very low share of products handled by CFC. It is anticipated that the CFC will have a better impact in the coming years.

Currently the private traders (Mudalalis) play an important role. Many buy fish at the landing centres from fishermen who are obliged to sell under financial obligation. Purchases are also made at auction centres. The fish purchased is iced in wooden boxes and sent to consuming centres in open vans and lorries and also in trains. Fish is also sold by cycle vendors in the areas around landing centres. Fish meant for Colombo wholesale market is generally sent to the Commission Agents. The Agents retain 10% of the sales proceeds and balance given to the traders who then pay back to fishermen. The ratio between fishermen price and retail price varies with species and sales centres.

7.1 Export and Import

Sri Lanka is an exporter as well as importer of fish and fish products. The foreign trade in fisheries is quite insignificant - roughly 2% of the total foreign trade of Sri Lanka. However trade balance in this sector is negative as shown below:-

Table 5: Import/Export of fish and aquatic products (Rs million)

Year	Import	Export	Trade Balance
1985	756.17	453.60	-292.57
1986	838.99	608.58	-232.50
1987	956.58	576.21	-380.38
1988	1 137.02	825.00	-312.02

Source: MOH, Sri Lanka

Sri Lankan export that started with dried sharkfins has now diversified into many items like shrimp, lobster, cuttlefish, etc in frozen form apart from beche-de-mer, sharkfins etc in dried form. However shrimp constitute the lion's share with 54% in volume and 65% in value of exports. The export details of main fishery products are given below:

Table 6: Exports of fish and fishery products (MT)

Item	1984	1985	1986	1987	1988
Fresh fish (chilled frozen)	95	104	124	119	162
Prawns	2 609	1 648	1 973	1 271	1 826
Lobsters	100	64	139	168	223
Other crustaceans & molluscs	604	1 220	934	649	575
Shark fins & fish maws	34	26	34	50	45
Beche de mer	36	23	41	13	54
Shells	134	151	166	146	310
Others	102	4	-	-	-
Total	**3 714**	**3 240**	**3 411**	**2 416**	**3 195**
Value (mill. Rs.)	615.1	452.7	608.5	576.2	825

Source: MOH, Sri Lanka

Sri Lanka imports a substantial portion of fish for her domestic requirements. The bulk of fish imported is dried fish followed by canned fish, Maldive fish etc. Import details of different fish products are as below:-

Table 7: Sri Lankan imports of fish and fish products (Rs.'000s)

Item	1985	1986	1987	1988
Canned fish	244.37	209.42	189.69	191.82
Dried fish	453.05	550.87	660.28	832.90
Maldive fish	56.51	72.95	94.67	108.30
Others	2.24	5.75	11.94	4.00
Total	**756.17**	**838.99**	**956.58**	**1 137.02**

Source: MOH, Sri Lanka

7.1.1 Major markets

Japan is the traditional market for Sri Lankan frozen sea foods. USA and the Netherlands are the other major markets. Small quantities are exported to Singapore, Hong Kong and South Africa. Market wise details are given below:-

Table 8: Major markets for Sri Lankan fish/fishery products

Q = MT, V = Rs. Mn.

Country		1981	%	1982	%	1983	%	1984	%
Japan	Q	1 454	66	1 523	62	1 243	46	2 271	61
	V	254.5	73	235	53	224.3	51	424	69
USA	Q	210	9	346.2	10	527	19	486	13
	V	18.8	5	38.3	8	847	19	81	13
Netherlands									
	Q	319	11	461.5	13	231	8	109	3
	V	32.7	9	53.2	12	291	6	14	2

Source: MOH, Sri Lanka

7.2 Disposition of catch

A large part of the fish caught is consumed locally in wet form. Nearly 12-15% of the marine fish landings and 25% of the inland production are dried prior to sale. Over 60% of the fish caught is transported in wet form by road/rail. Though ice is used for preservation and transport, very little freezing is done for domestic sales.

Fish contributes over 65% of anim . protein consumed in the island.

The domestic fish consumption is expected to reach 329 376 MT by 1994. Though per capita fish consumption in Sri Lanka increased from 11.34 kg in 1978 to 15.75 kg in 1983 it has fallen to 14.61 kg in 1986.

Table 9: Dry fish production by varieties (MT)

Variety	1984	1985	1986	1987	1988
Seerfish	56	99	23	25	26
Trevally	213	379	125	137	144
Tunas	101	179	777	855	898
Shark/skate	359	639	177	195	205
Rock fish	666	1 185	1 776	1 954	2 052
Shore seine-varieties	3 335	5 933	4 051	4 456	4 678
Others	348	620	2 823	3 105	3 260
Total	5 078	9 034	9 752	10 727	11 263

Source: MOH. Sri Lanka

8. FISHERIES ADMINISTRATION

The subject of fisheries is under the charge of the Minister of Fisheries and Aquatic Resources who is assisted by a Deputy Minister. The main administrative and policymaking organization for fisheries in Sri Lanka is this Ministry. It was set up in 1970, and since 1978 it has been organised as an integrated ministry with several divisions. The functions of the Ministry are to promote the development of the fishing industry, regulate fisheries activities and look after the welfare of those engaged in fishing. The administrative head of the Ministry is the Secretary who is assisted by two Additional Secretaries. The Directors who head the divisions of the Ministry report either directly or through the Additional Secretaries to the Secretary. There are eight divisions: Planning and Programming, Development, Marine Fisheries, Welfare, Inland Fisheries, Training and Education, Finance and Administration. The former Coast Conservation division is now a department of the Ministry. The Ministry is guided in its activities by a Parliamentary Consultation Committee and a local Investment Advisory Committee. A statutory agency, the National Aquatic Resources Agency (NARA) and two state industrial corporations, the Ceylon Fisheries Corporation (CFC) and the Ceylon Fishery Harbours Corporation (CFHC), are agencies of the Ministry.

8.1 Research and development institutions

The National Aquatic Resources Agency (NARA) was established as a corporate body by an Act of Parliament in 1981. Its functions are to develop and manage renewable and non-renewable aquatic resources; to promote and coordinate research activities among institutions engaged in the exploitation and development of these resources; to undertake research studies related to resources development; to provide advisory services on scientific, technological and legal matters relating to the management and development of resources; and to provide training of personnel.

The structure of NARA comprises the National Aquatic Resources Management Council, the Governing Board, the Scientific and Technical Committee and the Secretariat of the Agency headed by a Director-General.

NARA is located at Crow Island, Colombo North, and has modern facilities for experimental processing and analysis of fish and fishery products, laboratory facilities for fisheries research and some experimental fishing vessels.

While the functions of NARA relate to areas besides fisheries, its present activities are concentrated mainly on fisheries

research and post-harvest fish technology. The fisheries activities include inter alia population studies of commercially important fish species, studies of the tuna and prawn fisheries, survey of pearl oyster beds, algal and seaweed surveys, investigation of the fisheries potential of lagoons, monitoring of the coastal fishery, experimentation and technology development in handling, processing, storage, transportation, packaging and retailing of fish, enforcement of quality control of fish products, and fishing boat and gear technology. The nucleus for the performance of these activities consists of two former Ministry divisions, the Research Division and the Fish Technology Institute which were transferred to NARA and now function within the framework of the latter.

8.2 Training Institutions

The Sri Lanka Fisheries Training Institute was established in 1975 with Japanese assistance to impart theoretical and practical training for the improvement and development of off-shore and deep-sea fishing techniques.

This institute is located at Crow Island, Colombo North. The facilities include lecture rooms, demonstration rooms with fishing gear, engines and other machinery, fish-finding and navigation equipment, hostel, transport vehicles, and several fishing vessels including a tuna longliner and a pole-and-line boat.

Four Fisheries Training Centres are in operation at Negombo, Tangalle, Batticaloa and Jaffna. The centre at Negombo was the first to be established with Japanese assistance in 1962. The others came into operation in 1973.

The centres are equipped with engines, fishing equipment and fishing boats of up to 10 m for demonstration purposes.

8.3 Ceylon Fisheries Corporation (CFC)

The CFC was established in 1964 under the State Industrial Corporations Act to assume the commercial activities carried out at the time by the Department of Fisheries and the Ceylon Cooperative Fish Sales Union.

The main purpose for which it was set up was to catch, purchase and sell fish. The original objectives also include fish processing, construction and operation of fishery harbours and associated shore facilities, import and sale of fishing gear, construction, repair and maintenance of fishing boats and general fisheries promotion. In 1972 the size and variety of operations was reduced by the transfer of functions

concerned with fishery harbours to a new corporation Ceylon Fishery Harbours Corporation - (CFHC). Since 1977 the CFC 's fishing operations have been considerably curtailed. More recently, its boat-building activities were transferred to the Cey-Nor Development Foundation. In 1980, a considerable retrenchment of the excess staff with which the CFC had been burdened for many years was effected. Another important measure taken in 1980 was the decentralization of operations by the establishment of 10 profit centres, which operate as autonomous units with a portion of the profit shared among employees.

The operational centre for the CFC is the Mutwal Fishery Harbour. The shore facilities at Mutwal are being currently refurbished to provide cold storage of 800 t. freezing capacity of 25 t and a 10 t block ice plant. Shore facilities outside the Mutwal harbour consist of four cold storages with a total capacity of 255 t at Pesalai, Batticaloa, Colombo, and Kandy and six ice plants with a total capacity of 45 t/day at Wennappuwa, Pesalai, Ratnapura, Anuradhapura, Hambantota and Jaffna.

The fishing activities of the CFC are limited to the operation of two trawlers, some 34' drifnetter/longliners, and a number of 28' boats, on a catch share basis. The 34' and 28' boats are operated through the regional set-up.

The CFC operates two wholesale markets at Colombo and Kandy, ten retail stalls in various parts of Colombo and thirty retail sales points in the outstations. There is a fleet of 107 transport vehicles of which 44 are insulated trucks and 13 are refrigerated trucks.

8.4 Ceylon Fishery Harbours Corporation (CFHC)

The CFHC was established in 1972 under the State Industrial Corporations Act to take over part of the activities of the CFC. The tasks assigned to the CFHC are the establishment, construction, maintenance, operation and management of fishery harbours, anchorages and shore facilities and the provision of repair and maintenance facilities for fishing craft.

The CFHC is responsible for the operation of six fishery harbours, viz. Galle, Trincomalee, Beruwala, Tangalle, Mirissa and Myliddy. Three additional harbours are being constructed at Mannar, Wennappuwa and Valachchenai. The CFHC is also responsible for six anchorages of Negombo, Chilaw, Kalmunia, Sagarapura, Kalpitiya and Hambantota - some shore facilities are also provided at the first three anchorages. At Chilaw it operates a boat-building yard with annual capacities of 150 and 50 respectively for 18' and 28' FRP boats.

8.5 Fisheries Cooperative Societies

The first fishery cooperative was registered in 1941 as a result of the recommendations of a commission appointed by the Government in 1938 to inquire into the fishing industry. A decision to channel loans, given to fishermen as part of the fish marketing scheme operated by the Department of Fisheries between 1942 and 1948, as far as possible through cooperatives, gave an impetus to their formation.

The role of fishery cooperatives was reviewed in 1970 and was re-defined as being the organization of fishermen for improvement of the efficiency of the small-scale sector of the industry in the catching, handling and marketing of fish. Between 1970 and 1973, under a scheme of reorganization, 292 small primary societies were amalgamated into 45 large primaries. The membership of primary fishery cooperatives in 1982 was 24 904 or about 34% of the total number of fishermen.

There are three regional unions, the Northern Province Fishermen's Cooperative Societies Union (NPFCSU), the South-Western Fishermen's Cooperative Union, the Southern Regional Fisheries Cooperative Union and an apex organization, the Ceylon Cooperative Fish Sales Union (CCFSU).

The Cooperatives' main source of finance is the Government which channels funds to them through the Ministry of Fisheries for purchase of motorized boats, outboard motors, fishing gear, repairs, construction and purchase of indigenous craft. Credit is also provided by the People's Bank and Bank of Ceylon for fishing gear and engine spare parts.

The present credit policies, in terms of which individual fishermen are eligible to obtain the benefit of credit from the state banks and government subsidies irrespective of membership in cooperatives, have vitiated the role of the cooperatives, and their importance within the industry is much less than it appears to be from the membership figures on the rolls.

9. GOVERNMENT POLICY

The overall economic and financial policy of the government is designed to create a liberal economic environment and to guide the economy towards a course of rapid and self-sustaining growth by dismantling administrative controls and encouraging private enterprise. The development objectives are: acceleration of the growth rate; expansion of employment; rehabilitation and expansion of the capital stock; and a progressive improvement in the balance of payments.

High priority has been accorded to fisheries development by the government in view of the industry's contribution to food production and nutrition, its employment potential, its potential as a valuable foreign exchange earner through export of fish and fishery products, and its socio-political significance due to an influential segment of the population of some 45 coastal electorates being in some way connected with the fishing industry.

The priority given to fisheries development is reflected in the progressively increasing budgetary resources made available each year for fishery development.

Fisheries policy is designed to achieve the objectives of increasing fish production; raising per capita consumption; raising the income and living standards of the fishermen; and maximising employment opportunities in the fisheries sector. Key elements of the fisheris policy are: assignment of the predominant role in fishing operations, manufacture and supply of fishing vessles, engines and other inputs to the private sector; limitation of state-sector intervention to provision of infrastructure, institutional support and incentives for investment including tax concessions, subsidies and concessionary bank financing; development of the coastal fishery through the efforts of small-scale fishermen; development of offshore fisheries through local companies or individuals and with foreign collaboration; promotion of the deep-sea fishery through joint ventures or similar arrangements; and the according of high priority to the development of inland fisheries.

9.1 Incentives

The subsidies and bank credit available for purchase of fishing craft, engines and fishing gear are as shown below:-

Subsidies for Purchase of Fishing Craft, Engines and Fishing Gear

Scheme	Type of craft/engine	Subsidies (per cent of total costs)
1. Outright purchase scheme	17-23 ft FRP boats	35[1]
	28-32 ft boats	35[1]
	32-40 ft boats	35[3]
	Inboard engines	50
	Outboard motors	50
	Non-mechanised craft	90[2]

Scheme	Type of craft/engine	Subsidies (per cent of total costs)
2. Cooperative scheme	17-23 ft boats	50[1]
	28-32 ft boats	50[1]
	Non-mechanised craft	90[2]
3. Sail subsidy	All craft	70[4]
4. Self-employment bank finance scheme	17-23 ft boats	35[1]
	28-32 ft boats	35[1]

1 On total costs of hull, engine and fishing gear.
2 On total costs of hull and fishing gear.
3 On total costs of hull and engine only.
4 On costs of sails only.

The subsidies provided to promote the development of inland fisheries is shown below:-

Subsidies for Inland Fishermen and Fish Farmers

Nature of subsidized activitiy	Rate of subsidy
1. Construction of new ponds Improvements to existing ponds. Erection of ancillary structures. Purchase of equipment Purchase of seed, feed, fertilizer	50% of the total cost, subject to maxima based on the extent of the pond, ranging from Rs. 2 000 for an extent for 1/16 acre to Rs. 10 000 for an extent of 2 acres.
2. Purchase of boat and fishing gear for use in inland fishing.	90% of the total cost.

The other incentives and concessions provided for investors in the fisheries sector include the standard benefits in such other sectors like tax holiday, income tax exemption, investment relief, customs duty exemption or reduction and so forth.

9.2 Foreign investment

In line with the Sri Lankan Government's policy of fostering the development of fisheries industries, three investment project proposals for which foreign collaboration is sought and were formulated in 1990 by the local company Sri Lanka Business Development Centre (all based on pre-feasibility studies carried out with the assistance of an international consultant):

- production and export of ornamental fish guppies, swordtails, etc;
- breeding of fresh water prawns for export;
- mariculture of shrimp for export.

All these projects were developed within the UNDP/UNIDO integrated foreign investment promotional programme for Sri Lanka and are being promoted through the UNIDO network. They will also be negotiated with potential foreign partners during the Sri Lanka Investment Forum, which is to be convened in 1991 in Colombo.

10. CONCLUSION

The Fisheries and Aquatic Resources Ministry has launched a National Fisheries Development Plan to cover the five year period from 1990 to 1994. The major objectives are (1) To increase fish production in order to increase the nutritional status of the people. (2) To promote the rational and optimum exploitation of Sri Lanka's fisheries. (3) To support the national programme for poverty alleviation by increasing the income and living standards of all those dependent on fisheries and fishery related activities. (4) To increase employment opportunities through fishery related activities and finally, to increase foreign exchange earnings by a stronger export thrust.

With the effective implementation of the development plan coupled with the end of political problems in the island, Fishery sector of Sri Lanka looks poised for a bigger growth!

THAILAND

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1. INTRODUCTION

Bordered by the Gulf of Thailand to the East/South-East and the Andaman Sea on the West/South-West, Thailand which is predominantly an agricultural State is traditionally a fishing nation. With a total land area of some 542,000 km^2, Thailand coastline of 2,600 km includes 1,850 km along the gulf of Thailand and 750 km of Andaman Sea-coast. The area of the continental shelf up to 200m depth is estimated at 305,000 km^2. The present production from aquatic sources that reached 2.8 million tons in 1988 places Thailand fishing industry in the fifth position in Asia after Japan, China, India and the Republic of Korea in that order.

Thai population as estimated in February 1990 is 56 million and is projected to grow at an average annual rate of 1.5% during 1987 - 2000. Out of the total labour force of 29.17 million in 1987, agricultural sector including fisheries accounted for 17.54 million or 60% of the total. With an impressive GDP growth rate at 11.0%, per capita GNP is US$ 1,194. Current account deficit is US$ 2,200 million and foreign debt is US$ 27.3 billion. Inflation rate is 5.8% over the consumer price index (February 1990 estimates). During the period 1960 to 1977, the Thai fishery sector showed an average growth rate of 15% per annum. However, from 1978 - 87 it came down to 2.7%. Though the share of contribution by fisheries to the national income had reached 3.2% of the GNP by 1977, the percentage has been gradually falling during the subsequent years reaching 1.32% by 1987. Nevertheless, exports of marine products have continued to be one of the largest foreign exchange earners to the national exchequer. During the five year period from 1982 to 1987, the value of exports have more than doubled from US$ 516.8 million in 1982 to US$ 1.27 billion in 1987 and about US$ 1.6 billion in 1988.

2. FISHERY RESOURCES

Thai fishery resources comprise marine fisheries and inland fisheries, each in turn further divided into capture and culture fisheries. Nearly 93% of the total fishery production is from marine fisheries. The importance of the inland sector can be attributed mainly to the aquaculture potential in fresh and brackish water areas.

2.1 Marine resources

The Department of Fisheries has estimated the total Maximum Sustainable Yield (MSY) from the Thai Exclusive Economic Zone at 1.5 million MT. This includes 910,000 MT for the gulf of Thailand, of which about 770,000 MT are demersal and 140,000 MT pelagic species. Annual fish production from Thailand waters has been more or less equal to the MSY for several years now, with the resultant fall in production of commercial species.

Marine fishery resources consist of some 850 species of fish and shellfish of which nearly fifty are of commercial importance, that include pelagic and demersal species. Some of the dominant species of pelagic fishes are Indo-pacific mackerel (Rastrelliger brachysoma), Indian mackerel (R. kanagurta), Scad (Decapterus spp.), Spanish mackerel (Scomberomorus commersoni), Little Tunny (Euthynnus spp.) Sardine (Sardinella gibbosa), Anchovy (Stolephorus heterolobus) and Carangids (Selar crumenophthalmus, Selaroides leptolepis).

As for the demersal fishes, the more common species are of 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.)

Among the crustaceans and molluscs, Penaeus merguiensis, P. monodon, P. semisulcatus and P. latisulcatus as well as, Metapenaeus spp. are of commercial and export value. Similarly squids, cuttlefish, octopus, and a wide range of bivalves are produced in considerable quantities from capture fisheries with some of the bivalves also from culture. Spring lobster and crabs are also of commercial importance.

While the squid species landed include Loligo and Sepioteuthis spp., the important cuttlefish species are Sepia and Sepielle spp. The major bivalve species are green mussel (Mytilus viridis), horse mussel (Musculus senhausenil), cockle (Arca granulosa), baby clam (Paphia undulata), hard clam (Meretrix meretrix) and oysters (Crassostrea commercialis, C. beleheri, C. buguleris). Three species of economically important crabs are, swimming crab (Portunus pelagicus), musk crab (Charybdis cruciata) and mud crab (Scylla serrata).

2.2 Inland resources

The inland fishery resources consist of a large number of rivers, flood-plains, reservoirs, man-made lakes, natural lakes, swamps, and irrigated rice fields.

The combined length of major rivers of Thailand comes to 20,000 km whereas the areas of rivers and canals is 119,200 ha. Altogether some 1.8 million ha of flood plains and 255,000 ha of reservoirs is available for inland fish culture. The total waterspread area of natural lakes is estimated at around 300,000 ha. In addition to these, freshwater ponds of 6,000 ha, brackishwater area of 30,792 ha and 3.1 million ha of paddy field are also suitable for fish culture. There are some 27 species of commercially important freshwater fishes common in Thailand. Of these, carps such as common carp (Cyprinus carpio), Thai silver carp (Puntius gonionotus), Silver carp (Hypophthalmichthys sp.), small scale mud-carp (Cirrhina microlepis), Tilapia (Oreochromis niloticus) and freshwater shrimp (Macrobrachium rosenbergii) are some of the popular species.

Though the total production from freshwater fish culture has almost doubled during the six year period from 1982 to 1987, production from inland capture fisheries has not shown any growth during the same period, with a slight decline in 1987 as against the figure for 1982. This might point to the limitations in further increase from inland capture fishery resources.

3. PRODUCTION

The total fish production in Thailand from capture and culture sources increased from 213,000 MT in 1960 to 2.2 million MT in 1977 recording an annual growth rate of 15%. Thereafter, however the production from marine capture fisheries experienced a gradual decline thereby the total production reaching 1.8 million MT in 1980. This was mainly due to a combination of factors such as the hike in fuel cost, loss of traditional fishing grounds resulting from the declaration of the 200 nautical mile EEZ by the neighbouring countries and the depletion of resources in the gulf of Thailand. It has been estimated that with the introduction of the EEZ by the neighbouring countries, Thai fishermen lost around 300,000 sq km of traditional fishing grounds, corresponding to between 400,000 to 600,000 MT of fish annually. This shortfall has been partly made up by the extension of aquaculture areas especially for shrimps, that has led to substantial increase in production from a little more than 10,000 MT in 1978 to nearly 62,000 MT in 1987. The production somewhat regained its previous peak of 2 million level by 1982 thereafter steadily increasing to the all-time record level of 2.78 million MT in 1987. (Table 1)

Table 1

Total Fishery Production 1967 - 87

Year	Total	% annual growth	Freshwater	Marine
1967	847 443	17.7	85 225	762 188
1968	1 089 303	28.5	85 245	1 004 058
1969	1 270 034	16.6	90 439	1 179 595
1970	1 448 404	14.0	112 714	1 335 690
1971	1 587 077	9.6	116 788	1 470 289
1972	1 679 540	5.8	131 383	1 543 157
1973	1 678 901	-0.04	140 865	1 538 016
1974	1 510 466	-10.03	158 876	1 351 590
1975	1 555 300	2.97	160 692	1 394 608
1976	1 699 086	9.2	147 294	1 551 792
1977	2 189 907	28.9	122 374	2 067 533
1978	2 099 281	-4.1	141 496	1 957 785
1979	1 946 334	-7.3	133 176	1 813 158
1980	1 792 948	-7.9	144 995	1 647 953
1981	1 989 025	10.9	164 581	1 824 444
1982	2 120 133	6.6	133 562	1 986 571
1983	2 255 433	6.4	155 447	2 099 986
1984	2 134 838	-5.3	161 819	1 973 019
1985	2 225 204	4.2	167 453	2 057 751
1986	2 539 967	14.1	1087 763	2 352 204
1987	2 777 071	9.4	177 142	2 601 921

Average annual rate of growth 1967-87 = 7.15%
Average annual rate of growth 1978-87 = 2.7%
Source: Directorate of Fisheries, Thailand.

The increase in production in the recent years has been mainly on account of aquaculture production, marine landings and production of bivalve molluscs as well as freshwater shrimps. (Table 2)

Table 2

Fisheries Production by Sub-Sectors (1978-87) in MT

Year	Total	Marine			Inland (Freshwater)		
		Sub-total	Capture	Culture	Sub-total	Capture	Culture
1978	2,099,281	1,957,785	1,947,734	10,051	141,496	102,129	39,367
1979	1,946,334	1,813,158	1,802,300	10,858	133,176	103,714	29,462
1980	1,792,948	1,647,953	1,587,860	60,093	144,995	110,490	34,505
1981	1,989,025	1,824,444	1,756,904	67,540	164,581	116,468	48,113
1982	2,120,133	1,986,571	1,949,681	36,890	133,562	87,733	45,829
1983	2,255,433	2,099,986	2,055,225	44,761	155,447	108,481	46,966
1984	2,134,838	1,973,019	1,911,485	61,534	161,819	111,409	50,410
1985	2,225,204	2,057,751	1,997,165	60,586	167,453	92,199	75,254
1986	2,539,967	2,352,204	2,313,110	39,092	187,763	98,438	89,325
1987	2,779,071	2,601,929	2,540,052	61,877	177,142	87,360	89,782

Source: Directorate of Fisheries, Thailand

3 Marine fish landings

There has been a marked increase in marine fish landings during the past five years from 1983 to 1987. Both the quantity and value of catches have increased by 23.9% and 51.5% respectively as seen from Table 3 below:

Table 3

Quantity and Value of Main Species Groups Landed from 1983 - 1987

Q = Quantity in MT
V = Value in Million Baht

Species Group	1983		1984		1985		1986		1987	
	Q	V	Q	V	Q	V	Q	V	Q	V
Pelagic fish	512,603	3,900	572,639	4,182	588,104	4,234	570,081	4,968	629,589	5,359
Demersal fishes	90,110	2,722	88,526	2,742	97,478	3,852	131,545	1,181	152,726	1,458
Shrimp/prawns	160,981	4,855	137,336	4,236	127,643	4,624	141,174	5,189	151,636	7,612
Crabs	28,563	546	27,046	613	26,829	675	35,606	906	40,401	996
Squids & Cuttlefish	132,044	2,687	129,269	2,277	116,035	2,457	134,915	3,344	132,538	3,689
Other molluscs	115,582	385	153,395	394	183,523	582	164,323	454	217,785	934
Others (Jellyfish, Seaweeds, Sea-Cucumbers,etc)	180,968	66	11,693	8	33,282	..	77,256	42	42,172	25
TOTAL	2,099,986	15,236	1,973,019	14,541	2,057,751	15,651	2,352,204	18,883	2,601,929	23,083

Source: Directorate of Fisheries, Thailand

While shrimps/prawns group account for less than 6% of the total landings in quantity, value-wise it represents nearly 33% of the total. Next in order of prominence is pelagic fish group followed by squids and cuttlefish.

Though large tunas are not normally caught in Thailand waters, little tunas and tuna like species such as king mackerel (Scomberomorus commersoni), spotted tunny (Euthynnus spp.) and bonito (Sarda spp.) are landed in substantial quantities as seen from Table 4 below:

Table 4

Landings of Major Species of Tuna and Tuna Like Fishes, Shrimps and Cephalopod 1983-87. (Quantity in MT)

Species	1983	1984	1985	1986	1987
Tunas and Tuna like fishes					
King mackerel	9,297	10,364	11,724	14,770	15,502
Spotted tunny	53,805	44,378	48,000	48,299	65,911
Bonito	32,015	32,460	38,881	45,473	36,708
Sub total	95,117	87,202	98,605	108,542	118,121
Shrimps/Prawns					
Banana shrimp	18,055	19,872	19,132	19,722	19,060
Jumbo tiger prawn	596	522	463	1,179	10,839
Tiger shrimp	1,670	1,449	1,293	1,175	1,079
King prawn	1,852	1,541	1,375	1,694	1,763
School prawn	15,158	13,538	13,985	13,465	14,145
Other shrimp	102,803	80,479	71,224	82,878	82,783
Sergestid shrimps	21,153	18,810	18,818	19,359	20,055
Flathead Lobster	529	779	1,014	958	1,337
Mantis shrimp	165	346	339	444	467
Macrobracium	-	-	-	300	108
Sub total	161,981	137,336	127,643	141,174	151,636
Cephalopods					
Squids	76,489	66,340	63,996	71,344	75,420
Cuttlefishes	47,319	56,352	42,814	51,625	45,695
Octopuses	8,236	6,549	9,225	11,946	11,423
Others	-	28	-	-	-
Sub total	132,044	129,269	116,035	134,915	132,538
Grand Total	389,142	353,807	342,283	384,631	402,295

Source: Directorate of Fisheries, Thailand.

3.2 Inland fish production

Marine freshwater species landed from capture and culture sources are Tilapia, Gourami, Snakehead, Catfish, Eels, local carps, common carps, freshwater shrimps, etc. Altogether these species accounted for 177,142 tonnes of production from inland sources during 1987. Compared to the figure for 1978 at 141,496 this represents an increase of 25% during the previous ten years. However, when the capture fishery production alone is considered there has in fact been a fall to the extend of 14% from 102,129 tonnes in 1978 to 89,782 tonnes in 1987. Culture production on the other hand has shown marked increase during this period rising from 39,367 tonnes in 1978 to 89,782 tonnes in 1987.

Species-wise production from inland fisheries in 1987 is given in table 5 below.

Table 5

Species	Quantity landed (MT)
Snake head	19,561
Catfish	33,328
Tilapia	27,347
Gourami	20,189
Local carp	16,894
Climbing perch	7,432
Common carp	6,360
Swamp eel	6,443
Macrobrachium	13,023
Other shrimps	1,966
Others	24,599
Total	177,142

Source: Directorate of Fisheries, Thailand

4. FISHING FLEET AND GEAR

The total number of fishing boats in operation as per 1985 data is 53,440 including non-powered and powered vessels. There are 8,302 non-powered boats against 45,138 powered. Among the powered boats, 28,233 are provided with out-board engines while 16,905 have in-board engines. In other words, nearly 53% of the total fishing boats have out-board engines, 32% in-board engines and 16% are non-powered.

Almost half of the landings are from industrial trawl fishery while 25% of the total catch is by purse seiners. Other methods of fishing include gill nets, push nets, stake nets, cast nets, scoop nets and so forth.

In terms of fish species caught, out of 610,056 tonnes landed by purse seiners, 13% or 82,280 tonnes were tuna like species namely spotted tunny of which another 10,000 tonnes were also caught by gill nets. Similarly, 58% of the total landings of shrimp at 151,636 tonnes was caught by trawls that too almost entirely by otter trawls. As for cephalopods including squids and cuttlefishes, nearly 54% of the total catch of 132,538 tonnes was landed by otter trawls followed by squid cast nets, purse seines and push nets.

5. AQUACULTURE

Total fish production from aquaculture has been steadily increasing during the past decade. While production from inland and marine culture sources put together in 1978 was only about 2.3%, the corresponding share in 1987 has more than doubled at 5.5%.

Apart from brackishwater shrimp culture and large-scale mariculture of bivalve molluscs, the production systems and practices include paddy-field culture, cage and net-pen culture as well as integrated fish farming with animal husbandry, poultry and horticulture.

There are some 3.1 million ha of rice paddies involved in fish culture. Further about 300 tons of carps and large quantity of catfish including Heteropneustes spp; Clarias spp. as well as Climbing perch Anabas spp. are also cultured in cages and net-pen enclosures.

Sea farming or mariculture is quite popular mainly producing some 113,000 tonnes of bivalve molluscs including blood cockles, green mussels, oysters and horse mussels.

5.1 Shrimp culture

Thailand has made remarkable progress in enhancing production from shrimp culture during the past few years. All the three methods of culture namely extensive, semi-intensive and intensive are adopted in the country. Rate of production per annum is 100-300 kg/ha for extensive, 1,000 - 3,000 kg/ha for semi-intensive and 4,000 to 6,000 kg/ha that goes even up to 15 to 25 MT/ha for intensive culture. Total production from shrimp culture is estimated at 90,000 MT (live weight) from an area of 80,000 ha at an average rate of 1.125 tonnes/ha production. New farms in the Northern Thailand adopt mostly semi-intensive and intensive method using P. monodon while the vast majority of traditional farms continue with the extensive system involving P.monodon, P. merguiensis and others.

The problem of seed production is being solved by the development of back-yard hatcheries of which there are more than two thousand at present, mostly established with Taiwanese assistance. Both freshwater prawn and marine shrimp seeds are thus produced. In 1984, as per reports, 17 million P. monodon post-larvae were produced by Government operated shrimp hatcheries while the estimated demand at that time was

180 million. As such, 98% of the shrimp farmers had to depend upon wild stock for culture. However, the situation has changed considerably with the advent of new technology, ideal growing conditions and readily available capital. Apart from in-country capital, considerable influx of capital and expertise has been forthcoming from Taiwan, Japan, HongKong, Europe and the U.S.

There are presently some 10 fully integrated shrimp farms consisting of hatcheries, growing ponds and processing facilities in operation in the country. Most of such processing companies rely on small scale farmers for part of their raw material requirements. In return, the suppliers are provided with services such as extension, disease control, feed supply etc.

The way in which shrimp farming in Thailand has recovered from the shocks of the devastating flood and rain in November 1988 together with the collapse of shrimp export market in Spring of 1989 is quite remarkable. The timely assistance from the Government including the relaxation on import of shrimp feed has been of much help in this regard.

The 6th National Economic and Social Development Plan for October 1986 to September 1991 has included a shrimp farming development project costing U$ 84 million. Investments are earmarked to upgrade the existing Government owned hatcheries as well as to build five more Government owned hatcheries each with a capacity of 30 million shrimp fry/year.

Credits for similar activities including developing shrimp farms will also be extended through the public sector Bank for Agriculture and Agricultural Cooperatives, for the private sector. Altogether 15 privately owned shrimp hatcheries with a collective total capacity of 270 million shrimp fry a year are to be specifically benefitted through this credit line.

6. HANDLING AND PROCESSING

Though the hygienic standards of the fish processing premises have been improving lately with the growth in exports, the fish handling methods are still not up to international standards, leading to frequent rejections and lower prices in export markets.

With very little use of ice except for prime varieties like shrimp, tuna and cephalopods the quality of the raw material is already deteriorated when received at the processing plants. The handling practices vary considerably depending on the size and kind of fishing vessels as well as the fish caught. The quality of the by-catch that comes to more than 40% of the total fish production, is generally poor due to lack of preservation facilities as well as inadequate ice and storage facility on board.

Fishing vessels used for catching small pelagic species through purse seining and light attraction devices are generally small to medium size ranging from 12-15 m to 16-19 m, made of wood and with an average crew of 20. Fishing trip lasts from same day trip to 4-6 days voyage, depending on the season and distance from home ports. Crushed ice is carried by these vessels and fish are normally bulk iced.

The fish-holds have capacity ranging from 2 - 4 cubic mts and are insulated; but with no drainage systems. Refrigerated fish holds are provided in bigger size boats of 20 m and above. Boats whose catch is destined for producing fish sauce and/or salted dried products carry salt instead of ice as preservative. Icing is generally done without sorting the varieties, at a ratio of fish to ice around 3-4:1.

Though small pelagic species caught nearer to the landing sites are of better quality, a large part of marine fish landed is unfit for human consumption due to improper handling and storage on-board, in the hot and humid tropical weather. Quality deterioration is also enhanced due to the practice of using polluted water from the harbour for washing the catch. Some of the fishing docks have no roof to protect the products from rain or sunshine. Rattan or bamboo baskets are commonly used by traditional vessels to transport fish from the landing site to the market mostly without ice.

Mackerels and other prime fishes are handled more scientifically by sorting, icing and boxing. But sardines used for canning are bulk-iced and transported some 800-1,000 km to canneries in open uninsulated trucks covered by canvas. Sardine and/other raw material used for fish meal are not iced at all.

6.1 Processing sector

Both traditional and modern fish processing activities are common in Thailand. The core of the industry is freezing and canning of shrimps and tuna respectively - that has been steadily growing over the years. But, at the same time, the traditional products like fish sauce, salted fish, dried shrimp, dried squids, dried mussels, steamed fish, smoked fish and 'Budu Sauce' have been showing a declining trend lately as seen from the table below :

Table 6

No. of fishery industry facilities 1983 - 1987

Type of activity/ production	1983	1984	1985	1986	1987
Ice-plant	151	155	153	160	166
Cold-storage	47	78	80	84	80
Canned fish	26	38	39	41	41
Fish sauce	110	113	114	111	110
Fish meal	98	95	92	93	95
Salted fish	759	800	978	943	671
Dried shrimp	276	284	148	165	176
Dried squids	854	865	879	828	711
Dried mussel	1,493	776	674	613	580
Steamed fish	142	138	115	94	78
Smoked fish	184	184	171	180	86
Fish-Shrimp Crackers	72	78	76	107	65
Fish ball	52	64	54	69	79
Budu sauce	37	37	33	30	23
Total units	4,301	3,705	3,606	3,518	2,961

Source: Directorate of Fisheries, Thailand

6.2 Freezing and Cold Storage

One eighth of the entire marine fish landings are diverted for freezing (1987) in Thailand. Shrimps, and other crustaceans, cephalopods like squids and cuttlefish and some prime quality fin fish are frozen for export markets. In accordance with the growth in exports, the facilities for freezing and storage have also shown an increasing trend. As against 44 freezing plants authorised to process and export seafood in the beginning of the eighties, presently (1990) there are some 50 processing plants in operation. Similarly the number of ice plants has gone up from 151 in 1983 to 166 in 1987 and cold storage from 47 in 1983 to 80 in 1987 (Table 6). Total cold storage capacity is estimated at 400,000 MT. Of the processing plants 15 to 20 plants have a turnover in excess of US$ 15 million per annum among themselves accounting for up to 70% of the industry's total export earnings. Though many of the processing facilities are of very high technical standards, some others are still lacking in good manufacturing practices.

A noteworthy feature of Thai fish processing and freezing industry is that most of the firms involved have several sister companies engaged in allied activities like refrigerated transport, ice-making plants and deep-sea fishing fleets. As such, they are in a way, vertically integrated production units.

6.3 Canning

Canning is an area that showed unprecedented growth in Thailand during the past decade. While the total number of canneries was 26 for all fishery products in 1983, there are at present 41 canneries out of which 17 are tuna canning factories. The two top canneries are Unicord and Thai Union each with 300 MT/day installed capacity. Kingfisher Holdings and Thai Union Manufacturing are the other two major canneries apart from 13 smaller scale operators. The main product form is tuna in brine for the U.S. market and dressed and in oil for European market.

While 70-80% of the raw material needed for tuna canning is imported from abroad, nearly 12.5% of the total marine fish landing in 1987 was used for canning. The major species used for canning are Indo-pacific mackerel (7.4%) shrimps (25%), Sea crabs (83.9%), Shellfishes (13.7%), Squid and Cuttlefish (2.8%) and other food fishes (28.4%) with the percentage of total landings used for canning in brackets.

Thailand has an established reputation and longer experience in tuna canning compared to her neighbour Indonesia. Nevertheless, the Thai industry is carefully watching Indonesian development in this area together with that Government's policies. This is mainly due to the competition resulting from the expansion of Indonesian tuna canning as a vertically integrated industry. This is unlike in Thailand where the major share of raw material has to be imported from several sources - including Indonesia till recently when they banned such exports of raw material to encourage processing in Indonesia.

6.4 Fish sauce

Fish sauce locally called "nam pla" is a traditional product of consumer interest in several South-East Asian countries. There were 110 fish sauce producing units in the country that utilized 2.65% of the total marine fish landings and 0.1% of the freshwater fish production during 1987. Of its production nearly 10,000 MT valued at 166.6 million Baht was exported in that year. Just five years before, in 1982, there was only 96 units in operation exporting 7,534 MT, against 1003 MT in 1973 emphasizing the growth in this cottage industry.

Anchovies, sardines and mackerels are the main raw material used for the preparation of "nam pla". However, anchovies are preferred due to its yielding a better quality product.

6.5 Other Products

There are a wide range of products both traditional and modern including the value added shrimp and cephalopod products and fish sausages gaining importance in Thailand. At the same time some of the traditional items like dried, salted and smoked products that are labour intensive have been losing ground lately. Four to five years ago, some 11% of marine landings and 22% of freshwater fish production were processed into dried,

salted or smoked fishery products. However, as per data for 1987 the corresponding percentage has fallen to 7% and 9.5% respectively. As seen from Table 6 the number of units engaged in the production of such items has also been falling gradually.

As labour intensive industries that require very little capital investment, the preservation of Thai traditional fish processing industry has an important social role in rural upliftment. Additionally, several products so produced are also exported in substantial quantities. In 1987, export of salted and dried fish, shrimp and squid were worth 232-, 984-, and, 1,401 million Baht respectively that put together accounts for 8.1 of the total export value.

Fish meal production in Thailand is based on the 100% utilization of her trash fish landings. However, against 98 fish meal plants in 1983 there are as per 1987 data only 95 plants in operation. There were only 93 plants in operation in 1986, when the combined production of fishmeal reached more than 450,000 MT of which 73,900 tonnes was exported. The trend is again one of growth. This seems to be an offshoot of the increasing demand for fish feed in the country due to the expanding aquaculture activities. However, the quality of Thai fishmeal is not very good from the low protein content and high sand content.

6.6 Quality Control

A number of Government agencies like the Agriculture Department, Fisheries Department, Public Health Department and its Food and Drug Administration, Industry Ministry, Commerce Ministry and a wide range of institutions under these ministries are involved in enforcing quality control standards. Nevertheless fish inspection and quality control activities are not up to international standards or commensurate with the growth of the seafood industry in Thailand.

The Fishery Technological Development Division (FTDD) of the Department of Fisheries is the technological arm directly responsible for fisheries post harvest technology including upgrading quality together with maximizing utilization of all fishery resources. Since 1985, the FTDD has expanded the work on quality control to cover plant inspection, product inspection and product certification as also research and development. Nevertheless, rejection of Thai fish and fishery products in her export markets due to quality problems is not uncommon. This is mainly because the raw material received for processing especially from local boats is already contaminated before landing or while reprocessing. There is a dearth of official mechanism to avoid such improper handling. Fish inspection and quality monitoring services of the FTDD or the Department of fisheries as such are quite limited in operation and confined mainly to Bangkok. Sanitary certification of processing plants is done voluntarily. Many types of export certificates are involved and there is need for a well defined system of accountability and authority in certifying quality. This is especially so in view of the glaring lack of fish inspection practice in the country where the minimum quality standards are not set officially. As such, upgrading the

quality of the final products becomes extremely difficult. The current level of rejection is said to be about 10% while nearly half the export of cuttlefish to Japan from Thailand is reportedly effected by quality problems. Consequently the Government had decided to impose heavy penalty on frozen food producers operating in an unauthorised manner.

The FTDO has been lately focussing their activities on training quality control personnel as well as consumers, through seminars, training courses etc. The upgrading of Technical Competence, facilities and services is carried out in cooperation, with the International Development Research Centre (IDRC) Canadian International Development Agency (CIDA), Food and Agriculture Organisation (FAO), Australian Development Aid Bureau (ADAB), ASEAN Food Handling Bureau (AFHB) and INFOFISH as well as the various national and foreign universities and research establishments.

7. MARKETING

7.1 Domestic Marketing

Fish and shell fish are particularly important to Thailand as a primary source of animal protein. There is a growing demand for fish and shell fish. With a wide range of products available to choose from, the consumer preference is for catfish, gourami and snakehead from freshwater, shrimps from both marine and freshwater, cockles and mussels as well as marine fin fishes. Per capita fish consumption is nearly 22kg/head, quite high for a developing country. However, the rate of consumption in Bangkok is estimated to be around five time that in North and North-east regions of the country. Apart from the disparity in income distribution the accessibility and traditional preference for fish as well as the better retail network available in the city are the reasons for lower level of fish consumption in the rural areas.

Consumption is mostly in fresh form for both marine and inland water fishes while in the case of the latter 86% of the total production is so consumed against 19% of marine fish.

The Fish Marketing Organisation

Fish trade is primarily in the hands of the private sector. However, the Fish Marketing Organisation (FMO), a state enterprise within the Ministry of Agriculture and Cooperation plays an active role in providing infrastructure facilities, together with their maintenance and upkeeping. The FMO provides fishing ports, auction halls and wholesale markets. This agency is also empowered to encourage the establishment of Fishermen's Cooperative associations and to support their activities. FMO has been responsible for improving the fish handling system at fish markets and landing centres by the introduction of returnable container system and providing handling equipments.

Fish is sold mainly fresh in local markets and there are good transportation network by boat, road or rail to supply urban centres

like the large wholesale market in Bangkok. The interesting trend noticed in the domestic fish price is that the average auction price for important marine species has been 40 to 50% lower than that of the freshwater species during the past several years. Moreover, while the average price for marine species was up in 1986 against the previous year and down in 1987, the figures for freshwater species show a different pattern with the price in 1986 less than the year before and after. In fact, 1987 prices at 19.34 Baht/kg for freshwater fish is much higher than 11.87 Baht/kg for marine species.

Apart from the general preference for freshwater species, this trend will also reflect the economic progress and the rising disposable income that enable people to go in for their preferred varieties even at higher prices.

7.2 International Trade

The growth of Thailand fishery export and import during the decade from 1977-87 has been remarkable. With an increase of 362% by volume and 900% by value in exports the trade surplus from export-import of fish and fishery products has also increased by 745% during the ten year period. Thailand Seafood industry is estimated to have exported US$ 1.6 billion worth products in 1988. Her position in the world seafood trade in 1987 was seventh in terms of value after Canada, USA, Norway, Denmark, Japan and the Republic of Korea. Just six years ago in 1981, Thailand was eleventh in a similar ranking. Though official figures for the subsequent years are yet to be released, both quantity and value of exports are estimated to have further increased in the subsequent years.

Exports

In the year 1987 the total volume of export of fish and fishery products reached an all time record of 663,650 MT valued at 32.65 billion Baht. More than twenty countries have been importing substantial quantities of marine products from Thailand over a number of years. Canned tuna, fresh and frozen shrimp, frozen squids and frozen fish are the major product as seen from the table below.

Table 7

Details of Export of Marine Products
1982 and 1987

Items	Quantity (MT)		Value (Million Baht)	
	1981	1987	1981	1987
Frozen shrimp	22 647	33 909	2 081	5 749
Frozen cephalopods	39 000	61 633	1 248	4 165
Frozen fish	49 000	130 387	530	2 493
Dried cephalopod	2 900	5 213	450	1 401
Dried shrimp	1 976	8 817	180	984
Canned seafood	40 848	227 240	2 092	13 224
Fishmeal	111 042	73 004	968	684
Others	52 912	123 441	1 553	3 954
Total	320 325	663 650	9 102	32 654

Source: Directorate of Fisheries, Thailand

While the share of canned tuna was rather negligible in 1981, the quantity and value of this item alone comes to 144,980 MT and 8,155 million Baht representing 22% by volume and 25% by value of total exports for the year, 1987. However, a significant development in export pattern during this period has been the increasing share of exports using imported raw material as in the case of canned tuna.

Similarly a marked improvement in the items exported is visible from the growing trend towards product diversification and value addition. Unlike the previous practice of exporting fish and fishery products as semi-processed, frozen blocks, many processors/exporters have been investing in processing and exporting of consumer and retail items. A pioneering firm in this line uses 200 tonnes of semi-processed raw material comprising 30% squid, 30% cuttlefish, 20% fish and 20% shrimps.

Table 8

Fishery Exports by Products 1987

Products	Quantity in MT	Value '000 Baht
Fish, live	371	28 856
Ornamental fish	620	53 510
Fresh/Frozen Fish	130 387	2 493 337
" Shrimp	33 909	5 748 885
" Crabs	658	34 064
" Squids	61 633	4 165 176
" Other molluscs	235	6 807
" Others	1 030	111 140
Salted,dried and smoked fish	9 417	232 141
" Shrimps	8 817	984 019
" Crabs	9	1 211
" Squids	5 213	1 401 190
" Other molluscs	153	7 418
" Others	10 094	606 670
In airtight containers,sardine	14 218	374 281
" Tuna	144 980	8 154 685
" Other fish	26 113	986 961
" Squids	2 400	128 416
" Asari	8 601	465 555
" Crabs	11 590	1 434 226
" Shrimps	17 489	1 588 554
" Others	1 792	91 185
Not in airtight containers,		
" Squids	4 931	844 673
" fish	3 508	168 743
" others	237	33 642
Fishmeal	73 004	683 606
Shrimp paste	163	6 381
Sharkfin	37	26 906
Fish sauce	105	31 897
Seaweeds	81 888	1 593 637
Total	663 650	32 654 341

These are used for battered and breaded products, fish fingers and several other value added products like microwavable, prepared and ready to cook meals and T.V. dinners. Nearly fifteen innovative packers from Thailand have already introduced such products to international markets like the EEC and Japan.

Export Markets

Japan, USA, United Kingdom, Malaysia, Canada, Italy, France, Australia and the Federal Republic of Germany are the major markets for Thailand

marine products. Japan that accounted for 31% of the total value-wise export in 1987 has been mostly importing fresh frozen shrimp, cephalopods and fish in considerable quantities. Other items exported to Japan include tuna and shellfish in canned form as well as several dried and preserved products. USA that bought 21% by value in 1987 is the second largest seafood market for Thailand, mainly buying canned tuna that makes up 47% of the entire tuna exports from Thailand in that year. UK is also an important market for Thai canned tuna, canned fish and bivalves as well as frozen shrimps. Some other European countries as well as Canada and Australia are also importers of canned tuna, canned fish and fresh frozen fish and shell fish from Thailand.

Imports

Imports of fish and fishery products have increased from 18,851 MT in 1977 to 227,327 MT in 1987 showing 1206% rise in 10 year period which in terms of value is from 184.5 million Baht to 7,017 million Baht or thirty-eight fold increase. Nevertheless, the trade surplus (Table 9) has also been rising due to the fact that a major share of import has gone in for export production, especially of canned tuna.

Table 9

Import and Export of Fish and Fishery Product and Trade Balance 1977-87

Year	Export		Import		Trade Balance (Million Baht)
	Quantity (MT)	Value (Million Baht)	Quantity (MT)	Value (Million Baht)	
1977	183,555	3,628	18,851	184	+ 3,443
1978	242,243	5,174	28,950	228	+ 4,946
1979	288,151	7,460	80,222	500	+ 6,960
1980	274,753	7,426	43,777	552	+ 6,874
1981	320,325	9,102	47,174	550	+ 8,552
1982	316,679	11,231	46,215	736	+10,505
1983	344,899	12,677	58,942	1,093	+11,584
1984	411,722	15,081	119,064	2,119	+12,962
1985	466,219	18,528	152,707	3,857	+14,670
1986	602,486	26,829	268,089	7,590	+19,239
1987	663,650	32,654	27,327	7,017	+25,637

+ Favourable balance
Source: Directorate General of Fisheries, Thailand

Of the items of imports the largest share goes to frozen fish of which tuna is predominant. In 1987, out of the total import value of 7,017

million Baht, 6,349 million was on account of frozen fish alone, followed by seaweeds and agar-agar at 122 million Baht and frozen squid 102 million Baht. Other items of regular import are ornamental fish, frozen shrimps, frozen bivalves and other molluscs, canned tuna, salted and dried products, shark fins, etc.

USA is the largest source for Thai import of fish and fishery products, accounting for more than 18% by value, followed by Japan at 12% and Indonesia at about 9% by value. However, the share of Indonesia has come down drastically in 1988 and 1989 as a result of the Indonesian Government policy to restrict the export of tuna. Taiwan, France, Singapore, Malaysia, Australia, New Zealand etc., are also regular exporters to Thailand.

7.3 Disposition of Catch

Disposition of marine and inland fish species show a distinct difference in terms of the quantity consumed in fresh and frozen form. While the share of fish consumed in fresh form among the marine landings was 19.13% in 1987, the corresponding figure for freshwater fish has been 86%. As seen from Table 10, more than 45% of the marine landings is used for reduction into fish meal and 12.24% for canning. Other methods of utilization include dried and salted, steamed or smoked, shrimp paste, fish sauce, etc.

Table 10

Utilization of Marine Fish by Product Form

	1986		1987	
	Marine	Freshwater	Marine	Freshwater
1. Fresh consumption	17.53	84.4	19.13	86.0
2. Frozen	12.82	-	12.51	-
3. Dried & Salted	5.87	5.0	3.59	6.5
4. Steamed or Smoked	0.45	2.9	0.46	2.8
5. Fermented	-	6.0	-	4.3
6. Shrimp paste	0.83	0.3	0.77	0.2
7. Dried shrimp	3.69	0.5	3.10	0.1
8. Fish Meal Animal feed	44.13	-	45.26	-
9. Canned fish	11.19	-	12.24	-
10. Fish sauce	3.21	0.7	2.65	0.1
11. Others	0.28	0.2	0.29	-
%	100%	100%	100%	100%
Total Quantity (MT)	2,348,5721	87,763	2,601,929	177,142

Source: Directorate of Fisheries, Thailand

Among the species used for freezing, the major share is occupied by shrimps, crabs and cephalopods that are almost entirely exported. But as per the available data, the entire quantity of 1,804 MT of lobster was used for fresh consumption in 1987 with little exports. Out of the freshwater fish and shell fish species landed, Macrobrachium, Tilapia, Cat-fish, Common Carp, Snakehead, Local Carp, Climbing Perch and Swamp Eels are the important species used for fresh consumption. However, snake-skin gourami that constitute some 11% of total landings is mainly used for drying and salting - 71% - with fresh consumption only 24.5%.

Fish Consumption

Per caput fish supply for Thailand is estimated at 21.7% kg/year (1984-86) which is comparatively higher than the world average of 12.4 kg for the period.

Natural preference when compared with meat is for fish in Thailand. The preferred species are the native catfish, shakehead, and gouramis in that order. Domestic demand for fish has been increasing rapidly during the past few years as a result of the general growth in economy as well as the increase in population. As such, fish consumption rate has been showing vast disparity between the urban and rural areas.

8. FISHERIES ADMINISTRATION

The Department of Fisheries (DOF) under the Ministry of Agriculture and Cooperation (MOAC) formed under the Fisheries Act of 1947 is responsible for the overall development of the fisheries sector and for the related activities. The DOF is headed by the Director-General of Fisheries (D.G.). The D.G. is assisted by a Deputy Director-General who in turn is in charge of five separate Divisions including the Marine Fisheries Division, Inland Fisheries Division, Fishery Technological Development Division, Fishery Policy and Planning Division, Exploratory Fishing Division and so forth.

8.1 Research and Development

The responsibility for fishery research and development is vested with the Department of Fisheries. The Exploratory Fishing Division (EFD) and the Marine Fisheries Division (MFD) are engaged in marine capture fishery research and development. They possess and operate their own research vessels for assessing fish stockers in Thai waters. The EFD also advises the Government on joint venture fishing agreements and their scope.

The Fishery Technological Development Division (FTDD) under the DOF is the technical arm responsible for developing fisheries post-harvest technology in Thailand. Apart from the upgradation of product quality, the main activity of this Division is maximising utilisation of marine,

brackish and freshwater fish through product development, designing of low cost processing equipments and trash fish/by-catch utilization. The DOF has also established some 34 fisheries stations in the provinces to facilitate transfer of technology, extension services, aqua-culture inputs and appropriate managerial advice.

In addition to the DOF, there are six universities offering fishery courses and research facilities at undergraduate and postgraduate levels respectively. The courses lead to the award of some four undergraduate degrees in fisheries. Kasetsart University offering aquaculture, fisheries biology, marine science and resource management as well as Chulalongkorn University (marine sciences) located on the East coast are the two important institutions engaged in post graduate studies and field research. As for degree programmes, the Prince of Songkhla University (food sciences and agriculture), Srinikarin Viraj University (Aquatic Sciences), Chiang Mai University and Bang Saen University (Biological Sciences) and Phuket Community College (aquaculture) are the universities engaged in fishery studies.

Several national and regional centres established through external assistance as specified below are also engaged in research, training and extension activities in different areas for fishery development.

Particulars	Year of establishment	Cooperating agency
1. Marine Fisheries Laboratory	1965	F.R. of Germany
2. Phuket Marine Biological Centre	1967	Canada
3. National Inland Fisheries Institute	1972	Canada
4. National Institute of Coastal Aquaculture	1981	Japan
5. Three Inland Fisheries Centres in Ayuthya, Surat Thain, and Trang Provinces	1984	Japan

Apart from the above, the FAO (UNDP) Network of Aquaculture Centres in Asia (NACA) based in Bangkok and other regional bodies like the International Centre for Living Aquatic Resources Management (ICLARM) are also engaged in research and development activities involving Thailand fisheries.

9. GOVERNMENT POLICY

Thailand has been making all out efforts for increased exports and improved foreign exchange earnings since 1985. Accordingly new initiatives were taken in the area of product development, value addition and quality improvement of exported products.

Under the Sixth National and Social Economic Plan (NSEP), covering the period 1986-91, poverty eradication, export promotion and financial stability of the country have been accorded top priority. Accordingly, the plan emphasizes diversification of production for which the fisheries sector has been identified as an area with good scope for development. The DOF has given priority to increasing the export of high value fishery products and to promotion of further development of fisheries. Such an approach is expected to help alleviate the national trade deficit while creating additional employment in rural areas.

Fishery product development especially using low valued species is viewed as an important means of increasing animal protein supply to the growing population.

With a view to achieving the above goals the governmental machinery has been attuned to enhance production through extension of aquaculture and joint venture fisheries; as well as by upgrading the quality of fish and fishery products. Through such measures it was expected to achieve 3% increase in fish production per annum.

9.1 Incentives and Credit Facilities

Thailand fishing industry has been receiving both technical assistance and credit facilities through governmental and international agencies. Development finance is provided through the Bank for Agriculture and Agricultural Corperatives and the Board of Investment. Moreover, the Industrial Finance Corporation of Thailand and the small Industries Finance Office assist in the establishment, expansion and modernisation of industries. Pooling of funds to provide credit which might otherwise be difficult to obtain, is the role of the Industrial Finance Corporation.

Funding for the construction of production facilities is also provided by multilateral organizations like the ADB and the ODA. A number of aquaculture projects have also received technical assistance like this. The Canadian International Development Agency (CIDA), the Overseas Economic Cooperation Fund (OECF) Japan, ODA, ADB and IFS have supported several fresh fish farming projects in Thailand. A loan was also provided by Japan for marine and freshwater shrimp culture while ADB funded two projects dealing with brackishwater shrimp culture. The IFS assistance was directed to projects on fish diseases and brine shrimp production.

Further, shrimp farming being a national priority, allocation to the tune of US$ 84 million has been made in the National Social and Economic (NSEP) development plan (1986-91) for investment and credit line in various related areas. Upgradation of the existing government owned hatcheries and building five more in public sector - each with a capacity of 30 million shrimp fry/year - are envisaged with these funds. Credits for financing shrimp farming and building hatcheries will also be extended through the Government owned Banks to private investors. Fifteen privately-owned shrimp hatcheries with a collective total capacity of 270 million fry a year are included in this credit component.

Despite the measures taken by the Government to promote fishery sector especially product development and export promotion, the seafood industry feels that it is not quite up to their expectations and requirements. Especially the case of inadequate infrastructure facilities in and around the fishing ports, lack of support in import of capital goods, non-availability of subsidised electricity rates for shrimp farmers and packers are some of their grievances. Though there is a first time exemption from import duty on machines brought in to set up a new factory, any further expansion or modernisation will attract normal import duty ranging from 30 to 60%. So also there is presently an export tax of 1.65 per cent of the FOB on items falling under ready to cook category such as frozen seafood that are not meant for direct consumption. However, boiled, dried or canned products fall within the ready to eat category, that does not attract this tax.

10. CONCLUSION

Thailand's seafood industry has made rapid strides during the past few years. Presently she is the largest canned tuna exporter in the world and the fifth largest fishing industry in Asia with export earnings amounting to some US$ 1.6 billion in 1988. Apart from her traditional markets in Japan and the South-east Asia, the Thai marine products have made successful inroads into the other sophisticated markets in the USA and Europe, especially capturing a major share of the canned tuna market. Consequently the rejection rate for Thai frozen seafood has also come down to some 10 per cent.

The industry has been rehabilitated on sound financial planning coupled with modern management and marketing strategies. There is even a publicly listed packer - Surapon Seafoods - in addition to Unicord, the canner as well as two major joint ventures - Aquastar and Frionor - actively promoting product diversification, value addition and aquaculture. Nevertheless, the industry still needs support and patronage from the government particularly in the following areas :

1. Conservation of fishery resources both marine and inland.
2. Upgradation of technology and product quality commensurate with the growth in the industry.
3. Modernisation of infrastructure facilities as well as processing facilities.
4. Ensuring adequate supply of raw material for tuna canning especially in the context of the emerging competition from the neighbouring countries in this area.
5. Preservation of traditional fishing and fish processing practices for safe-guarding the interests of the small scale and artisanal sector.

Considering the progress so far achieved in these areas it becomes obvious that the export oriented fish processing industry in Thailand is poised for further growth and expansion especially in areas of aquaculture, value addition and product diversification, in the immediate future. Now that the earnings from seafood export have exceeded that from rice - the traditional agricultural commodity - the Seafood industry will continue to play a major role in providing employment and animal protein to the population that is projected to grow at an average annual rate of 1.5% during 1987 - 2000 period. Undoubtedly, the hardworking, skilled and well disciplined Thai worker will continue to be an asset to the industry for years to come.