

Development of Minced Fish Industry in Thailand

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Introduction

Minced fish can be obtained from various species and offers opportunities for utilization of fish in products of various shapes and sizes. However, the characteristics of a product determine which type of raw material is used. For Asia, products of good elasticity are preferred; therefore, fish of good gel forming ability are chosen as raw material. In Thailand, when no technology has been developed, fish of good characteristic has been used, mixed with salt and seasoning such as chilli paste or vegetable. In recent years raw materials used have changed due to shortages of raw material, elevated prices of certain species and demand for other products of higher value. Moreover, as technology developed, new opportunities for utilizing low valued marine fish were opened. Common species which can be used for minced fish products are:

- Spotted featherback (*Notopterus chitala*)
- Barred spanish mackerel (*Chirocentrus nudas*)
- Spotted spanish mackerel (*Scomberomorus guttatus*)
- Black barracuda (*Cyanoglossus macrolepidotus*)
- Ocean barracuda (*Sphyraena picuda*)
- Yellow barracuda (*Syhyraena optusata*)
- Tongue sole (*Cyanoglossus macrolepidotus*)
- Large head ribbon fish (*Trichiurus haumera*)
- Japanese threadfin (*Nemipterus japonicus*)
- Sixth tooth threadfin (*Nemipterus hexodon*)
- Spotted finned bigeye (*Priacanthus tayenus*)
- Spiny bigeye (*Pseudopriacanthus niphodia*)
- Rough flathead (*Grammoplites scaher*)
- Spotted flathead (*Thysamophrys crocodilus*)
- Blackspotted trevally (*Caranc leptolepis*)
- Lizard fish (*Suarida* sp.)

Presently, spanish mackerel, barracuda and spotted featherback are used only in restaurants and noodle shops. Fishball factories, mostly use bigeye, ribbon fish and sole. Other low

value species such as flathead, and trevally would be their second option. Surimi factories would utilize the available threadfin bream and conger eel while bigeye and croaker would be their second option. Lizard fish is commonly utilized by fish *satay* plants.

The total production of these species between 1974 and 1984 is shown in Table 1. Note that while production of each species is relatively stable, their value is increasing. The price rise of raw materials has been due to an increase in demand. In some cases, this is for producing traditional products such as dried/salted, smoked and fermented products for local consumption. There is also an increase in export. In the fishball industry, the number of factories and their production capacity have increased. This industry once relied heavily on spanish mackerel but as its price rose, competition from the high value salted fish industry drew it away. There was therefore an urgent need for technology development; surimi factories have also substantially increased in number and production since 1981. The number of fishball and surimi factories from 1981 to 1987 is shown in Table 2.

Technology Development

Development in minced fish technology in Thailand has involved improvement of machinery to replace man power, development of new processing techniques and improved utilization of underutilized species as follows:

Mechanical fish deboner

This machine is used to prepare the mince in medium to large scale processing factories. At present two types are in use:

1. A stamping type, developed and produced in Thailand: High input-output capacity can be obtained but the flesh characteristic is inferior to the roller type deboner.
2. A Japanese roller type deboner and a Taiwanese deboner: These machines offer

better yield and flesh appearance, since the contact area between fish and the separation device is greater. Pressure can also be adjusted. However the price is higher — this applies particularly to the Japanese deboner.

The heading and gutting machine — this

machinery is not popular in minced fish processing factories because the cost of manual labour for this operation is low: from 0.40 bahts to 0.50 bahts per kg. Filleted fish are however, still demanded by fishball factories because the cost of filleting varies only from 1.25-2.00 bahts depending on species.

Table 1. Quantity and value of selected marine species 1974-1984

Species		1974	1976	1978	1980	1982	1984
Threadfin bream	Q.	18,975	16,904	23,678	18,016	17,340	15,052
	V.	79,696	71,842	124,547	111,339	117,867	90,227
Monocle bream	Q.	4,630	3,555	191	635	5,877	1,292
	V.	10,186	10,132	818	4,204	79,561	6,626
Conger eel	Q.	1,822	2,306	3,472	2,651	2,141	1,559
	V.	6,194	10,147	18,749	17,921	19,890	10,127
Croaker	Q.	17,933	9,786	15,241	11,206	10,977	11,534
	V.	44,835	46,944	100,896	61,835	64,928	79,352
Bigeye	Q.	12,454	11,673	13,861	16,429	9,630	10,000
	V.	23,633	33,852	73,324	79,024	62,878	43,699
Lizard fish	Q.	12,160	10,644	12,592	10,273	8,614	9,723
	V.	26,753	28,208	47,220	52,803	40,916	35,597
Ribbon fish	Q.	5,542	6,316	8,353	5,987	5,150	3,660
	V.	16,071	19,895	39,677	31,072	27,333	21,348
Wolf herring	Q.	1,454	1,523	3,470	3,574	2,844	2,598
	V.	9,305	11,497	32,756	29,092	29,364	30,159
Mackerel	Q.	4,857	8,849	9,376	11,354	10,252	10,364
	V.	58,771	120,778	141,203	195,630	247,664	288,642
Barracuda	Q.	3,757	3,166	5,044	5,103	5,626	5,261
	V.	20,666	19,469	41,513	45,774	51,936	47,012
Flatfish	Q.	4,092	6,053	7,896	5,969	6,830	5,782
	V.	8,593	22,396	41,549	31,217	41,728	34,927
Scad	Q.	34,792	83,760	107,376	30,964	35,838	44,256
	V.	66,105	137,038	403,734	121,998	169,146	175,455
Trevallies	Q.	10,602	22,284	35,587	23,431	12,851	20,323
	V.	34,986	103,621	224,554	203,147	104,525	178,633
Sardinellas	Q.	58,222	105,622	145,278	105,413	116,898	117,323
	V.	58,222	213,333	408,419	314,131	418,810	352,939
Other food	Q.	82,041	81,895	98,897	84,381	84,505	95,291
	V.	336,368	317,061	517,864	478,878	436,423	535,220
Trash fish	Q.	690,270	620,646	847,421	786,858	812,789	757,637
	V.	690,270	682,711	1,271,132	1,447,818	1,529,226	1,555,038

Source: The Marine Fisheries Statistics, 1974-1984, Department of Fisheries

Q — quantity in mt

V — value in '000 bahts.

Table 2. Number of fishball and surimi factories, 1981-1987

	1981	1983	1985	1987
Fishball factory ¹⁾	no record	117	139	—
Demand for raw material (ton/day)	—	37.87	36.5	—
Surimi factory ²⁾	3	4	6	11
Demand for raw material				
— full capacity (ton/day)	100	125	225	400
— run 50% capacity ³⁾	50	62	112	200

Source: Department of Fisheries (1981-1986)

1) Department of Fisheries statistics and estimated figure for Bangkok area by SRG (1978)

2) Survey data

3) At peak season (Sept-Dec), a big factory can take in as much as 80 tons/day of raw material.

Processing techniques

Fishball, the popular minced fish product, is produced by the same general process — of mixing minced fish with salt and ingredients, setting in warm water and cooking in boiling water. A mixture of fish fillet of various species of fish are normally used. Ingredients are salt (approximately 4%) monosodium glutamate (1%) pepper (1-3%) ice and vegetable. An unknown amount of NaCO₃ is sometime added. Starch is added at various percentages from 5-20% depending on the quality of the end product. Processing is heavily dependent on experience, and mostly under no form of weight control since fish used are the common species with known good gelforming characteristics. Processing techniques have not been developed but instruments have gradually replaced man power in the mixing stage and in product-forming. A fishball forming machines was developed in Thailand, and has been the only technical improvement for traditional fishball processing.

In 1980, the Fish Processing Subdivision of the Fishery Technological Development Division with the support of IDRC-(Canada) explored the possibility of using sorted by-catch as raw material for fishball. A leaching method modified from surimi production was also introduced to improve gel forming ability of the raw material. Food additives such as polyphosphate of various types were tried. A new processing method (MFRD, 1980) was studied and recommended to the private industry. This method involves washing minced meat with diluted salt solution, controlled mixing time, sequential addition of ingredients and double-step heating. The new method has been shown to improve the quality of fishball produced from sorted by-catch. Various other products using washed minced fish were developed and

promoted. They included fish fingers and fish sausage.

Since 1983, surimi technology has been adopted throughout the world. In Thailand the surimi industry started in 1970.

Surimi technology is a package of imported technology comprising machinery, techniques and technologist. The technology was adapted to suit the local species. Machinery comes from two sources; Japan and Taiwan. The two types have different layout and different design for washing tanks. A refiner will gradually replace the strainer because a strainer causes a temperature elevation of 3-4°C. Polyphosphates (about 0.3%) such as sodium polyphosphate, sodium-pyrophosphate and sodium tripolyphosphate are used. Surimi without polyphosphate are also produced because of the market demand; however, it has short storage life. Quality control in the production line is of great importance.

Critical control points are as follow:

1. Freshness and temperature of fish.
2. Water
 - temperature
 - hardness
 - pH
 - metal content
 - volume used
3. Time in washing.
4. Washed mince temperature.
5. Ingredients.
6. Freezing and storage temperature.
7. Plant sanitation.

At present, buyers set standards for Thai surimi based on the following qualities:

1. Gel strength.
2. Whiteness.
3. Impurities.
4. Microbiology.

Product development

Surimi is an intermediate product which can be used as raw material for various kind of products. Surimi is commonly divided into three grades AA, A and B according to gel strength and colour. AA grade will have over 1,000 gm. cm, A: over 700, B: 500-700. Price varies according to grade. High grade surimi are all exported; however, competitive market-structure may force the utilization of high grade surimi to value added products prior to export. Various kind of products have been studied and introduced to producers and consumers — for instance fish finger, fish roll, fish noodle, fish *wonton* and fish sausage. However, no market testing has been done.

FTDD is now working on product diversification based on technologies available to the Thai food processing industry. Among these, sausage and canned products have the best prospects although marketing development still has to be done.

Surimi processing technology for the abundant supplies of pelagic fish, is being developed. However lack of equipment has retarded this development. Freshwater fish was also used in surimi production on a pilot scale.

Through its Analytical Research Subdivision, FTDD will set up a pilot imitation crabmeat plant for research and development. The facilities will later be available for use by the private sector. Research and development using various species such as threadfin bream, jew fish, sardine and lizard fish will be carried out in depth, to develop information for the use of the industry.

Future Development

Several topics in minced fish, surimi manufacturing and fabrication of minced fish and surimi based products need further study. Research areas that require further work include:

- Development of proper on-board storage systems to preserve fresh fish and handling of fish on shore. CSW

should be encouraged to replace conventional ice storage system.

- Utilization of red meat fish in the form of minced fish product.
- Product development from surimi for local consumers.
- Heat sterilization of surimi products.
- Fabrication of surimi products.

Socioeconomic Factors

As statistical data on demand and supply of fish in the minced fish business (and as data on labour and income) are not available, the following section is based on interview data. It is generally felt that the development of the minced fish industry has contributed to overall social well-being as follows:

1. Increasing price of raw material

According to FMO (1977-1986), mode auctioning price of fish has been increasing by almost 50% especially threadfin bream and flatfish (See Table 3). In practice fish previously sold as trash fish are now gradually sorted out for surimi processing. The price has increased from 1.50 baht to at least 3.50 bahts.

However, competition for raw material has also occurred between surimi factories and cured fish processing factories.

2. Increasing employment

Labour was normally required in filleting houses preparing raw material for fishball factories. When the number of surimi factories expanded from three to eight in central Thailand with another three in southern part. The size of the workforce engaged in heading and gutting was estimated to increase from 350 people in 1980 to 1,200 people in 1987.

Not only surimi factories but also small-scale plants producing dried minced sheet (*satay* fish) have offered significant job increase in villages and towns where these facilities are located. It is estimated by one industry source that a labourer can earn, depending on experience, from 2000-4000 bahts a month.

3. Consumer benefits

Consumers up to now have sustained a bad impression of minced fish and fishball because of the raw material and other ingredients used

— notably the addition of borax in fishball. The new processing methods have no offensive odour, have good elasticity and offer better overall product quality and safety.

Fish mince can also be utilized in various forms which offer the industry new opportunities for product innovation.

Table 3. Price of outstanding fresh marine fish auctioned at Bangkok Fish Market, 1977-1986

Species		(BAHT/Kg.)				
		1977	1980	1982	1984	1986
Hairtails	MIN	2	2	2	2	4
	MAX	9	15	15	29	18
	MODE	4	8	12	12	13
Wolf-Herrings	MIN	3	4	5	4	4
	MAX	23	26	45	40	65
	MODE	12	14	23	18	17
Trevallies	MIN	2	4	4	2	3
	MAX	16	8	25	20	18
	MODE	7	12	14	12	12
King mackerel	MIN	11	10	5	8	12
	MAX	33	40	70	70	75
	MODE	24	24	35	45	50
Croakers	MIN	2	3	2	2	3
	MAX	17	18	22	23	30
	MODE	7	10	12	15	16
Big-eyes	MIN	2	2	2	2	3
	MAX	8	7	8	7	7
	MODE	4	6	5	5	6
Monocle bream	MIN	1	2	2	2	2
	MAX	5	5	10	16	10
	MODE	2	3	4	4	6
Treadfin bream	MIN	2	3	3	3	3
	MAX	19	12	18	18	18
	MODE	6	8	11	12	12
Lizard fishes	MIN	2	2	2	2	2
	MAX	6	7	8	8	9
	MODE	5	5	5	4	5
Flatfishes	MIN	2	3	3	3	4
	MAX	15	16	28	27	30
	MODE	7	8	17	20	20
Scades	MIN	—	2	2	2	4
	MAX	—	8	10	8	10
	MODE	—	6	7	5	7
Conger eels	MIN	3	4	4	4	4
	MAX	9	8	12	8	12
	MODE	6	6	10	6	10
Barracuda	MIN	3	4	5	4	5
	MAX	18	16	30	28	32
	MODE	10	12	20	20	25

Source: The Fish Marketing Organization Fisheries Record (1977-1986)

Technology Transfer

Since 1983 the Fishery Technological Development Division has communicated new methods of fishball production to all levels of fish processors through seminars and training courses. Technical assistance to processors are also provided upon request.

Transfer of technology is done at three levels:

1. Food processors

Seminars and workshops have been conducted for food processors in order to introduce utilization of by-catch, new processing methods, equipment as well as quality control program.

2. Consumers

A workshop was conducted to show consumers how to utilize and preserve fish mince, and to acquaint them with product development. Workshops were carried out through both mobile training and pilot scale operations.

3. Extension officer

Training covers utilization and preservation of fish. Minced fish processing is one of the topic discuss. An extension officer who is trained in the FTDD laboratory for 3-5 days

will then approach consumers in their responsible area.

All training were done outside the regular programme because of lack of staff and budget: The workshop and seminar were done under the technical project. Extension work, especially mobile training and technical assistance, were done through aid programme.

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