

The Fish Processing Industry In Thailand

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Status Of The Thai Fishery Industry

The fish processing industry of Thailand is economically important as it provides job opportunities, incomes and foreign currency and the Government has put strong emphasis on the development of this sector in the National Economic and Social Development Plans. The current Sixth 5-year plan will end in the year 1991; the processing industry and related sectors, viz fish production and processing sectors, have progressively grown and developed throughout the period.

In the past five years, though capture fisheries have grown at a slow rate and have a tendency to be stagnant, aquaculture production has grown dramatically to serve the demand of the country (Tables 1 and 2). Fish supply for local consumption is decreasing because of population and export growth. Yet, local demand is to some extent met by freshwater aquaculture species. The fish process-

ing industry, especially factories of export scale, has become one of the top world exporters despite trade barriers and competition, and Thai exports are recognized as quality products. Comparing the years 1985 and 1988, the country's exports grew by 71% in quantity and 140% in value (Table 3). Lack of supply seems to be a major problem of the industry. The Government has been trying to offset the problem by promoting freshwater and coastal aquaculture as well as joint-venture fisheries. However, the industrial sectors have had to import supplementary raw material. Imports of fish grew by 128% in quantity and 281% in value from the year 1984. Support from the government has also taken the form of technical services to maintain self-sufficiency in the supply of fish by reducing post-harvest losses and maximizing utilization. In the up-coming Seventh National Economic and Social Development Plan these activities remain in focus. The government realizes that the collabora-

Table 1. Growth rate of Thai fisheries.

Year	Capture	Growth	Unit : 1,000 mt	
			Culture	Annual growth : %
1988	2,418.7	-7.85	211.0	39.00
1987	2,624.7	8.26	151.7	18.14
1986	2,407.9	15.22	128.4	-16.00
1985	2,089.4	3.2	152.8	36.6
1984	2,022.9	-	111.9	-
Average Growth 84:88;%	-	19.56	-	88.56

Source: Fisheries Record of Thailand, 1990.

Table 2. Fisheries production in quantity by subsectors.

Year	Total	Unit : 1,000 mt			
		Capture		Culture	
		Marine	Freshwater	Coastal	Freshwater
1988	2,629.7	2,337.2	81.5	108.9	102.1
1987	2,779.1	2,540.0	84.7	61.9	89.8
1986	2,356.3	2,309.5	98.4	39.1	89.3
1985	2,225.2	1,997.2	92.2	60.6	75.2
1984	2,134.8	1,911.5	111.4	61.5	50.4

Source: Fisheries Record of Thailand, 1990.

tion between the government and private sector is the key factor in the development of the industry. Thus, the improvement and strengthening of service and assistance to the people involved in fish processing are included as specific items in the Plan.

Fish Production

Total fish production in 1988 was 2,629,700 mt of which 88% was from the marine capture fisheries, 3.1% from freshwater fisheries, 4.1% from coastal aquaculture and 3.9% from freshwater aquaculture (Department of Fisheries, 1990).

Marine Fisheries Production

In 1988, the total production of marine fisheries including coastal aquaculture was 2,446,100 mt. This quantity can be classified as fish 1,867,700 mt, shrimp 137,300 mt, cephalopods 114,200 mt and molluscs 227,200 mt (Table 4).

Among the fish, trash fish accounted for the highest quantity 956,100 mt or 39% of the total landings. Pelagic fish accounted for 638,000 mt or 26% of the total landings. Pelagic species landings comprised Indo-Pacific mackerel 111,700 mt (1,111.5 million bahts), tonggol 92,900 mt

Table 3. Thailand's international trade in fishery commodities.

Year	Quantity : mt Value : million bahts			
	Import		Export	
	Quantity	Value	Quantity	Value
1988	347,666	14,713	798,572	44,437
1987	227,327	7,016	603,650	32,654
1986	268,089	7,590	602,486	26,829
1985	152,707	3,857	466,219	18,527
Average growth 85:88;%	127.7	281.4	71.28	139.8

Source : Fisheries Record of Thailand, 1990.

Table 4. Marine fish landings - major species.

	Unit : 1,000 mt				
	1988	1987	1986	1985	1984
Total	2,446.1	2,601.9	2,352.2	2,057.7	1973.0
Fish	1,867.7	2,017.4	1,798.9	1,570.4	1514.1
Pelagic	638.0	629.6	570.1	588.1	572.7
Demersal	141.2	152.7	131.5	97.5	88.5
Other food	132.4	129.4	121.1	108.4	95.3
Trash fish	956.1	1,105.7	976.2	776.4	757.6
Shrimp	137.3	127.7	141.2	151.6	165.9
Tiger	41.2	10.8	1.2	0.5	0.5
Banana	18.9	19.1	19.7	19.1	19.9
School shrimp	12.9	14.1	13.5	14.0	13.5
Sergistid	23.0	20.0	19.4	18.8	18.8
Others	41.3	63.7	97.4	99.2	113.2
Crab	41.9	40.4	35.6	26.8	27.0
Swimming	37.1	34.7	30.4	22.2	22.4
Mud	4.5	5.0	4.6	4.5	4.3
Others	0.3	0.7	0.6	0.1	0.3
Cephalopods	114.2	132.5	134.4	116.0	129.3
Squid	67.2	75.4	71.3	64.0	66.3
Cuttlefish	45.3	45.7	51.6	42.8	56.4
Octopus	6.6	9.2	12.0	11.4	11.7
Molluscs	227.2	217.8	164.3	188.5	153.6
Baby clam	115.4	131.2	101.2	83.7	50.5
Green mussel	66.8	46.8	31.8	61.0	62.2
Horse mussel	30.7	15.7	8.4	8.0	14.3
Others	14.3	24.1	22.9	30.8	26.6
Seaweed	0.8	1.7	1.2	4.3	0.7
Others	18.4	40.5	76.1	29.0	153.6

Source: Fishery Record of Thailand, 1990.

(1,784.2 million bahts), little tuna 53,500 mt (736.8 million bahts) and sardinellas 123,700 mt (394.1 million bahts). Demersal fish accounted for 141,200 mt valued at 1,515,500 bahts. The catch mainly comprised 3,200 mt grouper (238.7 million bahts), 29,600 mt threadfin bream (201.1 million bahts), 4,000 mt sand whittings (183.3 million bahts) and 22,600 mt bigeye (105.8 million bahts).

Shrimp, which are of the highest economic value per unit, accounted for 137,300 mt or 5.6% of the total production. Among these, tiger shrimp and banana shrimp were major species landed at 41,200 mt (6,650 million bahts) and 18,900 mt (2,621 million bahts) respectively.

Cephalopods accounted for 114,200 mt or 4.7% of total production. Major species comprised 67,200 mt squid (1,994 million bahts) and 45,300 mt cuttlefish (1,474 million bahts).

Molluscs accounted for 227,200 mt or 9.3% of the total landings. The major economic crab species were swimming blue crab and mud crab. Other marine species included jelly fish and sea cucumber (18,400 mt) and seaweed (800 mt), or 0.7% and 0.03% of the total production respectively.

Capture fisheries have been an important source of supply for domestic consumption. Yet it is recognized that the marine fisheries, which accounted for 89% of the total landings, cannot be expanded much further due to various limits described in the country report in 1987 (Sundaravipat and Suwanrangsi, 1988). Therefore, coastal aquaculture will play an increasingly important role in meeting the demands of domestic consumption and the export industry.

Thailand is blessed with 2,600 km of fertile coastline where 78,200 hectares are devoted to coastal aquaculture, mainly shrimp, reef fish (sea bass and grouper) and molluscs. Thirty-eight per cent of this area is under intensive shrimp cultivation. The annual shrimp production doubled its 1979 production of 7,064 mt in about six years. Within the time span of 10 years, shrimp production rose ten-fold. The latest figure (1989) was 100,000 mt, of which up to 90,000 mt were processed for export (Table 5).

Table 5. Shrimp aquaculture statistics.

Year	No. farm	Area (ha.)	Production (mt)
1989	10,347	78,209	100,000
1988	10,347	77,680	75,000
1987	7,264	52,148	25,000
1986	5,534	45,367	17,855
1985	4,939	40,769	15,841
1984	4,519	36,792	13,007
1983	4,327	35,537	11,550
1982	3,943	30,972	10,090
1981	3,657	27,459	10,728
1980	3,572	26,036	8,063
1979	3,378	24,675	7,064

Source : Suraswadee, 1990.

Freshwater Fisheries

In recent years total freshwater fish production has grown slowly but freshwater aquaculture growth has risen more than 50% above the level of 1984. The reason for this is that the wild catch has been continually declining. Total production of freshwater fish in 1988 accounted for 183,600 mt or 7.0% of the total production, of which 56% was produced by aquaculture (Table 6).

The quantity and value of major freshwater species are as follows :

Tilapia accounted for 27,600 mt or 15% of the total freshwater fish production and were valued at 361.3 million bahts.

Catfish (*Pangasius* spp.) accounted for 25,400 mt and were valued at 237.6 million bahts.

Local carp (*Puntius gonionotus*) accounted for 21,900 mt and were valued at 406.8 million bahts.

Sepat Siam (*Trichogaster pectoralis*) accounted for 17,600 mt and were valued at 265.9 million bahts.

Fish with low production volume but high value were, in order of importance, freshwater prawn, snakehead (*Ophicephalus straitus*) and catfish (*Clarius* spp.).

Table 6. Freshwater species production.

	Unit : 1,000 mt				
	1988	1987	1986	1985	1984
Total	183.6	177.1	187.8	167.5	161.8
Tilapia	27.6	27.3	23.3	15.41	21.5
Other food fish	27.6	21.1	35.5	24.1	26.9
Catfish (<i>swai</i>)	25.4	16.5	15.8	18.2	11.3
Local carp	21.9	16.9	21.8	16.0	20.1
<i>Sepat Siam</i>	17.6	20.2	23.0	23.1	18.9
Catfish (<i>duk</i>)	17.2	16.8	18.9	18.0	14.9
Snakehead fish	15.8	19.6	23.5	21.8	20.4
Freshwater prawn	13.1	13.0	6.4	7.2	4.7
Climbing perch	7.7	7.4	7.9	9.6	9.2
Common carp	4.7	6.4	4.0	3.6	4.6
Swamp eel	1.6	6.4	1.6	2.6	2.4
Others	3.4	5.5	6.1	7.9	6.9

Source: Fisheries Record of Thailand, 1990.

Fish Utilization

It is interesting to observe (as in Table 7) the fish supply available for consumption in Thailand from 1984 to 1988. The total production minus trashfish landings, which are regarded as non-edible fish products; post-harvest loss which is always estimated at 15%; and total exports/imports; gives the total domestic supply. When that figure is divided by the population, one arrives at annual per capita fish supply. To convert per capita fish supply to average consumption it is necessary to consider the weight of fish bones and viscera, losses in processing and preparation, and plate waste at the time of consumption. The average conversion factor used here is 60%; ie, the edible portion of fish is approximately 60% of its whole, ungutted weight. The edible portion of molluscs and crustaceans is smaller (Floyd, 1985).

In the past five years per capita fish supply was approximately 12-13kg and average consumption was a rather low 7-8kg. However, consumption varied from region to region and fish produced through fish ponds and small-scale fisheries have not been taken into account in the

fisheries statistics. Nevertheless, this estimated figure gives some indication of the so-called limited supply.

The pattern for fish utilization remains the same. Fish are mainly consumed fresh and cured (salted, dried, steamed, smoked and so on). Canned products are consumed locally in smaller quantities compared with export volume and most of the frozen products are for export. Tables 8 and 9 illustrate the utilization of marine and freshwater fish. In the past three years marine fish available for fresh marketing has declined from 26.3% in 1985 to 19.95% in 1988, while the amount of fish used in freezing and canning increased to 14.28% and 13.28% or by 34% and 36%, respectively. On the other hand, fish used in curing decreased to 9.7% in 1988 or by 40% from 1985. The main reason for this change in the pattern of fish utilisation could be the increasing cost of raw material resulting from limited supply. This would make small entrepreneurs less competitive in securing their raw material for production. Cured products produced from marine fish included dried salted fish, fish sauce, dried shrimp, dried squid, smoked

Table 7. Supply available for consumption in Thailand.

	Unit : 1,000 mt				
	1988	1987	1986	1985	1984
Total domestic production	2,446.1	2,601.9	2,352.2	2,057.7	1,973.0
Non-edible fish products	956.1	1,105.7	976.2	776.4	757.6
15% post-harvest loss	366.9	390.3	352.8	308.7	296.0
Total exports	798.6	603.7	602.5	486.2	411.7
Total imports	347.7	227.3	268.1	152.7	119.1
Total domestic supply	672.2	729.5	688.8	639.1	626.8
Population (million)	54.96	53.87	52.97	51.80	50.54
Annual per capita supply (kg)	12.36	13.54	13.00	12.34	12.4
Estimated av. consumption (kg)	7.42	8.12	7.80	7.40	7.44

Source : Fisheries Record of Thailand, selected years

* To convert per capita fish supply to average consumption, it is necessary to consider the weight of fish bones and viscera, losses in processing and preparation, and plate waste at the time of consumption. The average conversion factor used here is 60%.

Table 8. Utilization of marine fish.

	1988		1987		1984	
	mt	%	mt	%	mt	%
Marketed	488,002	19.95	497,749	19.13	560,900	26.3
Frozen	349,307	14.28	325,501	12.51	201,000	9.4
Cured	236,051	9.65	279,447	10.74	346,700	16.21
Canned	324,845	13.28	318,476	12.24	181,300	8.5
Other	1,047,920	42.84	1,185,178	45.55	844,900	39.6
Total	2,446,125	100.00	2,601,929	100.00	2,314,800	100.00

Table 9. Utilization of freshwater fish.

	1988		1987		1984	
	mt	%	mt	%	mt	%
Total	183,607	100.00	177,142	100.00	161,819	100.00
Marketed	144,498	78.7	152,342	86.6	117,555	72.7
Frozen	-	-	-	-	-	-
Cured	39,108	21.3	24,827	14.0	44,264	27.3
dried/salted	22,583	12.3	11,542	6.5	21,022	13.0
steamed/smoked	6,242	3.4	4,960	2.8	5,669	3.5
fermented	8,630	4.7	7,617	4.3	13,455	8.3
fermented paste	184	0.1	354	0.2	212	0.1
fish sauce	1,469	0.8	177	0.1	2,583	1.6
dried shrimp	-	-	177	0.1	166	0.1
others	-	-	-	-	1,157	0.7

Source : Fisheries Record of Thailand, 1984, 1987 and 1988.

fish, steamed fish, fishball, dried mussel, fish crackers and *budu* sauce.

Most freshwater fish is utilized domestically, 87% of it, in fresh form. Curing absorbed 21% of total raw material. Dried and salted took 12.3% (of total freshwater production) or 22,538 mt, followed by fermented fish which utilized 4.7% or some 8,630 mt.

Fish Processing Industry

Since 1984 the number of fish processing plants has not substantially increased but their capacity has increased, except for plants processing certain traditional products (Table 10).

Freezing Plants And Cold Storage

In 1987, there were 80 registered freezing and cold storage plants. Their main activities were preparing, freezing and holding products including fresh products destined for local consumption. Many of these plants have increased their production capacity in response to demand in the international markets between 1988 and 1990.

During 1989, there were shortages of cold storage holdings as shrimp aquaculture products dramatically increased. Since then, the Board of Investment has regranted investment privileges to investors in this area, including those producing value-added products. This has contributed to a great expansion of cold storage holdings, production capacity and to diversification of processing.

Major species utilized by this industry are miscellaneous fish (27%), cephalopods (27%), shrimp (16%), Indo-Pacific mackerel (10.4%) and tuna (10%). The last two were stocked for local consumption and for further processing respectively. The processors normally produced block frozen products, eg shrimp are processed in the form of head-on, headless, peeled, deveined, undeveined. Cephalopods are processed in the form of whole cleaned and uncleaned, squid tube, cuttlefish fillet, squid rings and tentacles. Fish, for the most part, are processed into fillet form.

Thai processing establishments that ship their products overseas are up to international standards in design, construction, equipment and processing practice. The Department of Fisheries inspects these plants at least twice a year. Lists of the approved plants (they must achieve at least 'B'

Table 10. Number of fish processing factories.

Type of plant	1987	1986	1985	1984
Cold storage	80	84	80	78
Cannery	41	41	39	38
Fish sauce	110	111	114	113
Fish meal	95	93	92	95
Shrimp paste	nd	nd	2,725	2,860
Salted fish	671	943	978	800
Dried shrimp	176	165	148	284
Dried squid	711	828	879	865
Dried mussel	580	613	674	776
Steamed fish	78	94	115	138
Smoked fish	86	180	171	184
Fish-shrimp cracker	65	107	76	78
Fishball	79	69	54	64
<i>Budu</i> sauce	23	30	33	37

Source : Statistics of Fisheries Factories, 1989.

grade on the plant rating scale) are sent to importing authorities overseas to provide reasonable assurance that fish and fishery products from Thailand have been processed under hygienic conditions and practices and also meet standard requirements of authorities in importing countries.

A major industrial development in this line is the production of battered and breaded products using various seafoods as base, and the introduction of some other value-added products in terms of new product development and packaging diversification.

Canneries

The number of canneries has not increased in recent years because the existing factories have not reached their full capacity. There are at the moment 41 factories. Twenty-two of these produce, mainly, canned tuna. The rest are engaged in the

production of canned shrimp, crabmeat, baby clam, cephalopods, sardine and mackerel.

Major species utilized by the industry are tuna (38.6%), tonggol and little tuna (18.3%), sardinella and scad (17%), shrimp (6.42%) and crab (6.71%) (Department of Fisheries, 1990).

Canneries in Thailand are up to international standards. Process control is the key critical control point of the industry. The Department of Fisheries has stringently inspected retort equipment, cooking time, post-process handling and seam defects in order to assure the safety of the products. Emphasis has been given to the training of retort operators and personnel involved in heating processes.

The industry has made efforts to increase production yield and efficiency, improve product quality, styles of pack and packaging. On the production line, new equipment has been extensively used to increase production efficiency. Most companies have hired well-trained production and

quality control personnel. In addition to conventional packing media, various new packing media have been developed to add value to the products. The traditional three-piece can has been replaced by two-piece cans and by easy-open end-cans. Some canneries produce their own cans.

A large-scale cannery has already invested in technology for the utilization of the processing wastes, for example, the processing of sauce from tuna cooking water. Canned petfood is another way to utilize waste from the canneries. (But 50% of canned petfood is made of fresh sardine.)

Surimi And Surimi Based Products Processing

There are, at the moment, nine active surimi processors, but according to the Board of Investment, 14 processors have applied for investment privileges related to surimi production. Among these are two plants that process imitation crabmeat. A third imitation crabmeat plant is being established. According to the owner, 75% of the surimi it will use will be imported.

Total surimi production capacity is 50,000 mt/year and one major producer claimed his share of it was 70%. Most of the surimi plants produce secondary products such as fishball, breaded fish cake and cuttlefish ball.

Value-Added Products Processing

Production of value-added seafood products started with the production of surimi (frozen minced fish block) in 1967 and cooked and peeled shrimp at about the same time. Later major developments in value-added products were consumer-pack frozen seafood, surimi products (eg, fishball, imitation crabmeat and Japanese-style fish jelly products) and semi-processed products (eg, spring roll, battered and breaded products). In the early stages of development, the industry faced problems in the form of inadequate product development technology, capital investment shortfalls, and the lack of market access to end consumers, the latter due to importer resistance and import regulations.

To date, 40% of exported seafood products (as estimated by processors) are either processed and packed into consumer packs or made into prepared seafood products for direct institutional/retail sale in major world markets. This is done through upgrading quality, using new technology or improving packaging. Diversifications are mainly based on shrimp, cephalopods and fish. Currently shrimp is value-added into the following forms: cooked and peeled shrimp, cooked whole shrimp, peeled butterflied, tail-on, peeled *tempura*, battered and breaded shrimp, shrimp skewer and processed products. The processed products include shrimp *shaomai*, *hargao*, shrimp spring roll, shrimp on sugar cane, shrimp dumpling, shrimp patties and *tom yam kung* (Thai-style shrimp soup). Today, most cephalopod products have undergone at least primary processing. Many are also processed to convenience products and delicacies such as cooked squid ring, squid/cuttlefish skewer, stuffed squid and breaded squid ring.

Traditional Products Establishments

Processing of traditional products is done by small entrepreneurs. To date, even though they do not use much modern technology, they have made progress in upgrading quality standards and are packing more and more in response to their customers' requirements for quality. However, there is still much room for improvement in processing practices, equipment and hygiene. It is estimated that 275,159 mt of raw material or 10.5% of total fish production were utilized in producing traditional products in 1988. Improvement in any of the abovementioned areas would result in better utilization of resources, and, indirectly increase fish supply for local consumption.

Export Of Fish And Fishery Products

Thailand is currently one of the world's major exporters of fish and fishery products, and seafood is one of the country's most important and successful industries. Due to excellent product quality and competitive prices, the industry has been able to expand and diversify its markets, which now in-

clude over 60 countries throughout the world. Over the past two years, frozen shrimp and canned seafood have been among the leading fishery exports (Table 11) and ranked 9th and 10th among Thailand's major export earners.

Exports of fishery products accounted for more than 50,000 million bahts in 1989 (Department of Business Economics, 1991). Types of products exported have been diversified from traditional shrimp, fish and cephalopods. There are now 17 major fish and fishery products which earn foreign currency income. These include frozen shrimp, canned tuna, canned seafood, frozen tuna loins, frozen cephalopods, frozen fillet and surimi and others. Exports grew by 139.8% from 1985 to

1988, and increases in both volume and value are expected to continue. In 1989, fish and fishery product exports were valued at 55,000 million bahts and the value in 1990 is estimated at 63,000 million bahts. The 1991 export target is 65,000 million bahts.

The present status and prospects of some major items are described below :

Frozen Shrimp

Over the past years, during which shrimp aquaculture boomed, the shrimp market has also shown tremendous flexibility in sourcing and product development in terms of country of origin

Table 11. Export target of fish and fishery products - major commodities

	1991*		1990**		1989	
	Quantity	Value	Quantity	Value	Quantity	Value
Shrimp	82,500	19,560	80,100	18,200	76,979	16,432
+/- (%)	3.0	7.47	4.05	10.76	42.11	60.11
Tuna	344,000	22,400	335,000	21,500	307,877	19,767
+/- (%)	2.61	4.02	8.10	8.05	10.45	5.51
Cephalopod	70,300	5,970	73,790	6,225	79,084	7,622
+/- (%)	-4.73	-4.56	-6.69	-17.93	14.67	22.69
Fish	289,000	6,970	247,500	6,000	202,975	4,308
+/- (%)	16.77	16.17	21.94	39.36	26.29	19.08
Value-added	85,000	5,600	56,000	3,700	22,053	1,165
+/- (%)	51.9	51.35	153.93	217.49	-6.42	-20.05
Pet food	140,000	3,300	130,000	3,000	122,473	3,045
+/- (%)	7.69	10.0	6.15	-1.47	10.19	27.26

* Target figure

** Estimated figure

Source: Department of Business Economics, 1991.

Table 12. Export target of fish and fishery products - by commodities.

	1991*		1990**		1989	
	Quantity	Value	Quantity	Value	Quantity	Value
Frozen shrimp	81,000	19,200	77,600	17,850	74,298	16,059
+/- (%)	3.09	7.57	4.44	11.16	49.11	65.53
Canned tuna	260,000	16,000	250,000	15,000	225,123	13,797
+/- (%)	3.84	6.67	11.05	8.72	12.01	6.41
Canned seafood	15,000	4,800	45,000	5,000	44,281	4,564
+/- (%)	-66.67	-4.00	1.60	8.72	-5.48	-3.16
Tuna products	60,000	4,300	33,000	2,500	118	8.2
+/- (%)	81.82	72.00	27,866	30,387	145.83	446.67
Frozen cehalopods	62,000	4,300	65,000	4,500	69,054	5,238
+/- (%)	-4.62	-4.44	-5.87	-14.10	17.51	34.64
Fillet and surimi	80,000	4,000	70,000	3,5000	42,192	2,080
+/- (%)	14.29	14.29	65.91	68.26	3.32	9.41
Pet food	140,00	3,300	130,000	3,000	122,473	3,045
+/- (%)	7.69	10.00	6.15	-1.47	10.19	27.26
Chilled fish	192,000	2,400	160,000	2,000	143,712	1,726
+/- (%)	20.00	20.00	11.33	15.87	32.19	34.57
Value-added	25,000	1,300	23,000	1,200	21,935	1,157
+/- (%)	8.70	8.33	4.86	3.70	-6.73	-20.53
Canned fish	15,000	700	15,000	750	15,982	781.2
+/- (%)	0	-6.67	-6.14	-3.99	-0.54	19.30
Canned sardine	30,00	900	25,000	750	22,491	626.1
+/- (%)	20.00	20.00	11.16	19.79	51.54	55.32

* Target figure

** Estimated figure

Table 12. Export target of fish and fishery products - by commodities (contd.).

	1991*		1990**		1989	
	Quantity	Value	Quantity	Value	Quantity	Value
Dried squid	4,300	1,050	4,500	1,100	3,900	1,505
+/- (%)	-4.44	-4.55	15.38	-26.93	-20.75	-4.12
Seasoned squid	4,000	6,200	4,290	655	6,130	878
+/- (%)	-6.67	-5.34	-30.02	-25.41	16.08	16.11
Dried fish	15,000	400	16,000	350	15,166	340
+/- (%)	-6.25	14.29	5.50	2.91	60.08	16.11
Cooked/peeled shrimp	1,100	170	1,000	150	979	146
+/- (%)	10.00	13.33	2.15	2.53	-57.75	-50.03
Live fish and fries	2,000	170	1,500	150	1,905	162
+/- (%)	33.33	13.33	-21.26	-7.52	12.39	14.71

* Target figure

** Estimated figure

Source: Department of Business Economics, 1991.

and species. A notable example is the recent success of black tiger shrimp (*Penaeus monodon*). Initially shrimp importers like Japan were reluctant to procure large quantities of this species whose colour and texture differ sharply from their traditionally-preferred species. However, the price at which this species was offered, and its quality and availability soon overcame importer resistance. Within five years, the species has become a major market determinant in a niche previously monopolized by white shrimp.

After years of continuous expansion caused by aquaculture, Thailand is now one of the top five major suppliers of frozen shrimp in the international market. Thailand ranks second in the Japanese market, third in the US market and is the top supplier of warm-water shrimp to various EC countries. The species of economic importance are

black tiger shrimp (estimated to be 56% of the total shrimp export), white shrimp and freshwater prawn. The popular product forms among traders are raw headless shell-on, constituting 70% of the total world trade, and head-on shrimp which account for about 10%. About 10-15% consists of peeled shrimp and breaded shrimp.

Thailand has been able to gain a significant market share in those countries because

- (a) The country has increased production of frozen shrimp with the expansion of its aquaculture, which is dominated by *P. monodon*, and with increased demand from the market. In 1988, Thailand was able to hold a strong market share in Japan, USA and even in the EC countries which have now become familiar with cold water shrimp.

- (b) Total shrimp consumption in the main consuming countries has continually expanded. Imports of farmed shrimp into Japan and the US have increased to 33% of their total shrimp imports.
- (c) Processors are able to control size and quality from the point of catching to processing.
- (d) Although exporters to the US are often handicapped by automatic detention-for-inspection by the USFDA, most Thai exporters have overcome this problem and they can supply shrimp which meet the USFDA quality requirements.

A particular problem faced by the industry in major markets has been competition from suppliers in other developing countries. To offset this, processors have intensified efforts to build a quality image and to diversify markets and product forms. New ready-to-cook products and packing styles have been developed along with new chemical- and drug-free products.

Canned Tuna

The success of the Thai canned tuna industry has caught the world by surprise. The country now holds 70% market share in the USA, 50% in the EC countries including Britain, West Germany and Switzerland, and 60% in Canada. Exports rocketed from 1,854 million bahts in 1984 to close to 13,800 million in 1989. They are expected to reach 16,000 million bahts or 260,000 mt in 1991 (Department of Business Economics, 1991).

Thai processors use both domestic and imported tuna for canning, and the domestic catch consists of tonggol and little tuna. The Department of Fisheries has estimated that each year's domestic catch is approximately 60%-70% tonggol and 30%-40% little tuna; these are fish locally-caught in the Gulf of Thailand and the Andaman Sea. The majority of tuna that Thailand imports are skipjack (approximately 85-90%), followed by yellowfin (8-12%) and some albacore (2-3%). Imports now account for over 70% of the tuna used in the

processing. In 1989, imports rose from approximately 275,000 mt in the prior year to approximately 325,000 mt.

The reasons for this success are

- (a) The industry's ability to meet quality standards in major importing countries eg, USA, Japan, Canada and European- producer countries.
- (b) The processors' ability to penetrate the Canadian market, where the import authority applies stringent quality standards to imported fishery products, especially canned tuna. This has given exporters the confidence to enter other new markets.

Since 1990, the world tuna industry has struggled with the dolphin issue, which has now spread from the USA to western Europe. Thai processors have adopted 'dolphin safe' policies by which the processors agree not to purchase, process and sell tuna caught in association with dolphin and to monitor tuna fishing in the Eastern Pacific to ensure that tuna purchased, processed and sold by the Thai processors is not associated with dolphin death or injury. In addition, the processors have ceased purchasing any tuna caught in highseas driftnets.

The dolphin controversy between the environmentalists and the tuna catchers is not likely to be resolved soon. However, the demand for canned tuna is expected to increase further. Thai canneries are working continuously to maintain their high quality standards. Improved quality control and standardization are emphasized to raise consumers' positive perception of the quality and reliability of the products:

Frozen Cephalopods

Compared with shrimp and tuna, the cephalopods' volume of trade is much smaller. In 1989, exports accounted for 69,054 mt and were valued at 5,238 million bahts. However, in 1990 it is estimated that exports decreased to 65,000 mt, valued at 4,500 million bahts. This would repre-

sent a decrease of 5.87% and 14.10% in volume and value respectively. Exports are expected to decrease to 62,000 mt (4,300 million bahts) in 1991 (Department of Business Economics, 1991).

The principal markets for these species are Japan and southern Europe. Thailand is a major supplier of cuttlefish and octopus to both markets to which it shipped 15,600 mt. Also, the country has successfully penetrated the Italian market. Italian demand for Thai loligo squid and cuttlefish is strong despite the stringent regulation on cadmium and biotoxin.

For the past three years, Thai processors have suffered from limited supply of squid and octopus, a situation which has resulted in high prices, uncompetitive products, and decreased export quantities and values. Consequently, since 1989, export volume has fallen and this trend is expected to continue.

In addition to shortage of raw material, the industry faces the problem of poor-quality raw material - particularly that supplied by trawlers. Import regulations, quotas and inspection procedures have also retarded the expansion of the market.

In response to the shortage of raw material, the Department of Fisheries has carried out research on cuttlefish aquaculture. The experiments have been successful at both the pilot and commercial scales.

Fish

Chilled fish have been major export items over the past five years. The volume of trade soared from 1,726 million bahts in 1989 to almost 2,000 million bahts in 1990. This trend is expected to continue in 1991 (Department of Business Economics, 1991).

Prepared fish products, particularly surimi and frozen fillets, are increasingly important. Fish fillet is a standard item of the international trade and with a high potential for growth, and many processors have diversified into this area. Production capacity, at present, is about 10,000 mt/year. Ninety per cent of the raw material is imported.

Another interesting item is frozen tuna loins. In the past, loin operation was considered to be an intermediate form of processing and the technology had not been extensively developed and perfected. In 1987, Thai processors acquired new processing techniques which allow fish to be cooked and frozen in ways that retain odour and flavour. Under this system, labour-intensive gutting, cleaning and initial cutting of tuna will be done in Thailand. The output - frozen tuna loins - will then be shipped to the US and Europe for the capital-intensive packing operation. The volume of trade has greatly expanded from 118 mt valued at 8.2 million bahts in 1989 to 33,000 mt valued at 2,500 million bahts in 1990. In 1991, the trade is targeted to be around 60,000 mt (value: 4,300 million bahts). Importers now appear to be confident that frozen loin quality is comparable to fresh loin. In addition, the canning of loins is indeed a solution to the problem of the US and European industry since it allows those canning industries to capitalize on the low wage rates in those countries where the loining takes place.

Value Added Seafood Products

Changes in major importing countries such as improving economic status, changing life styles, consumption patterns and various socio-economic influences, have made current favourites of high-value and value-added seafood products. Thailand has enjoyed an advantage, during this period, because of the favourable quality image in terms of product standard and processor reliability. The trade volume of value-added products has increased substantially; however figures on all products traded are not presently available. It is estimated that value-added products trade in 1990 accounted for 56,000 mt, valued at 3,700 million bahts (Table 11). A 50% increase in volume and value is targeted for 1991. This figure includes imitation crab meat, breaded fish and fishball and excludes cephalopods and shrimp products. To penetrate new markets and to increase the export of value-added products, both government and the private sectors have carried out a programme of continuous product development, product adapta-

tion, technology development and quality control as well as a packaging development programme.

The problems faced by this industry are:

- a) More stringent standards for consumer pack and ready to eat products by importing countries.
- b) The market for value added products is highly competitive, involving changes in type of products, forms and packaging as well as consumer behaviour. Often, importers are disadvantaged by the complexity of health and quality regulations. Exporters must be aware of market requirements, regulations and standard of importing countries including any possible changes and should check with the authorities of importing countries before shipping their products.

Problems Faced By The Industry

As the fishery industry expands, the industry faces the following problems:

Shortage Of Raw Material

The Thai industry has faced this problem for more than half a decade with supplies remaining limited as capacity increased. The industry has tried to overcome this problem by importing raw materials such as tuna and other fish, and by using raw materials from aquaculture and joint venture fisheries.

Quality Of Raw Material

The industry cannot fully control the quality of raw material, especially from capture fisheries. Even though it has applied strict standards in the purchase of raw material, competition among processors has forced them to be more flexible to maintain their share of supply. Control of the quality of aquaculture products is easier. Some processors own aquaculture farms along with refrigerated trucks and sufficient ice to apply to the catch as soon as it is taken out of water. However,

there are some cases in which processors cannot know whether or not the catch is drug-free or chemical-free. For this reason, strict monitoring procedures are presently implemented by both the processors and the Department of Fisheries to ensure that raw materials and products are free from drug and chemical residue. These monitoring systems also cover heavy metals and biotoxin in wild catch species.

Trade Competition

Competition among developing countries is becoming intense. As a result these countries need to embark on new products which will give higher profit. The competition can be briefly listed as follows :

- Competition between different sources of supplies (eg, between domestic and imported products and among foreign suppliers)
- Competition between types and species (eg, squid versus cuttlefish, *Illex* versus *Loligo*; among tiger shrimp/white shrimp and cold water shrimp, etc.)
- Competition between different sizes and forms.

Trade Barriers

Barriers to the processors and exporters can be classified as:

Technical barriers to trade, for example:-

- Sanitary inspection
- Marketing standards and regulations
- Labelling requirements
- Food additives residue, chemical and drug residue
- Biotoxin and contaminants.

Law and legislations such as:-

- Quotas and tariffs
- Marine animal conservation legislation eg, marine mammal protection acts

- (USA), turtle conservation legislations
- (USA), highseas driftnets legislations
- (USA, Canada and Australia)
- EC single market.

Technical Capability

Packaging technologies are needed for the further development of the industry. At the moment, the industry depends on imported technology in the area of processing techniques and equipment acquired from joint-venture and equipment suppliers. Self-developed technologies are also employed but progress is slow in this area. Faster progress is being made on technology adaptation. Improved packaging is crucial, not only to protect the products but also to market the products.

Role Of Government

In the Sixth Economic and Social Development Plan (1986-1991), the government is emphasizing rural development, poverty eradication and export promotion. The Department of Fisheries, in pursuit of these objectives and to deal with the problems facing the industry, has prioritized the activities as follows :

Promoting Aquaculture To Secure Fish As Animal Protein For People In Rural Areas

The Department encouraged fish farming through village fish pond and school fish pond programmes in northern and north-eastern Thailand. The people were taught fish rearing, hatchery techniques, preservation and processing.

Promoting Aquaculture For Export

Recognizing the need for raw materials for the fish processing industry, the Department has boosted research, development and extension work on shrimp, fish and cuttlefish aquaculture in order to meet the needs of the growing industry.

Negotiating Joint Venture Fisheries

Joint ventures with neighbouring countries, eg, Myanmar, Vietnam, ASEAN countries and India are promoted by the government to obtain fish for the export industry.

Ensuring Quality Of Fish And Fishery Products

In this area the Department has emphasized the upgrading of fish processing plants and fishery products for export. The Department's prime emphasis is on the inspection of fish processing plants and fishery products.

The Department of Fisheries, through the Fishery Technological Development Division (FTDD), provides service to the fish export industry. The aims are to :

- promote production and export of safe and high quality products.
- provide reasonable assurance that fish and fishery products from Thailand will be safe and of good quality and will otherwise meet standard requirements of authorities in importing countries.
- ensure that any problems due to quality of products are quickly identified and dealt with.
- collaborate with authorities in importing countries to create confidence and to upgrade the system so as to minimize the need for extensive sampling.

The current seafood safety and quality control programme is based on Good Manufacturing Practices (GMP) and the Hazard Analysis and Critical Control Point (HACCP) principles. The programme emphasizes continuous problem solving and prevention, from the water to the consumer, rather than a reliance on analysis of product samples prior to exporting. Although this programme is voluntary, the Ministry of Commerce requires that fishery products for export be certified for their

safety and quality by the Department of Fisheries. In addition, the certificate for fish processing plant hygiene required by importing countries must be issued by the Department of Fisheries. Services provided through this programme are as follows :

a. Plant Inspection

The Division carries out plant inspections at the rate of 2-4 times/year based on the standards and recommendations of the CODEX Alimentarius Commission and various importing countries. The inspection is done by inspectors specialized in raw material handling, process operations and plant hygiene and the inspection team is made up of at least three inspectors. The inspection focuses on the condition and maintenance of construction, equipment, processing operations, plant hygiene and personnel. Processing plants must score at least a 'B' grade to obtain a sanitary certificate. If the plant is found to be not in compliance with the requirements, it is given one to three months to make the necessary corrections.

b. Product Certification

The Division provides analytical, microbiological and sensory evaluation services, by well-trained scientists and panelists, to the fishery industry. Certifications are made according to the established standard and grades and requirement of different importing countries. Examples include Sanitary Certificate, Certificate of Analysis and Health Certificate.

c. Shrimp Farm Inspection

This programme was launched to serve shrimp farmers and exporters, to ensure

good farming practices and farm sanitation. The goal is to be able to identify quality and safety problems of shrimp either for export in fresh chilled form or for further processing for export as frozen products. The programme is designed to monitor levels of chemical (pesticide and antibiotics) and microbiological contaminants. It also covers farm hygiene and the gathering and establishment of parameters for upgrading practices and standard.

d. Process Analysis

This service is provided upon the request of the fish canning industry. The service includes heat distribution testing, assessment of cooking time and temperature for various canned products, etc.

Carrying Out Research And Development On Fish Handling, Processing And Quality Control

Following are some areas of research conducted by the FTDD.

a. Fish Handling

- Development of technology to prolong product life, eating quality and freshness of live, chilled and frozen fishery products,
- Development of economic methods for fish handling at sea, on shore and for fish transportation and distribution systems,
- Improvement of hygiene of fish handling, pre-processing and distribution,
- Development of shellfish depuration and control programmes, and
- Fundamental research on product composition, nutritional value,

application of preservatives in fish and fishery products.

b. Traditional Product Development

- Modernization of the processes by introduction of technology,
- Improvement of product form and style of pack,
- Improvement of quality and techniques,
- Improved understanding of chemical and biochemical processes involved, and
- Establishment of processing and product standards.

c. New Product Development

- Improved utilization of by-catch and low value species,
- Improvement of product form and quality,
- Development of value-added products, and
- Development of convenience foods and nutritive snack foods.

d. Engineering

- mechanization of fish-landing, handling, processing and transportation systems,
- development of small-scale equipment.

e. Development

The Division plays an important role in the improvement of the local fishery industry with the emphasis on the following areas :

- Improvement and maintenance of product quality and safety,
- Improvement of processing practices,

- Expansion of output through diversification of products,
- Improved utilization of fish as a protein source, and
- Improvement of the technical competence of personnel involved in the fishery industry.

The development programmes include :

- Rural development,
- Small-scale industry development,
- Industrial development, and
- Training for fishermen, entrepreneurs, quality control and production personnel.

Promotion And Support Of The Fish Processing Industry Through Domestic And International Collaboration

- participation in the drafting of Standards, Guidelines and Code of Practices at the national and international level, eg, at the CODEX Commission meetings,
- participation in the GATT Negotiating Group on Agriculture on Sanitary and Phytosanitary Issues, in order to lessen the technical barriers to trade, and
- cooperation with research, marketing and inspection institutes to develop technology and techniques for fish handling, processing and quality control.

Future Development

The Department of Fisheries' most recent thinking on future plans for the development of the fish processing industry stems from the 7th National Economic and Social Development Plan (1992-1996) and centers around the following objectives:

'Development and management, in co-operation with the industry, of the processing and quality assurance techniques needed to secure optimum and economic benefits for the nation and to promote the export of quality fish and fishery products'.

Specific objectives are to:

- improve the income of small-scale fishermen and fish processors, achieve and maintain self-sufficiency in the supply of fish to the domestic market, by reducing wastage and spoilage losses and increasing utilization,
- maximize the participation of rural population in commercial fish processing activities, assist the industry in controlling the quality of fish and fishery products, and
- increase export earnings from the sale of fish and fishery products.

Specific items in future plans for fish processing development include:

- assistance to small-scale fishermen and villagers to help them organize themselves for fish processing and fish distribution activities. This includes provision of technical and marketing assistance,
- establishment of regional R&D centers and fish inspection and quality control centers to carry out technology development and services, geared to the needs of each region,
- establishment of information centers to serve as sources of information on fish processing and marketing, and
- strengthening of research and development in the areas of fishery food safety, biotechnology and packaging.

In the industrial sector, future plans for development include:

- diversification of fish and fishery product exports to new markets,
- implementing quality management program based on HACCP principles, and
- utilization of industrial waste.

Discussion

When asked what type of machines were used to process cooked peeled prawns in Thailand, Miss Suwanrangi said that 90% of these products are processed manually. In response to a query about the utilization of shrimp by-catch in Thailand, Miss Suwanrangi replied that the Department of Fisheries had started a development work on by-catch utilization about ten years ago, and that the surimi and fish jelly product industry are now utilizing these by-catch. An indication of the extent of usage is that the average fish size of the by-catch is now much smaller than before.

Regarding the utilization of shrimp by-catch, a question was asked about the raw material used in the production of fish meal in Thailand. The reply was that, in addition to the local by-catch, production waste from the fish processing industry is being used.

Asked about the technology for producing tuna concentrate, Miss Suwanrangi said that cooking water from tuna canning industry was concentrated by a reversed phase.

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