

# Advances And Technical Problems Of Fish Processing In Southeast Asia

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The fisheries and fish processing industry in Southeast Asia has shown tremendous growth over the past decade. This is reflected in the extension of cold chain distribution systems, diversification of fish processing techniques, and advances in quality control hygiene and sanitation management. However, progress has been uneven from country to country, with change taking place rapidly in some and slowly in others.

In general, the people of Southeast Asia are fond of seafood. Also, except for Singapore and Hong Kong, these countries depend more on

primary industries such as agriculture, fisheries, forestry and mining than on secondary and tertiary industries.

Most high-quality and high-priced fishery products are exported to developed countries to earn foreign currency, and this dampens domestic demand for products such as prawns and molluscs. Fig.1 shows the total production, imports and exports of major fish-importing countries in Southeast Asia. Fig. 2 makes a similar breakdown for major fish-importing countries. Table 1 shows per capita supply of fish for this region (1984-

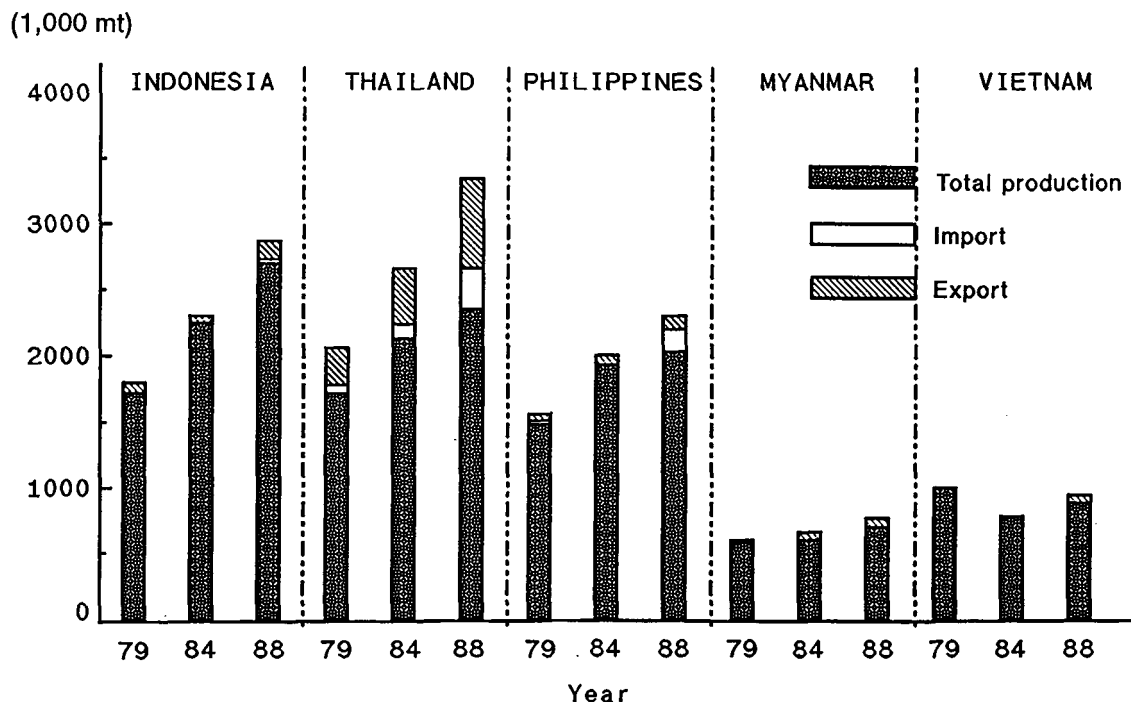


Fig. 1. Seafood export-oriented countries in Southeast Asia.

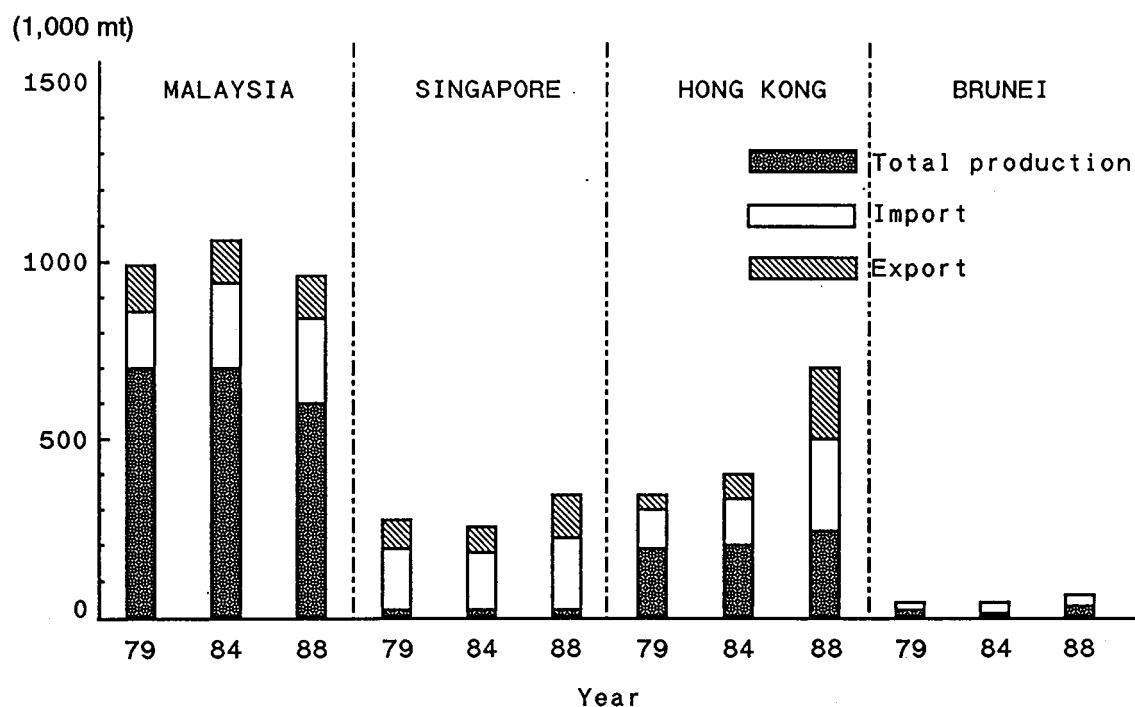


Fig. 2. Seafood import-oriented countries in Southeast Asia.

Table 1. Per capita supply kg/year\* (1984 - 1986)

| Country                 | Total catch (mt) | Non-food use (mt) | Import (mt) | Export (mt) | Population (1,000) | Per Capita supply (kg/year) |
|-------------------------|------------------|-------------------|-------------|-------------|--------------------|-----------------------------|
| <b>Major Exporter :</b> |                  |                   |             |             |                    |                             |
| Indonesia               | 2,370,720        | 12,726            | 5,879       | 102,185     | 166,421            | 13.6                        |
| Thailand                | 2,298,795        | 915,145           | 220,951     | 501,652     | 51,593             | 21.6                        |
| Philippines             | 1,907,366        | 0                 | 14,805      | 72,105      | 185,721            | 33.7                        |
| Myanmar                 | 626,074          | 20,000            | 0           | 8,464       | 37,544             | 15.9                        |
| Vietnam                 | -                | -                 | -           | -           | -                  | 12.5                        |
| <b>Major Importer :</b> |                  |                   |             |             |                    |                             |
| Malaysia                | 638,077          | 110,225           | 246,644     | 208,499     | 15,450             | 36.6                        |
| Singapore               | 22,999           | 12,887            | 197,089     | 103,377     | 2,558              | 40.7                        |
| Hong Kong               | 203,808          | 12,762            | 205,715     | 145,478     | 5,462              | 46.1                        |
| Brunei Darussalam       | 2,657            | 0                 | 7,159       | 245         | 224                | 42.7                        |

\* FAO Yearbook of Fishery Statistics, 1988 : (Total catch - Non-food use + Import - Export) ÷ Population

1986). Note that per capita supplies of the export-oriented countries are lower than those of the import-oriented countries. However, in every country the per capita supply is higher than the world average of 12.4kg/year.

It is generally accepted that the trawlable fishing grounds of tropical warm waters are narrower than those in temperate waters and that a richer variety of species is available in tropical waters. For this reason, the challenge of maintaining the marine fishery catch at the maximum sustainable yield (MSY) and of utilizing the trash fish catch will become more critical. On the other hand, the culture of fish and shellfish in tropical waters enjoys advantages over similar operations in temperate waters and can therefore be expected to develop rapidly.

Remarkable advances have been achieved in fisheries and fish processing in the Southeast Asian region in the following areas:

- (1) tuna fisheries and processing,
- (2) seaweed culture and processing,
- (3) shrimp and prawn fisheries and processing, and
- (4) surimi and comminuted products processing.

These improvements are discussed in greater detail below.

### Tuna Fisheries And Processing

The total world tuna catch was about 3.2 million mt in 1984 and 3.8 million mt in 1988. In the same years the tuna catch in the Southeast Asian region was about 0.6 million mt and 0.9 million mt respectively, or 19 to 24 % of the world catch.

Table 2 shows the amount and species of tuna caught by countries of the region in 1984 and 1988.

The majority of tunas and skipjack are consumed as *sashimi*, canned food, steak and *katsuwobushi* in Japan, USA and Europe, and they accounted for about 80% of the total catch. There is a large market for *sashimi* and *katsuwobushi* in Japan while the USA and Europe are the main markets for canned tuna and frozen tuna block

loins. The highest prices for tuna are paid in the *sashimi* and *katsuwobushi* markets; the prices of canned tuna, frozen tuna and frozen tuna block are at the lower end of the market.

Bluefin tuna, big-eye tuna and yellowfin tuna reach the *sashimi* market from Korea, Taiwan and Southeast Asian countries. Portions of the catch that lack freshness or that have been flawed by poor handling are transferred to the canned-tuna or other fish processing markets.

Longtail tuna, skipjack, eastern little tuna, albacore, bonitos and some yellowfin tuna are processed as canned products mainly in Thailand and the USA. The breakdown by country is shown in Table 3.

Recently, the pattern of canned tuna production has been changing with some of the U.S. and Japanese share being transferred to Thailand. In 1988, the share of Thailand was 21% of the world total; in 1990 it may be about 30%. The share of Philippines has been increasing slowly.

The majority of the raw material for canned tuna is imported into Thailand. The canned products are mainly exported to USA and EEC countries.

The light-coloured canned tunas manufactured from yellowfin tuna, longtail tuna and albacore are more expensive than the dark-coloured canned tunas manufactured from skipjack and bonitos. These raw materials are imported into Thailand from Japan, Taiwan, USA, Maldives, Papua New Guinea and the Solomon Islands.

There is also a similar trend in the processing of frozen tuna block loins in Thailand. The ASEAN region in general has several advantages in this area: proximity to good tuna fishing grounds, cheap and good labour, low operating costs, developed fish processing sector, reliable quality control, and political stability. Thailand enjoys the greatest advantage in the region, followed by Philippines and Malaysia.

So Thailand has now become the main center for tuna processing and output of canned products.

Most of the sailfish and swordfish caught by ASEAN countries are exported to Japan, and consumed as *sashimi*, steak and seasoned or fermented products.

Table 2. The catch of tunas in Southeast Asian countries, 1984 and 1988.

|   | Indonesia |         | Malaysia |        | Philippines |         | Thailand |         | Singapore |      |
|---|-----------|---------|----------|--------|-------------|---------|----------|---------|-----------|------|
|   | 1984      | 1988    | 1984     | 1988   | 1984        | 1988    | 1984     | 1988    | 1984      | 1988 |
| Total catch (mt)  | 256,827   | 349,668 | 34,063   | 37,739 | 244,805     | 296,058 | 87,202   | 161,633 | 836       | 575  |
| Skipjack<br>( <i>Katsuwonus pelamis</i> )   | 80,658    | 127,543 |          |        | 44,671      | 55,940  |          |         | 81        |      |
| Yellowfin tuna<br>( <i>Thunnus albacares</i> )  | 30,697    | 42,979  |          |        | 54,924      | 57,060  |          |         | 417       | 549  |
| Big eye tuna<br>( <i>Thunnus obesus</i> )   |           |         |          |        |             |         |          |         |           |      |
| Eastern little tuna<br>( <i>Euthynnus affinis</i> )                                   |           |         | 6,871    | 6,322  | 41,899      | 56,266  | 32,460   | 53,450  |           |      |
| Longtail tuna<br>( <i>Thunnus tonggol</i> )   |           |         | 17,723   | 20,730 | 44,378      | 92,925  |          |         |           |      |
| Frigate tuna<br>( <i>Auxis thazard</i> )  |           |         |          | 142    | 80,305      | 105,436 |          |         |           |      |
| Sailfish or swordfish<br>( <i>Xiphias &amp; Iseioophorus</i> spp.)                    |           |         |          | 147    | 5,281       | 7,560   |          |         |           |      |
| King mackerel or narrow<br>barred king mackerel<br>( <i>Scomberomorus commerson</i> ) | 42,293    | 16,790  | 9,268    | 10,398 | 13,725      | 13,796  | 10,364   | 15,258  | 338       | 26   |

Source : FAO Yearbook of Fishery Statistics, 1988.

Table 3. Processing share of canned tuna (%).

| Country                  | Year    |         |         |
|--------------------------|---------|---------|---------|
|                          | 1979    | 1984    | 1988    |
| U.S.A.                   | 46      | 37      | 27      |
| Japan                    | 15      | 16      | 11      |
| Spain                    | 10      | 7       | 7       |
| Italy                    | 7       | 7       | 8       |
| France                   | 4       | 5       | 5       |
| Philippines              | 1       | 3       | 4       |
| Thailand                 | 0       | 5       | 21      |
| Others                   | 17      | 20      | 17      |
| Total<br>Production (mt) | 602,213 | 783,022 | 996,603 |

Frozen tunas exported from ASEAN countries for the *sashimi* market must be very fresh with good meat colour. They must meet high standards of hygiene and they have to be frozen and stored under  $-40^{\circ}\text{C}$ . The high level of technology needed to meet these requirements is currently available in the ASEAN region.

Although the raw material for canned tuna need not be as fresh or have as good meat colour as that used for *sashimi*, it must have uniform meat quality, good appearance, and be free of abnormal odour and extraneous substances. At the processing stage, in which dark meat is removed and the meat is put into cans, many labourers work together in the same place. At this point, quality control to preserve uniformity of the meat and to protect against contamination by extraneous substance, is most important. Utilisation of the by-products of canned tuna, such as the dark meat, and the raw waste, is an important aspect of the operation. The dark meat is generally processed as canned pet food.

As for local tuna products, smoked tuna has been processed in Malaysia and Philippines using small tuna. About 22 thousand mt were produced in 1988.

Smoked fish products are popular in the Southeast Asian region, especially in Philippines. Boiled tuna has been processed in the Tagalog region of Philippines, but because it is expensive, it is not processed widely.

### Advances In Aquaculture And Related Processing Activities

Total aquaculture production by sub-sector and by country in Southeast Asia is shown in Fig. 3. In the Southeast Asian region, commercial aquaculture has developed vigorously under favourable conditions including the ready availability of solar energy and warm water. Primary aquaculture activities include mariculture of red algae in Philippines and Indonesia, brackish-water culture of milkfish in Philippines and

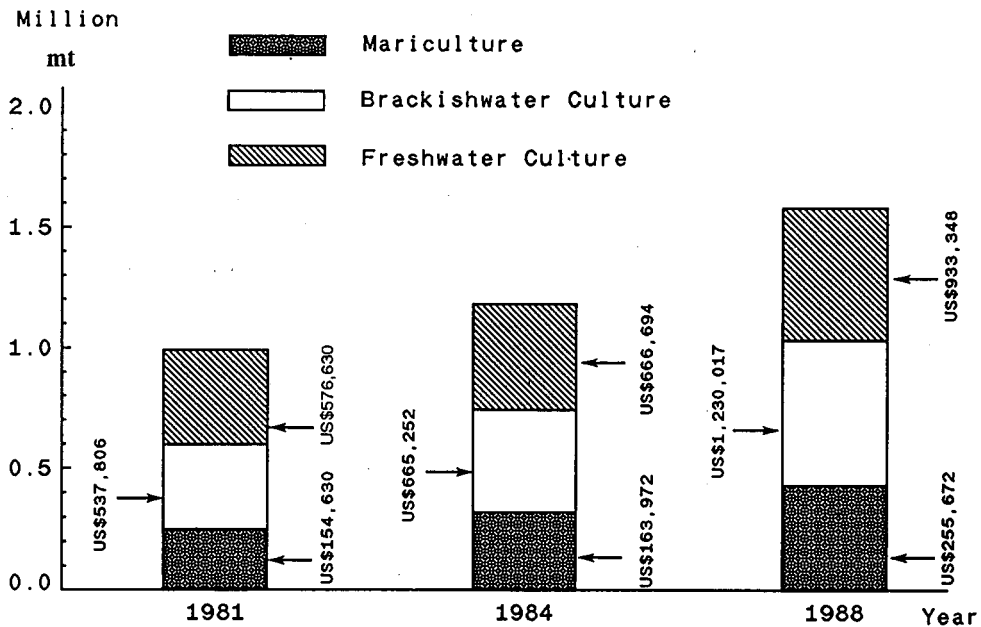


Fig. 3. Aquaculture production in Southeast Asia.

Indonesia, brackishwater culture of tiger prawn and white prawn in all Southeast Asian countries, freshwater culture of tilapia in Philippines, Indonesia, Thailand and Malaysia, and freshwater culture of freshwater prawn in Thailand.

### Red Algae

Red algae production in the main harvesting countries is shown for 1985 and 1988 in Table 4. Total world red algae production was about 1.1 million mt in 1985 and about 1.3 million mt in 1988. About 60% is *Porphyra* spp. which is used mainly as human food. The remaining 40% comprises *Galidium*, *Gracilaria* and *Euचेuma* spp., and is mainly for industrial use.

Red algae cultured in Philippines and Indonesia are mainly *Euचेuma* and *Gracilaria*.

**Table 4. Red algae production in the main harvesting countries.**

(Wet weight : mt)

| Country          | Use                    | Year      |           |
|------------------|------------------------|-----------|-----------|
|                  |                        | 1985      | 1988      |
| China            | Food Consumption       | 123,670   | 155,790   |
| Japan            |                        | 361,808   | 452,755   |
| Korea Rep.       |                        | 114,783   | 125,841   |
| U.S.S.R.         |                        | 10,804    | 11,538    |
| Indonesia        |                        | 427       | 540       |
| Thailand         |                        | 2         | 10        |
| Indonesia        | Industrial Consumption | 55,250    | 90,800    |
| Philippines      |                        | 184,410   | 257,305   |
| Thailand         |                        | 4,231     | 990       |
| Mexico           |                        | 7,542     | 8,110     |
| Chile            |                        | 146,377   | 95,466    |
| World Production |                        | 1,076,971 | 1,250,677 |

Source: FAO Yearbook of Fishery Statistics, 1988.

From these algae carrageenan and agar are extracted, respectively, and dried. Estimated world production of seaweeds used for colloids by region is shown in Fig. 4.

Alginate, agar and carrageenan are competitors with each other for a share of the international colloid market. Carrageenan has very similar characteristics to agar, and is sometimes called western agar. Carrageenan is more popular than agar in Europe and North America.

Southeast Asia produces about half of the world's supply of the raw materials of agar and carrageenan, and most of this is exported to USA and Europe. Nearly 70% of the world market for agar and carrageenan is in the food sector, where they are used as suspension, thickening and gelling agents. Residual non-food uses include the manufacture of bacteriological medium, toothpaste, cosmetics, glue of silk and solid air fresheners.

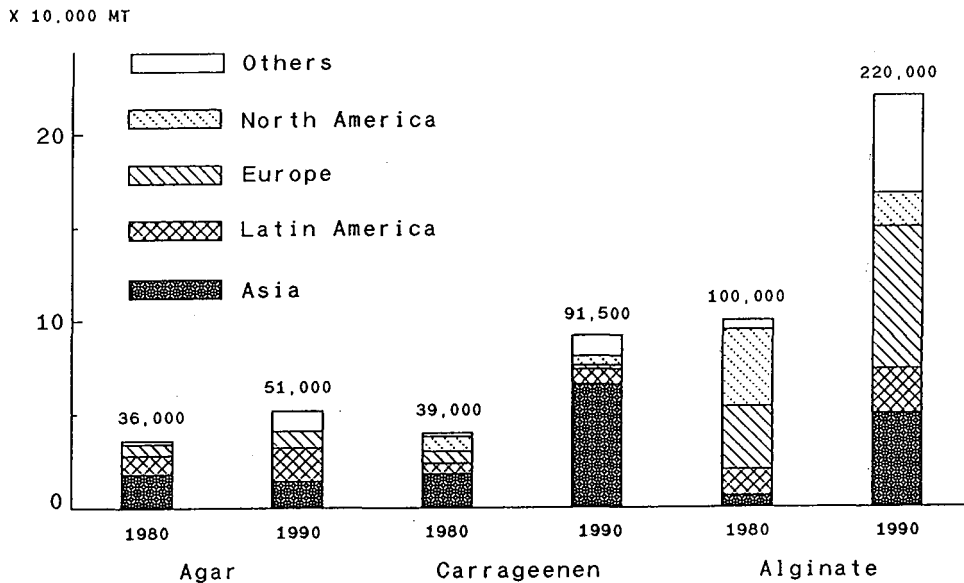
Because growth in demand for these products is slow, increased production has lowered the price of dried red algae. It is therefore necessary to encourage the production of value-added products incorporating this algae in producing countries. A red algae powder factory will probably be built in the region within this year.

### Shrimp And Prawn

World shrimp and prawn production was about 2.3 million mt in 1984 and about 2.7 million mt in 1988. Shrimp and prawn production in the ASEAN region was about 560 thousand mt (marine catch 413,800 mt and aquaculture 146,300 mt) in 1984. It was about 664 thousand mt (marine catch 426,400 mt and aquaculture 237,400 mt) in 1988. These totals make up 24-25% of world production.

Aquaculture production has been increasing rapidly year by year. The species of shrimp and prawn caught and cultured in the ASEAN region are mainly tiger prawn, banana prawn and other *Penaeus* prawn.

*Metapenaeus* prawn, sergestid shrimp, and other species are also caught in the region. The main international markets for shrimp and prawn are the USA, Japan and the EEC, where warm-



Source: INFOFISH

Fig. 4. Estimated world production of seaweeds used for colloids by region in 1980 and 1990 (dry weight).

water prawns are considered separately from cold water prawns. Although it had been assumed that shrimp and prawn demand in the developed countries had peaked, demand has continued to grow. Most of the supply has been provided by warm-water shrimp and prawn.

Most of the shrimp and prawn supplied to the international market takes the form of frozen whole, frozen headed, and frozen, headed and cooked. Recently, transportation of live prawn has been increasing in the ASEAN region.

Improved equipment for the freezing of tuna is being introduced in some of the more advanced factories for production of IQF and for the prevention of prawn blackening. But the majority of cold storage rooms of commercial plants are about  $-20^{\circ}\text{C}$ , so they are not suitable for long periods of cold storage.

Exporters of frozen tuna and frozen prawn are often expected to take the lead in adopting new and advanced technology. However, governments and

the relevant organizations within the ASEAN region should emphasize the consolidation of food standards, the implementation of reliable inspection systems and ensure the safety of food products.

Within the region, Thailand has been taking positive steps in this direction. In 1988 about 60 thousand mt of canned shrimp was produced in Thailand, and this accounted for about 60% of the canned shrimp production of the world. The canned shrimp markets are in USA and EEC, but the demand is not large. ASEAN is in a very advantageous position for canned shrimp production.

Shrimp paste and shrimp sauce made of small shrimp such as *Acetes* spp. are very tasty and popular traditional fish products in this region, and are mainly manufactured in Thailand and Malaysia. Technical development in this area has been very slow, but it can be further improved by food packaging techniques.

## Frozen Surimi And Surimi-Based Products Industry

Frozen threadfin bream surimi production in Thailand started in 1984 in earnest and its production reached about 25 thousand mt in 1988. Of this, about 20 thousand mt, was exported to Japan. The remainder was exported to Singapore and other Southeast Asian countries.

In 1988, world frozen surimi production was about 490,000 mt with ASEAN production accounting for about only 5% of the total. The quality of frozen threadfin bream surimi remains very stable during cold storage.

In 1988, trawl-by catch made up about 10% of the total marine fish caught in Thailand, and about 20% of the total marine fish caught in Malaysia.

Selected by-catch species could be used as raw materials for surimi and comminuted products; these include threadfin bream, croaker, big eye snapper and lizard fish. Minced fish meat is produced in many Asian countries including Taiwan, Hong Kong, Singapore, Malaysia and Myanmar now.

Many kinds of surimi-based comminuted products are manufactured in Southeast Asian countries, as shown in Table 5. Several fish species, including demersal fish, pelagic fish, molluscs and shrimps are used as raw materials of the

comminuted products. Fish cakes mixed with coconut milk such as *otak otak*, are very popular. Since the shelf lives of the comminuted products are normally only two or three days at 5°C, distribution of the products is limited.

In Singapore, the cold chain of food distribution is quite well developed and in recent years a greater variety of comminuted products has been manufactured. The main use of raw materials for comminuted products has shifted from fresh fish to frozen surimi, and the supply of raw materials has been stable. Due to the shortage of labour in Singapore the next step is in the development of automatic manufacturing equipment to increase productivity.

Because comminuted products are generally sold in supermarkets the products must be packaged. Food packaging technology in Southeast Asia has shown remarkable advances recently, but technical competence varies significantly amongst the ASEAN countries.

## Problems And Solutions

### Improvements In Traditional Fish Processing Technique

Improvements in fish processing techniques and equipment are important in commercial production. High value, processed products such

Table 5. Comminuted products in Southeast Asia.

| Country     | Products  |
|-------------|---|
| Brunei      | Fishball, fishcake  |
| Indonesia   | Fishball  |
| Malaysia    | Fish sausage, prawn sausage, cuttle-fish ball, prawn <i>wantan</i> , prawn burger, prawn dumpling, scallop flavoured fishcake, fish burger, cuttlefish sausage and cocktail, fishball, fishcake, <i>otak-otak</i> |
| Philippines | Native sausage, fishball, fish burger   |
| Singapore   | Fishball, fishcake, cuttlefish/squid balls, imitation crab sticks   |
| Thailand    | Fishball, fish noodles, frozen surimi, imitation crab sticks  |

Source: Southeast Asian Fish products, 2nd ed., 1991. MFRD/SEAFDEC.



as exported frozen tuna, frozen prawn, frozen molluscs, canned tunas and canned shrimp, normally require the use of new, imported equipment. At the same time it is necessary to access current international information on such matters as fish processing techniques, quality control techniques, sanitary management of the factory, etc. The exporting industry has systems for the collection of this information.

On the other hand, traditional fish products are manufactured by small-scale producers and the rate of technical advance here is very slow. In this sector, the collection and transfer of technical information is difficult. If the price of the traditional fish products increased, their consumption will gradually decrease. So improvement to the quality of these quality has to be achieved by the use of low-cost methods. This is very difficult technically and more experimentation and research is needed.

Scientists and technicians working in the government and relevant organizations should therefore concentrate on improving the technology of the traditional fish processing sector.

### **Transfer Of Technology And Dissemination Of Information**

The technical differences between ASEAN countries is very great and this may be a political and economic problem. But economic and technological development can be accelerated by cooperation and competition.

The Marine Fisheries Research Department has been providing extension services for the transfer of post-harvest technology to the Southeast Asian region since 1980. These have covered surimi and surimi-based product processing techniques and fish handling and fish preservation procedures. I believe the regional training courses have been useful for technologists, and that demonstration courses have been useful for fish processors. Study tours of fish markets, retailer markets and fish processing factories in advanced nations have been most useful for traditional fish processors. Such tours should also be planned for the processors of each country.

### **Variety Of Frozen Surimi**

The main raw material used for making frozen surimi is the threadfin bream. In Thailand, limited supplies of demersal fish such as threadfin bream, big-eye snapper, and lizard fish make it difficult to maintain the amount of frozen surimi for export. Since consumption in the ASEAN region is low, this is not a severe problem. But the variety of frozen surimi is a current feature of the world surimi market. There are few data on the gel-forming ability of warm water fish.

We must collect more data about their suitability as fish jelly products. The quantity and quality of underground and tap water is very important to the fish processing industry, especially in frozen surimi processing.

The processing of frozen surimi requires twelve times as much water as the processing of raw fish and the quality of water affects the gel-forming ability and microbiological quality of the product. It is therefore important to pay attention to the microbiological and chemical quality of the water.

### **Large Scale Fish Processing In Southeast Asia**

Large fish processing bases appear to be developing in Thailand and Philippines.

The necessary raw materials needed are often imported while the final products are exported throughout the world. One problem is that by-products and waste waters are often discharged untreated. There is a need to look into the treatment and effective utilisation of these processing wastes and it can be expected that these will become important research themes in the future.

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## Discussion

In the discussion of per capita fish consumption, it was noted that estimation may vary from country to country in the region. It was suggested that a standard method of computing the per capita consumption be used based on the FAO method of estimation.