The Application of HACCP In The Fish Processing Industry In Southeast Asia

2000 - 2003

Brunei Darussalam • Cambodia • Indonesia • Lao PDR • Malaysia • Myanmar • Philippines • Singapore • Thailand • Vietnam

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SEAFDEC

Marine Fisheries Research Department

THE APPLICATION OF HACCP IN THE FISH PROCESSING INDUSTRY IN SOUTHEAST ASIA

2000 - 2003

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in collaboration with
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Southeast Asian Fisheries Development Center

The Southeast Asian Fisheries Development Center is a technical organization devoted to the accelerated development of fisheries in the region. The member countries of SEAFDEC are Japan, Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam. SEAFDEC has four Departments, namely the Aquaculture Department in the Philippines; the Training Department in Thailand, the Marine Fishery Resources Development and Management Department in Malaysia; and the Marine Fisheries Research Department in Singapore.

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INTRODUCTION

Japanese Trust Fund Project on the Application of HACCP in the Fish Processing Industry in Southeast Asia, 2000 - 2003

At the 31st SEAFDEC Council Meeting in March 1999, it was proposed that a Japanese Trust Fund Project financed by the Fisheries Agency of Japan be established to support the programmes under the ASEAN-SEAFDEC Fisheries Consultative Group (FCG) collaborative mechanism. Under the Project's component on 'The promotion of the regional fisheries management', the MFRD proposed to conduct a 4-year programme from 2000 - 2003 on the application of HACCP in the fish processing industry in the S E Asia in view of the increasing importance and rapid development of HACCP application in the region. In line with international trends and the need to comply with the regulations of importing countries especially the EU and the US, the Hazard Analysis and Critical Control Point (HACCP) system has been endorsed for ensuring food safety in the ASEAN member countries. This programme was developed to assist ASEAN member countries (which now includes all S E Asian countries) further promote the implementation of HACCP in their fish processing industry not only for the export sector but also for the traditional fish products which are largely for the domestic market. The objective of the programme is to document HACCP application in the fish processing industry in the region and provide a useful platform for the sharing of information and experiences on HACCP application among the ASEAN member countries.

This programme is also in line with Resolution 14 and Plan of Action C4 endorsed by the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium: 'Fish for the People' held on 24 Nov 2001 in Bangkok and as stated below:

Resolution 14: Improve post-harvest technologies to ensure fish quality assurance and safety management systems, which are appropriate for small and medium-sized enterprises in the Region, taking into account the importance of traditional fish products and food security requirements.

Plan of Action C4: Develop and apply fish quality and safety management systems that ensure food safety and support the competitive position of ASEAN fish products on world markets through the implementation, validation and verification of Hazard Analysis and Critical Control Point (HACCP) based systems and improved laboratory practices, and adapting quality and safety management systems so that they may be applied to small and medium enterprises in the ASEAN region.

Under the programme, the MFRD would conduct an annual series of regional workshops, which will be attended by the appointed country coordinators for the programme from each ASEAN member countries. A total of four regional workshops has been held with the inaugural 1st regional workshop in Singapore in 2000, the 2nd regional workshop in Ho Chi Minh City, Vietnam, in 2001, the 3rd regional workshop in Manila, Philippines and the 4th (final) regional workshop in Bangkok, Thailand in 2003. The reports of these workshops which include HACCP case studies in fish processing establishments in the respective countries (workshop venue) have been published and circulated.

In addition, a research activity on HACCP for fermented fish products in Myanmar was conducted by MFRD under the programme in response to Myanmar's request to SEAFDEC for technical assistance in fisheries post-harvest technology. The objective of the research activity was to assist the Department of Fisheries, Myanmar, develop HACCP plans for selected fermented fish products in Myanmar to help upgrade the traditional fish processing industry. In 2001, MFRD carried out the activity which involved two field study trips to Myanmar with technical support from Thailand in the form of a specialist in traditional fermented products. Product descriptions, production flow diagrams, Hazard Analysis and HACCP Plans have been developed for the following traditional Myanmar fermented fish products: Ngan-pya-ye (fish sauce) and Nga-pi (fish paste). In 2002, the activity assisted the Export Quality Control Laboratory, Department of Fisheries, Myanmar, which is the national laboratory supporting the implementation of the country's HACCP program, to upgrade its laboratory expertise through the attachment of two of the Laboratory's technical staff in MFRD to upgrade their analytical expertise in histamine and antibiotic residue testing using the HPLC equipment.

This publication is the final output of the 4-year programme and summarises the developments and progress made in HACCP application in all the Southeast Asian countries from 2000 - 2003. The publication includes a section on generic HACCP plans for selected traditional fish products of the region which are already being exported or have export potential. The publication is a definitive work highlighting to the importing countries the region's commitment to applying HACCP to ensure the safety of fish and fish products from the region.

COUNTRY REPORTS

BRUNEI DARUSSALAM

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INTRODUCTION

The fisheries industry in Brunei Darussalam has been identified as one of the sustainable industrial sectors that contribute to the country's economy. In 2002 alone, fisheries industry contributed BND$ 67.9 million to the national Gross Domestic Product, of which a large portion was from the captured fisheries industry and the others from aquaculture and seafood processing industry.

The Department of Fisheries (DOF), under the Ministry of Industry and Primary Resources, is the competent agency responsible for the control of import, export and transhipment for fresh and live fish products. DOF's primary concern is to ensure food safety, quality and compliance of product to the importing country requirements. DOF is also the competent agency that issues Health Certification, a pre-requisite requirement for the products to be exported to other country. This Health Certification is issued in the form of Letter of Attestation (LOA). Issued since 1998, this LOA is based on the Guidelines provided by Codex, as well as adhering to the specific requirements that of the importing countries concerned.

PRESENT STATUS OF FISH PROCESSING INDUSTRY

The fish processing industry in Brunei Darussalam consists of two broad categories, namely small and medium processing establishments. Small processing establishments make up the larger group, consisting of 49 out of the total 63 fish processing establishments. Products processed by these establishments include salted-dried fish, fish and prawn crackers, shrimp paste and fermented fish products. Medium processing establishments process products such as frozen fish, prawn and crabs, canned fish and surimi-based products in commercial scale. Most of the fish products are domestically consumed. The number of fish processing establishments from 2000 to 2003 is listed in Table 1.

Table 1. Fish processing establishments, 2000 - 2003

	2000	2001	2002	As in Jun 2003
Small processing establishments	63	49	42	49
Medium-commercial processing establishments	4	4	14	14
Total	**67**	**53**	**56**	**63**

Since 1997, Brunei has been exporting fisheries products to countries such as Hong Kong, Japan, Thailand, Malaysia and US. The quantity and value of seafood export is shown in Table 2.

Table 2. Export of seafood from 2000 - 2002

	2000		2001		2002	
	Quantity (tonnes)	Value (million BN$)	Quantity (tonnes)	Value (million BN$)	Quantity (tonnes)	Value (million BN$)
Live, fresh, frozen fish	7.1	0.33	4.49	0.21	1.52	0.1
Fish meal	-	-	333.1	0.13	-	-
Shrimp	58.8	0.71	128.15	1.5	100	1.2
Total	**65.9**	**1.04**	**465.74**	**1.84**	**101.52**	**1.3**

HACCP IMPLEMENTATION

The concept of HACCP is relatively new to Brunei. Nevertheless, the government recognise the importance of HACCP as the best tool currently available to achieving the quality and safety level required in food products. Various government efforts had been made to initiate the implementation of HACCP in the fish processing industries. This included HACCP awareness talks and seminars to various government officials and private sectors, consultative joint project between the fish processing establishments and technical assistance as provided by Promotion and Entrepreneurial Development Division (PED) under the Ministry of Industry and Primary Resources (MIPR).

Currently, MIPR is working toward fulfilling the 'HACCP Implementation Programme' with the assistance of SIRIM, QAS, Malaysia. Under this programme, two fish processing establishments are selected for the Product Certification programme, which include the implementation of Good Manufacturing Practices (GMP) and Sanitary Standard Operation Procedures (SSOP). To date, these two companies, Semaun Seafood Sdn. Bhd. and Tuah Maju Multifood Sdn. Bhd. (TMM) have been awarded and are in the process of implementing HACCP in their establishments.

PROBLEMS/ DIFFICULTIES ENCOUNTERED

As most of the fish processing establishments in Brunei are relatively small, and most of the products are domestically consumed, HACCP implementation is viewed by the industry to have only a minor impact. This leads to the slow pace of implementation of HACCP in Brunei. Some of the problems encountered are:

- Lack of understanding of HACCP by food processors
- Lack of education and extension on the part of fish handlers to reduce post harvest losses
- Lack of budget to develop the system
- Lack of trained manpower
- Lack of facilities and equipment for Inspection laboratories, fish landing, and fishing vessels
- Lack of qualified laboratory analysts to carry out analysis for the need of fish industries

FUTURE DIRECTIONS

To achieve the effective implementation of HACCP in the local fish processing establishments successfully, various programmes and activities need to be done:

- To provide better understanding on the importance of HACCP system to all fish processing establishments in order to produce better quality and safe products
- To assist the processing establishment in enhancing the safety and quality of their product by providing technical training on HACCP, Good Manufacturing Practices (GMP) and Good Hygiene Practices (GHP), hygiene and sanitation and other related subjects to various personnel
- To assist the processing industry in the application of HACCP in their production operation
- To have regular inspections carried out at the processing establishments in order to ensure compliance with the HACCP requirements
- To develop rules and regulations for quality management programme
- To provide a standardized inspection Laboratory with sufficient facilities and equipment to carry out laboratory analysis for the need of industries
- To train qualified laboratory analysts
- To seek regional collaboration and to participate in all the conference, training, meeting in all the quality assurance related matters

CONCLUSION

Although the implementation of HACCP in the seafood processing industry in Brunei Darussalam is going slowly (but steadily), its importance as the best tool currently available towards achieving the quality and safety levels required of food products produced has been increasing. The Department of Fisheries as the agency responsible for the development of the fisheries sector will continue and further enhance its primary functions in planning and managing the fisheries resources, verifying and developing resource exploitation technology, providing technical support services, developing value added products, controlling and maintaining marine environment, and implementing safety and quality control programmes for seafood products.

CAMBODIA

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INTRODUCTION

Cambodia's fisheries sector encompasses extensive freshwater fisheries within floodplains, river and lakes; marine fisheries; rice field fishery and some aquaculture. Department of Fisheries (DOF) of the Ministry of Agriculture, Forestry and Fisheries is the competent agency responsible to manage all marine fisheries and inland water in the country, including mangrove forests.

The freshwater capture fisheries contribute more to national food security and economy than other fishery resources in Cambodia. The annual catch ranges between 290,000 - 430,000 tonnes (Table 1), which is the fourth largest in the world. Cambodia has a wide range of freshwater species. It has been reported that approximately 500 species are likely to be found in the Cambodian Mekong and Tonle Sap-Great Lake.

In 1960s the Cambodia's annual marine catch was around 40,000 tonnes. A Cambodia/ USSR study in 1980s reported that around 435 fish species from over 97 families were found in Cambodia marine water, with a total stock of around 50,000 tonnes/ year. Mackerel, Scad, Anchovy, Sardine, Tuna and Pomfret were identified as the most commercially important pelagic fish species and Threadfin Bream, Croaker Big-Eyes, Lizard Hair-tail fish, Flat fish, Snapper, Barracuda, Grouper, Shark and Conger eel as the most important demersal fish species. Seven shrimp species, one squid species, and two cuttlefish species with a stock of about 1,300 tonnes/ year were also identified. By early 1980s the production has fallen drastically due to a number of interrelated factors, including decrease of population in urban areas, thus reducing private sector production and marketing arrangement. In 2002, the marine fisheries catch was 45,000 tonnes (Table 1).

Cambodia's aquaculture development, particularly small-scale aquaculture, is significant. Its production has increased from 1,600 tonnes in 1984 to 18,000 tonnes in 2002. Cage and pen culture production contribute more than 70% of the total aquaculture. The major cultured species in cage and pen system are *Pangasius hypophthalmus* (73%) followed by *Channa micropeltes* (21%). Other species cultured include *Puntius sp., Clarias batrachus, Oxyeleotris marmorata, Cirrhinus sp., Puntius altus* and *Leptobarbus hoevennii* which fishermen used to stock for a couple of months for fattening during abundant catches and sell it when fish were scarce.

Table 1. Cambodia's annual fish catch

Type of fishery in Cambodia	Catch from 1994-2002
	Annual catch range (tonnes)
• Large scale fisheries	
- Fishing lots [1]	30,000 - 60,000
- Dai (bag nets)[2]	15,000 - 20,000
• Middle scale fisheries[3]	85,000- 100,000
• Family fisheries[3]	115,00 - 140,000
• Rice field fisheries[4]	45,000 - 110,000
Total Inland Fish Catch	**290,000 - 430,000**
Including marine fisheries productions = 45,000 t	**335,000 - 475,000**
Including aquaculture productions = 18,000 t	**353,000 – 493,000**

Source: DOF (1999/2002); Deap et al.(1998); and Ahmed et al. (1998)

[1]Range reflects uncertainty in actual catch levels.

[2]Range shows approx. minimum and maximum value in 1994-1998.

[3]Based on socio-economic survey data extrapolated to entire country.

[4]Approx. 1.8 million ha (rice fields) x likely range of fish yields: 25-62 kg/ha.

Fish contributes to 75% of the total animal protein intake of the population. A well- managed fisheries sector is essential for the Royal Government of Cambodia (RGC) to meet its key goals of food security, poverty alleviation and national revenue generation in the country. The monetary value of both marine and aquaculture production is around US$ 250-300 million, which is approximately 8 - 10% of the total national GDP of US$ 2,800 million.

FISH PROCESSING INDUSTRY

Though fresh fish is much preferred in Cambodia, a significant proportion of fish is processed for human and animal consumption. Most processed fish product is consumed domestically. A proportion of higher-quality, higher-value product is exported, mainly to Southeast Asia. The main species processed are freshwater and marine fish (dried, iced and frozen), followed by squid, octopus and beche-de-mer (FAO, 1993). FAO (1991) reported that about 60% of total fish were consumed fresh, 18% were fermented, 13% salted-dried, 5% smoked, 2% fish sauce and 2% other derived products.

Most of the fish are processed traditionally, e.g. sun-dried, salted-dried, smoked and steamed. The most significant traditional fish products are fermented fish and fish sauce. Traditional processing method utilizes a high volume of small fish (from inland fishery) and trash fish (from marine fishery) for human and animal consumption. The volume of processed fish for both local consumption and export can be seen in Table 2.

Table 2. Volume of processed freshwater and marine fish in Cambodia, 2001

Product	Local consumption (tonnes)	%	Export (tonnes)	%	Total production (tonnes)
Dried finfish	3,032	57.80	2,214	42.20	5,246
Dried shrimp	277	66.11	142	33.89	419
Dried squid/octopus	25	3.37	717	96.63	742
Smoked finfish	512	65.06	275	34.94	787
Steamed finfish	458	100.00	0	0.00	458
Fermented finfish	1,257	43.83	1,611	56.17	2,868
Paste	7,187	56.68	5,494	43.32	12,681
Crabmeat/ shrimp	652	99.54	3	0.46	655
Iced finfish	0	0.00	4,941	100.00	4,941
Frozen finfish	0	0.00	230	100.00	230
Frozen shrimp/ crab	0	0.00	1,676	100.00	1,676
Frozen squid/ octopus	0	0.00	25	100.00	25
Dried trash fish (fish feed)	1,492	65.04	802	34.96	2,294
Fish meal (fish feed)	740	98.67	10	1.33	750
Total	**15,632**	**46.29**	**18,140**	**53.71**	**33,772**
Fish sauce (litre)	3,414,000	100.00	0	0.00	3,414,000

Source: Department of Fisheries Statistics (2002)

Freshwater and marine fish are processed by traditional and modern technology. Most of the traditionally processed fish are consumed domestically, whereas the modern processed fish products are supplied for both domestic and export markets.

Traditional processing technology

The fisheries commodity produced by this traditional processing technology are normally supplied to domestic market, including those who are living within the country as well as outside the country. The traditional fish processing establishments are classified to small, medium and large scale.

Small-scale

The products processed in small-scale processing establishments include fish paste, fermented fish, fish sauce, sun-dried and salted-dried fish, smoked fish, and steamed fish. Small-scale processing establishments are generally household-based. The products are low-value and intended for family consumption.

Medium-scale

Like small-scale processing establishment, medium-scale establishments are also household-based, whose workers are generally household members, their relatives, and hired labours, particularly during peak period. The products are sun-dried and salted-dried, smoked, fermented and pasted fish. Sun-dried trash fish is exported to Vietnam. The fish products processed by medium-scale traditional establishments generally have lower value than those processed by large-scale establishments.

Large-scale

Large-scale processing establishments are generally located in fishing villages or nearby fishing lots. The number of workers ranges between 40 - 60, most of them are women. They are employed during peak season of fish catch from January-February to May-June. The products processed include salted-dried fish, ordinary fish paste and high-value boneless fish paste. Thousand of tonnes of these products are annually produced from Tonle Sap-Great Lake, where fish are caught by middle scale and large-scale fishers. Fish sauce manufacturing is also part of large-scale processing establishments, providing jobs for about dozen of men in each enterprise.

Modern processing technology

In general, these fish products are produced for export to the international markets. The modern-processing establishments are run by local private companies and foreign-based companies. They are operated under supervision of the Department of Fisheries. There are three freezing plants in Cambodia, and these plants have export permits issued by Department of Fisheries. One plant is located in Phnom Penh and the other two in Sihanoukville.

Lian Heng Trading Company

This company has two processing plants, one in Phnom Penh and one in Sihanoukville.

1) *Processing plant in Phnom Penh*

It produces processed freshwater fish products intended for export to:

- US/Australia: Frozen fish and shrimp and smoked and salted-dried fish
- Singapore: Frozen freshwater fish.

In 2001, the plant exported 350 tonnes of processed fish products to the above countries, worth around US$ 700,000. The company is unable to export to the EU yet.

2) *Processing plant in Sihanoukville*

The main investors of this company are Hong Kong and Taiwan-based companies. In 2001, the plant exported 300 tonnes product, worth US$ 900,000. All products were exported to two respective buyers in Hong Kong and Taiwan. They were frozen shrimp, frozen squid, and stuffed crabmeat.

Sun Wah Fisheries Co., Ltd. (in Sihanoukville)

Established in Aug 1996, this company's major investor is a large Hong Kong company called SUN WAH. It is a medium-scale operation with a daily capacity of 10 tonnes of raw materials.

In 2002, the plant exported over 450 tonnes of processed fishery products mainly to its parent company in Hong Kong. Some products were then re-exported to other international destination markets.

SUN WAH is the highest quality seafood processing plant in Cambodia. This company has been authorized from the top government management to run the business successfully in Cambodia.

Marketing and distribution of fish products

The distribution and marketing of fish products are done by private sector. The marketing and distribution networks of freshwater fish and fish products are well developed, unlike its marine counterpart. A wide range of freshwater and marine fisheries products is exported regularly. There is, however, no reliable correspondent data for value of production, value of export or destination of export. These issues should be addressed as a matter of urgency in the context of strengthening fisheries/aquaculture data collection.

Domestic markets

There is high demand for fish and fish products in the domestic market (Table 2). The most important products marketed and distributed are freshwater finfish and their traditionally processed derivatives. A small quantity of freshwater shrimps and bivalves are also sold. In marine areas many residents are self-sufficient, in term of fish production. High value species are usually sold to traders in Phnom Penh for export. Only 20-40% of the total small-scale freshwater aquaculture production (Tilapia, Common Carp, Chinese Carps, and Indian Carps) is sold directly at farm for local consumption.

The domestic market for marine products is relatively small. Consumption of marine species by Cambodians is generally restricted to marine areas.

The freshwater fish products are distributed in a few different ways. In many locations around the Great Lake and along river systems, fish are sold to consumers at the 'farm gate'. This method is especially applicable for small-scale processors of traditional products who target for domestic sale. In other cases, fish is transported by ox-cart, motorbike and small trucks to urban markets. In addition, cages are towed to Phnom Penh from the Great Lake region, hence fish distribution systems decline with increasing distance from the inland water.

In the marketing system for the freshwater fisheries, the main persons involved are fishermen, wholesalers/ middlemen and retailers.

- The fishermen are the workers that do fishing, either in small, medium or large scale
- The wholesalers/ middlemen are the marketers and providers who lend capital to most of the fishermen to buy and collect fish from small, medium and large-scale fishing operators, and then they sell fish to retailer
- The retailers are those that sell fish directly to the consumers

The place for fish landing, selling, and the key contacted place between lot owners, fishermen, middlemen and buyers are called the landing place. Generally, both fishermen and all types of buyers gather here.

The domestic distribution of marine species is poorly developed, and is limited to fresh or frozen high-valued species (e.g. shrimp, seabass, grouper and bech-de-mer). The marketing and distribution are primarily restricted to Phnom Penh.

Export markets

Around 24,150 tonnes of freshwater and marine fish (Table 3) and 18,140 tonnes of fishery products (Table 2) were exported in 2001. Table 3 listed the species exported and their export volumes.

The actual exports can be higher than the listed figures as collusion is a common practice at the border of Cambodia-Thailand/ Vietnam. For instance, freshwater fish and fishery products collected from Battambang, Siem Reap, Pursat, Kampong Thom and Kampong Chhnang provinces have been exported to Thailand, while reported to be collected from Kampong Cham, Kandal, Takeo, Prey Veng provinces, Phnom Penh and Vietnam. A substantial quantity of marine fish and fishery products, mainly high-value finfish, shrimp, and cephalopods that is exported to Thailand and Vietnam is possibly underestimated.

The main export destinations of fish and fishery products are Thailand and Vietnam. Others are Asian markets, such as Singapore, Malaysia, Hong Kong, China, Japan, and USA and Australia (Table 4). Cambodia has yet to have the European Union Commission's approval to export fish and fishery products to the EU markets.

Table 3. Volume and species of fresh inland and marine fish exported (DOF, 2001)

No	Common Name	Scientific Name	Cambodian Name	Volume (tonnes)
1.	Sand gobi	*Oxyeleotris marmoratus*	*Trey Domrey*	384
2.	Oriental flat head lobster/ Matis shrimp	*Thenus orientalis/ Oratosquilla nepa*	*Bangkang Pak/ Bangkang Kandobses*	69
3.	Pomfret	*Formio nigo/ Parastromateus nigo*	*Trey Chap*	10
4.	Grouper	*Serranidae*	*Trey Teker*	66
5.	Snakehead	*Channa micropeltes/ striatus*	*Trey Ros/ Chdor*	3,778
6.	Clariid catfish	*Clarias macrocephalus/ batrachus*	*Trey Andeng*	NA
7.	Soldier river barb	*Cyclocheillichthys enoplos*	*Trey Chkaok*	NA
8.	Black Ear catfish/ Pangasiid catfish	*Pangasius larnaudi/ Pangasius hypophthalmus/bocourti*	*Trey Po/ Trey Pra*	230
9.	Frog	-	*Kangkeb*	15
10.	Tiger shrimp	*P. monodom*	*Bangkear Khlar*	260
11.	Freshwater eels	*Honopterus albus*	*Antong Teksap*	43
12.	Mud crab	*Scylla serrata*	*Kdam Thmor Khieu*	49
13.	Water Snake	-	*Pours Tek*	19
14.	Snail, clam, blood cockles	*Mollusks*	*Khayorng, Leas, Khchao, Kreng Cheam*	NA
15.	Freshwater hard/ soft-shelled turtle	-	*Andak/kantheay*	12
16.	Asian bony tongue/ Boxfishes	*Ostractonidae*	*Trey Tapot*	NA
17.	Great white sheatfish	*Wallagonia attus*	*Trey Sanday*	26
18.	Featherback	*Chitala lopis*	*Trey Kray*	409
19.		-	*Trey Khaya*	11
20.		*Notopterus notopterus*	*Trey Slart*	25
21.	White lady carp	*Thynnichthys thynnoides*	*Trey Linh*	150
23.	Peacock eel	*Macrognathus siamensis*	*Trey Chlonh*	10
24.	Sheatfish	*Micronema*	*Trey Kes*	9,796
25.	Baby crocodile		*Koun Krapeur*	25,000*
26.	Ornamental fish		*Trey Lum Or*	NA
27.	Other species			8,788
	Total			**24,150**

Source: DOF Fisheries Statistic (2001)

* Exported to Thailand, China and Vietnam

Table 4. Imports of fisheries and fishery products from Cambodia into selected markets, 1998 - 2001

Importing country	Quantity (tonnes)	Value (US$)
Hong Kong (1999)	648	6,137,820
Malaysia (1998)	173	2,632,849
Vietnam (2001)	233	188,889
Thailand (1999)	3,342	1,224,989
US (1999)	280	1,063,464
Singapore (1999)	108	1,000
China (2001)	153	962,305

Source: INFOFISH/ Cambodian DOF Fisheries Statistics (1999-2001)

STATUS OF HACCP IMPLEMENTATION

The HACCP implementation in fish processing industry in Cambodia is relatively slow. DOF is still in the process of preparing HACCP regulations. The implementation of HACCP in the fish processing industry in Cambodia is currently on a voluntary basis. No HACCP has been widely introduced into fish processing industry yet.

One export-oriented plant (Lian Heng) applied for HACCP for export-purpose to US in 1996. The FDA approved and agreed in 1998 to allow the fish products to be exported to the US after a group of experts from the US made a direct observation to the plant site and recommended what should be done to meet the requirements of HACCP.

Regarding to EU market, Department of Fisheries of Cambodia is now under the process of drafting processing regulations to meet the EU's requirements.

DIFFICULTIES ENCOUNTERED

The difficulties in implementing HACCP are as follow:

- Lack of HACCP knowledge as well as technical knowledge on food safety hazards and their control
- Lack of understanding in HACCP implementation
- Inadequate number of qualified personnel
- No proper laboratory available
- Legislation is not strong enough to enforce HACCP implementation

STRATEGIES AND POLICY FOR IMPROVING HACCP IMPLEMENTATION

- Training on HACCP plan development for small-scale, middle-scale and large scale processors and stakeholders
- Training of personnel in the industry, government and academia in HACCP principles and applications, and increasing awareness of consumers
- Training on internal audit of HACCP programs
- Training on rapid tests/assessment of hazards
- Developing specific training to support a HACCP plan, working instructions and procedures
- Developing cooperation among primary producers, industry, trade groups, consumer organizations and responsible authorities
- Maintaining an effective plant hygiene and sanitation program
- Study tours, fellowships, exchange visits
- Joint training and control authorities to encourage and maintain a continuous dialogue and create a climate of understanding in the practical application of HACCP

CONCLUSIONS

In order to export the fish products to overseas markets, especially EU, food safety and quality assurance are very important. The DOF is encouraging the application of HACCP system in fish processing plants, both small to medium scale and large scale. However, DOF would need to set up inspection facilities and to establish regulations for application of HACCP, GMP and SSOP in processing plants.

INDONESIA

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INTRODUCTION

Consisting of a total of 17,500 islands with a coastal length of about 81,000 km, Indonesia has land areas of over 2 million square km and 5.8 million square km of marine waters. Of this, 3.1 million square km is classified as archipelago and territorial waters. The remaining 2.7 million square km is Indonesia's Exclusive Economic Zone (IEEZ). About 775,000 sq. km of marine waters are coastal areas of less than 200 meters deep.

With this vast area of inland, coastal and marine waters, fisheries have been playing an important role in the socio-economic life of Indonesia, in particular in coastal communities. The sector provides employment for more than 4.5 million fishermen/ fish farmers. Currently, while most sectors suffer from the current economic crisis, fisheries have demonstrated its ability to sustain contribution to national economy. In 2000, fisheries generated about US$ 1.675 billion from more than 500,000 metric tonnes total fish export and in 2002, US$ 1.7 billion from more than 600,000 metric tonnes.

Production trends

The fish landing, both marine and cultured, has been increasing consistently from 1996 to 2000. The production in 1996 was 4,452,258 tonnes and in 2000, 4,875,649 tonnes. The average increase is around 3.51% per year. Table 1 shows the fisheries production by sub sector of fisheries, from 1996 to 2000.

Table 1. Fisheries production by sub sector of fishery, 1996-2000

Unit: 1000 tonnes

Sub Sector	1996	1997	1998	1999	2000	Annual rate of increase (%)
Total	**4,452.258**	**4,579.766**	**4,642.209**	**4,893.060**	**4,875.649**	**2.31**
Marine fishery	3,383.456	3,612.961	3,723.746	3,682.444	3,807.191	3.03
Inland fishery	1,068.802	966.805	918.463	1,210.616	1,068.458	1.38
- Inland open water	335.707	304.258	288.666	327.627	305.212	-1.96
- Culture	733.095	662.547	629.797	882.989	763.246	3.02
- Brackish water	404.335	370.259	353.750	412.935	430.017	1.99
- Freshwater pond	182.918	171.768	168.478	177.622	214.393	4.53
- Cage	44.630	26.186	17.639	32.323	25.773	-2,75
- Paddy field	101.212	94.334	89.930	94.634	93.063	-1,97

The production comprises marine fish, inland open water fish, brackish water fisheries and freshwater fisheries. In 2000, marine fisheries made up to 78.09% of total fish landing, inland open water 6.26%, brackish water fisheries 8.82% and freshwater fisheries 6.83%.

Trade on fishery products

The export of fish products reached its peak in 1998 and declined slightly in the following years. By volume, the average decrease was 2.75% from 1996 - 2000 and by volume it decreased by 1.5% (Table 2). The major market for fish products are Asian countries, mostly Japan, followed by EU and US (Table 2). Frozen shrimp is the main product export, followed by tuna and tuna products. By value, shrimp accounted for 59.83% of the total export value in 2000.

The import of fish products has increased by the average of 20.68% (by volume) or 7.68% (by value) yearly from 1996 - 2000. Fishmeal was the major imported fishery product during this period, mainly from Peru, Chile and Germany.

Table 2. Trade of fishery products, 1997-2002

Year	Volume (tonnes)		Value (US$ 1,000)	
	Export	Import	Export	Import
1997	574,419	151,802	1,686,168	122,369
1998	650,291	61,104	1,698,666	52,491
1999	644,604	115,818	1,605,421	76,291
2000	519,416	179,463	1,675,074	111,476
2001	487,116	162,471	1,631,898	103,616
2002 (Jan to Nov)	525,246	115,169	1,457,052	84,619
Annual rate of increase (%)	-0.011	-0.265	-0.027	0.018

Total export of fish products in 2001 (from Jan to Nov) are presented in Table 3

Table 3. Total export by country of destination in 2001

Importer Countries	Volume (kg)	Value US$
US	54,160,295	318,961,865
EU	83,487,416	190,843,618
Asia	**137,647,711**	**509,805,483**
1. Japan	120,702,961	772,616,287
2. Singapore	62,619,589	91,634,726
3. Hong Kong	32,215,039	67,009,952
Canada	2,671,241	9,941,600
Other	131,259,591	180,890,539
Total	**487,116,132**	**1,631,898,587**

Annual fish consumption per capita

The supply of fish for domestic consumption has grown at an average of 5.44% annually and the consumption/ capita yearly at a rate of 4.20% annually from 1997 - 2001 (Table 4). As the national consumption target for fish consumption is 26.44 kg/ person/ year, the consumption level of fish consumption in 2001 is still 17% below the recommended level.

Table 4. Fish consumption per capita, 1997-2001

Unit : Kg

	1997	1998	1999	2000	2001	Annual rate of increase (%)
Total consumption	3,807.20	4,052.52	4,278.55	4,502.68	4,705.79	5.44
Consumption/ capita/ year	19.05	19.98	21.09	21.87	22.44	4.20

Fish processing industry

Over 50% of the export-oriented establishments produce frozen fish products, while others produced other processed products, such as salted-dried, salted-boiled, smoked, fermented, frozen, canned and fishmeal (Table 5). The main types of commodities include shrimp, tuna/ skipjack, frog legs, ornamental fish, seaweed and other fish.

Table 5. Export-oriented fish processing establishments*

Processing Activity	In 2000	In 2003	Export Destination
Canning (C)	36	36	Asia, Canada, EU, US
Freezing (B)	371	373	Asia, Canada, EU, US
Chilling (A)	68	71	Asia, EU, US
Other processed product (D) (Fish/ shrimp cracker, drying)	36	36	Asia, EU, US
Total	**573**	**578**	

*) The same company may have more than one product

FISH INSPECTION AND QUALITY CONTROL SYSTEM

Historical development of fish inspection and quality control

Since the enactment of the Foreign and Domestic Investment Acts, the development of industrial fisheries has brought about significant progress to the export fish products. In 1970-1972, frozen shrimp was the prime fish product for export to Japan, US and Europe. Despite the fact that the export of fish and fish products continued to expand, Indonesia was still unable to take advantage of the export of shrimp, particularly to the

US. Due to inferior quality, Indonesia used to be included in the 'block list' and the import of Indonesian shrimp product was subject to 'automatic detention'.

This market access restriction led government to establish a Memorandum of Understanding (MOU) between the Minister of Health and Agriculture in setting-up jointly a compulsory Fish Inspection and Quality Control Regulation in 1975, based on the Health and Hygiene Acts of 1960 and 1962 respectively. In the MOU, Directorate General of Capture Fisheries (DGCF) took over the responsibility for inspection and quality control of fish and fish products. The fish inspection and quality control programme administered by the DGCF includes development of fishery standards, hygiene and sanitation, of which DGCF adopted the CAC FAO/ WHO - Codes of Practices for infrastructure, environment, facilities, plant personnel and operation of fish processing plant. The programme includes development of standards, fish inspection and certification of fish production facilities in accordance with Good Manufacturing Practices (GMP), certification of competence and certification of the quality of the final product for export.

Since the issue of promoting quality assurance became a growing concern of several Ministries, the National Council of Standardization was established and it later issued regulations setting forth the Indonesian National Standardization (INS) and its implementation of the system. The regulations require compliance on: (i) Code of practices, (ii) Technical specification, (iii) Method of testing, (iv) Safety and health requirement, (v) Methods of packing, marking and labelling, and (vi) Methods of producing and description.

The INS aims to: (i) provide consumers with safety and health protection, (ii) provide quality assurance, (iii) promote efficiency and productivity of fish processing plant and meet the standard, (iv) promote competitiveness in international trade/ market, and (v) take part in environmental conservation.

Current legislation and jurisdiction

There are a number of legislative decrees concerned with the regulation of quality control and inspection of seafood products. These are:

(1) Fisheries Law. No. 9. Year 1985, chapter 19: Government Administration of Fish Inspection and Quality Control

(2) Government Regulation. No. 102, Year 2000: Laying down the Indonesian National Standardization

(3) Presidential Decree No. 13/1997 issued on March 26, 1997, Setting Forth the National Standardization Agency

(4) Decree of Ministerial of Agriculture No. 41/KPTS/IK.210/2/98 as last amended by Decree of Minister of Marine Affairs and Fishery No. Kep. 01/MEN/2002 issued on Jan 25, 2002 setting forth the HACCP-based Integrated Quality Management System of Fishery Products

(5) Decree of Minister of Marine Affairs and Fishery (MMAF) No. Kep. 06/MEN/2002 issued on Feb 11, 2002 setting forth the Requirement and Procedure for Fish Quality Control of Fishery Products entering the Republic of Indonesia

(6) Decree of Director General of Fisheries No. 14128/Kpts/IK.130/XII/98 issued on Dec 17, 1998 setting forth the Implementation Guidelines of HACCP-based Integrated Quality Management System of Fishery Products

Apart from the above legislations, technical guidance under respective jurisdiction of the Ministry concerned are also stipulated.

1. Fish Inspection and Quality Control Supervisory Programme that is under jurisdiction of the Ministry of Agriculture viz. Directorate General of Fisheries.

2. Accreditation program, concerning Laboratories for Fish Inspection and Quality Control that is under jurisdiction of National Standardization Agency.
3. Control of additives used in Handling and Processing of Fish and Fishery Product that is under regulation of Food and Drugs Control Body.

INSPECTION AND QUALITY CONTROL AUTHORITY

Since Indonesia suffers from economic crisis, the government has placed more emphasis on the development of the fishery sector. The development of fishery sector is currently under the Ministry of Marine Affairs and Fisheries (MMAF). The organizational structure of MMAF is shown in Fig 1.

The Directorate General of Fisheries consists of 2 Directorate Generals, namely Directorate General of Capture Fisheries and Directorate General of Aquaculture Fisheries.

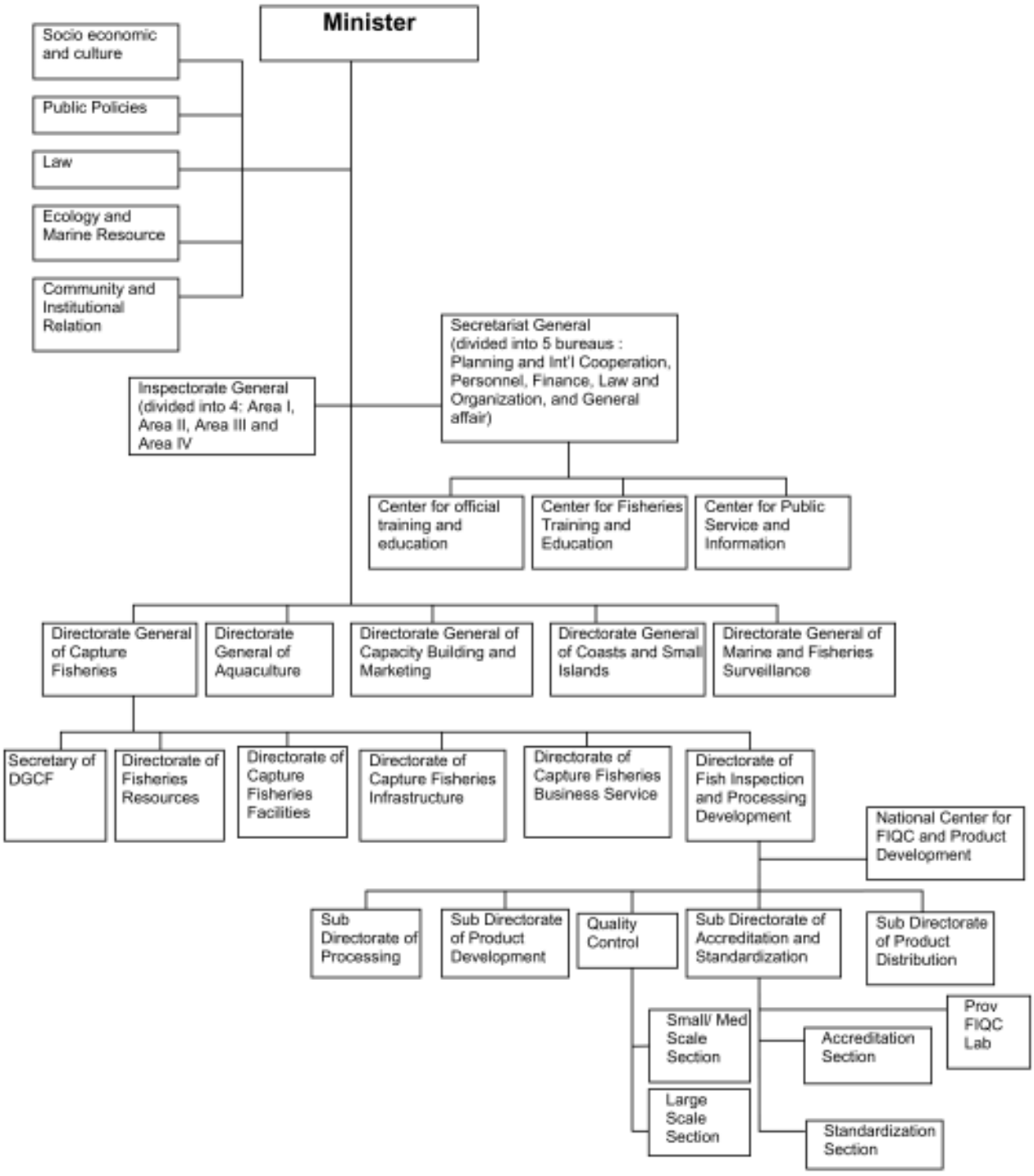
The main objectives of reorganization in fishery sector are:

- Optimisation of fishery production in both capture and aquaculture
- Optimisation of fish utilization both for local and international market
- Harmonization with the international regulation as mandated in the Code of Conduct for Responsible Fisheries issued by FAO 1995 and SPS- WTO

The Directorate General of Capture Fisheries is supported by five Directorates and one secretary:

1. Directorate of Fish Resources
2. Directorate of Capture Fisheries Facilities
3. Directorate of Capture Fisheries Infrastructure
4. Directorate of Capture Fisheries Enterprise
5. Directorate of Fish Inspection and Processing Development
6. Secretary Directorate General of Capture Fisheries

Fig 1. Organizational structure of the Ministry of Marine Affair and Fisheries



The Directorate of Fish Inspection and Processing Development conducts services on fish inspection and quality control. The Directorate is supported by 5 Sub - Directorates, that is:

1. *Sub - Directorate of Fish Product Development*
   Carries out and provide material for the formulation of technical guidance and policies for product development
2. *Sub - Directorate of Fish Processing Supervision*
   Provides supervision and guidance on handling and processing technology of fish and fishery products as well as technology packages on fish engineering
3. *Sub - Directorate of Fish Inspection and Quality Control*
   Acts as the technical coordinator concerning the supervision of Fish Inspection and Quality Control
4. *Sub - Directorate of Accreditation and Standardization*
   Sets up and monitor the application of Code of Practices and Quality Standard; develop, monitor and control the implementation of HACCP plan; set up, monitor and control the implementation of Good Laboratory Practices (GLP)
5. *Sub - Directorate of Fish Distribution*
   Develops formulation on technical policies and guidance for fish distribution

At the provincial level, the fisheries services are operationally assisted by the Sub-Directorate of Fish Inspection and Quality Control to coordinate local inspectors to conduct supervision, inspection and quality control on a daily basis, whilst the fish inspectors attached to the central office supervise and monitor the conduct of local inspectors and conduct cross-inspection of the processing plants periodically.

The provincial laboratories directly perform the fish quality control, including certification of fishery products for fish inspection and quality control. In total, there are 37 laboratories located in different provinces. The National Center for Fish Quality Control and Processing Development acts as the reference laboratory to provide supervision to the provincial laboratories in terms of analytical methods, processing technology development and training.

Certification body

Based on the Decree of the MMAF No. Kep. 01/ 2001 regarding the Organization Structure and Management, the Directorate General of Capture Fisheries is tasked to '*Formulate and Implement policies and Technical Standardization of Capture Fisheries*'. This task also includes the technical standardization for fish and fishery products either aqua-cultured or captured.

The MMAF Decree of Kep.01/MEN/2002 on '*Integrated Quality Management System of Fishery Product*' has appointed the Directorate General of Capture Fisheries as the competent authority on fish inspection and quality control. The Directorate General of Capture Fisheries then developed and implemented certification systems according to the HACCP-based Integrated Quality Management System.

Technical Guidance for the certification system is referred to the Decree of Directorate General of Fisheries No. 14128/Kpts/IK.130/XII/98 issued on 17 Dec 1998 (formerly under Ministry of Agriculture). The Decree set the procedures of certification for:

1. Prerequisite programme (SSOP & GMP)
2. Implementation of HACCP programme in the processing plants
3. Quality Control supervisor/ personnel
4. Fish and fish products for exports

IMPLEMENTATION OF HACCP IN THE FISHERY INDUSTRY

Fishery industry development policies

Strategic policies in the development of fishery industry are taken via the agribusiness development approach. The introduction of agribusiness sub-systems comprising stages of pre-harvesting, harvesting, post-harvesting and marketing consistent with implementation of HACCP. This approach is supported with improvement of infrastructure, facilities and human resources.

HACCP development program

The export market of seafood products is becoming more competitive in this global era due to the following reasons:

1. A supply-led approach in the fisheries development policies in most parts of the world tends to outstrip global demand;
2. Growing concern over public health and consumer protection based on food safety in the developed countries which leads to a tightening of requirement by importing countries;
3. Environmental issues, which have been stringently forcing the exporting countries into a difficult position, and has been used by some importing countries to protect their interest. Recent issues are the dolphin issue, antibiotic, pesticides etc

The government and the private sector have to address all the challenges above. As far as quality and safety are concerned, the fishery industry inevitably, has to keep pace with these requirements.

The traditional approach in quality control that emphasizes on the inspection of end product is no longer able to cope with the challenges. It has been replaced by a new approach based on the HACCP principles.

Many plants have used some process control and record keeping procedures similar to those required in HACCP-type programme in term of self-monitoring quality control. However, government provides more support to establishments in order to disseminate the implementation of the programme nationwide. For this reason, the HACCP supervisory programme in fish industry has been purposed to:

1. Improve seafood quality and safety
2. Improve the Indonesian product reputation in the international market
3. Reduce cost in the quality control and inspection in the Indonesia fish industry
4. Boost efficiency by reducing risk cost
5. Establish self-regulatory quality control in Indonesian fish industry based on HACCP concept

To achieve those objectives, the Directorate General of Fisheries carried out development programmes consisting of:

1. Strengthening the fish inspection and quality control institution by conducting training programme both in country and overseas on HACCP. The target group for training programmes are senior fish inspectors and quality controllers from the DGCF who were trained as trainers (TOT) on the application of HACCP-based programme
2. Training workshop for provincial fish inspectors engaged in both government and private sector. This programme emphasizes the implementation of HACCP in the fish processing industry
3. Supervising the complete implementation of HACCP at selected fish processing plants based on the result from the provincial training workshop
4. Disseminating the implementation of HACCP in the Indonesian seafood industry during pre-harvest, harvest and post-harvest
5. Disseminating the implementation of HACCP in the fish/ shrimp culture
6. Legislative support for the implementation of HACCP

The implementation of the HACCP in the fishery industry needs to be supported with adequate legislation, which will govern the relationship between the government and private sector. The role of the government, in particular fish inspectors and benefits that will be gained by private sector having applied the new system should be clearly identified. This has been outlined clearly in the MMAF Decree No. 01/MEN/2002, and the decree of Director General of Fisheries (now Directorate General of Capture Fisheries) No. 14128/Kpts/IK.130/XII/1998.

The development of the programme has partly been funded within the auspices of the ASEAN-Canada Fisheries Post Harvest Technology Project Phase II (1992 - 1997) and the US-AID supported Project on Development of Agribusiness.

PROBLEMS/ DIFFICULTIES ENCOUNTERED

The development of HACCP is hindered by some factors that are mainly due to more technical, social and economic reasons. A number of constraints remain in the way of developing an effective HACCP. Some of the constraints include:

1. Lack of enforcement to comply to the regulation
2. Lack of harmonized basic concept displayed by the regulatory agencies on strategic approach to promote quality assurance for the enhancement of Indonesia's share in the international market
3. Lack of understanding of HACCP by fish processors
4. Lack of effective training method to all levels, from the inspectors to the processors
5. Lack of education and extension on the part of fishermen and traders
6. Lack of budget to develop the system

The inspection and quality control programme carried out by the government personnel, and the 'self-regulatory quality control' carried out by the processor needs to be effectively and efficiently implemented. There is a need to:

1. Empower more skilled and experienced fish inspectors and in-plant quality control personnel
2. Upgrade educational level of fishermen
3. Enhance awareness and understanding to processors with regard to the task of fish inspectors
4. Provide sufficient facilities and equipment for laboratories, fish landings, fish auctions and fishing vessels
5. Empower qualified laboratory analysts

EXPECTED GOALS IN IMPLEMENTING HACCP

For the recent National Development Plan, concerning fish export markets development, the DGCF has positioned itself to meet these challenges by development of an integrated quality management system in the fish industry. This programme purposed to improve the system that covers all aspects of fish production, both at pre and post-harvest stages, in order to provide high quality assurance of seafood for consumers. The goal is to enhance seafood safety. To implement the integrated quality management system on fishery products, good practices in all aspects of production are required, that is:

1. Good Farming Practices
   Covers all key hygiene and sanitation aspects, from site selection for farming establishment to the final phase of fish production

2. Good Handling Practices
   Includes hygiene and sanitation aspects during harvesting and loading, transportation or handling on-board at fishing vessel before further handling and processing stages
3. Good Manufacturing Practices
   Deals with hygiene and sanitation aspects of handling and processing techniques, construction, facilities and equipment, personnel and self-regulatory quality control management in fish processing plant
4. Good Laboratory Practices
   Includes laboratory management for conducting quality control of fishery products at all stages of production. The GLP requires establishment of standardized laboratories
5. Good Inspection Practices
   Includes improvement of inspection system. Its implementation does not only apply to government fish inspectors but also to the processing plants in their self-regulatory quality control, to enhance preventive measures at critical control point
6. Improved Standardization System
   Under National Standardization Agency, DGF develops standard for fish products and other related measures and procedures and implement the adopted Indonesian National Standards

IMPLEMENTATION OF HACCP IN SMALL/ MEDIUM SCALE FISH PROCESSING UNIT

Based on inventory of fish processing unit in Indonesia, there were about 12,500 fish processing establishments in 30 provinces in 2002. Of these, 339 are export-oriented, which most of them have adopted pre-requisite programme (SSOP and GMP). Around 5 - 6% of them have the certificate of sanitation issued by the Head of Provincial Fisheries Services.

Inspection and Quality Control Supervisory Programme

Within the Ministerial Decree of Marine Affairs and Fisheries, in regard to HACCP- based Integrated Quality Management System on Fish Products, the activities of inspection and quality control supervisory programme cover harvesting, transport, handling, processing, packaging and storage to distribution. This is to ensure the fish and fish products are wholesome and safe for human consumption.

The inspection and supervisory programme are targeted of all stakeholders who deal with fish harvesting, handling, processing, packing, storage, and distribution, at production sites (vessel and pond-sites), auction and landing places, distribution sites, processing plants, fish markets, and cold storage. The stakeholders include fishermen and fish farmers, collectors, traders, processors, quality control personnel and fish inspectors. They are encouraged to implement good handling, harvesting and manufacturing practices according to prescribed Code of Practices.

To carry out those activities, DGCF have registered another 284 Fish Inspectors who serve fish processing plants in different provinces of Indonesia in 2003. The Fish Inspectors are classified as Provincial Fish Inspectors that is local government-based, and National Fish Inspector that is central government-based.

The activities of Fish Inspectors include (1) assessment of Pre-Requisite of Processing Plant, (2) performing pre-validation, (3) validation, (4) audit and (5) audit verification of the implementation of HACCP. Activities (2) and (4) are conducted by Provincial Fish Inspectors whilst (3) and (5) are by National Fish Inspectors.

The programme is manifested into certification, namely:

1. Certificate of GMP/SSOP issued by Directorate General of Capture Fisheries
2. Certificate of HACCP implementation issued by Directorate General of Fisheries
3. Certificate of Competence Required by Plant Quality Control Supervisor issued by Directorate General of Fisheries
4. Certificate of Quality or Health Certificate for Export Product issued by Provincial Laboratory and Inspection Services

As shown in Table 6, most export-oriented fish processing plants, including canning, freezing, chilling, drying and shrimp/fish cracker processing have implemented SSOP and GMP. In 2003 most export-oriented fish processing plants (339 units) are HACCP-implemented. As compared to 2000, this number is an increase of 13%.

Table 6. Number of establishments implementing SSOP and HACCP, 2000 - 2003

	2000	2001	2002	Up to Jun 2003
SSOP/ GMP	481	479	545	578
HACCP	249	204	295	263
Number of fish-processing establishments	±11,281	±11,815	±12,500	±12,500
Export-oriented fish processing establishments	290	305	322	339

OTHER ISSUES

It is widely anticipated that the international market for seafood will become more competitive. The major issues in the fish industry, environment and safety, have influence on fish trade relation between exporting and importing countries. These issues have been reflected in fish hygiene legislation applied by the importing countries, such as EU Commission Decisions and Council Directives, US Federal Regulation, etc.

To deal with the 'new trend' in the business climate, the government has been making extra effort to establish a cooperation or mutual arrangement with fish importing countries. These include:

1. CD No. 2001/254/EC, Mar 2001 (amended from EU' Commission Decision No. 94/324/EC, dated 19 May 1994) that appointed Ministry of Marine Affairs and Fisheries, Directorate General of Fisheries to be the Competent Authority in Indonesia for verifying and certifying compliance of fishery and cultured products
2. MOU between DGCF and the Australia Quarantine and Inspection Services
3. MRA between DGCF and the Canadian Government Canadian Fish Inspection Agency (CFIA) on 7 Mar, 2002 regarding Fish and Fish Products Inspection and Control System
4. Initiation of MOU with US-FDA Development of MOU between Indonesia and US, regarding Fish Product Inspection and Certification has been initiated. Progress of the MOU has been achieved, such as side-by side evaluation, exchanges of information (regulation, and procedures) and field visits to fish processing. The results indicate that MOU between the two countries will be achieved in reasonable time

CONCLUSION

1. As the fishery sector is expected to increase its contribution to the country by generating foreign exchange and fish consumption, the country will cooperate to achieve harmonization or mutual recognition of the national quality and food safety assurance and certification system through exploring possibilities for establishment of a mutual recognition arrangement
2. The Directorate General of Capture Fisheries has made necessary actions to meet all those challenges by making policies that are consistent to HACCP system and other appropriate requirement issued by international body, such as FAO/WHO
3. The Directorate General of Capture Fisheries sets standards for safety and quality assurance and assures that fishery industries effectively applied the standards. Some improvements by strengthening the fish inspection system have been made, such as providing training programme to instructors, fish inspectors, quality control personnel; holding workshops to industries; performing supervision on the application of HACCP and establishment of legislative supports on the application of the HACCP
4. Agribusiness-led approach in the fishery industry development policies is taken, based to the HACCP system, which requires good practices in every sub system of the agribusiness system. The objectives are to maximize the utilization of resources, minimize fish losses during handling and processing and maintain safety in seafood production
5. In the implementation of HACCP system, DGCF as competent authority for fish inspection and quality control consistently performs validation, audit and verification to fishery industries

LAO PDR

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INTRODUCTION

Lao PDR is a landlocked country of 236,800 square km, bordered by Cambodia, Vietnam, Myanmar, Thailand and China. Relatively isolated, Lao PDR has a high degree of geographic, cultural and language diversity. Around 83% of the country is classified as rural area, thus agriculture is still considered as the major industry in Lao PDR, contributing around 50.3% of the country GDP in 2002. Livestock sub sector contributed more than 18% of the National GDP and fishery sub sector contributed around 35% of GDP as part of livestock sub sector.

STATUS OF FISHERY IN LAO PDR

The fishery in Lao PDR is restricted to inland fisheries and freshwater aquaculture. The overall policy framework is gearing towards the sustainable use, appropriate management and protection of natural resources. In year 2002, fish accounted for about 7-8% of National GDP with the production of 87,000 tons (for this fiscal year 2002-2003), in which Aquaculture contributed 61,000 tons. The source was received Mekong and Mekong tributaries (30%), Pond-swamps-wetlands-flood plains (43%), rice field (21%) and cage culture (6%) (Figure 1).

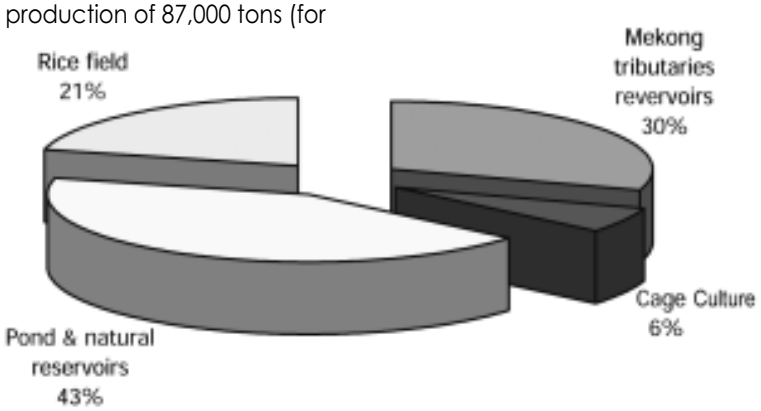

Fig 1. Fishery production in Lao PDR, 2002

The total fish production in fiscal year 2002 - 2003 is an increase as compared to previous years, mainly due to the increase in aquaculture production (Table 1).

Table 1. Fish production in Lao PDR, 2001 - 2003

	2000 – 2001	2001 – 2002	2002 – 2003
Total fish production	74,400	83,500	87,000
Fish production from aquaculture	43,900	57,000	61,000

STATUS OF FISH PROCESSING INDUSTRY

Most of fish products are domestically consumed and are marketed in fresh form, as there is no freezer facility in the country (in village level). Due to lack of facility systems, the fish price in the market is not stable, i.e. during the peak season of the catch, the fish price is very low, but during low fish catch season especially in dry season, the fish price is very high.

The fish products have been processed traditionally in household scale since long time ago. The types of fish products are: dried, fermented, smoked, fish sauce, salted, cured. Those household-industries do processing from their home with poor or little storage and maintenance. They have inadequate knowledge on hygiene, quality control and food safety.

The fish industry in Lao PDR is relatively small, contributing to around 14% of the country's GDP in 2001. This industry is dominated by small to medium establishments, mostly household-based. There is no large or commercial-size processing establishment registered. Based on the annual statistic in 1999 - 2000, there were 800 small food-processing establishments in the country, which include fishery and non-fishery products such as bakery, beverages and other agriculture processed products. There is a trend of increasing number of fish processing establishments, mostly the small-scale establishments.

SOME MEASURES AND FOOD STRUCTURE CONTROL

In June 1991, Lao PDR established Food and Drug Administration commission (FDA) to control food. The commission consists of 11 member representatives from 9 ministries. One of those is Ministry of Agriculture and Forestry that has two representatives of DLF (vet. specialist) in the bureau in Food and Drug Department (FDD), which carry out all activities of the commission. These are responsible to manage, control the quality of a variety of food and drug that are imported and domestically produced in order to protect the population and ensuring the consumers health.

Presently, food safety have been controlled by legislative documents, that is:

- Regulation of domestically-produced food
- Regulation of food stuff circulation
- Regulation of export and import-oriented food
- Regulation of registration

GMP for HACCP application and some Lao food standards Lao have been established, based on Codex Alimentarius commission guideline, such as drinking water, fish sauce. For other food products, which Lao food standards are not available, Codex standards are used as reference document for inspection purposes.

Some measures used to control the quality of local food products are built upon the existing regulation of provision on quality. The Control of Domestic Fish Food Products (No. 048/FMC) that includes some hygiene

parameters that are required to ensure acceptable levels of microbiological safety to be met on a continuous basis will be applied in the future. This measure will be introduced to the food factories, as a preventive measure that offers more control than only end-product testing.

PROBLEMS/ DIFFICULTIES ENCOUNTERED

As HACCP is relatively new, there are a few problems encountered in its application, such as:

- Lack of regulatory tools
  Food laws did not previously exist in Lao PDR, only some regulations and decrees related to food control to address food safety problems. Currently only three provisions concerning food quality control activities issued by the Council of Prime Minister in Dec 1991 was used as stronger measure for regulating all activities in regard to food processing and safety
- Lack of facilities and qualified food inspectors
- Lao consumers are lack of information on food safety
- Lao consumers are lack of understanding on the implication of food safety and hygiene
- Fish processing establishments are lack of understanding on the relationship of food hygiene and final product quality

PROGRESS OF HACCP IMPLEMENTATION

Though HACCP is recognized as the best tool for achieving the quality and safety levels required for food products, it is still a relatively new concept in Lao PDR. To date, there are no recorded companies that implement HACCP in their establishments.

Government, however, is actively communicating HACCP among the fishery sector. Trainings are conducted for inspectors and fish processors as well as small laboratory. Technical assistance are also given for development of HACCP in processing unit, culture, handling, packing and laboratory as well as introduction of sanitary measures such as Good Manufacturing Practice (GMP), Good Laboratory Practice (GLP) and the HACCP - based system.

To date, there are three HACCP-related workshops/ trainings conducted by government, namely:

1. HACCP implementation on traditional fish products, conducted at Namngumoudom Traditional Dried Fish in Vientiane Province and Nakasang Fermented Fish Group in Champasak Province
2. On-the-job training on Fish Processing Technology, targeted to fish processors, conducted in Pakse, Thalad, Namhum
3. After the above-mentioned training, the fish processors trained farmers on fish processing technology and HACCP programmes

In accordance with these three trainings/ workshops on the HACCP implementation for traditional products, there is increase awareness on the hygiene, quality control and food safety among the food processors. In addition, this HACCP concept is applied on the transportation of fresh fish, which use the model fisherman and middleman, as well as the method to raise and catch fish.

FUTURE DEVELOPMENT

To achieve the successful implementation of HACCP, there are various programmes and activities need to be done:

- To have and improve regular inspections carried out at the processing establishment in order to ensure compliance with the HACCP requirements
- To assist the fish processing traditional and industry (in the future) in the application of HACCP in their production operations
- To provide technical assistance for development of HACCP in processing unit, culture, handling in handling site
- To improve the areas of handling of fresh fish, processing of traditional fisheries products and control of food borne trematodes (FBT)
- To provide training program for the inspectors, TOT and fish processors as well as small laboratory analysis

MALAYSIA

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INTRODUCTION

Status of fisheries industry

The fisheries sector has been growing in Malaysia. Apart from providing direct employment to more than 84,000 fishermen and 22,000 fish culturist, this sector contributes to RM 5.45 billion or around 1.54% Malaysian GDP in 2001. This value consisted of RM 5.45 billion of marine and aquaculture landings and RM 81 million of ornamental fish production, obtained from 1.4 millions tonnes of marine and aquaculture catch and 338 million ornamental fish.

In the marine fishery sector, a total of 1,231,289 tonnes of fish was landed in Malaysian water, valued at RM 4.166 billion in 2001. In the aquaculture sector, 177,019 tonnes fish was produced, making up to 12.6% of the total fish production. This aquaculture production was valued RM 1,206.59 million, an increase from RM 970.32 million (24.35%) in 2000.

Export and import

In 2001, Malaysia exported about 144,590 tonnes of fish and fish products valued at RM1.35 billion. Frozen shrimp made up the largest proportion of these export. In the same year, Malaysia imported about 323,199 tonnes fish and fish products, valued at RM 1.17 billion. Table 1 indicates the quantity and value of fish and fish products export from 1999 to 2001 and Tables 2 and 3 specify the breakdown detail of fish and fish product export, based on importing countries.

Table 1. Seafood export, 1999 - 2001

	1999		2000		2001	
	Quantity (tonnes)	Value (RM$ Billion)	Quantity (tonnes)	Value (RM$ Billion)	Quantity (tonnes)	Value (RM$ Billion)
Fish and fish products	136,044	1.155	NA	NA	144,590	1.35

Table 2. Quantity of fishery export to various countries, 1999 - 2000

Country	1999		2000		Change (%)
	Quantity (tonnes)	Percent (%)	Quantity (tonnes)	Percent (%)	
Thailand	25,556	18.8	28,439	19.7	+11.3
Singapore	27,608	20.3	27,191	18.8	-1.5
China	12,383	9.1	12,251	8.5	-1.1
Japan	14,885	10.9	9,871	6.8	-33.7
Hong Kong	7,399	5.4	9,093	6.3	+22.9
Indonesia	6,002	4.4	7,383	5.1	+23.0
Italy	6,581	4.8	7,022	4.9	+6.7
Australia	4,820	3.6	5,591	3.9	+16.0
Others	30,810	22.7	37,749	26.0	+22.5
Total	**136,044**	**100.0**	**144,590**	**100.0**	**+6.3**

Source: Department of Fisheries, Malaysia (2000)

Table 3. Value of fishery export to various countries, 1999 - 2000

Country	1999		2000		Change (%)
	Value (RM Million)	Percent (%)	Value (RM Million)	Percent (%)	
Japan	260.0	22.5	255.8	19.0	-1.6
Singapore	144.1	12.5	158.1	11.7	+9.5
Hong Kong	88.9	7.8	118.0	8.7	+32.7
Italy	105.7	9.1	116.6	8.6	+10.3
US	61.8	5.4	90.5	6.7	+46.4
Netherlands	56.8	4.9	79.6	5.9	+40.1
Australia	62.2	5.4	61.1	4.5	-1.8
China	59.2	5.1	58.5	4.3	-1.2
Others	316.4	27.3	411.3	30.6	+30.0
Total	**1,155.1**	**100.0**	**1,349.5**	**100.0**	**+16.8**

Source: Department of Fisheries, Malaysia (2000)

DEVELOPMENT OF FISH PROCESSING INDUSTRY IN MALAYSIA

The fish processing establishments in Malaysia can be classified into traditional, small and medium scale and commercial. The fish processing industry is dominated by small and medium scale enterprise (SME), with capital asset of less than RM 100,000. Most of these are small operations and located mainly in the coastal area, close to fish landing ports. Traditional fish processing establishments also form a sizeable part in Malaysian fish processing industry. Mostly home-based, these establishments produce traditional fish products, e.g. fish cake, fish ball, fish cracker for the domestic market. Some of them only operate during peak season

of fish landings, that is, when fish supply is readily available and the price of fish is relatively low. It is estimated that a total of 30% fish landed is being processed.

Although the fishing industry is expanding, there are still very few big fish processors. In 2002, there were 238 medium and commercial-size fish processing establishments, but only 48 of them export their products. Less than 10 of these establishments were listed in the Kuala Lumpur Stock Exchange. While traditional and SME scale processing cater for domestic market, these medium and commercial size fish processors cater for urban and export markets.

National Policy and Programme on Seafood Safety

The demand for fresh and safe seafood has increased both locally and internationally. The challenge for Malaysia, thus, is to increase production as well as achieving the global needs for safe and high quality food in international trade. HACCP has been recognised as most effective means of managing seafood safety. Importing countries, such as EU, US, Japan and Australia are working toward enforcing HACCP for imported fish products.

In this respect, the Malaysian government has formulated the Third National Agricultural Policy (NAP-3) that emphasize on the enhancement of quality and safety assurance of fisheries product. The Department of Fisheries (DOF) Malaysia is moving toward this direction, in line with this NAP-3, through its Fisheries Act, which includes quality assurance system.

Another emphasise on food safety is the setting up of the National Food Safety and Nutrition Council in 2001. Under this council, the Food Safety Policy is developed to ensure safe food production at all levels. One of the efforts of this council is the attempt to integrate the roles of various agencies in ensuring food safety.

To ensure the safety of fish and fish products, Malaysia has and will take undertake various control measures from farm to table. Such measures include:

1) Quarantine measures on fish health and diseases control for live fish

These comprise the issuance of import and export permit, health certificate and country of origin certificates. It is to ensure that control of import, export and quarantine of live fish can be effectively implemented for the control of fish disease carrying agent that pose a threat to aquaculture.

2) Safety measures at source of fish and fishery products

a) Sanitary and Phytosanitary (SPS) monitoring program on marine fisheries.

This program was initiated by the DOF to ensure that fish are caught from safe and non-polluted areas; and that fish caught is of good quality and safe to consume. The program has been carried out since 1999 where samples from selected landing sites are collected and analysed regularly. Analyses include bacteriology, histamine, heavy metals, pesticides, fish freshness index and plankton identification through water samples susceptible for micro algae biotoxins.

b) Aquaculture Farm Certification Scheme (SPLAM)

The SPLAM will be soon implemented by the DOF, where a certificate and quality mark (logo) will be awarded by the DOF for qualified fish farm which fulfil and comply with the requirements and criteria based on guidelines, standards, and practices set by the DOF. The certificate and logo will be used as an official trademark for the farm and it is valid for a period of two years.

3) HACCP Certification

HACCP IMPLEMENTATION

The HACCP system was first introduced and adopted by low acid canners in Malaysia in the 1990s. However, the Malaysian Certification for HACCP was only officially launched by the Minister of Health in Sep 2001. It describes the procedures for obtaining HACCP Certificate, as well as adequacy, compliance and follow-on audits by appointed certified auditors. Even though the Ministry of Health administers the scheme, it was developed through the collaboration of various government departments, that is Department of Fisheries (DOF), Fisheries Development Board of Malaysia (LKIM), Malaysian Agricultural Research and Development Institute (MARDI), Ministry of Health (MOH) and Standards and Industrial Research Institute of Malaysia (SIRIM). MOH is responsible for the surveillance audit, which ensures that certified plants implement and maintain the HACCP system continuously. The HACCP certificate is valid for one year. Some of the benefits gained by the certified plants are: the issue of health certificate is speedier as it does not depend on end product testing per consignment; the plants can use MOH logo on their products; and the number of routine inspection will be reduced if the proper system is continuously maintained.

MOH is the only recognised agency by EU, and lately by US, to issue HACCP certificate, whereas MARDI is given the mandate to audit HACCP plans for fish processing in Malaysia.

The implementation of HACCP is still on a voluntary basis. Only export-oriented and commercial scale plants are encouraged to apply HACCP to fulfil the requirements of importing countries and some international hypermarkets.

As of Jan 2002, there are 238 medium and commercial-sized fish processing plants operating in Malaysia (Table 4). Out of these, 48 are currently HACCP-certified under the HACCP certification scheme, which is being managed by the Ministry of Health. These are mostly export-oriented plants and 45 have approved EU numbers. Another 67 plants applied have yet to be HACCP-certified. An integrated HACCP/ISO certification scheme is currently being plan to integrate both safety and quality assurance as needed by the industry.

Table 4. Status of HACCP implementation of fish processing industry in Malaysia, 2001 - 2002

	2001	2002
No. of fish processing plant*	238	238
No. of HACCP implemented plant	29	48

* Medium and commercial-size plant

With a view to assist the fish processing industries, the government provides various assistances for SME to encourage them to adopt HACCP in their premises. Companies can apply for tax exemption on all costs involved in getting the HACCP certificate. DOF conducts free training programmes for line supervisors and line workers at the Fisheries Training Institute. MARDI and the Department of Veterinary Services carry out various training programmes that are needed by the industries at very reasonable rate. In addition, courses and seminars are also conducted by some private companies and universities for industries.

Some of the trainings/ campaigns conducted to promote HACCP are:

a. HACCP awareness campaign for fish processing industry

Campaigns were carried out by the DOF in 1999/ 2000 in Taiping Perak, Kuantan Pahang, Sibu Sarawak and Sandakan Sabah. The objective was to create awareness on the importance of implementing HACCP in fish processing industry so as to ensure food safety and enhance export trade. More than 50 processors participated in each session.

b. HACCP courses

MARDI offers regular courses in HACCP for food industry in general. Courses that have been conducted include:

1. Prerequisite to HACCP Implementation
2. HACCP and Its Implementation
3. Hygiene and Sanitation - Prerequisite to HACCP Implementation
4. Course on HACCP Verification and Auditing
5. Introduction to HACCP
6. Documentation for HACCP Programme
7. Concept - Food Safe to be Eaten (for staff from the Ministry of Agriculture)
8. Training Course on Introduction to HACCP Programme in Livestock Industry
9. Microbiology in HACCP Implementation - Methods and Application

c. Other initiative

The FAO/LKIM/INFOFISH Regional Workshop on Verification and Auditing of HACCP System in the Fishery Industry was conducted in Penang, Malaysia on 7 -11 Jul 2003 to about 30 local and foreign participants. A similar workshop had been conducted in 2000.

PROBLEMS/ DIFFICULTIES ENCOUNTERED

- Lack of understanding of the background information on the fish and fishery products processing amongst QC leads to inappropriate selection of CCP (e.g. misunderstanding on the selection of frozen storage step as a CCP or just a CP and as part of GMP)
- Lack of understanding of the background information on the fish and fishery products processing and regulations of importing countries, e.g. EU and US, amongst auditors, leading to HACCP non-compliance
- Lack of proper records as to the step taken in actual implementation of processing, i.e. what is written in the record not being actually implemented
- Insufficient data recording frequency for selected parameter, e.g. temperature in manual recording
- Lack of continuous training for line-workers, production supervisors and QC for better understanding on HACCP and importers regulatory requirements
- Lack of qualified HACCP auditors
- Lack of trained trainers in HACCP in fish and fishery products

FUTURE DIRECTION

There is an urgent need for updating existing legislation and development of new legislation to support a more stringent seafood safety control namely:

- Draft Food Import Regulation
- Draft Food Irradiation
- Draft Food Hygiene

- Draft Aquaculture and Inland Fisheries Regulation
- Draft Quarantine Regulation
- Draft Animal Feed Act
- Draft National Food Safety Policy

There is also a strong need to update existing seafood standards and develop new standards for the industry. Future efforts would include:

- Integration of HACCP/ISO
- Integration of HACCP/HALAL
- Integration of HACCP/ISO/HALAL
- Integration of HACCP/Other QAS

HACCP is acknowledged as an effective food safety control system. It is evolving and more emphasis has been given by different trading blocks (i.e. US and EU) on the understandings of the actual implementation of HACCP, and later on the requirements of verification and auditing. Codex guidelines would remain as the reference standard in HACCP implementation, and industrial application of the standard guideline would lead to a better understanding of the real situation when implementing HACCP.

Parallel to that, concerted effort to overcome constraints in analytical laboratory capability, man-power capacity on analytical works such as on biotoxin analysis, and qualified trainers in HACCP implementation, verification and auditing; need to be carried out to address the current situation. This is especially so, in view of the requirements of the new paradigm on food safety measures incorporating Risk Analysis.

MYANMAR

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INTRODUCTION

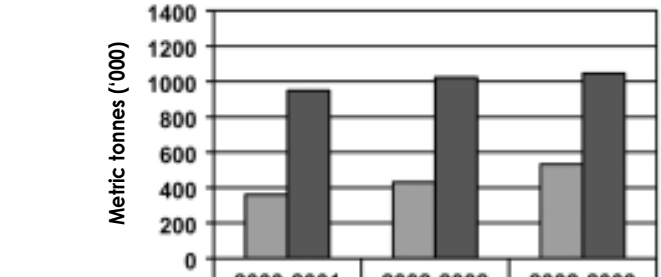
The fishery sector has become an increasingly important sector in Myanmar, contributing both to social and economic development. The fishery sector is the fastest growing sector in the Myanmar economy and is now ranked third in export value. HACCP system, implemented since 1998, is a crucial tool to ensure food safety and quality required by consumers and trade regulations.

The Department of Fisheries (DOF), under the Ministry of Livestock and Fisheries, is the government agency responsible for the inspection and licensing of all export-oriented fish processing industry in Myanmar. It is the competent agency responsible to ensure seafood safety and quality.

PRESENT STATUS OF FISH PROCESSING INDUSTRY

Myanmar is blessed with an abundance of fishery resources. Having a 2,820 km coastal line, 8.2 million hectares of inland water resources and about 0.5 million hectares of swamps along the coasts, it provides an ideal environment for various types of fish, both fresh water and marine water. In Myanmar, the fish production has been increasing consistently, from a mere 0.83 million metric tonnes in 1995 - 1996, to 1.579 million metric tonnes in 2002 - 2003. This trend is expected to increase further, mainly because there is still a large potential from aquaculture production.

Per capita consumption in Myanmar has also increased, as shown in Table 1.



	2000-2001	2002-2002	2002-2003
Fresh water fish	360	430	532
Marine fish	949	1024	1047

Fig 1. Production of fish and fishery products (in 1000 metric tonnes)

Table 1. Fish consumption per capita

Year	Per capita consumption of fish (kg)
1999-2000	21.8
2000-2001	22.7
2001-2002	24.5
2002-2003	26.2

Fish and fish products are exported in a few forms, such as fresh, chilled, frozen, dried, and salted. It is transported via sea, air and land. More than 40 countries have been importing fish and fishery products from Myanmar annually. Significant importing countries are China, Japan, US, EU, ASEAN, Australia and Arabic countries. The market segments and export trend are shown in Figures 2 - 5.

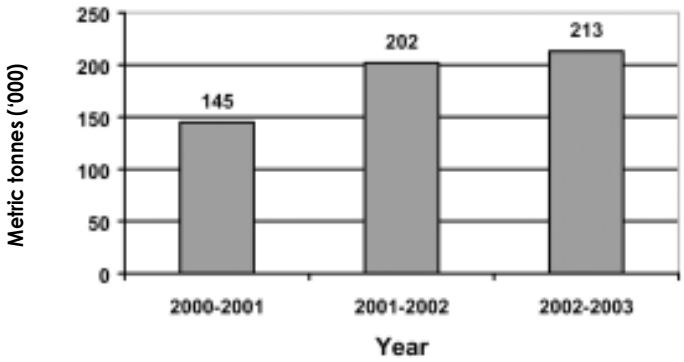


Fig 2. Export of fish and fish products (in 1000 metric tonnes)

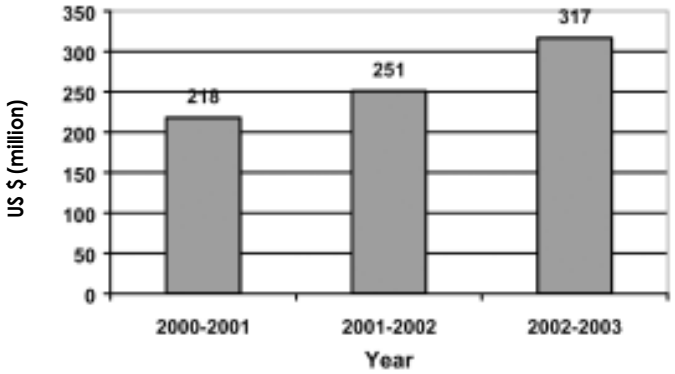


Fig 3. Export value (in million US$)

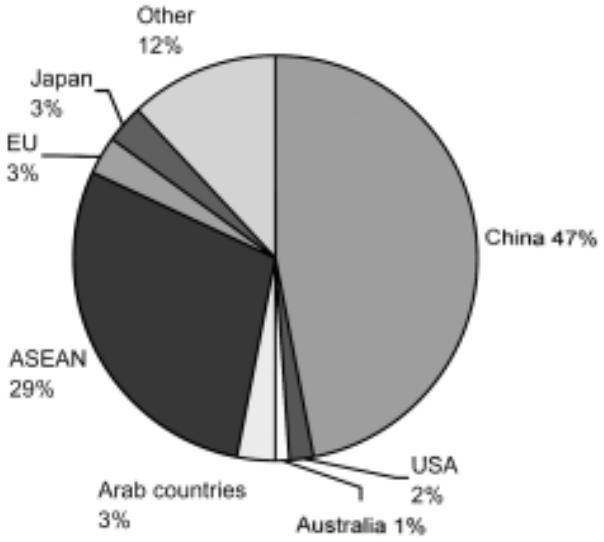


Fig 4. Quantity of fish product export by country in 2002 – 2003

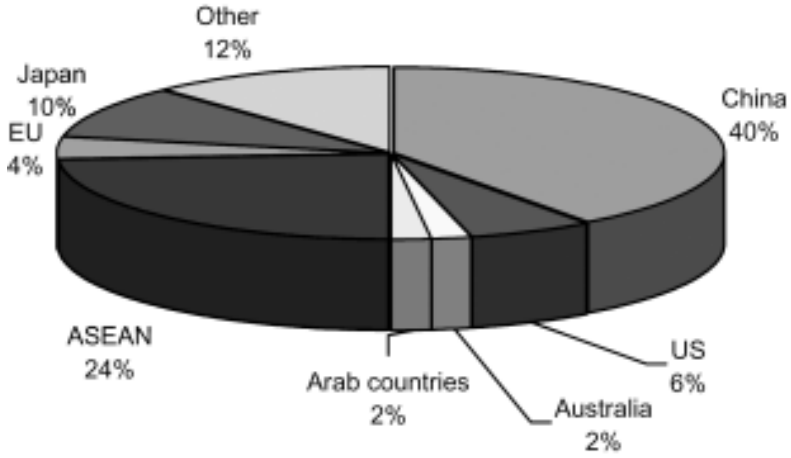


Fig 5. Value of fish product export by country in 2002 – 2003

Table 2. Fish product export quantity and value from 2000 - 2003

Year	Quantity (1000 tonnes)	Value (million US$)
2000-2001	145	218
2001-2002	202	251
2002-2003	213	317

As of 2002 - 2003, there are a total of 134 fish processing plants, with frozen fish products establishments making up the majority of all fish processing plants. Table 3 shows the breakdown and number of fish processing plants in Myanmar from 2000 to 2003.

Table 3. Fish processing plant in Myanmar

Year	Frozen fish and prawn	Dried fish	Surimi	Fish meal	Total
2000-2001	84	2	2	6	**94**
2001-2002	120	3	2	6	**131**
2002-2003	120	4	3	7	**134**

IMPLEMENTATION OF HACCP IN THE FISH PROCESSING INDUSTRY

The Export Quality Control Section under the DOF is the main organization providing services to the export-oriented fish and fishery product industries on fish inspection and quality assurance. The Export Quality Control Section inspects fish and fishery products for compliance with international standards for export, where applicable and the imported requirements related to health, quality, safety and identity.

The DOF recognized that end-product inspection alone is not enough to ensure the quality and safety of the products, hence since 1999 the inspection system was based on HACCP. Inspection procedures and operations were revised with reference to CODEX guidelines, standard and code practices on HACCP and GMP.

The concept of HACCP has been introduced to fish processing plants since 1998. Since then, the government has been actively communicating HACCP to local fish processing establishments. Training on HACCP application were conducted to fish processing establishment's staff as well as DOF inspectors. In 1998, seven fish processing plants, out of 94 took part in the program. Factory inspections have been done twice a year since.

The training on seafood safety and quality assurance were conducted for DOF inspectors and lab technicians, by FAO and SEAFDEC (MFRD). HACCP, GMS and SSOP training were carried out yearly in state and divisions where processing plants are located. DOF would then conduct the extension training for fish processors. Training on GMP and SSOP were conducted to fish processing plants by DOF. HACCP application training was conducted by DOF to the fish processing plants, upon requests by plant owners. In 2002, 19 DOF staff were trained in connection with seafood safety programme by MFRD. From 2000 - 2003, there are a total of 164 DOF officers, which in turn trained and 699 fish processors.

In 2001, a project entitled 'Upgrading the Safety and Quality of Fish and Fishery products' sponsored by FAO was implemented. This project included:

- Revise and Review of DOF Directives
- HACCP implementation training in processing plants
- Lab operation procedure for lab technician of DOF

FAO project was extended up to Dec 2002 to further continue laboratory training, that is:

- HPLC / GC operation test for Histamine
- ELISA test chloramphenicol
- PCR test white spot virus syndrome
- Insecticide Survey Programme

NATIONAL PROGRAMMES, REGULATION AND POLICIES

It is compulsory for every registered fish processing establishment to be inspected and rated by DOF twice a year. The inspection is related to HACCP audit that is conducted by DOF once a year. This plant rating-program was approved by ministerial management committee in 2001 and started to conduct in 2002.

Plants are rated A, B, C, D and E in order of merit related to compliance relevant to DOF directives. The plant that is rated E has to be upgraded to D and upwards within six months. Should the plant not upgrade, it is not allowed to export its products. Plants rated A and B are allowed to export their products to EU, US, Australia, Canada and Japan. C and D-rated plants are able to export their products any other countries except EU, US, Australia, Canada and Japan. To date, there are 45 processing plants that have A and B rating. The status of HACCP application in the fish processing plants in Myanmar is as shown in Table 4 below.

Table 4. Status of HACCP-approved fish processing plants, 2000 - 2003

Year	Type of Plant	Register	Plant rating approved by DOF				
			A	B	C	D	E
2000-2001	-Frozen fish and prawn	84	2	15	20	21	26
	-Dried fish	2	-	-	-	2	-
	-Surimi	2	-	1	1	-	-
	-Fish meal	6	-	-	-	6	-
	Total	**94**	**2**	**16**	**21**	**29**	**26**
2001-2002	-Frozen fish and prawn	120	5	18	29	31	37
	-Dried fish	3	-	-	-	3	-
	-Surimi	2	-	2	1	-	-
	-Fish meal	6	-	-	1	5	-
	Total	**131**	**5**	**20**	**31**	**39**	**37**
2002-2003	-Frozen fish and prawn	120	4	42	20	27	27
	-Dried fish	4	-	-	-	4	-
	-Surimi	3	-	2	1	-	-
	-Fish meal	7	-	-	2	5	-
	Total	**134**	**4**	**44**	**23**	**36**	**27**

The application of HACCP has greatly assisted the fish processing establishments to meet the requirements of importing countries, leading to the increase export ability of fish processing establishments. There is a significant progress in fish and fish products export from Myanmar to EU and other countries (Table 5 and Table 6).

Table 5. Export of Myanmar shrimp, 2000 - 2003

No	Market	2000-2001		2001-2002		2002-2003	
		US$	%	US$	%	US$	%
1	Japan	22,536,194	21.60	22,049,930	23.40	27,786,739	26.40
2	US	11,516,816	11.00	14,681,584	15.0	14,872,286	14.10
3	EU	3,477,044	3.30	5,420,582	5.70	7,541,139	7.20
4	China	11,021,253	10.80	12,536,894	13.30	11,586,078	11.00

Table 6. Export of Myanmar fish and fish product, 2000 - 2003

No	Market	2000-2001			2001-2002			2002-2003		
		Tonnes	US$	US%	Tonnes	US$	US%	Tonnes	US$	US%
1	Japan	4,293.54	24,102,629	11.04	4,651.14	23,317,907	9.27	6,817.85	30,895,251	9.73
2	US	2,936.21	12,886,155	4.58	3,732.61	16,058,146	6.38	3,792.02	17,675,841	5.56
3	EU	4,116.71	6,596,721	3.02	5,894.48	10,229,428	4.06	5,767.67	13,315,152	4.19
4	China	69,015.13	66,788,243	30.59	77,311.89	86,701,932	34.47	100,807.85	128,583,447	40.51

PROBLEMS/ DIFFICULTIES ENCOUNTERED

Some difficulties in HACCP implementations in fish processing industries are:

- High cost in implementing HACCP, as perceived by small and medium-size plant
- Lack of enforcement by government
- Lack of trainings for inspectors and fish processors
- Lack of training for boat crews and farmers
- Lack of awareness on HACCP by fishermen
- Fish processors lack interest in implementing HACCP in their establishments
- HACCP training for fish processing establishments' staff are not effective due to their low education level
- Lack of FAO and WHO-approved lab equipments and techniques that are necessary to support food safety certification system
- Lack of risk assessment and hazard necessary for setting up critical limits in fish processing
- Insufficient power supply and diesel in fish processing establishments, due to high price and unstable foreign exchange, resulting to fluctuation in cold store temperature

FUTURE DIRECTION

- To conduct more HACCP training for government officers and fish processors
- To conduct HACCP training in fish catch and aquaculture procedure for boat crew and farmers respectively
- To conduct insecticide survey programme, as assisted by FAO
- To introduce GMP/ SSOP in traditional fish products processing
- To standardize lab procedures to harmonize with other ASEAN countries
- To install regional laboratory in all states and divisions
- To monitor hand swab, table swab and products test once a monthly in order to assist the Health Certification

CONCLUSION

Food safety and quality assurance are crucial for consumer protection and trade facilitation. Food safety is the responsibility of processors. HACCP system has to be implemented to ensure food safety in the processing plants. The success of HACCP application in the processing plants in Myanmar is still far from completion. More efforts will be continued to encourage the application of HACCP in the fish processing industry.

PHILIPPINES

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BACKGROUND

With the increasing concern of the food safety worldwide, the mandatory implementation of Hazard Analytical Critical Control Point (HACCP) in the processing of fish and fishery products have been imposed by regulatory authority of the seafood importing countries, such as US, EU, Australia and Japan. Philippines is among the Southeast Asian's net exporters of fish and fish products in the international seafood market. In order to maintain the Philippines' significant position in the fish export market, the government and private sectors have taken the bolder steps to adapt this trend.

The food control program of the Philippines is primarily regulated by the Department of Agriculture (DA) to ensure that foods traded meet the quality and safety requirements of the consumers. However, as other departments are involved in the implementation of laws, rules and regulations pertaining to food, DA maintains a coordinative link and networking with such other departments i.e. the Department of Health (DOH), Department of Environment and Natural Resources (DENR) and the Department of the Interior and Local Government (DILG).

The DA Bureau of Fisheries and Aquatic Resources (BFAR) is the agency mandated under Republic Act 8550, known as the Fisheries Code of 1998, to be responsible for the conservation, management and development of the country fisheries and aquatic resources. As such, it takes the lead in implementing the legislations pertaining to fish and fish products traded domestically and abroad.

The Fisheries Code of 1998 promulgated several Fisheries Administrative Orders (FAO) to support the implementation of the HACCP system through the fish inspection and quality and safety management programme of the Philippines. Among them are FAO No. 211 s of 2001, FAO No. 212 s. of 2001 and FAO No. 214 s. of 2001 that regulate processing SSOP, implementation of HACCP system and Code of Practice for Aquaculture.

The government takes a coordinative approach in implementing the country's food safety and quality control program in order to maximize the resources available among all other government agencies that are likewise mandated to implement this program.

Currently, the BFAR implements the Ginintuang Masaganang Ani (GMA) Program for Fisheries for 2002-2004. This program provides the national directions and framework to develop and manage the country's

fisheries resources, in order to ensure food security and the socio-economic upliftment of the fisherfolk. Under this program, development efforts are focused on the expansion and revitalization of productivity programs and the provision of support systems through appropriate technology, research, extension and adequate financial and marketing assistance. The participation of the private sector is vital to the realization of the goals of this program.

ACCREDITATION PROGRAMME FOR HACCP IMPLEMENTATION

BFAR, as the regulatory agency for fish and fish products for export, has initiated a mandatory accreditation programme for fish processing plants based on verified HACCP compliance in conformance to international requirements for the export of fish and aquaculture products. This accreditation is carried out to enable the fish processors to continue their exports to EU and US and other export markets where mandatory implementation of HACCP is required.

The mandatory accreditation programme requires the company to submit its Licence to Operate (LTO), Quality/ Safety Assurance Programme, which include the HACCP plan for the specific products to be exported as well as Sanitation Standard Operating Procedures (SSOP). LTO, issued by the Department of Health-Bureau of Food and Drugs, will be released to the company on the basis of their compliance to GMP and SSOP.

BFAR conducts on-site inspection to validate the implementation of the submitted documents and to verify compliance to the relevant international and national legislations. A certificate of accreditation with a validity of 6-12 months and a notice of approval of HACCP program will be issued to those that meet the requirement. The validity of the accreditation varies depending on the plant rating obtained after each inspection. A certificate of implementation on the HACCP will be given to the company as requested.

Monitoring/ inspection of the plants is conducted at least twice a year to ensure compliance to the requirements. For those that fail to sustain their accreditation, official sanctions are applied accordingly, based on legal provisions of applicable rules and regulations.

PROGRESS ON HACCP IMPLEMENTATION

The progress of HACCP implementation in the country is shown in the increasing number of HACCP-certified plants from 2000 to 2003. In 1995, there was only 9 fish processing plants that are HACCP-certified. These plants were export-oriented plants with products such as canned tuna and frozen aquaculture shrimps that are for export to EU market. The number of HACCP-certified fish processing plants has since increased significantly (Table 1).

Table 1. Number of HACCP certified fish processing plants and their location

Geographical location	Number of HACCP certified processing plants, 2000-2003			
	2000	2001	2002	2003
Luzon	14	14	15	19
Visayas	3	3	4	7
Mindanao	21	24	32	41
TOTAL	**38**	**40**	**51**	**67**

In 2002, a significant number of fish processing plants have been added to the list of HACCP-certified plants. This can be attributed to increased number of trainings and technical assistance made available to the private sector. Moreover, the industry has increasingly realized the importance of implementing the HACCP system. The new products added to the HACCP-implemented list include frozen tilapia, smoked marinated milkfish and sardines in glass.

More and more plants are applying for HACCP certification. Currently, there are about 20 plants applying for certification. Most of them are located in the Mindanao and a few in Luzon. The products consist mainly of frozen fish and aquaculture products, value-added products, pasteurised crabmeat and traditional products, such as pasteurised shrimp paste.

Products manufactured under the HACCP system

Table 2 shows the types of fisheries and aquaculture products that are processed by the HACCP certified plants and their major markets from 2000 to 2003.

Table 2. Types of product manufactured under the HACCP system and their major export markets, 2000 - 2003

Year	No. of HACCP certified plants	Type of products exported	Major export markets
2000	38	Canned tuna, fresh frozen octopus, shrimps, tuna products, milkfish products, pasteurised shrimp paste, squalene capsule, canned sardine, fish sauce, fermented anchovy	US, EU, Canada
2001	40	Canned tuna, canned sardine, fresh frozen octopus, milkfish products, pasteurised shrimp paste, fish sauce, canned abalone	EU, US, Canada, Singapore
2002	51	Canned tuna, canned sardine, fresh frozen octopus/ shrimp, tilapia, tuna products, tilapia, IQF abalone, canned abalone, squalene capsule, pasteurised shrimp paste, fish sauce, fish paste, fermented anchovy, smoked Round scad	EU, US, Australia, Canada, Singapore, China
2003	67	Canned tuna, canned sardine, fresh frozen octopus, milkfish products, smoked Round scad, IQF abalone, canned abalone, squalene capsule, pasteurised shrimp paste, fish sauce, fermented anchovy, fish sauce, seaweed powder, sardine in glass jars, value-added fish products, pasteurised crab meat and seaweed powder	US, EU, Canada, Australia, Singapore, China

Export of fish and fish products

Tuna remains the country's top export product. The tuna export increased from 56,752 MT in 2001 to 72,296 MT in 2002 (Table 3). Shrimp exports also increased from 12,757 MT in 2001 to 16,919 MT in 2002.

Table 3. Seafood export quantity (MT), 2000 – 2002

Commodity / Kind	2000	2001	2002
1. Tuna Fresh/ chilled/ frozen/ canned/ smoked/ dried	80,108	56,752	72,296
2. Shrimp Prawn Fresh/ chilled/ frozen	12,061	12,757	16,919
3. Octopus Fresh/ frozen	10,239	41,267	31,098
4. Seaweeds Carrageenan, kelp powder, seaweed and algae	56,841	41,267	31,098
Grand Total	**159,249**	**122,582**	**132,134**

HACCP training conducted

Many training courses related to HACCP have been conducted by BFAR as well as other agencies for both government regulatory officers and industry personnel. In fact, BFAR has been actively conducting the HACCP training under its Fish Quality and Safety Management Programme.

The training courses conducted for the regulatory officers and local government units include: the Principles and Application of HACCP, the Review of the Requirements for the Export of Fish and Fish Products, and the Regulatory Audit of Fish Processing Plants. The HACCP training for industry personnel include: Training on HACCP Concept and Application in the Fish Processing Industry, Requirements for the Accreditation of Fish Processing Plants, Training on Proper Fish Handling On-Board the Fishing Vessel, Trainers Training on HACCP and HACCP Competency for Line Workers. Table 4 shows the number of participants of HACCP training conducted from 2001 – 2003.

Table 4. Number of participants attending HACCP training courses, 2001 – 2003

	2001	2002	2003 (as of Jul 2003)
Government officers	35	38	41
Non-government officers	250	340	325
Total	**285**	**378**	**366**

SOCIO-ECONOMIC BENEFITS OF HACCP IMPLEMENTATION

During the past years of HACCP implementation, the industry has begun to realize the significant socio-economic advantages of HACCP implementation. Since HACCP is meant to ensure the safety of the products, it has somehow form part of product promotion to some processors, thus encouraging them to comply with the food safety requirements of their buyers to sustain continued consumption of their products.

HACCP implementation also enables the processors to expand their markets, thereby giving a continuous employment security and job opportunities for the people. Such advantages are demonstrated in the manner each accredited processor has put value in to the system and continued to support its implementation.

Since the implementation of HACCP has become a partnership between the government and the industry sectors, maintaining and sustaining its implementation has become a continuing challenge towards global competitiveness on seafood trade.

ISSUES AND CONCERNS ON HACCP IMPLEMENTATION

While the significant of HACCP implementation cannot be over-emphasized, there are certain issues and concerns that affect the industry and government as well. The primary issues are:

From the industry:

1. Limited technical qualification of some HACCP team members. This leads to many deficiencies occur during recording data for CCP monitoring, as well as incorrect identification of hazard and CCP
2. Lack of scientific information or standards for specific products, leading to inconsistency in the setting of critical limits for some products
3. Lack of financial capabilities needed for upgrading premises and implementing HACCP, particularly in small and medium establishments

From the government:

1. Lack of trained manpower and financial resources at the regional and local government level
2. Limited manpower capacity, resulting in low frequency of inspections of the fish processing establishments at the regional level
3. Lack of communications and transport services to support to fish inspection activities (internet connectivity and transport vehicle).
4. Limited budget and politics situation leading to non-implementation of planned activities
5. The stringent requirements of the fish importing countries
6. The inadequate resources available in Philippines to cope up and meet such requirements from importing countries
7. The need for external technical assistance

NEW STRATEGIES AND DIRECTIONS

1. Raw material control program

To ensure that products are free from chemical contaminants and marine biotoxins, the safety 'From Water to Table' concept has been adopted and is now posing a problem among the aquaculture fish producers and suppliers. The government has commenced implementing Fisheries Administrative Order no. 214, known as the Code of Conduct for Responsible Aquaculture to ensure the production of high quality broodstocks, seeds and fingerlings. The exporters are now required to observe proper control of raw materials from the source through the provision of suppliers' guarantee, product tests for antibiotics, and other contaminants Production sites are subjected to regular monitoring and surveillance

2. Advocacy and information and educational campaign (IEC)

Continuous training on HACCP, GMP and SSOP and on the marketing of fish and other fish products, in order to create awareness on food safety and on export market requirements for the key players from production to processing and distribution

3. Technical and advisory assistance

Collaboration with fish processors on proper plant design and process layout in order to address the hygienic and sanitary aspects in plant construction

4. Inter-agency collaborations for mutual technical and financial assistance from international bodies

5. Promulgation of additional legislations to further support the fish inspection and fish product quality and safety management system

6. Review of the current organizational structure within the BFAR to further strengthen the fish product safety and quality management implementation

7. Involvement of the local government units in the inspection of fish markets and other ancillary fish post harvest facilities such as fishing ports and fish markets, in order to ensure safe fish supplies

SINGAPORE

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INTRODUCTION

The application of HACCP concept to the fish processing industry has gained increasing popularity in many developed countries as the system of choice for enhancing food safety and quality. Many of these countries have integrated this system into their food inspection programme and national legislation. Some have gone one step further by also requiring their domestic industry as well as those that export fish and fishery products into their markets to adopt the same concept in their production and operations.

In Singapore, the Food and Veterinary Administration (FVA) of the Agri-food and Veterinary Authority of Singapore (AVA) is the competent agency responsible for the inspection and licensing control of all fish processing establishments in Singapore. AVA's primary concern is to ensure wholesomeness and public health safety of fish and fishery products for human consumption as well as to meet with the health and sanitary requirements of the importing countries in respect of the plants' exports and premises.

The concept of HACCP has been introduced in Singapore in the mid 1990s after it was incorporated into the food legislation in the EU, after the adoption of the EU Food Hygiene Directives in Jun 1993. Since then AVA has been actively communicating the basic principles and necessary information required for its effective implementation to the fish processing industry. In Dec 1999, The Wholesome Meat and Fish Act was enacted. One of the key features of this act is the requirement for all fish processing establishments in Singapore to develop and implement a food safety programme at their premises. In addition to numerous benefits arising from the implementation of HACCP and in view of the need to align with international food safety requirements, AVA has mandated HACCP requirements for all types of fish processing.

FISH PROCESSING INDUSTRY IN SINGAPORE

The fish processing industry in Singapore consists of two broad categories, that is, export-oriented processing establishments and local processing establishments. These establishments produce a wide range of fish products such as comminuted fish products, e.g. fish ball and fish cake; Chinese delicacies, e.g. dried shark fin; and frozen and chilled seafood, e.g. prawn, fish fillet and mollusc. The majority of the fish processing establishments produce for domestic market while others produce mainly for export.

Export-oriented fish processing establishments

Singapore, though being a net importer of fish and fishery products, also export a significant amount of fresh, frozen and other processed fish and fishery products. The quantity and value of seafood export from year 2000 to 2002 is shown in Table 1.

Table 1. Export of seafood from 2000 – 2002

Export	2000		2001		2002	
	Quantity (tonnes)	Value (S$)	Quantity (tonnes)	Value (S$)	Quantity (tonnes)	Value (S$)
Fresh, chilled and frozen fish	98,328	566,342	78,308	469,038	60,859	324,880
Processed fish (including dried, canned and preserved fish)	13,835	167,670	16,826	153,936	20,663	189,882
Total	**112,163**	**734,012**	**95,134**	**622,974**	**81,522**	**514,762**

Some of the importing countries for Singapore fish and fish products are EU, Australia, US, Japan, Hong Kong, China, Canada and Taiwan. In order to facilitate the industry's export abroad, AVA provides health certification for them. Processing of the products destined for export are monitored closely to ensure that they comply not only with the requirements imposed by importing countries but also that sanitary and hygiene standards are maintained at the highest level at all time. Samples of the products are collected for the relevant laboratory tests, i.e. microbiological tests, heavy metals, antibiotics, etc. Health certificates are then issued upon satisfactory laboratory results. Some of these export-oriented fish processing establishments also process their products for the local market.

Many of export-oriented establishments, especially those exporting to EU, are HACCP-certified and have readily adopted Good Manufacturing Practices (GMP) to meet the requirements of the importing countries.

Local fish processing establishments

Local processing fish establishments make up the majority of the fish processing establishments in Singapore. They consist of small to medium-sizes enterprises, many of them are family-owned business. Most of their processing is still done manually and are labour-intensive. The floor areas for these establishments are relatively small, typically around 90 - 120 square meters. This physical space constraint can give rise to poor housekeeping and increase the possibility of cross contamination between cooked food and raw materials. Moreover, unlike their export-oriented counterparts, many of the workers of local establishments have inadequate knowledge of hygiene and sanitation.

Status of fish processing industry in Singapore from year 2000 – 2003

The number of fish processing establishments in Singapore has been declining from 99 in 2000, 95 in 2001 and 88 in 2002. To date, there are 90 fish processing establishments in Singapore in 2003. The number of establishments according to each category is shown in Table 2.

Table 2. Fish processing establishments in Singapore from 2000 – Jun 2003

Product type	2000	2001	2002	As in Jun 2003
Comminuted fish products (e.g. fish ball, fish cake, *otah*)	49	48	46	46
Frozen fish products (e.g. tuna, swordfish)	25	24	22	24
Dried seafood products	0	0	0	0
Chinese delicacies (e.g. shark fin, sea cucumber)	23	19	17	17
Crustaceans, mollusc	2	4	3	3
Total	**99**	**95**	**88**	**90**

AVA'S APPROACH TO THE HACCP IMPLEMENTATION IN FISH PROCESSING INDUSTRY

Since The Wholesome Meat and Fish Act was enacted in Dec 1999, it has been mandatory for all fish processing establishments to submit HACCP plans to AVA upon licence application or renewal. However, the implementation of HACCP is still on voluntary basis.

Table 3. HACCP implementation in fish processing industry

	2000	2001	2002	As in Jun 2003
No. of licensed fish processing establishments	9	95	88	90
No. of EU-approved fish establishments	11	14	15	12
No. of HACCP-certified (3rd party) fish establishments	3	5	9	9

From Table 3, it can be seen that although the number of licensed fish processing establishments have decreased but the number of EU-approved establishments and HACCP-certified establishments have steadily increased. The decline as of Jun 2003 was due to closure of 3 plants due to the economic downturn.

Some fish processing establishments have enlisted third party-accreditation organisations to audit their HACCP plans and system. Following successful auditing of the system, processing establishment would be awarded certifications under various HACCP schemes. Audit checks would then performed regularly to ensure that the HACCP plans were correctly administered and the system was working effectively. To ensure that the auditing party are competent to perform certification of HACCP, AVA is in the process of developing HACCP audit and certification procedures and auditor approval criteria to accredit

organisations that are competent to perform this scheme on behalf of AVA. To date, there was one workshop organised by AVA in Oct 2002 to train its staff in HACCP auditing procedures and techniques.

Another scheme to encourage small fish processing establishments to implement HACCP was proposed by Marine Fisheries Research Department (MFRD) and Standards, Productivity, and Innovation Board (SPRING, formerly known as PSB). This scheme proposed cost sharing among the plants to reduce the cost of implementing HACCP. This scheme, proposed in 2002, currently has yet to be implemented due to economic downturn.

As incentive for the local industry, the Government has provided financial assistance for consultancy cost under the Local Enterprise Technical Assistance Scheme (LETAS). Processing establishments can apply for grants up to 70%, maximum of S$ 14,000 for consultancy costs and up to 50%, maximum of S$ 5,000 for certification costs.

PROBLEMS/ DIFFICULTIES ENCOUNTERED

The implementation of HACCP in local establishments is noticeably slower than its export-oriented counterparts. Some of the possible reasons are:

- **Misconceptions about HACCP**
  Small-medium enterprises often associate the implementation of HACCP as criteria that need to be complied only by those who intend to export the products overseas. In actual fact, HACCP has to be implemented by all processing establishments, to ensure product safety and quality and to prevent potential food hazards. In addition, there is a misconception that HACCP is difficult to apply in small processing establishments, as there is a large cost involved and expert needed.
- **Economic downturn**
  Due to the recent economic downturn, many establishments are affected and delaying HACCP implementation as it is still on a voluntary basis

CONCLUSION

Although HACCP has been mandated as the system of choice to ensure food safety by AVA, the driving force lies heavily on the industry's eagerness and commitment to develop and implement it to in order to make this initiative a success. Even though many fish processors recognised the usefulness and importance of HACCP to ensure product safety and quality but the implementation of HACCP has generally been quite slow, especially in small establishments. This is due largely to the lack of resources (technical, financial and manpower) and the limited understanding of HACCP principles and application. In view of this, the government through AVA has and will continue to assist the industry, by providing training and incentives for HACCP implementation.

THAILAND

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INTRODUCTION

HACCP, which stands for Hazard Analysis and Critical Control Point, clearly expresses its approach to food safety, which is to identify the pertinent hazards and establish control measures to prevent them. Since the process of designing such control measures requires a science-based judgment, the HACCP system, if developed and implemented effectively, can assure product safety (though not 100%) and has become acceptable worldwide for food safety improvement.

HACCP becomes well known when developed countries like the US and EU have incorporated it into their food regulations. The new HACCP regulations, 21CFR 123 of the USFDA and the directive 94/356/EC of the EU, impose fish processors to be responsible for identifying hazards that are likely to occur and for establishing critical control points to prevent or reduce contamination. Thailand, as a fish processing country, has also adopted the HACCP program and made it mandatory to its export-oriented fish processors since 1996 under the jurisdiction of the Department of Fisheries, the competent authority responsible for inspection and export certification of fish products.

As in many other countries, the HACCP principles were not thoroughly understood and difficult to apply effectively at the early stages of its implementation. Lots of trainings were organized for both private sectors and regulators to enable them to have a better understanding on the HACCP, which should not be seen as a trade barrier, but as measures to ensure product safety. 2003 is the sixth year since HACCP was implemented in Thailand. Though there are still a few problems faced, it has been much less than in the beginning. This report will describe the progress made in the application of HACCP in the export fish industry in Thailand, problems encountered, and planned strategy to overcome the problems.

PROGRESS MADE IN THE APPLICATION OF HACCP

The Department of Fisheries' (DOF) HACCP requirements mandate fish processors to conduct an analysis to identify hazards that are reasonably likely to occur and develop, as well as to implement plan to control them. Apart from the HACCP plan, the processors are also required to develop the written procedures for controlling GMP and implement it to avoid the spreading of contamination from working

environment to the product. Examples of those controls are condition and cleanliness of construction and equipment, control of personnel hygiene, control of pests, etc. When the submitted documents are deemed to be satisfactory in accordance with food safety requirements, the DOF will proceed to in-plant audit to verify its compliance. The processors need to rectify the non-compliances found from the audit within the agreed time frame. The processor will be graded as 'compliance' only when the follow-up audit shows that all corrective actions are taken. The HACCP certificate will be issued upon request from the processor. The first issue will be valid for 6 months and thereafter will be in accordance with its later assessment records. The DOF will conduct an audit at the frequency of 2 - 4 times per year for each processor depending on its previous audit results.

Table 1. Number of fish processing plants implementing HACCP

Processing type	2000		2001		2002		2003*	
	R	H	R	H	R	H	R	H
1. Frozen - shrimp - cephalopod - fish - value added - surimi - surimi based products	118	91 (77%)	124	120 (97%)	153	150 (98%)	161	153 (95%)
2. Canned - tuna - sardine/ mackerel - shrimp - bivalve mollusk - cephalopod	30	23 (77%)	34	32 (94%)	38	36 (95%)	43	38 (88%)
3. Traditional - salted - fermented - dried - fish sauce - shrimp paste	26	10 (38%)	29	15 (52%)	38	30 (79%)	40	31 (78%)
Total	174	124 (71%)	187	167 (89%)	229	216 (94%)	244	222 (91%)

* as of June 2003

R: registered processors H: HACCP implemented processors

FISH PROCESSING INDUSTRY IN THAILAND

The fish processing establishments in Thailand can be classified into three groups according to their products, that is, freezing plants, canneries and traditional fish products plants. The products from freezing plants include frozen shrimp, fish and cephalopod. Canneries products include canned tuna and other canned fish. Traditional products include dried and fermented fish, and chili shrimp paste.

Canneries and freezing plants sector show better progress in implementing HACCP in their premises than traditional fish products plants. This is because most canneries have developed the control procedures and carried out monitoring and recording as required in low acid canned food regulations of the USFDA and Canada even before HACCP came into force. This eases the development and implementation of HACCP in their premises. In addition, it was a common practice for the established cannery to have buyers or appointed agency to inspect their premises. This practice, similarly, enable the cannery to understand the proper control of particular hazard.

Unlike the established cannery, new canneries often do not have sufficient experience in quality control and/ or lack experienced staff to establish the appropriate control in processing.

Deficiencies found in canneries, at the beginning of HACCP application, were often associated with inappropriateness of written plans, e.g. invalid critical limit, inadequate frequency of monitoring, or inappropriate corrective action procedures. Later on, deficiencies are associated with the practice done, e.g. incompliance of monitoring frequency, corrective action not taken when deviation occur. The incompliance with the monitoring frequency is mostly due to the too stringent design of monitoring frequency, which often impractical in the actual operation. The most often cases are the frequency of checking the fill weight at filling step and seam tear down measurement at the seaming step. Similarly, the deficiencies in corrective action are often associated with the too restrictive critical limits. In many cases, the product will still be considered safe, thus the processors often choose not to take corrective action, as it is deemed unnecessary. However, from auditor's point of view, noncompliance will be considered failure to comply with the written plan. In this case, the processor can opt to either revise its plan to suit the actual operation and monitoring or strictly follow the plan even though hazard will not actually occur from some certain deviation.

Freezing plants are another group that has been successfully implementing HACCP system. The main products of this group are frozen, raw or cooked black tiger shrimp; frozen cephalopods, both for ready-to-eat consumption and for cooking purpose; frozen fish; and value-added products, such as dimsum, breaded product, and Japanese style product. Some of these frozen products do not need HACCP plan, since there is no significant hazard that likely to occur, either from the raw material itself or from the process. Examples are frozen raw fish (with exception of scombroid group) and frozen raw cephalopods which required heating before consumption. Nevertheless, the non-HACCP product (does not need HACCP) is still required to comply with the minimum standard of GMP and sanitation control to eliminate introducing of contamination from environment onto the products.

Since frozen black tiger shrimp is mostly farm-raised shrimp, it's inevitable to include drug residues that are likely to be used during aquaculture period. In the past, control of this hazard was conducted upon shrimp arrival at the processing plants, where samples were taken for analysis. Acceptance of raw material lot relies

on the test results that sometimes did not represent the whole lot, if shrimp were from different sources and pooled up to be one lot. The more effective control that recently applied will focus on the control at the farm level. Good Agricultural Practice (GAP) has been introduced to shrimp farming. The DOF has conducted training for farmers and provided certification for the compliance farms. Though GAP is currently a voluntary program for the farmers, with effect from 1 Jan 2004, any processors who wish to comply with the DOF's requirements on drug control are required to use raw material only from the GAP farms. The processors are also required to establish system that enable tracing the product back to the source of raw material.

As for the process related controls, especially the cooked products, deficiencies found are associated with invalid critical limits of cooking time/ temperature or too restrictive cooking time/ temperature applied. Invalid cooking process is due to the lack of available studies to identify the proper procedure that is necessary to reduce the *Listeria monocytogenes* to 6D, which is one of the safety requirements. Too restrictive process time/ temperature causes noncompliance with the written plan. Like deviation in cannery, corrective action might not be taken for deviation since processors know that the products are still safe.

The most frequent deficiencies from frozen raw products processing is the invalid critical limit. As pathogenic bacteria were identified as a hazard from raw material, to reduce or eliminate bacteria, the critical control point was set at washing step, thus set critical limit was set as level of chlorine residue in water and water changing frequency. It is difficult to prove during validation whether the set level of chlorine and water changing time will be capable to eliminate the pathogenic bacteria, if present. It is often not mentioned on the actual condition of washing compared with the study condition, the initial load of bacteria, and how to maintain the chlorine levels as required at all the time of washing.

Traditional product sector is the last group to join implementation of HACCP. It is relatively slower than the cannery and frozen sectors. Traditional fish product sector is dominated by medium and small-scale enterprises. The medium scale establishments are generally more ready in implementing HACCP than small-scale counterparts, where most of their prerequisite requirements are still not yet in place. However, there are more and more traditional fish processing establishments that are successfully implementing HACCP for export purpose.

The government has noted the difficulties of small-scale establishments in achieving the food safety requirements. The main reasons are due to their limited financial abilities and technical knowledge. To ease and encourage industry in developing HACCP system, the Ministry of Industry and the Small Industry Finance Corporation have launched two projects for financial and technical support to the industry. These projects have been successfully operated as proven by the increasing numbers of small-scale establishments that have been granted HACCP certification.

Overall, deficiencies from HACCP implementation were likely associated with CCP determination, invalidated critical limit and impractical corrective action. The processors have the misconception that only CCP can control contamination, hence absence of CCP on certain steps may not satisfy the external auditor. Hence some processing steps that did not really need CCP were apparently determined as CCP. Control procedures of critical limits, monitoring, and corrective actions of such CCP is not correctly targeted on the hazards, thus impractical to follow. Moreover, too many CCP also cause more difficulties to the processors to maintain effectiveness of their HACCP system, as too many factors need to take care of and verify, especially for

the small-scale processors. Another deficiency was related to the prerequisite controls. This was the case when determining if the hazards identified at that particular processing step were significant or likely to occur. The prerequisite controls e.g. GMP, SSOP were normally referred to as a justification for not being a significant hazard and hence not a CCP. No monitoring and recording to prove the existing of such activities.

EXPORT OF FISH AND FISH PRODUCT

Table 2 shows the value of the major exported fish products from 1999 to 2002. US is the largest market for frozen shrimp and canned tuna, EU is the main market for frozen cephalopods and Asia in particular Malaysia and Japan for fresh and frozen fish.

Table 2. Exports of fresh and frozen shrimp in quantity (metric tonnes)

Items	1999	2000	2001	2002
1. Asia	63,912	60,037	57,366	47,672
2. US	52,746	65,261	67,167	42,296
3. Canada	4,609	4,498	5,802	4,901
4. EU	7,743	6,612	7,059	1,814
5. Australia	5,906	3,927	3,643	3,209
6. Others	3,189	4,053	3,569	2,861
Total	**138,105**	**144,388**	**144,606**	**102,753**

It is irrelevant to point out that the application of HACCP increases the export quantity. The figure for HACCP-implemented establishments (Table 1) does not correlate with export quantities (Table 2 - 5). However, it is worth to note that the application of HACCP is something that unavoidably must be carried out if the processors wish to maintain their trading status and seek for the new markets.

The shrimp exports were quite stable from 1999 to 2001 but declined dramatically in 2002, especially to the EU market which decreased by more than 50% from the previous years (Table 2). This is due to the issue of nitrofurans residue in aquaculture black tiger shrimp. It has since been resolved and strictly controlled from the upstream and processing plants. The processors are required to add this drug as a CCP at the receiving step. The controls must include the shrimp sources and proper system to ensure reliability of the sources.

Similarly, the cephalopods export has been quite steady from 1999 to 2001 and increased substantially in 2002 (Table 3). Most of frozen cephalopod processors do not need HACCP plan for their premises, as their products require heating before consumption. The bacterial contamination that may be introduced during the process can be controlled by applying proper GMP. However, there is a possibility of chemical hazard in the final products due to the occurrence of high amount of heavy metals in some catching area. In this case, CCP would be the control of raw material source.

Table 3. Exports of fresh and frozen cephalopods in quantity (metric tonnes)

Items	1999	2000	2001	2002
1. Asia	47,092	46,991	44,881	46,837
2. US	3,144	3,324	3,201	4,426
3. Canada	1,516	1,254	964	1,640
4. EU	27,880	27,036	26,916	32,337
5. Australia	2,703	2,542	3,955	4,648
6. Others	2,974	2,243	2,108	2,928
Total	**85,309**	**83,390**	**82,025**	**92,816**

The largest market for fresh and frozen fish is Asia, in particular Malaysia and Japan, followed by Middle East countries (Table 4). The products are in whole, fillets and breaded form. With the exception of scombroid fish, there is relatively no hazard concerning this raw product. Like cephalopod processors, fresh or frozen fish process will not need HACCP plan, only the prerequisite GMP or SSOP.

Table 4. Exports of fresh and frozen fish in quantity (metric tonnes)

Items	1999	2000	2001	2002
1. Asia	220,209	181,248	176,121	175,573
2. Middle East	5,003	6,705	7,267	7,912
3. US	2,627	2,028	2,028	1,653
4. Canada	591	597	413	545
5. EU	4,911	2,888	3,034	1,903
6. Australia	2,945	565	646	334
7. Others	15,479	14,489	9,501	6,217
Total	**251,765**	**208,520**	**199,007**	**194,137**

The total export value of canned tuna is relatively stable from 1999 to 2002. The main markets like US, Australia, and EU require processors to have HACCP in place.

Table 5 Exports of canned tuna in value (US$ millions)

Items	1999	2000	2001	2002
1. US	187.3	126	158.1	138.2
2. Canada	62.2	52.8	60.4	57.2
3. Australia	45.4	38.6	41.8	47.6
4. Japan	36.2	38	39.3	47.4
5. Egypt	20.3	40	43.5	32.8
6. Saudi Arabia	25.4	13.1	28.7	28.7
7. UK	37.8	23.3	32.8	28.7
8. Others	163.7	138.5	175.2	180.5
Total	**578.3**	**470.3**	**579.8**	**561.1**

SUMMARY OF PROBLEMS IN IMPLEMENTING HACCP FROM 2000 TO 2003 AND STRATEGIES TO OVERCOME PROBLEMS

As the DOF is responsible for the certification of exported fishery products only, the issues that will be mentioned below are limited to the export processing plants, of which most are medium to large size enterprises. Problems encountered by industry, especially the medium to small size enterprises, are related to personnel qualification and technical knowledge.

1. The main problem encountered during the first stage of HACCP application is the misunderstanding of HACCP principles of the HACCP team. Inappropriate written HACCP documents often miss some significant hazards and include inappropriate control measures to prevent hazards from occurring. This also includes an impractical HACCP plan that design too restrictive critical limit, which result to many deviations and corrective actions that need to be taken during the daily operation

To help develop effective HACCP plan, more advanced HACCP training have been organized by the DOF to clarify the industry on the gray areas and issues frequently misunderstood of HACCP application as well as new emerging hazards that need to be controlled. After a period of time, more understanding of HACCP is learnt and improvement of HACCP documents and implementation are gained

2. Invalid critical limits is another issue especially for the shrimp cooking process. Like the retorting process of the Low Acid Canned food, the cooking process of the shrimp needs to prove its sufficiency to reduce the pathogenic bacteria, such as *L. monocytogenes* to 6D. At present, large factories have their own equipment to establish the process based on the data provided by the DOF. Some institutes such as university and the National Food Institute also provide the services for those who do not have knowledgeable personnel and equipment to conduct the study.

3. Inconsistent implementation of the HACCP plan as written in the approved manual. It was observed that the later regulatory audit to the HACCP effectiveness sometimes found that the plans are not followed as they were in the first audit. One of the causes of this problem relate to improper conducting of internal verification. This is because the HACCP team does not really understand what verification activities should be carried out and how to verify. Many processors choose to conduct the sanitation and GMP check rather than observing the HACCP activities like monitoring, corrective action, etc. In the case of the processor who is also certified for ISO 9000, internal audit is required by the ISO but will be more focused on ISO quality assurance activities rather than HACCP food safety issues.

Internal verification training has been organized by the DOF for the industry. Clarification of the internal audit and examples are given. From the later regulatory audits, it shows the improvement of this problem.

4. Lack of financial resources for improving construction and equipment and personnel competency to carry out the HACCP development and implementation, especially for the small processors. In regard to this, the Small Industry Finance Corporation has provided financial supports for renovation purpose and the National Food Institute, with the financial assistance from the Ministry of Industry, has also provided consultancy services and training with low fees to encourage the smaller enterprises to implement HACCP.

FUTURE DIRECTIONS

The Government has set 2004 as food safety year. As such, all sectors involved in the food chain, either private or government have to establish its own strategies to accomplish the food safety goal. As for DOF, the regulator for the fish product certification, future directions have been set to support the HACCP implementation of the industry as follows.

1. More controls to be focused on the raw material safety up to the sources, catching areas, culture farms and hatcheries. In the past, the safety of finished products is the entire responsibility of the processors. But as some hazards could come from the raw material itself and cannot be eliminated by any processing step, the strict control of incoming raw material will serve to enhance the safety of the final products. Product traceability is also required as part of the raw material controls
2. Conducting on-going training for the industry, e.g. internal verification, advanced HACCP course, etc
3. Conducting and designing more scientific studies to support the lack of scientific judgments in hazard controls
4. Strengthening the HACCP implementation of the traditional product manufacturers and upgrading themto meet the requirements
5. Conducting HACCP audits more frequently in the processing plants, in order to reduce the product sampling and testing
6. Outsourcing the HACCP audit activities to independent bodies that are certified by the DOF. However, before this can be done, standardization of the HACCP audit need to be carried out between the DOF and the nominated subcontractors to establish same standard of audit

VIETNAM

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INTRODUCTION

The Ministry of Fisheries of Vietnam (MOFI) with its executive authorities - National Fisheries Inspection and Quality Assurance Centre (NAFIQACEN) and Fishery Resource Protection Department, is the competent agency to control the food safety and quality of fishery products 'from farm, catching, to wholesales'.

On 2 May 2003, the Government of Vietnam issued the Decree No 43/2003/ND-CP on the function, task and organization restructuring of Ministry of Fisheries. According to this decree, NAFIQACEN and Fishery Resource Protection Department is merged to a new organization called National Fisheries Quality and Veterinary Department (NAFIQAVED). This restructuring purposed to ensure the more effective operation 'from farm to wholesale'. NAFIQAVED is now the competent authority to guide and inspect quality and safety assurance of food industry, in order to ensure the safety of final product and protect the consumers.

FISH PROCESSING INDUSTRY IN VIETNAM

The fishery sector is one of the most important industries in Vietnam. In 2000, it was the fourth largest hard currency earning industry of the country. The fish processing industry has gradually progressed since then. There is a noticeable increase in the number of fish processing plants and total fish production and export (Table 1).

Table 1. Figure of fish processing establishments and fishery products export, 2000-2003

No	Detail	Year			
		2000	2001	2002	By June 2003
1	Total production (in 1000 metric tonnes)	2,003	2,207	2,411	1,235
2	Export turnover (in million US$)	1,402	1,760	2,014	988
3	Export volume (in 1000 metric tonnes)	276	359	444	217
4	No. of export-oriented fish processing establishments	238	264	279	335

As shown in Table 1, the total fisheries production was growing from 2,003,000 tonnes in 2000 to 2,411,000 tonnes in 2002. This trend is expected to continue in 2003 as the half-year production has already reached 1,235, 000 tonnes. At the same time the number of fish processing factories has been increasing consistently from 238 factories in 2000 to 322 factories by Jun 2003. Some of them are newly established. Most of them used to be small scale and now they are registered as fish processing factories producing fish for export.

The fish processing industry in Vietnam is classified into four main categories, that is, frozen, dried, canned and fermented fish products. Frozen fish product is the largest group, in terms of both volume and number of fish processing establishments. It makes up 71% of total fishery product export and almost 78% of the total number of total fish processing establishments. The products included in this group are frozen shrimp (raw or cooked), fish (mainly fillets), cephalopods (cleaned, rings), value-added (spring rolls, buttered or breaded) and surimi.

Dried fish product is the second largest group, which makes up to 8% of the total production volume, and 18% of total number of fish processing establishments in Vietnam. Dried fish processing factories are mainly small-scale establishments unlike frozen fish products. Dried fish products include squid, tiny shrimp, anchovy, shark fin and some seasoned products.

Table 2. Number of registered fish processing factory (Column 1) and HACCP- implemented factory (Column 2)

Type of production	2000		2001		2002		2003	
	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Frozen products	NA	NA	NA	NA	229	**112**	259	**133**
Dried products	NA	NA	NA	NA	38	**4**	59	**9**
Canned products	NA	NA	NA	NA	7	**5**	11	**7**
Fermented products	NA	NA	NA	NA	5	**2**	6	**2**
Total	238	**68**	264	**78**	279	**123**	335	**152**

Canned and fermented fish products are the smallest group, though the volume produced and the number of fish processing establishments has been increasing gradually. However, it will take some time for this category to be a developed sub sector. Recently, canning factories have started to produce canned shrimp and canned swimming crabmeat mainly for export.

Fermented fishery products are normally produced on a small scale. Now, due to the requirements of importing markets, fishery processors are more aware that the implementation of HACCP in their establishments can give them more competitive edge in entering new markets. The export of fermented fish products, such as fermented shrimp, anchovy and fish sauce, is still in the infant stage, though it is growing.

HACCP IMPLEMENTATION IN THE FISH PROCESSING INDUSTRY

Implementation of HACCP is mandatory for factories that export their fishery products to EU and US. There are a growing number of countries which require the fish products exported to their market to be handled, prepared, processed, stored and transported under hygiene conditions and safe for human consumption. This is in line with the application of HACCP in fish processing establishments.

The implementation of HACCP in fish processing establishments is a necessity for a seafood-exporting country in order to maintain and promote its fishery sector in a competitive world seafood trade. Hence, since 1997, based on the project sponsored by DANIDA, MOFI introduced HACCP to fish processing establishments. Since that time the number of establishments having HACCP plans in place has been increasing. The number of factories that implement HACCP program and approved by MOFI and EU has also increased respectively from 68 to 152 factories and 49 to 94 factories (Table 3).

Table 3. Number of fish processing factories during 2000- 2003

No.	Indicators	Year			
		2000	2001	2002	By June 2003
1.	No. of fish processing factories	238	264	279	335
2.	No. of MOFI approved factories	68	78	122	152
3.	No. of EU approved factories	49	61	68	94
4.	Non HACCP plan	144	172	157	147

The implementation of HACCP program in fermented and dried fish products is much slower than frozen and canned. One of the major reasons is lack of experienced and qualified personnel in dried or fermented fish establishments. Hence when those factories intend to apply HACCP program in their establishments, they have to invite the HACCP trainers from NAFIQACEN or VASEP Co. Ltd (Vietnam Association of Seafood Exporter and Producers) to conduct training on HACCP to the managers, quality controllers and line workers based on the training manuals on HACCP program recognized by MOFI.

Amid much slowness, the implementation of HACCP in fermented and dried fish products still continue to grow. The major reason is that the standard requirements for export of these products, even for Asian countries, are getting higher. Importing countries, like South Korea and China require the fishery products to be processed under hygienic conditions, which is similar to Vietnam's seafood safety procedure that is based on HACCP. This encourages the food processing establishments to develop and implement HACCP programs in their premises.

The assessment and certification of HACCP is carried out b NAFIQAVED based on the regulation on assessment and approval of food safety and hygiene assurance condition for fish products, as regulated in Decision No. No 649/2000/QD-BTS and other standards for food safety. Upon inspection, the inspectors from NAFIQAVED check the establishments' compliance to HACCP and hygiene program to the current regulation and standards. Based on this inspection, the establishment will be graded A to D. A and B-grade establishments have the right to export their products.

On the other hand, C and D-grade establishments are required to improve the facilities and HACCP program as recommended by NAFIQAVED inspectors.

Currently most of the accreditations for HACCP implementation in fish processing establishments are conducted by NAFIQAVED. However, some fish processing establishments have enlisted third-party accreditation, e.g. SGS from UK and Surefish from US to audit their HACCP plans and systems. Due to their high cost, not many fish processing establishments use third-party accreditation.

OTHER ISSUE

Since the competent authorities in EU, US and other importing countries has been applying a strict control to antibiotic residues in fishery products, such as chloramphenicol (CAP) and nitrofurans (NTR), MOFI and food processing establishments have put a lot efforts to avoid the presence of these antibiotics in fish products. Some measures conducted are as follows:

- MOFI issued the decision No 01/2002/QD-BTS to prohibit the production, trading and use of 10 antibiotic substances in the market, farming, preservation, processing of fishery products
- MOFI assigned its competent authorities, from the central to locals, to monitor and control the import, trading and use of antibiotics in the market, farming, preservation, processing of fishery products
- MOFI invested Gas-chromatography/mass-spectrograph (GC/MS) and Liquid-chromatography/mass-spectrograph (LC/MS/MS) for NAFIQAVED's laboratories and sent the technicians to Netherlands laboratory to learn the method of detecting CAP and NTR in fish products
- Food processing industries are required to monitor the HACCP application especially at receiving of raw material step and conduct effective measures to ensure the safety of their products
- Food processing industries are required to ensure that their raw material come from approved source and the suppliers have undertaken certain measures that raw materials are free from CAP and NTR

After conducting a series of measures mentioned above, Vietnam has regularly avoided the presence of CAP and NTR in fish products. Based on the action undertaken by Vietnam fishery sector, EU has cancelled the testing requirement of all Vietnam shrimp upon entry of EU market. In addition, EU has also added 32 more Vietnam fish processing establishments into the list of 62 Vietnam factories that have already been approved by EU to export their fish product to EU market.

HACCP TRAINING

MOFI, in cooperation with SEAQIP project, conducted HACCP training courses since 1997, targeted on the fish processing establishments' manager, quality control officers and line workers. Since 2000, HACCP internal audit training courses have been conducted by SEAQIP to MOFI officers, NAFIQACEN inspectors and fish processing establishments' quality control officers. The number of participants attending those training courses is shown in Table 4.

Table 4. Number of participants of HACCP and HACCP audit training courses

	2000	2001	2002	By June 2003
No. of participants in HACCP training courses	495	700	826	481
No. of participants in HACCP audit training courses	28	26	16	3

The number of participants in HACCP training courses has been increasing gradually each year due to the rapid growing number of fish processing factories as well as increasing number of the previously non-HACCP fish processing establishments, which are now aware of the importance of HACCP implementation to their business.

PROBLEMS/ DIFFICULTIES ENCOUNTERED

1. The methods and equipment for determining the harmful substances in fish and fish products are developing rapidly, especially in developed countries. Less developed country like Vietnam is unable to follow this rapid development as fast as its developed counterparts
2. The situation of small-scale production of fishery products from catching, farming to processing makes the problem more complicated. The food processing establishments are still exposed to the risks coming from the presence of hazardous substances in raw material. Government shall spend more time, expenditures and personnel to assist the industry
3. Lack of qualified personnel to develop and conduct HACCP programme in the fish processing establishments
4. The implementation of HACCP in traditional fish product establishments are more difficult than its frozen and canned counterparts, mostly because of the lack of trained workers in traditional fish product establishments
5. Difficulty in developing HACCP programs in traditional fish processing establishments due to lack of risk assessment of traditional fish products

NATIONAL STRATEGY

Vietnam perseveres to introduce HACCP program to fish processing establishments and to implement the relating auxiliary program such as hazardous substance monitoring program in farming fish and fishery products, Good Aquaculture Practices, application of technical standards set up for different types of fishery production. This measure is represented by the annual program for safety and quality assurance of fishery products issued by MOFI. The annual program concentrates on:

1. Promoting the capacity of competent authority - NAFIQAVED both personnel and equipment from the centre to the local level
2. Introducing HACCP and relevant food safety assurance programs to processors, fishermen, fish farmers, traders of both raw materials and end products to ensure the safety and quality of fishery products
3. Controlling and monitoring the implementation of the mentioned programs to protect the consumer both in domestic and export markets
4. Cooperating with regional and international countries to upgrade and improve its capacity in the assurance of the quality and safety of fishery products

CONCLUSION

It has been 10 years since HACCP was first started in the Vietnam fish processing industry after the first project sponsored by UNIDO was carried out and 4 years since the workshop of HACCP Application in Fish Processing Industry in Southeast Asia coordinated by MFRD. The Vietnam fish processing industry has shown a rapid growth on the development of the fishery sectors, both in quality and quantity. Though the importance of HACCP is greatly acknowledged, its application in Vietnam fish processing industry still faces some hurdles. The Vietnam government will continue to introduce and encourage HACCP implementation to the fish processing industry. More effort, emphasizing on training in internal and external HACCP audit will be conducted for government and fish processing establishments officers.

HACCP PLANS

Traditional Fish Products

Brunei Darussalam
Marinated fish
(*Liking*)

Cambodia
Fermented fish paste
(*Prahok*)

Indonesia
Dried anchovy

Lao PDR
Dried fish

Malaysia
Fish crackers (*Keropok ikan*)

Myanmar
Shrimp paste (*Hmyn ngapi / Seinsar ngapi*)

Philippines
Pasteurized sauteed tiny shrimps

Vietnam
Fish sauce

Singapore
Fish ball

Thailand
Dried shrimp

BRUNEI DARUSSALAM

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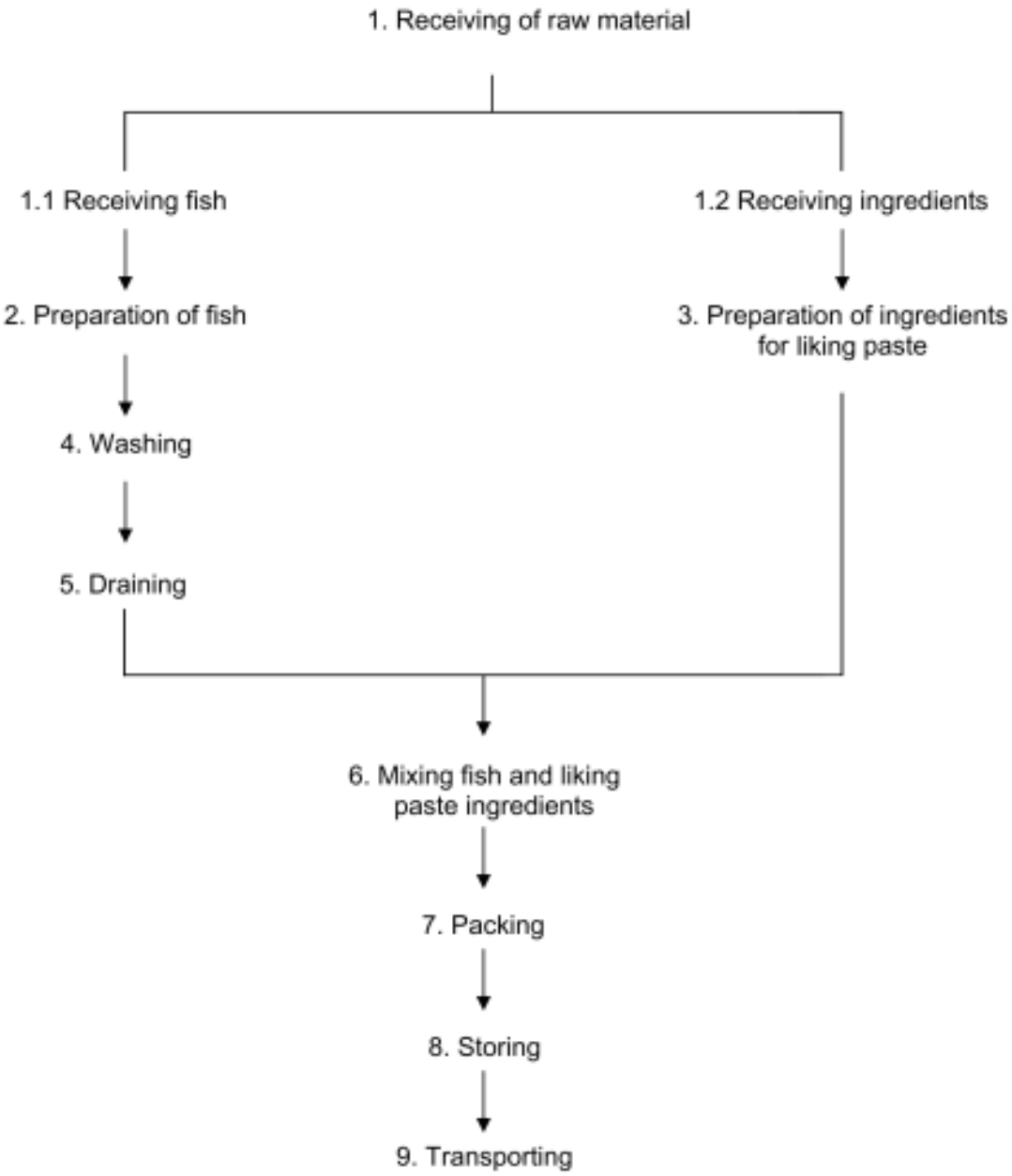
MARINATED FISH *(LIKING)*

Product description

Product name	Marinated fish *(Liking)*
Raw material	Fish
Source of raw material	Trawler and fish market
Ingredients material	Dried chilli, tamarind, salt, vinegar, chilli powder, sugar or MSG (optional)
Packaging	Styroform tray with cling wrap, plastic bag
Intended use	Ready to cook
Intended consumer	General public
Storage/ distribution	Keep chilled <10° C or frozen at -18° C
Shelf life	1 week under chilled condition (<10°C) or 3 month in frozen condition (-18°C)
Other info	*'Liking'* is a traditional Bruneian fish dish which is made by marinating fish with salt and other spices, such as chilli paste, tamarind, vinegar and turmeric. The product is fried before consumption and served with plain rice. The species commonly used are Croaker, Indian mackerel and Shads. The product is commonly produced by home-based processors and sold in the open markets *(tamu)*, fish market, corner shops and several supermarkets. *Liking* is usually packed in styrofoam tray with cling wrap and plastic bag. It has a shelf life of 2 days under room temperature, 1 week if stored refrigerated (<10°C), and 3 month if stored frozen (-18°C) *'Liking'* is traditionally prepared by cutting fish along the backbone, seasoning it for 6 – 12 hours in chilled condition and finally, packing it prior to distribution. It may also be prepared by using fillets or other methods of split fish. The composition of the ingredients may vary to suit the different market or tailored according to the customer's requirements.

Flow diagram of production of marinated fish *(liking)*



Hazard analysis worksheet

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
1.	Receiving of raw material					
1.1	Receiving fish	**Biological** Pathogen contamination	Yes	Fish can be contaminated with pathogen from the sea	Subsequent step will reduce pathogen	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
1.2	Receiving ingredient	**Biological** Pathogen contamination	Yes	Pathogen could contaminate during harvesting, transportation and processing	Subsequent step will reduce pathogen	No
		Chemical Pesticide residue	Yes	Pesticide is likely to be used during farming period and after harvesting	Certification from the supplier indicating absence of pesticides	No
		Physical None	NA	NA	NA	NA
2	Preparation of fish	**Biological** Pathogen growth	Yes	Time and temperature abuse encourage pathogen growth	Subsequent step will reduce pathogen	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
3.	Preparation of ingredients	**Biological** Pathogen growth and contamination	No	Step proceeds quickly so not likely to occur	-	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
4.	Washing	**Biological** Pathogen growth	No	Controlled by GMP/SSOP, step proceeds quickly so not likely to occur	-	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
5.	Draining	**Biological** Pathogen growth	No	Step proceeds quickly so not likely to occur	-	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
6.	Mixing	**Biological** Pathogen growth and contamination	Yes	Contamination from food handler, and time and temperature abuse encourage pathogen growth	Apply GMP and time and temperature control	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
7.	Packing	**Biological** Pathogen growth and contamination	No	Controlled by GMP, step proceed quickly so not likely to occur	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
8.	Storing	**Biological** Pathogen growth	Yes	High temperature encourage pathogen growth	Temperature monitoring	**Yes**
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
9.	Transporting	**Biological** Pathogen growth	Yes	High temperature encourage pathogen growth	Temperature monitoring	**Yes**
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

CCP Table

CCP	Production step	Hazard (s)
1	Storing	Pathogen growth
2	Transporting	Pathogen growth

HACCP Plan

CCP	Significant hazards	Critical limits	Monitoring				Corrective action	Record	Verification
			What	How	When	Who			
CCP#1 Storing	Pathogen growth	Chilled temperature not more than 10°C or Freezing temperature not less than -18°C	Temperature of chiller or freezer	Visual inspection of thermometer and time	Continuous visual check, once per day	QC	Adjust temperature	Chilling or freezing record	Daily and weekly review
CCP#2 Transporting	Pathogen growth	Chilled temperature not more than 10°C	Temperature of product and time	Visual inspection of thermometer and time	Before and after loading	Operator	Adjust temperature	Temperature and time record	Daily and weekly review

CAMBODIA

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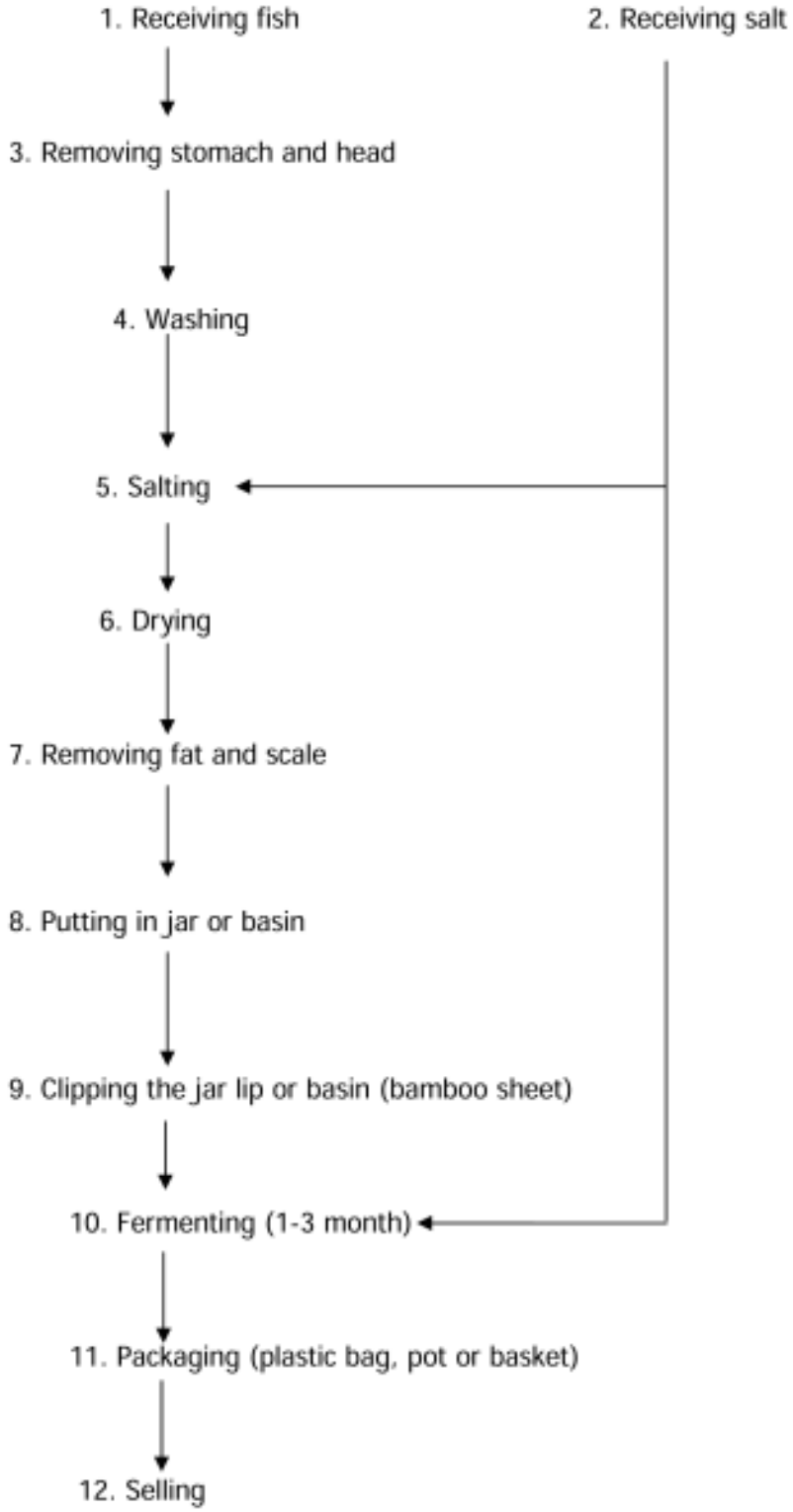
FERMENTED FISH PASTE *(PRAHOK)*

Product description

Product Name	Fermented fish paste *(Prahok)*
Raw material	Fresh or low quality fish - *Cirthia jullieni* -*Thynnichthys thynnodes* -*Labiobarbus* -*Cyclo cheilichthy opagan* -*Ostechilus hasseltic* -*Morulius chiysopekadion*
Ingredients	Salt
Packaging	Plastic bag or basket, pot, jar
Intended used	Can be consumed as it is or cooked for soup or other dishes. Sold in stores or markets in Cambodia
Intended consumers	General public
Storage	Room temperature
Shelf life	3 year at room temperature • Salt must be cover on the lip of jar or pot or basin • Prevent broken in any case • Plastic bag must be cover on the lip of jar, pot or basin

Flow diagram of production of fermented fish paste *(prahok)*



Hazard analysis worksheet

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
1	Receiving raw material	**Biological** Bacteria contamination	Yes	Fish can be contaminated with pathogenic bacteria from collecting fish lot	• Drying step and salting will destroy pathogenic bacteria • Inspect spoiling	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
2	Receiving salt	**Biological** None	NA	NA	NA	NA
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
3	Removing head and stomach	**Biological** Bacteria contamination from equipment	No	Control hygiene	NA	NA
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
4	Washing	**Biological** Bacteria contamination from water	No	Controlled by processor (water quality control)	Control hygiene in washing step and water quality	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
5	Salting	**Biological** Pathogen survival	Yes	Bacteria can still survive within 5 – 10 hours of the salting process	Used salt >15% to control bacteria growth	**Yes**
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
6	Drying under sun for 1-3 days	**Biological** Pathogen survival	Yes	Bacteria can still survive during drying process	Adequate time for complete drying under normal temperature of >30ºC	**Yes**
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
7	Removing fat and scale	**Biological** Bacteria contamination from equipment or processor	No	Control hygiene (personal hygiene and equipment)	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
8	Putting in jar or basin	**Biological** Bacteria contamination from jar or processor	No	Personal hygiene control	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
9	Clip the jar or basin by bamboo sheet	**Biological** None	NA	NA	NA	NA
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
10	Fermenting (1-3 months)	**Biological** Bacteria contamination by processors	No	Personal hygiene control	Control keeping place and salt and product color	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
11	Packing	**Biological** Bacteria contamination by processors	No	Personal hygiene control	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
12	Selling	**Biological** None	NA	NA	NA	NA
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

CCP Table

CCP	Production step	Hazard (s)
1	Salting	Pathogen survival
2	Drying	Pathogen survival

HACCP Plan

CCP	Hazard	Control Measure	Critical limit	Monitoring	Corrective action	Record	Verification
CCP#1 Salting	Pathogen survival	Add adequate amount of salt	At least 15% salt	Salt concentration	Add more salt to appropriate concentration	Amount of salt added record Corrective action record	Review records
CCP#2 Drying	Pathogen survival	Adequate drying time at temperature of >30ºC	Drying temperature must be >30ºC	Temperature	If temperature is lower than 30ºC, dry for another 1–3 days more	Temperature record	Review temperature record

INDONESIA

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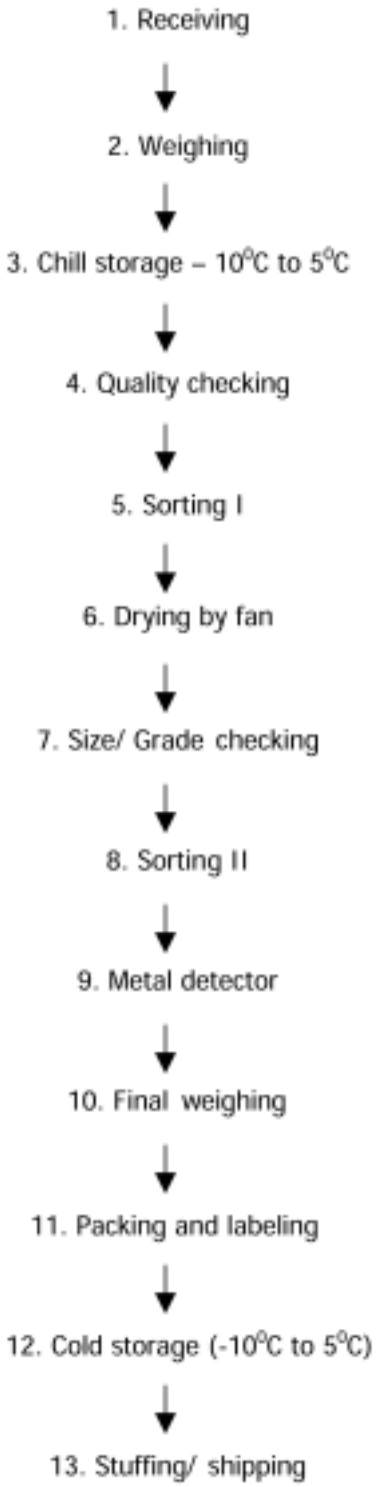
DRIED ANCHOVY

Product description

Product name	Dried anchovy
Raw material	Dried anchovy *(Stolephorus spp.)*
Raw material origin	Caught from Java sea
Receiving of raw material	Dried anchovy is received from suppliers and mini plants in plastic box or tray, transported by refrigerated truck at temperature – 10^{0}C to 5^{0}C
Food Additive	-
Processing Step	Receiving, Weighing, Chill Storage, Sorting I, Drying by fan, Size/ Grade Checking, Sorting II, Metal Detector, Final Weighing, Packing and Labeling, Cold Storage, Stuffing/ Shipping
Packing Type	Cardboard/ corrugated carton box
Storage Requirements	Keep in cold storage at – 10^{0}C to 5^{0}C
Shelf life	1 year in chill condition
Label/Specification	Name and type of products, production code, net weight and product size, origin of country, name of distributor, list of ingredients
Intended Use	Cooked before consumption
Intended customer	General public

Flow diagram of production of dried anchovy



Hazard analysis worksheet

Processing Flow	Cause of Hazard	Potential Hazard	Hazard Belong to			SSOP/ GMP Adequately Control Hazard		Is the Potential Hazard Significant				Justification	Preventive Measure
			F S	W H	E F	SSOP	GMP	Probability L/M/ H	Severity Auto, M/L,N/L	Yes	No		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Receiving	- Temperature abuse - Contamination	Pathogenic bacterial growth	v v	 v		No No	No No	M M	Auto M/L	Yes Yes		Handling is performed before plant controlled	
	- Time/ temperature abuse	Decomposition										Handling is performed before plant controlled	Quality check at sequent step
2. Weighing	- Time abuse - Contamination	Pathogenic bacteria growth	v			Yes	Yes	L	M/L		No.	Properly controlled by GMP and SSOP.	
	- Temperature abuse	Decomposed		v		Yes	Yes	L	M/L		No		Maintain temperature of the processing room at max 18^{0}C
	- Human error	Under weight			v			M	M/L	Yes		If not properly controlled, short weight may occur	- Calibrate scale periodically - Check by QC staff and trained personnel
3. Chill storage -10°C to 5°C	Time/ temperature abuse	Pathogenic bacterial growth	v			Yes	Yes	M	N/L		No	Properly controlled by GMP and SSOP.	-

Processing Flow	Cause of Hazard	Potential Hazard	Hazard Belong to			SSOP/ GMP Adequately Control Hazard		Is the Potential Hazard Significant				Justification	Preventive Measure
			F S	W H	E F	SSOP	GMP	Probability L/M/ H	Severity Auto, M/L,N/L	Yes	No		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
4. Quality checking	- Time abuse - Contamination	Pathogenic bacterial growth	v			Yes	Yes	L	M/L		No	- Properly controlled by GMP and SSOP - Maintaining temperature at <0^{0}C	-
	- Temperature abuse	Decomposed		v		Yes	Yes	L	M/L		No		Maintain processing room temperature at max 18^{0}C
	- Human error	Mixed with other fish, filth		v	v	No	Yes	M	M/L	Yes		If not properly controlled, hazard may occur	Checked by QC staff at interval of 30 minutes
5. Sorting I	- Time abuse - Contamination	Pathogenic bacterial growth	v			Yes	Yes	L	M/L		No	- Properly controlled by GMP and SSOP - Maintaining temperature at <0^{0}C - Maintaining personal hygiene and using cleaned equipment	
	- Human error	Mixed with other fish, filth		v		No	Yes	M	M/L	Yes		If not properly controlled, hazard may occur	
6. Drying by fan	- Time abuse - Contamination	Pathogenic bacterial growth	V			Yes	Yes	L	M/L		No	- Properly controlled by GMP and SSOP - Maintaining temperature at <0^{0}C, - Maintaining personal hygiene and using cleaned equipment	
	- Temperature abuse	Decomposed		v		Yes	Yes	L	M/L		No		Maintain temperature of the processing room at max 18^{0}C
	- Human error	Filth, foreign material	v			No	Yes	M	M/L	Yes		If not properly controlled, hazard may occur	Checked by QC staff at interval of 30 minutes

Processing Flow	Cause of Hazard	Potential Hazard	Hazard Belong to			SSOP/ GMP Adequately Control Hazard		Is the Potential Hazard Significant				Justification	Preventive Measure
			F S	W H	E F	SSOP	GMP	Probability L/M/ H	Severity Auto, M/L,N/L	Yes	No		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
7. Sizing/ grade Checking	- Excessive time - Contamination	Pathogenic bacterial growth	v			Yes	Yes	L	M/L		No	- Properly controlled by GMP and SSOP - Maintaining temperature at <0^{0}C - Maintaining personal hygiene and using cleaned equipment	
	- Temperature abuse	Decomposed		v		Yes	Yes	L	M/L		No		Maintain temperature of the processing room at max 18^{0}C
	- Human error - Inaccurate scale	Inaccurate information			v	No	Yes	L	N/L		No	If not properly controlled, hazard may occur	
8. Sorting II	- Excessive time - Contamination	Pathogenic bacterial growth	V			Yes	Yes	L	M/L		No	- Properly controlled by GMP and SSOP - Maintaining temperature at <0^{0}C - Maintaining personal hygiene and using cleaned equipment	
	- Temperature abuse	Decomposed		v		No	Yes	M	M/L	Yes			
	- Human error	Foreign material	v	v		No	Yes	M	M/L	Yes		If not properly controlled, hazard may occur	Maintain temperature of the processing room at max 18°C
9. Metal detector	- Time abuse - Contamination	Pathogenic bacterial growth	v			Yes	Yes	L	M/L		No	Properly controlled by GMP and SSOP	
	- Temperature abuse											Maintaining temperature of the products <0°C	Maintain temperature of the processing room at max 18°C
	- Human error	Foreign material (ferrous) re-contamination	v			No	No	L	N/L	Yes		Properly controlled by GMP and SSOP	

Processing Flow	Cause of Hazard	Potential Hazard	Hazard Belong to			SSOP/ GMP Adequately Control Hazard		Is the Potential Hazard Significant				Justification	Preventive Measure
			F S	W H	E F	SSOP	GMP	Probability L/M/ H	Severity Auto, M/L, N/L	Yes	No		
1	2	3	4	5	6	7	8	9	10	11	12	13	14
10. Final weighing	- Time abuse - Contamination	Pathogenic bacterial growth	V			Yes	Yes	L	M/L		No	- Properly controlled by GMP and SSOP - Maintaining temperature at <0°C - Maintaining personal hygiene and using cleaned equipment	
	- Temperature abuse	Decomposed		v		Yes	Yes	L	M/L		No		Maintain temperature of the processing room at max 18°C
	- Human error	Material under weighed			v			M	M/L	Yes		If not properly controlled, short weight may occur	- Calibrate scale periodically - Checked by QC staff and trained personnel
11. Packing and labeling	- Time abuse	Pathogenic bacterial growth	V			Yes	Yes	L	M/L		No	Properly controlled by GMP	-
	- Human error	Miss labeling for size/grade			v	No	Yes	L	M/L		No	If not properly controlled, short weight may occur	
12. Cold storage (-10°C to 5°C)	Temperature abuse	Mould growth and discoloration	v			No	No	M	M/L	Yes		Properly controlled by GMP, maintaining temperature –10°C to 5°C during loading and shipping	Controlled by QC staff and trained personnel
13. Stuffing/ Shipping	Temperature abuse		v			Yes	Yes	L	N/L		No	Properly controlled by GMP, maintaining temperature –10°C to 5°C during loading and shipping	-

Notes:
FS: Food Safety WH: Wholesomeness EF: Economic Fraud
RM: Raw Material, Auto: Automatic, M/L: May Likely, N/L: Not Likely

CCP Table

CCP	Production step	Hazard (s)
1	Sorting ll	Foreign material, decomposed product (FS and WH)
2	Final weighing	Material under weighed (EF)
3	Cold storage (-10ßC to 5ßC)	Mould growth and discoloration (FS)

HACCP PLAN

CCP	Significant Hazard (s)	Critical Limits	Monitoring				Corrective action	Record	Verification
			What	How	Frequency	Who			
1. Sorting II	**FS and WH** Foreign Material, Decomposed	1. No foreign material found in the product	Foreign Material	Visual Check	Each lot	QC Staff	Hold the lot and rechecked again	GMP	Record reviewed periodically by QC supervisor
		2. No decomposed product detected	Color, Off odor, texture	Sensory Evaluation	Each pack	QC Staff	Decomposed, discolor, off texture, off odor, will be separated	GMP	Record Reviewed by QC Supervisor
2. Final weighing	**EF** Material under weighed	Every master carton has weight 6 kg	Weight of dried anchovy	Weight of dried anchovy per carton	Each pack	QC staff	Should the weight is not conforming specification	GMP	Record Reviewed by QC Supervisor
3. Cold storage (-10°C to 5°C)	**FS** Mould growth and discoloration	Temperature at –10 °C to 5°C	Temperature of cold storage	Monitoring temperature of cold storage	Checking every hour	ME person	Adjust of cold storage	Finished product temperature	Daily record review

Notes:
QC = Quality Control ME = Mechanical and Electrical

LAO PDR

Contributed by
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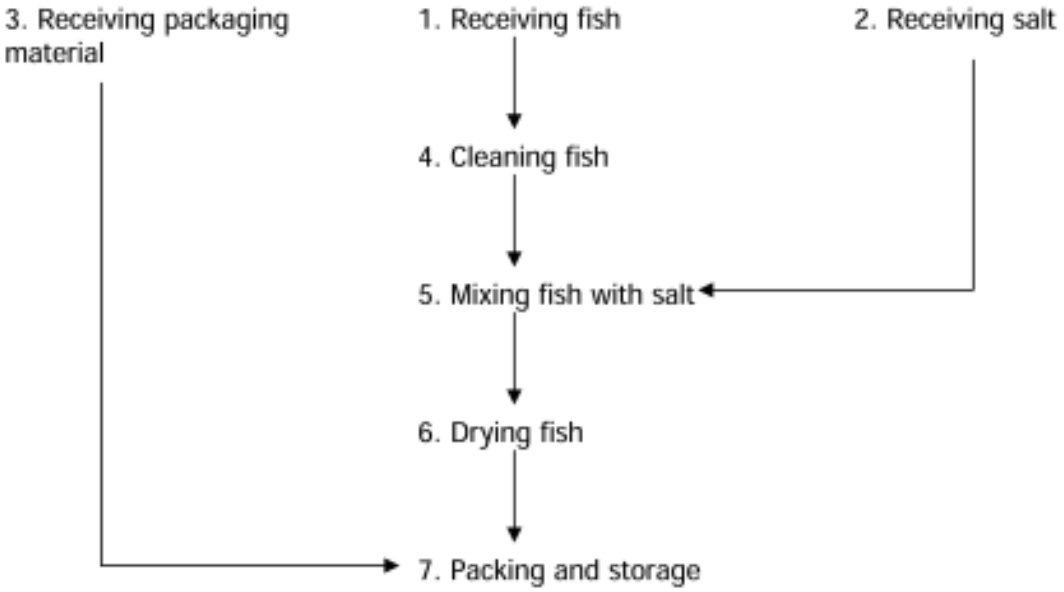
Lao PDR

DRIED FISH

Product description

Product name	Dried fish
Raw material	Freshwater fish
Source of raw material	NA
Ingredients material	Salt
Packaging	3 – 5 kg bamboo basket
Intended consumer	General public
Storage/ distribution	Keep dry in general kitchen with low humidity

Flow diagram of production of dried fish



Hazard analysis worksheet

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
1.	Receiving fish	**Biological** Pathogens	Yes	Fish can be contaminated with pathogens/ parasites	Check supplier certification on PAFO (parasites)	**Yes**
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
2.	Receiving salt	**Biological** None	No	NA	NA	NA
		Chemical None	NA	NA	NA	NA
		Physical Foreign materials	No	Can be sorted out during process	NA	NA
3.	Receiving packaging	**Biological** None	NA	NA	NA	NA
		Chemical None	NA	NA	NA	NA
		Physical Extraneous materials	No	Can be controlled by SSOP	NA	No
4.	Cleaning fish	**Biological** Pathogens	No	Can be controlled by SSOP	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
5.	Mixing fish with salt	**Biological** Pathogens	No	Can be controlled by SSOP	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
6.	Drying fish	**Biological** Pathogens	No	Can be controlled by SSOP	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
7.	Packing and storage	**Biological** Pathogens	No	Can be controlled by SSOP	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

CCP Table

CCP	Production step	Hazard (s)
1	Receiving fish	Contamination with parasites

HACCP Plan

CCP	Significant Hazard	Control measure	Critical limit	Monitoring	Corrective action	Record	Verification
CCP#1 Receiving fish	Contamination with parasites	Supplier certificate, containing date	Lower than PAFO's update of parasites	Check suppliers' certificate for every incoming raw material	- Inform the supplier on the company's raw materials specification - Reject lot if company standard are not meet - Record this to Corrective Action Report	Corrective Action Report Lab analysis report	- Weekly review of Supplier's Certificate - Monthly test analysis Report - Weekly Review of Corrective Action

MALAYSIA

Contributed by
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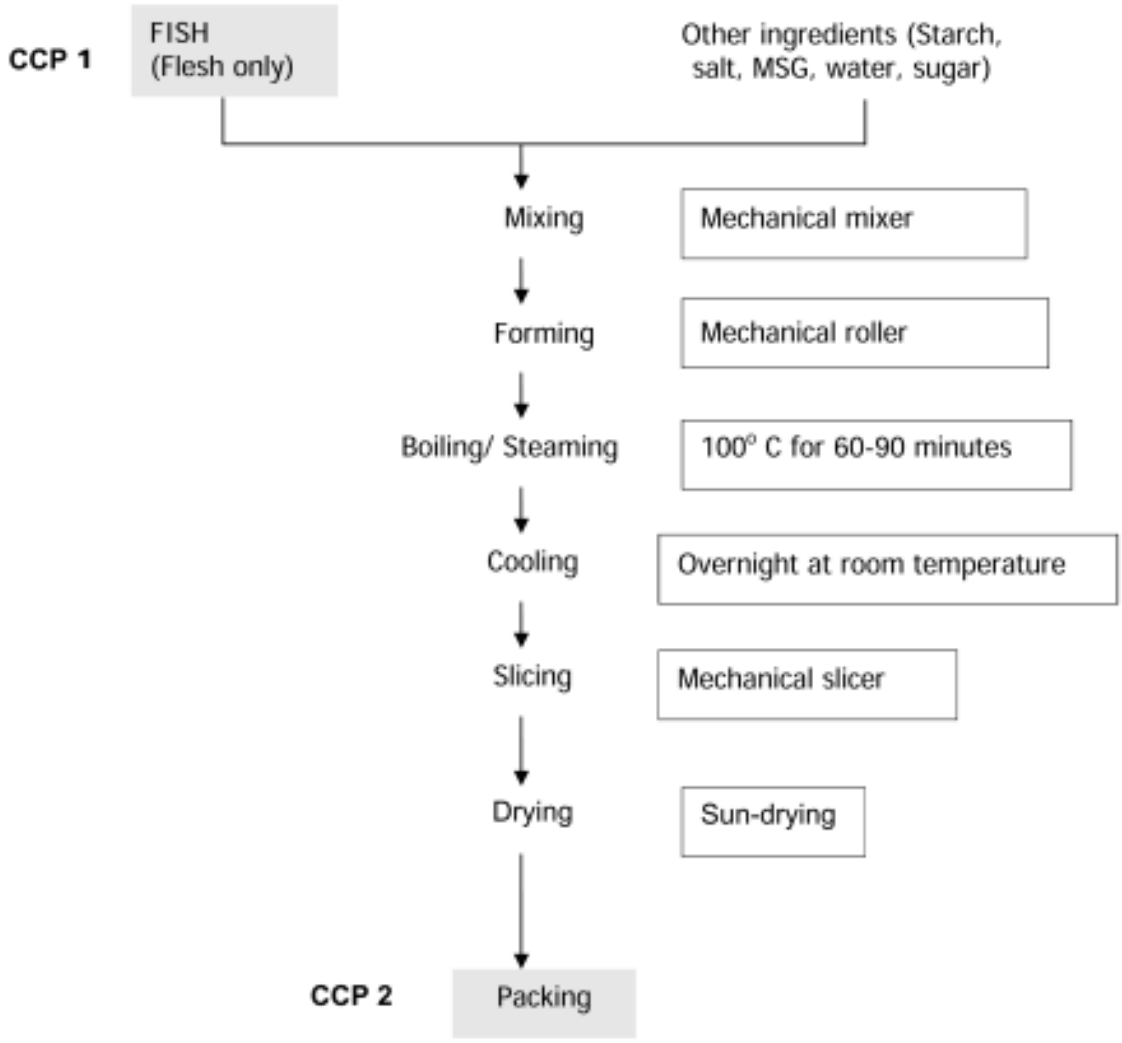
FISH CRACKER *(KEROPOK IKAN)*

Product description

Product name	Fish crackers –*(Keropok ikan)*
Raw material	Chilled small pelagic, e.g. 1. Round scad, Redtail scad, Slender scad, Shortfin scad *(Decapterus spp.)* 2. *Sardinella (Amblygaster spp., Sardinella spp.)*
Source of raw materials	Locally captured fish
Ingredients	Salt, sugar, MSG, starch, water
Packaging	200 – 500 g in a suitable packaging material which is moisture proof and gas impermeable (e.g. plastic (HDPE) bags)
Intended use	Freshly deep-fried before serving as a snack food
Intended consumers	General public
Storage/ distribution conditions	Keep at room temperature and maintain its integrity in the packaging material which is moisture proof and gas impermeable
Shelf life	6 month – 1 year depending on the storage condition (away from direct sunlight and in dry place)

Flow diagram of production of fish cracker *(keropok ikan)*



Hazard analysis worksheet

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
1.	Fish (flesh)	**Biological** Pathogen growth and contamination	No	Product is either boiled or steamed at >100°C. Pathogen growth unlikely after heat treatment	NA	No
		Chemical Presence of histamine		Formation of histamine at temperature >5°C due to bacterial decarboxylation of amino acid histidine	Keep temperature <4°C control the possible breakdown of histidine to histamine	**Yes**
		Physical Presence of bone	Yes	Potential presence of bone > 3 mm in diameter and 5 mm in length	Visual inspection or use of strainer in the pre-process step for fish flesh	**Yes**
2.	Ingredients (Starch, salt, MSG, sugar, water)	**Biological** Pathogen growth and contamination	No	Unlikely to occur. Controlled by GMP/SSOP	NA	No
		Chemical Contamination	No	Unlikely to occur. Controlled by GMP/SSOP	NA	No
		Physical None	No	NA	NA	No
3.	Mixing	**Biological** None	No	NA	NA	No
		Chemical Introduction of foreign matters such as grease oil	No	Not reasonably likely to occur Controlled by GMP/SSOP	NA	No
		Physical Metal inclusion	Yes	Possible introduction through mechanical mixer	Controlled by Metal Detection at Step 9	No

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
4.	Forming	**Biological** None	No	NA	NA	No
		Chemical Introduction of foreign matters such as grease oil	No	Not reasonably likely to occur Controlled by GMP/SSOP	NA	No
		Physical Metal inclusion	Yes	Possible introduction through mechanical roller	Controlled by Metal Detection at Step 9	No
5.	Boiling/ Steaming	**Biological** None	No	NA	NA	No
		Chemical None	No	NA	NA	No
		Physical None	No	NA	NA	No
6.	Cooling	**Biological** Cross Contamination	Yes	Not reasonably likely to occur Controlled by GMP/SSOP	NA	No
		Chemical Contamination	Yes	Not reasonably likely to occur Controlled by GMP/SSOP	NA	No
		Physical None	No	NA	NA	No
7.	Slicing	**Biological** None	No	NA	NA	No
		Chemical Introduction of foreign matters such as grease oil	No	Not reasonably likely to occur Controlled by GMP/SSOP	NA	No
		Physical Metal inclusion	Yes	Possible introduction through mechanical slicer	Controlled by Metal Detection at Step 9	No

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
8.	Drying	**Biological** None	No	Low moisture content and low Aw Controlled by SSOP	NA	No
		Chemical None	No	NA	NA	No
		Physical None	No	NA	NA	No
9.	Packing	**Biological** None	No	Low moisture content and low Aw Controlled by SSOP	NA	No
		Chemical None	No	NA	NA	No
		Physical Introduction of foreign matters	Yes	Presence of foreign matters (e.g. hairs, sands, metals)	Visual inspection over candling system, metal detectors	**Yes**

CCP Table

CCP	Production step	Hazard (s)
1	Raw material preparation (fish flesh)	Histamine and bone
2.	Packing	Presence of foreign matters (e.g. Hairs, metals, sands, etc)

HACCP Plan

CCP	Significant Hazard	Critical Limits	Control Measure	Monitoring	Corrective Action	Records	Verification
CCP#1 Fish (flesh)	Presence of histamine	Temperature less than 5°C	Control temperature of fish flesh	Measure temperature upon receipt and prior to processing	Keep product chill below 5°C	Temperature record of raw materials (Fish)	Histamine analysis on 10 fish in each lot received
		Histamine level less than 20mg/100g		Sample for histamine testing	Collect representative sample and analyze for histamine. If any shows > 20 mg/100g, reject lot or subdivide (if practical) and retest	Histamine analysis record	Review monitoring, corrective action and verification records weekly
		No more than 2.5% decomposition in the incoming lot		Amount of decomposition in incoming lot by sensory evaluation	Reject lot or reject only the decomposed fish	Sensory evaluation record	
CCP#2 Fish (flesh)	Presence of bone	Less than 3 mm in diameter and 5 mm in length	Visual inspection	Daily online visual inspection	Remove and send to the strainer to reduce bone size	Online visual inspection record	Review visual inspection record weekly
CCP#3 Packing	Introduction of foreign matters	Absent	Visual inspection and metal detectors	Visual inspection and metal detection on-line	Reject	Online visual inspection record and metal detection record	Review monitoring, corrective action and verification records weekly

MYANMAR

Contributed by
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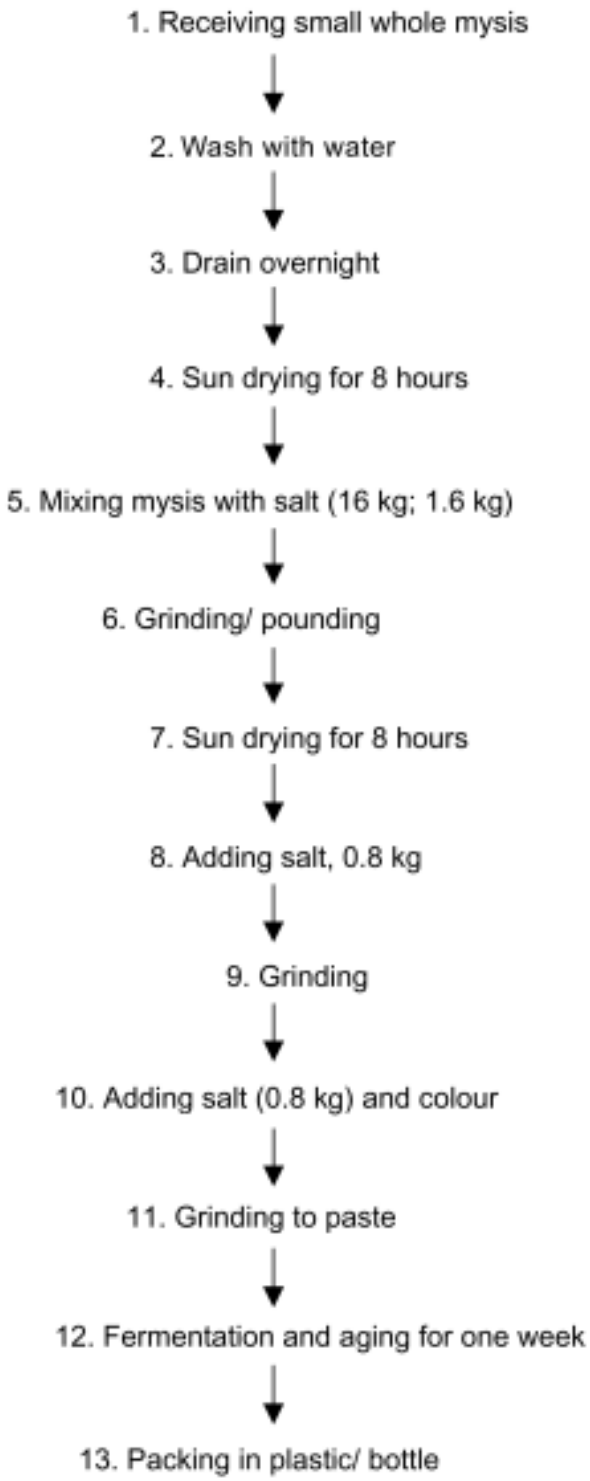
SHRIMP PASTE *(HMYN NGAPI/ SEINSAR NGAPI)*

Product description

Product name	Shrimp paste *(Hmyn ngapi/ Seinsar ngapi)*
Raw materials	Small mysis (acetes) Local name: *Hymn/ Gwae*
Ingredients	Salt Food grade dye (for low grade)
Important product characteristic of end products	Pinkish purple colour, homogenous, salty, smooth paste Approximate nutritional composition: water (40%), protein (18%), salt (10-20%), pH 5 – 6
Intended use	Condiment and/ or used to flavour dishes Target consumer: general public
Packing	Sold loose by weight, packed inside the plastic bottle
Shelf life	6 – 12 month
Storage/ distribution condition	Chilled

Flow diagram of production of shrimp paste *(hmyn ngapi)*



Hazard analysis worksheet

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
1.	Receiving small whole mysis	**Biological** Pathogen	No	Controlled by GMP	NA	No
		Chemical Histamine	Yes	Histamine may occur due to poor handling and insufficient use of salt to retard bacterial growth	In-house checking, Histamine shall be <50 ppm	**Yes**
		Physical Sand, small stone	No	Controlled by GMP	NA	No
2.	Washing	**Biological** Pathogen	No	Controlled by SSOP (water handling)	NA	No
		Chemical No	NA	NA	NA	NA
		Physical No	NA	NA	NA	NA
3.	Draining overnight	**Biological** No	NA	NA	NA	NA
		Chemical No	NA	NA	NA	NA
		Physical No	NA	NA	NA	NA
4.	Sun drying	**Biological** Pathogen (from bird dropping)	No	Controlled by GMP	NA	No
		Chemical No	NA	NA	NA	NA
		Physical Bamboo splinter	No	Controlled by GMP	NA	No

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
5.	Mixing mysis with salt (16kg: 1.6kg)	**Biological** Pathogen growth	Yes	Pathogens can grow due to inadequate amount of salt used	Appropriate amount of salt added	NA
		Chemical No	NA	NA	NA	NA
		Physical No	NA	NA	NA	NA
6.	Grinding to paste	**Biological** Pathogen recontamination (from grinding machine)	No	Controlled by GMP	NA	No
		Chemical No	NA	NA	NA	NA
		Physical No	NA	NA	NA	NA
7.	Sun drying for 8 hours	**Biological** No	NA	NA	NA	No
		Chemical No	NA	NA	NA	NA
		Physical Bamboo splinter and bird dropping	No	Controlled by GMP and SSOP	NA	No

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
8.	Adding salt, 0.8 kg	**Biological** Pathogen growth	Yes	Pathogens can grow due to inadequate amount of salt used	Appropriate amount of salt added	NA
		Chemical No	NA	NA	NA	NA
		Physical No	NA	NA	NA	NA
9.	Grinding	**Biological** Pathogen recontamination	No	Controlled by GMP	NA	NA
		Chemical No	NA	NA	NA	NA
		Physical No	NA	NA	NA	NA
10.	Adding salt and coloring	**Biological** Pathogen growth	Yes	Pathogens can grow due to inadequate amount of salt used	Appropriate amount of salt added	NA
		Chemical No	NA	NA	NA	NA
		Physical No	NA	NA	NA	NA
11.	Grinding to paste	**Biological** Pathogen growth	Yes	Pathogens can grow due to inadequate amount of salt used	Appropriate amount of salt added	NA
		Chemical No	NA	NA	NA	NA
		Physical No	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
12.	Fermentation and aging for one week	**Biological** Pathogens (maggot infestation)	No	Controlled by GMP	NA	No
		Chemical No	NA	NA	NA	NA
		Physical No	NA	NA	NA	NA
13.	Packing	**Biological** Pathogens growth due to improper handling	No	Controlled by GMP	NA	No
		Chemical No	NA	NA	NA	NA
		Physical No	NA	NA	NA	NA

CCP Table

CCP	Production step	Hazard (s)
1	Raw material	Histamine

HACCP Plan

CCP	Significant Hazard	Critical Limits	Monitoring procedure	Corrective action	Record	Verification
CCP#1 Receiving small whole mysis	Histamine	<50 ppm	Test every batch of raw material	Reject if exceed CL	Results of histamine testing	1. Review records weekly 2. Histamine testing of final product

Remark:

According to present test results on raw material and final product at Export Quality Control Lab also by research done by Duchateus, Florkin and Hyunt Thwin 1953, Histidine content in Hymn is 51 ppm. Hence, it is justifiable to emphasize histamine content for food safety aspect

Production of shrimp paste *Hymn ngapi*

Fiscal year	2000 - 2001	2001 – 2002	2002 – 2003
Shrimp paste	132,960 MT	143,680 MT	145,440 MT

PHILIPPINES

Contributed by
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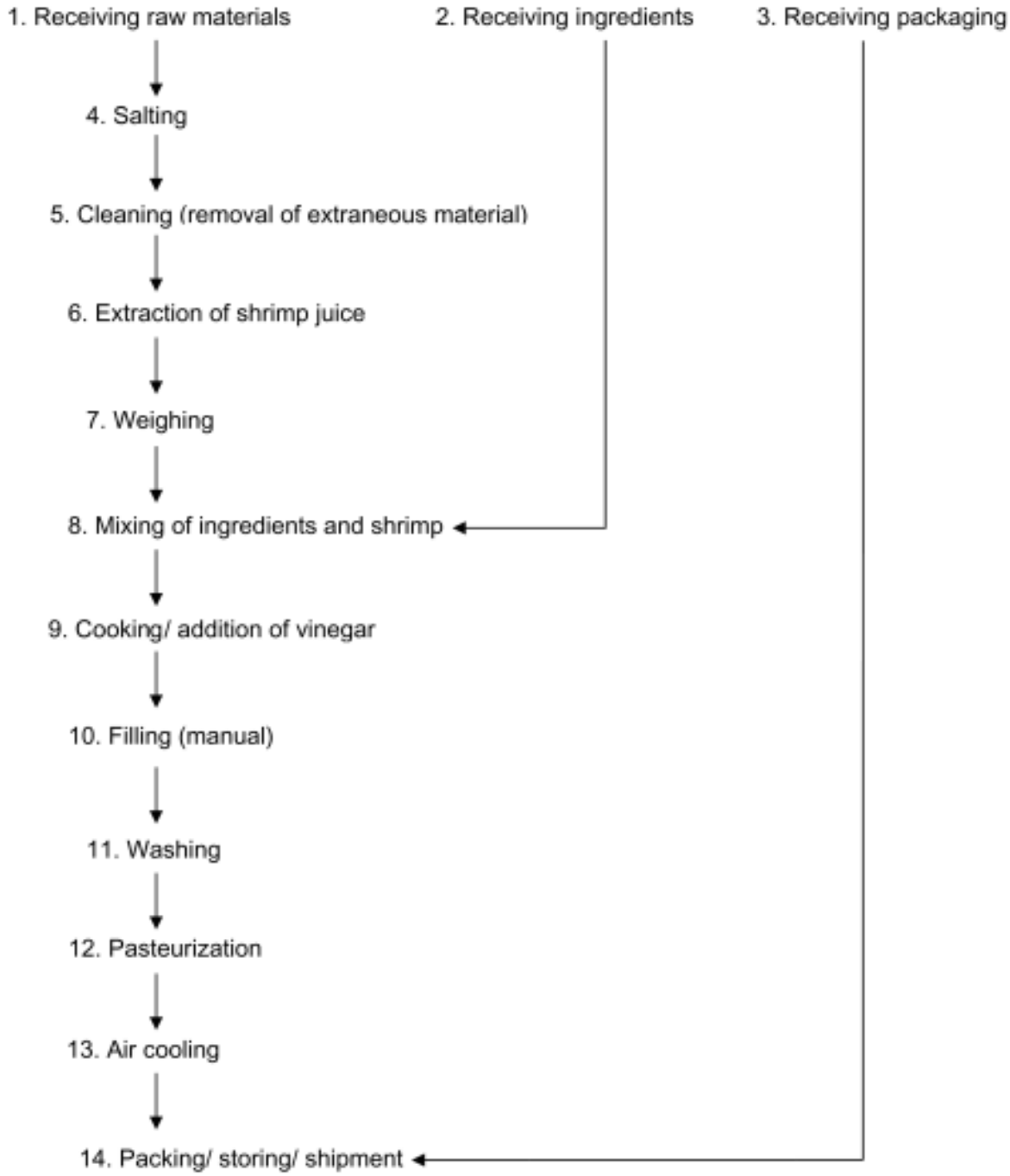
PASTEURIZED SAUTEED TINY SHRIMPS

Product description

Product name	Pasteurized sauteed tiny shrimps
Raw material	Salted tiny shrimp *(Acetes sp.)*
Source of raw material	Philippine coastal area (Region IV and V)
Ingredients material	Salt, sugar, vinegar, palm oil, potassium sorbate and brown sugar
Packaging	12 oz. Lug type bottle
Intended use	Ready to eat or to be cooked as ingredients of other food recipes
Intended consumer	General Public could consume, however people with allergies to shellfish should avoid eating this
Storage/distribution	Ambient temperature. Product after opening should be kept refrigerated
Shelf life	Two (2) years at ambient temperature

Flow diagram of production of pasteurized sauteed tiny shrimp



Hazard analysis worksheet

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
1.	Receiving raw materials	**Biological** Pathogen growth and contamination	No	The raw material received is salted thus, inhibit the pathogenic growth of bacteria	None	No
		Chemical Shell fish toxin (PSP)	Yes	Tiny shrimps are affected by red-tide toxin which can cause PSP when ingested and can cause death	1. Provision of Supplier Certificate for every delivery and checking against BFAR monthly 2. Red-tide update	**Yes**
		Physical Extraneous materials like pebbles, etc	Yes	Contamination of filth from the source	100% sorting of raw materials in the succeeding steps	No
2.	Receiving ingredient	**Biological** Pathogen contamination	No	Can be controlled by GMP/SSOP	NA	No
		Chemical None	NA	NA	NA	NA
		Physical Extraneous materials	No	Unlikely to occur	Buyer's specification	No
3	Receiving packaging materials	**Biological** Pathogen contamination	No	Lug-jug bottles are received in closed boxes/cartons	None	NA
		Chemical None	NA	Likely	NA	NA
		Physical Bottle defects	No	Not likely to occur	Visual inspection upon receipt	No

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
4.	Salting	**Biological** Pathogen contamination	No	Salt controls the growth of pathogens	Appropriate % concentration of salt	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
5.	Cleaning (Removal of extraneous materials)	**Biological** Pathogen growth contamination	No	Not possible to occur. Can be controlled by SSOP	NA	No
		Chemical None	NA	NA	NA	NA
		Physical Seaweeds, shellfish	No	Not possible to occur. Visual inspection/ sorting to eliminate foreign bodies	NA	No
6.	Extraction of shrimp juice	**Biological** Pathogen re-contamination	No	Not possible to occur. Can be controlled by SSOP	NA	No
		Chemical None	NA	NA	NA	NA
		Physical Filth, e.g. hair	No	Not likely to occur. Can be controlled by SSOP	NA	No
7.	Weighing (manual)	**Biological** Pathogen re-contamination	No	Not likely to occur. Can be controlled by SSOP	NA	No
		Physical None	NA	NA	NA	NA
		Chemical None	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
8.	Mixing of ingredients and tiny shrimps	**Biological** Pathogen re-contamination	No	Not likely to occur. Can be controlled by SSOP	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
9.	Cooking/ addition of vinegar	**Biological** Pathogens and spore-forming bacteria growth	Yes	Improper acidification will allow spores to grow	Acidify to pH 4.5 or below	**Yes**
		Chemical None	NA	NA	NA	NA
		Physical None	NA	Not likely to occur	NA	NA
10.	Filling (Manual)	**Biological** Pathogen re-contamination	No	Not likely to occur. Can be controlled by SSOP	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
11.	Washing	**Biological** None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
		Chemical None	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
12.	Pasteurization	**Biological** Vegetative and non-spore forming bacteria growth	Yes	Product is subjected to heat-treatment in a tested/approved time and temperature for total destruction of pathogens	Processing time and temperature control	**Yes**
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
13.	Air cooling	**Biological** None	NA	NA	NA	NA
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
14.	Packing/ storing/ shipment	**Biological** None	NA	NA	NA	NA
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

CCP Table

CCP	Production step	Hazard (s)
1.	Receiving raw materials	Paralytic shell fish toxin (PSP)
2.	Cooking/ addition of vinegar	Pathogen and spore-forming bacteria growth
3.	Pasteurization	Vegetative and non-spore forming bacteria growth

HACCP Plan

CCP	Significant Hazard	Preventive measure	Critical limits	Monitoring				Corrective action	Records	Verification
				What	How	Frequency	Who			
CCP#1 Receiving raw materials	Paralytic shellfish toxin (PSP)	Provision of supplier certificate	Supplier Certificate and date and places of harvest	Suppliers Certificate and date places of harvest and place	Check supplier's certificate against BFAR updates on red tide toxin monitoring at place of harvest	Every delivery	Production In-charge or In-line QC	1. Inform supplier of Company's raw materials specifications 2. Reject deliveries if Company standard are not met 3. Return rejected deliveries to supplier	Supplier's certificate Red tide update	1. Weekly review of supplier certificate 2. Get monthly Red Tide toxin Level Monitoring Report from BFAR 3. Weekly review of corrective action 4. Test of raw material for red tide toxin every month

HACCP Plan (Continued)

CCP	Significant Hazard	Preventive measure	Critical limits	Monitoring				Corrective action	Records	Verification
				What	How	Frequency	Who			
CCP#2 Cooking/ addition of vinegar	Pathogenic and Spore-forming bacteria	Proper acidification	pH of 4.5 or below	pH of the cooked sauteed tiny shrimps	Actual pH measurement	Every cooking batch	In-line QC	1. Adjust pH to required level by addition of vinegar 2. Record of cooking & pH monitoring report	Cooking and pH Monitoring report	1. Weekly review of pH and Cooking Monitoring report 2. Review of end product testing results 3. Weekly review of Daily Calibration of Instruments
CCP#3 Pasteurization	Vegetative & non-spore-forming bacteria growth	Process within established time/ temperature	Pasteurize for not less than 65 minutes at 95°C	Time and temperature	Actual monitoring and recording of time and temperature	Every batch	In-line Operator	1. Segregate the batch, tag with hold product/ pending analysis 2. Isolate/ incubate for one month 3. Conduct microbiological analysis 4. Maintain equipment to eliminate possible re-occurrence 5. Report to QA head for final decision and record to Hold Product/ Pending Result of Analysis	Pasteurization monitoring report	1. Weekly review of Pasteurization Monitoring Form 2. Review end product testing results 3. Product testing by government laboratory per shipment 4. Weekly review of corrective action 5. Review of Calibration Records of Bi-metal Pressure gauge

SINGAPORE

Contributed by
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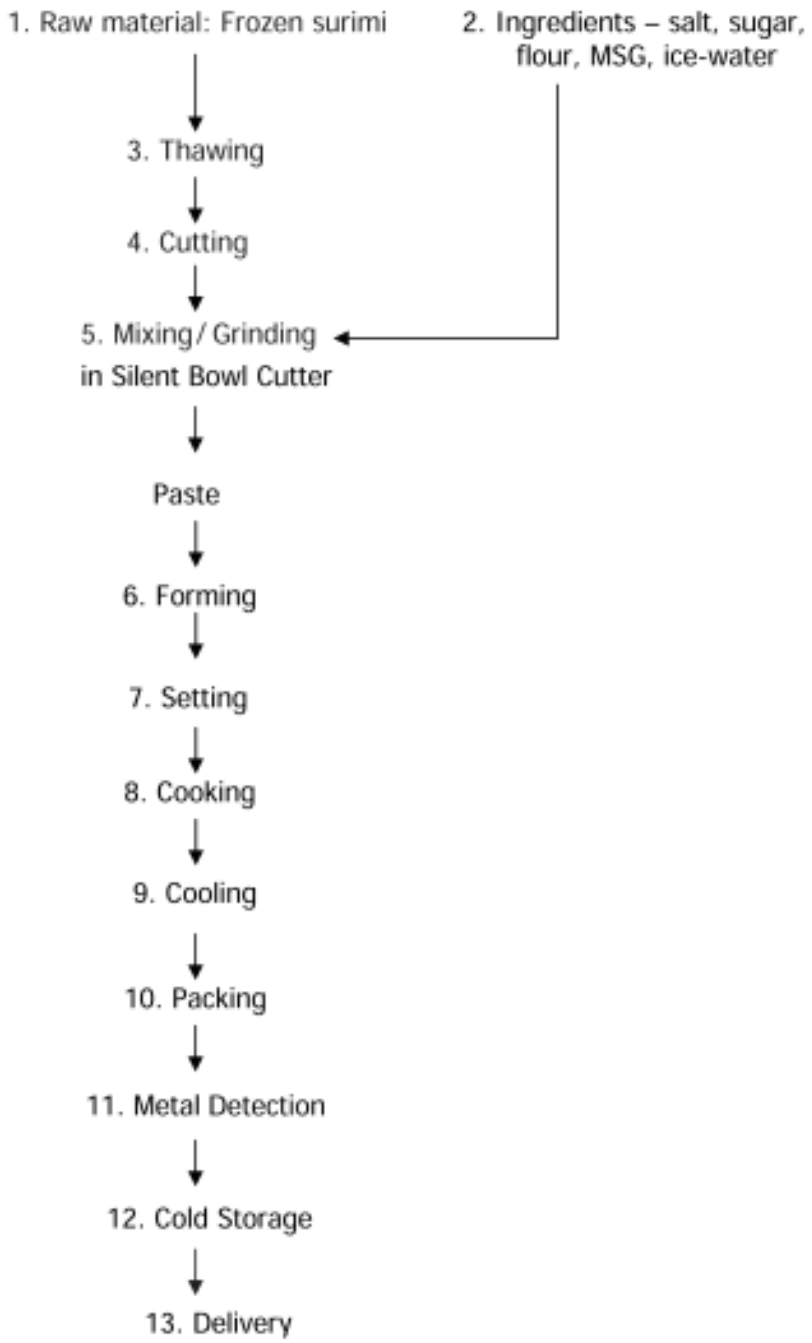
FISH BALL

Product description

Product name	Fish Ball
Raw material	Frozen Surimi
Source of raw materials	Imported from Thailand
Ingredients	Salt, sugar, MSG, starch, water
Packaging	1 kg plastic (HDPE) bags
Intended use	Ready-to-eat, sold in supermarkets, used as an ingredient in noodle and vegetable dishes, soups or eaten as a finger-food
Intended consumers	General public
Storage/distribution conditions	Keep chilled $<10^{0}$C
Shelf life	3 days under chilled storage conditions

Flow diagram of production of fish ball



Hazard analysis worksheet

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
1.	Raw materials - frozen surimi	**Biological** 1. Microbial contamination	Yes	Raw materials may be contaminated with pathogens such as Salmonella and Listeria during manufacture	1. Health certificates to accompany each consignment	No
		2. Microbial growth	Yes	Microbial growth can occur if there is poor temperature control during transportation.	2. Inspection of temperature. Records of delivery vehicles and of the raw materials to ensure that they are maintained frozen at below -18^{0}C at all times 3. Hazard is finally controlled at the cooking step	No
		Chemical None	NA	NA	NA	NA
		Physical Bones in fillets	No	Lateral pin bones are inherent in the fillets but they are mainly small <1 cm and soft, and are mashed up in the mincing step.	NA	No
2.	Ingredients	**Biological** 1. Microbial contamination	No	Only food-grade ingredients and potable water from the public water system are used. Ice is also made from potable water. Use and storage of ingredients are also according to GMP.	NA	No
		2. Microbial growth	No			
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
3.	Thawing (partial)	**Biological** 1. Microbial re-contamination from dirty equipment/ environment	No	Prevented by good SSOP	NA	No
		2. Microbial growth	Yes	Microbial growth can occur if there is poor temperature control during thawing.	1. Thawing is carried out for not more than 1 hr and temp. of surimi should not exceed 10°C in the process 2. Hazard is finally controlled at the cooking step	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
4.	Cutting of partially thawed surimi	**Biological** 1. Microbial re-contamination from dirty equipment	No	Prevented by good SSOP.	NA	No
		2. Microbial growth	No	Not likely to occur because of short time involved at this step.		
		Chemical Cleaning chemical/ sanitizer residues	No	Prevented by good SSOP.	NA	No
		Physical Metal fragments	Yes	Risk of contamination from broken or chipped blades	Hazard is controlled at the metal detection step	No

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
5.	Mixing/ Grinding	**Biological** 1. Microbial re-contamination from dirty equipment	No	Prevented by good SSOP	NA	No
		2. Microbial growth	No	Not likely to occur because of low temperature involved at this step and good SSOP		
		Chemical Cleaning chemical/ sanitizer residues	No	Prevented by good SSOP	NA	No
		Physical Metal fragments	Yes	Risk of contamination from broken or chipped blades	Hazard is controlled at the metal detection step	No
6.	Forming	**Biological** 1. Microbial re-contamination from dirty equipment/ worker's hands	No	Prevented by good SSOP	NA	No
		2. Microbial growth	No	Not likely to occur because of short time involved at this step		
		Chemical Cleaning chemical/ sanitizer residues	No	Prevented by good SSOP	NA	No
		Physical None	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
7.	Setting	**Biological** 1. Microbial re-contamination from dirty equipment/ water	No	Prevented by good SSOP.	NA	No
		2. Microbial growth	No	On-line monitoring has shown that this is not likely to occur		
		Chemical Cleaning chemical/ sanitizer residues	No	Prevented by good SSOP	NA	No
		Physical None	NA	NA	NA	NA
8.	Cooking in hot water	**Biological** Survival of microbes	Yes	Microbes may survive the cooking process if it is not properly done and they will not be eliminated at subsequent steps	Adequate cooking time and temperature to kill microbes	**Yes**
		Chemical Cleaning chemical/ sanitizer residues	No	Prevented by good SSOP	NA	No
		Physical None	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
9.	Cooling of cooked fish balls by blowing fan	**Biological** 1. Microbial re-contamination from dirty equipment/ workers' hands/ environment	No	Prevented by good SSOP	NA	No
		2. Microbial growth	Yes	Microbial growth can occur if cooling is carried out for too long a time at high room temperature and microbes will not be eliminated at subsequent steps	Cooling carried out in air-con. room for less than 1 hr.	**Yes**
		Chemical Cleaning chemical/ sanitizer residues	No	Prevented by good SSOP	NA	No
		Physical None	NA	NA	NA	NA
10.	Packing	**Biological** 1. Microbial re-contamination from dirty equipment/ workers' hands/ environment	No	Prevented by good SSOP	NA	No
		2. Microbial growth	No	Not likely to occur as packing is carried out in an air-con. room and in a short time		
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
11.	Metal detection	**Biological** None	NA	NA	NA	NA
		Chemical None	NA	NA	NA	NA
		Physical Metal fragments	Yes	Metal fragments from damaged blades of surimi cutter or silent cutter	Products to pass through a metal detector with reject mechanism	**Yes**
12.	Storage in chiller cold-room	**Biological** Microbial growth	Yes	Microbial growth can occur if chiller room temperature is too high and microbes will not be eliminated at subsequent steps	Maintain chiller room temperature at $<10^{0}$C	**Yes**
		Chemical Cleaning chemical/ sanitizer residues	No	Prevented by good SSOP	NA	No
		Physical None	NA	NA	NA	NA
13.	Delivery in refrigerated vehicle	**Biological** Microbial growth	Yes	Microbial growth can occur if temperature of the refrigerated compartment in delivery vehicle is too high	Maintain temperature of the refrigerated compartment in delivery vehicle at $<10^{0}$C	**Yes**
		Chemical Cleaning chemical/ sanitizer residues	No	Prevented by good SSOP	NA	No
		Physical None	NA	NA	NA	NA

CCP Table

CCP	Production step	Hazard (s)
1	Cooking in hot water	Microbial survival
2	Cooling (blowing fan) of cooked fish balls	Microbial growth
3	Metal detection	Metal fragments from damaged blades of equipment
4	Storage of products in chiller coldroom	Microbial growth
5	Delivery in refrigerated vehicles	Microbial growth

HACCP Plan

CCP	Significant Hazard	Control Measure	Critical Limits	Monitoring	Corrective Action	Records	Verification
CCP #1 Cooking in hot water	Survival of microbes due to inadequate cooking	Adequate cooking temperature and time	1. Cooking temperature >95^{0}C. 2. Cooking time >15 minutes. 3. Core temperature of cooked product >80^{0}C.	**What** 1. Cooking temperature i.e. temperature of the water in the cooking tank. 2. Cooking time i.e. the period of time the product is in the cooking tank. 3. Core temperature of the cooked product. **How** 1. Measure temperature of the water at two points in the cooking tank (a point at the beginning of the tank and another point at almost the end of the tank) with a portable digital thermometer. 2. Monitor time of cooking by timing the movement of the product through the cooking tank with a stopwatch. 3. Measure the core temperature of the product at the end of cooking i.e. immediately upon coming out of the cooking tank, with a portable digital thermometer equipped with a suitable probe. **Frequency** 1. Half-hourly. 2. Half-hourly. 3. Half-hourly. **Who** 1. Quality Control (QC) personnel or a competent worker. 2. QC personnel or a competent worker. 3. QC personnel or a competent worker.	If the time or temperature parameters are not met, then the cooking will be stopped and required adjustments made. All products produced during the deviation will be recooked.	1. Cooking time-temperature recording forms. 2. Product core temperature recording forms.	1. Daily review of cooking time-temp records and product core temperature records by the QC supervisor. 2. Monthly microbiological testing of random on-line samples of the cooked product for total aerobic plate counts, *E. coli* and *S. aureus* counts. QC personnel will collect the on-line samples and sent them to an accredited laboratory for testing. Results of the testing are to be kept on file as records for auditing purposes. 3. Weekly calibration of the portable digital thermometer by QC personnel according to manufacturer's instructions. Calibration records are to be kept on file.

CCP	Significant Hazard	Control Measure	Critical Limits	Monitoring	Corrective Action	Records	Verification
CCP #2 Cooling of cooked fish balls	Microbial growth	Cooling carried out quickly in air-conditioned room	1. Temperature of air-conditioned room <25°C. 2. Cooling time <1 hr.	**What** 1. Temperature of air-conditioned room. 2. Cooling time. **How** 1. Visual check of thermometer/temperature recorder in the air-conditioned room. 2. Monitor time of cooling of cooked fish cakes. **Frequency** 1. Every four hours. 2. Batch by batch. **Who** 1. Quality Control (QC) personnel or a competent worker. 2. QC personnel or a competent worker.	1. Re-adjust the temperature controller or thermostat of the air-conditioner. 2. Remind worker that cooling time should not exceed 2 hours.	1. Air-conditioned room temperature recording forms. 2. Cooling time recording forms.	1. Daily review of the temperature records for the air-conditioned by the QC supervisor. 2. Weekly calibration of the thermometer/ temperature recorder in the air-conditioned room by QC personnel. Calibration records are to be kept on file.
CCP #3 Metal detection	Metal fragments from damaged (broken, chipped) blades of surimi cutter, mincer, or silent cutters	Pass products through a metal detector with reject mechanism	No metal fragments detected.	**What** Metal fragments. **How** Metal detector. **Frequency** Continuous. **Who** Production supervisor checks hourly to ensure that the metal detector is switched on.	Product contaminated with metal fragments will be automatically rejected by metal detector and discarded. If metal detector is not on or fails sensitivity check, then all products since the last acceptable check is held and rechecked for metal.	Metal detector operation log book.	1. Run sensitivity check for metal detector according to manufacturer's instructions at the start of operation and every hour thereof by Quality Control (QC) personnel or a competent worker. 2. Daily review of metal detector operation log book by QC supervisor.

CCP	Significant Hazard	Control Measure	Critical Limits	Monitoring	Corrective Action	Records	Verification
CCP #4 Storage in chiller coldroom	Microbial growth	Adequately low temps to retard microbial growth	Temperature of chiller coldroom $<10^0$C.	**What** Temperature of chiller coldroom. **How** Visual check of chiller coldroom thermometer/temperature recorder. **Frequency** Every four hours. **Who** QC personnel or a competent worker.	Re-adjust the temperature controller or thermostat of the chiller coldroom.	Chiller coldroom temperature recording forms.	1. Daily review of the temperature records for the chiller coldroom by the QC supervisor. 2. Weekly calibration of the thermometer/temperature recorder in the chiller coldroom by QC personnel. Calibration records are to be kept on file.
CCP #5 Delivery in refrigerated vehicle	Microbial growth	Delivery to be carried out in refrigerated vehicles to maintain chilled temperatures of the product throughout delivery	Temperature of the refrigerated compartment in delivery vehicle $<10^0$C.	**What** Temperature of the refrigerated compartment in delivery vehicle. **How** Visual check of the thermometer/temperature recorder of the refrigerated compartment. **Frequency** At every delivery stop before the door of the refrigerated compartment is opened. **Who** Driver or delivery worker	Re-adjust the temperature controller or thermostat of the refrigerated compartment.	Refrigerated vehicle temperature recording forms.	1. Daily review of the temperature records for the refrigerated vehicle by the QC supervisor. 2. Weekly calibration of the thermometer/ temperature recorder of the refrigerated compartment by QC personnel. Calibration records are to be kept on file.

THAILAND

Contributed by
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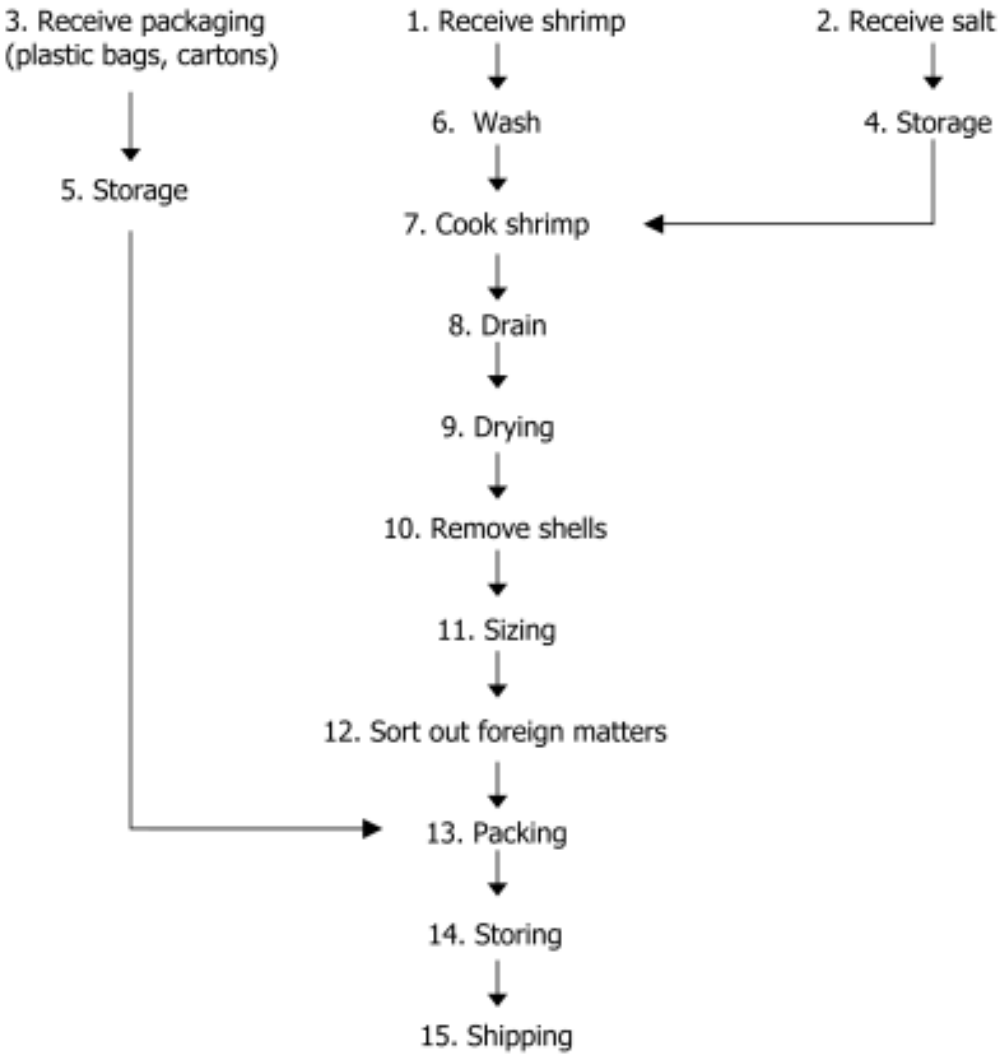
DRIED SHRIMP

Product description

Product name	Dried shrimp
Raw material	Fresh shrimp (sand shrimp) *(Metapenaeus spp.)*
Source of raw materials	Caught from Gulf of Thailand and Andaman sea
Ingredients	Salt
Packaging	PP, PE plastic bags
Intended used	Ready to eat, used as an ingredient in seafood dishes, sold in supermarkets
Intended consumers	General public
Storage/ distribution	None
Shelf life	3 months at ambient temperature 1 year at 4 - 7°C 2 years at -18°C

Flow diagram of production of dried shrimp



Hazard analysis worksheet

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
1.	Receive shrimp	**Biological** Pathogenic bacteria contamination	Yes	Shrimp can be contaminated with pathogenic bacteria from unhygienic practices during harvesting and transporting to processing plant	The further cooking and drying step will destroy pathogenic bacteria	No
		Chemical Sulfiting agent	Yes	Sulfiting agent may be used to preserve shrimp after harvesting	Inspect every incoming lot and reject lot that contains sulfite	**Yes**
		Physical Foreign matters	No	Can be sorted out during the process	NA	NA
2.	Receive salt	**Biological** None	NA	NA	NA	NA
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
3.	Receive packaging	**Biological** None	NA	NA	NA	NA
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
4.	Salt storage	**Biological** Pathogenic bacteria contamination	No	Controlled by SSOP (sanitation control)	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
5.	Packaging storage	**Biological** Pathogenic bacteria contamination	No	Controlled by SSOP (sanitation control)	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
6.	Wash	**Biological** Pathogenic bacteria contamination from water	No	Controlled by SSOP (water quality control)	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
7.	Cook shrimp	**Biological** Pathogen survival	Yes	Pathogen can survive due to improper cooking	Control cooking temperature and time	Yes
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
8.	Drain	**Biological** None	NA	NA	NA	NA
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
9.	Drying	**Biological** Pathogen survival	Yes	Pathogen can survive due to improper drying	Control drying temperature and time to achieve Aw 0.85 or less	Yes
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
10.	Remove shells	**Biological** Pathogenic bacteria recontamination from equipment	No	Controlled by SSOP (cleaning program)	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
11.	Sizing	**Biological** Pathogenic bacteria recontamination from equipment and employee	No	Controlled by SSOP (cleaning program and personnel hygiene)	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

No	Ingredient/ production step	Potential hazards	Significant (Yes/ No)	Justification	Control measures	CCP (Yes/ No)
12.	Sort out foreign matter	**Biological** Pathogenic bacteria contamination from employee	No	Controlled by SSOP (personnel hygiene)	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
13.	Packing	**Biological** Pathogenic bacteria contamination from employee	No	Controlled by SSOP (personnel hygiene)	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
14.	Storing	**Biological** Pathogenic bacteria contamination	No	Controlled by SSOP (sanitation control)	NA	No
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA
15.	Shipping	**Biological** None	NA	NA	NA	NA
		Chemical None	NA	NA	NA	NA
		Physical None	NA	NA	NA	NA

CCP Table

CCP	Production step	Hazard (s)
1	Receive shrimp	Sulfiting agent
2	Cook shrimp	Pathogen survival
3	Drying	Pathogen survival

HACCP Plan

CCP	Significant Hazard	Control measure	Critical limit	Monitoring	Corrective action	Record	Verification
CCP#1 Receive shrimp	Sulfiting agent	Inspect every incoming lot and reject which containing sulfite	No detectable sulfite residues (<10 ppm)	QC examines presence of sulfite every lot of incoming shrimp by using sulfite test kit	Reject lot if sulfite residues present	Shrimp receiving record	1. Review records daily 2. Laboratory testing for sulfite of finished product monthly
CCP#2 Cook shrimp	Pathogen survival	Control cooking temperature and time	Boil at boiling temperature for 7 minutes	Operator visually checks boiling and timing with stop watch every batch	1. Extend boiling process 2. Hold product for evaluation	Cooking control record	1. Review records daily 2. Check accuracy of stop watch monthly
CCP#3 Drying	Pathogen survival	Control drying temperature and time to achieve Aw 0.85 or less	Minimum air temperature 55°C and drying time 4 hours	Temperature and time recorded continuously by data logger and visual check each batch by operator	1. Extend drying process 2. Hold product for evaluation by testing Aw	Drying control record	1. Review records daily 2. Check accuracy of data logger monthly 3. Examine finished product for Aw monthly

VIETNAM

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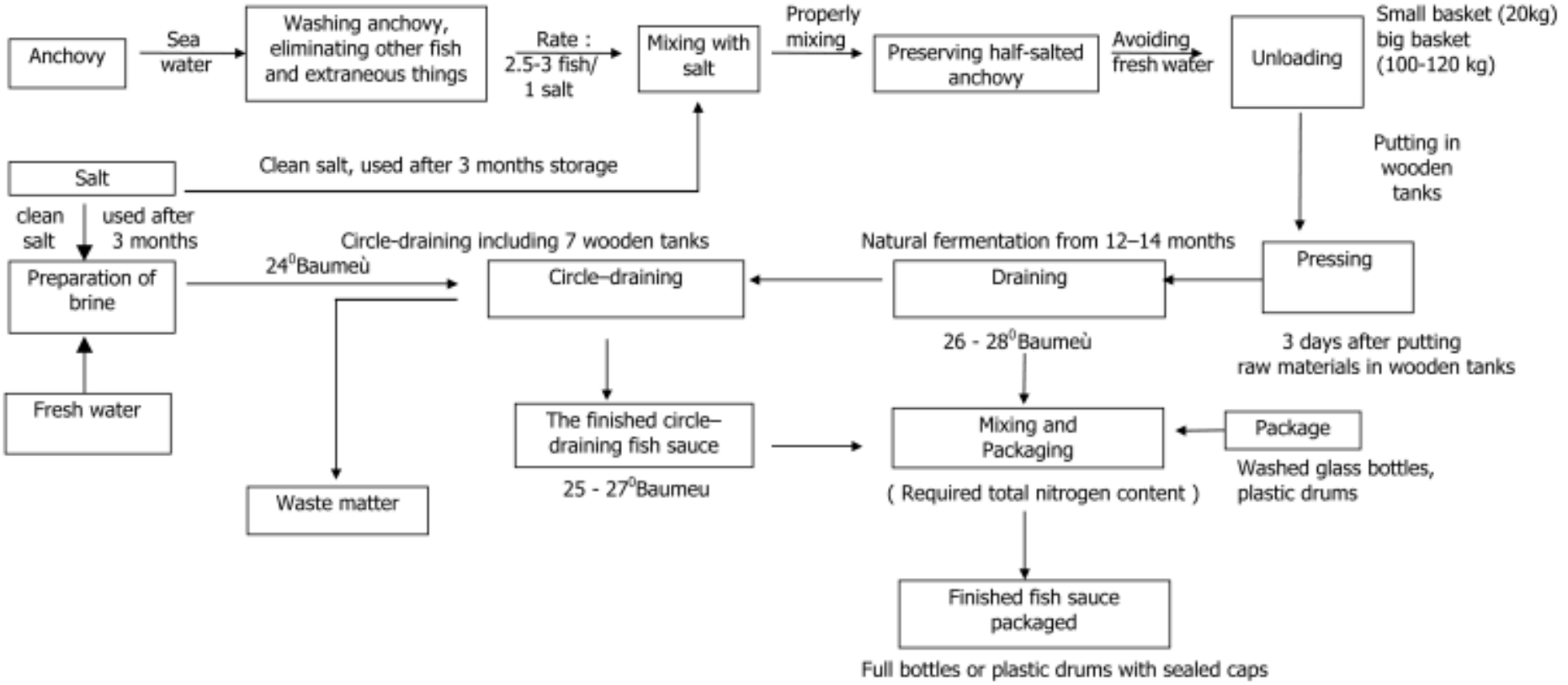
FISH SAUCE

Product description

Product name	Fish sauce
Raw material	Anchovy *(Stolephorus commersonii)*
Raw material harvesting area	Catching grounds in Southern of Vietnam (Phu Quoc island) – FAO area 71, Pacific Ocean
Method of transportation, preservation and unloading of raw materials	Used enterprise's fishing boats. Anchovy are washed, eliminated from other fish and extraneous things, then mixed with salt, preserved in the hold and brought to the quay of factory
Product specification	Fish sauce with the total nitrogen content from 20 - 40 (g/l)
Other ingredients	Salt (NaCl), water
General description of processing steps	- Preserving, transporting, unloading raw materials (half-salted anchovy) - Pressing, caring, draining first fish sauce - Preparation of brine - Circle-draining - Mixing and packaging
Types of packaging	Packed in glass bottles or plastic drums
Preservation conditions	Keep in dry, cool place. The fish sauce should be in full bottles or plastic drums with sealed caps
Distribution & transportation conditions	Normal temperature
Shelf-life	- Glass bottles: 24 months - Plastic drums: 12 months
Labeling requirements	Fish sauce brand, total nitrogen content, net volume, packing date, expiry date, company name, EU. code, lot identification, Product of Vietnam
Usage instruction	Used as instant spices. Add lemon, garlic, chili, sugar upon use
Intended customers	General public
Standard regulations, specifications to follow	TCVN 5526 - 1991 (Microbiological standard) TCVN 5107 – 1993 (Chemical standard)

Flow diagram of production of fish sauce



Hazard analysis worksheet

Ingredients/ processing step	Identify potential hazards introduced, controlled or enhanced at this step	Are any potential food safety hazards significant? (Yes/ No)	Justify your decision for column no. 3	What preventative measures can be applied to prevent the significant hazards?	Is this step a critical control point? (Yes/ No)
1	2	3	4	5	6
Salt	**Biological** No				
	Chemical No				
	Physical No				
Washing anchovy, eliminating from other fish and extraneous things	**Biological** Bacterial pathogen contamination	No	Controlled by SSOP		
	Chemical No				
	Physical No				
Mixing anchovy with salt and preserving half-salted Anchovy	**Biological** -Bacterial pathogen contamination -Bacterial pathogen growth caused toxin chemicals	No Yes	Controlled by SSOP The improper rates of salt and thickness salt surface are insufficient to inhibit the potential bacterial pathogen growth and formation of toxin.	 Mix fish with salt properly and strictly control thickness salt surface	 **Yes**
	Chemical Histamine formation	Yes	The improper rate of salt and thickness salt surface are insufficient to inhibit the potential Histamine formation	Mix fish with salt properly and strictly control thickness salt surface	**Yes**
	Physical No				

Ingredients/ processing step	Identify potential hazards introduced, controlled or enhanced at this step	Are any potential food safety hazards significant? (Yes/ No)	Justify your decision for column no. 3	What preventative measures can be applied to prevent the significant hazards?	Is this step a critical control point? (Yes/ No)
1	2	3	4	5	6
Unloading	**Biological** -Bacterial pathogen contamination -Bacterial pathogen growth	No No	Controlled by SSOP Not likely to occur because half-salted Anchovy is preserved by salt		
	Chemical No				
	Physical No				
Pressing	**Biological** -Bacterial pathogen contamination -Bacterial pathogen growth	No Yes	Controlled by SSOP Salt degree of half-salted Anchovy extract is insufficient to inhibit bacterial pathogen growth	Strictly control salt degree of half-salted Anchovy extract	**Yes**
	Chemical No				
	Physical No				

Ingredients/ processing step	Identify potential hazards introduced, controlled or enhanced at this step	Are any potential food safety hazards significant? (Yes/ No)	Justify your decision for column no. 3	What preventative measures can be applied to prevent the significant hazards?	Is this step a critical control point? (Yes/ No)
1	2	3	4	5	6
Draining	**Biological** Bacterial pathogen contamination	No	Controlled by SSOP		
	Chemical No				
	Physical No				
Preparation of brine	**Biological** -Bacterial pathogen contamination	No	Controlled by SSOP		
	Chemical No				
	Physical No				
Circle– Draining	**Biological** -Bacterial pathogen contamination	No	Controlled by SSOP		
	Chemical No				
	Physical No				
Mixing and packaging	**Biological** Bacterial pathogen contamination	No	Controlled by SSOP		
	Chemical No				
	Physical No				

Ingredients/ processing step	Identify potential hazards introduced, controlled or enhanced at this step	Are any potential food safety hazards significant? (Yes/ No)	Justify your decision for column no. 3	What preventative measures can be applied to prevent the significant hazards?	Is this step a critical control point? (Yes/ No)
1	2	3	4	5	6
Labeling	**Biological** No				
	Chemical No				
	Physical No				

CCP Table

CCP	Production step	Hazard (s)
1	Mixing anchovy with salt and preserving half-salted anchovy	• Bacterial pathogen growth producing toxin (Biological) • Histamine formation (Chemical)
2	Pressing	Bacterial pathogen growth

HACCP Plan

CCP	Significant Hazards	Critical limits	Monitoring				Corrective Actions	Records	Verification
			What	How	Frequency	Who			
CCP#1 Mixing Anchovy with salt and preserving half-salted Anchovy	**BIOLOGICAL** - Bacterial pathogen growth caused toxin chemicals **CHEMICAL** - Histamine formation	- Salt rate: 2.5–3 fish/ 1 salt - Thickness salt surface is 5 cm	- Amount of fish / salt - Thickness salt surface	- Measure by small basket (20 kg) - Measure by ruler	- Each lot - Each lot	QC (Captain) QC (Captain)	- Add salt - Add salt	Reports of Anchovy catching	- Review reports when fishing boat return - Take half-salted Anchovy / fish sauce samples for Histamine every 6 months
CCP#2 Pressing	**BIOLOGICAL** - Bacterial pathogen growth	- Salt degree of half-salted Anchovy extract must be ≥ 25^0 Baumeù	- Salt degree of half-salted Anchovy extract	- Measure by Baumeù-meter	- After pressing but before pumping half-salted Anchovy extract into the wooden tank	QC	- Add salt	- Reports of half-salted Anchovy pressing	- Review reports after every pressing

SUMMARY

Application of HACCP in the Fish Processing Industry in Southeast Asia 2000-2003

SUMMARY

The following is a summary on the status of the implementation of HACCP in the fish processing industry in the Southeast Asian countries collated from the country reports of the four regional workshops.

BRUNEI DARUSSALAM

Since the mid-1990's, various government efforts have been made to promote HACCP implementation as government recognizes that HACCP is the best system presently available to ensure food safety. Programmes such as seminars, talks as well as financial and technical assistance were made available to the industry to encourage HACCP implementation. However, HACCP implementation is on a voluntary basis and as the local fish processing industry is largely supplying to the domestic market, there is little 'pressure' for them to do so. In 2002, the Ministry of Industry and Primary Resources (MIPR) in collaboration with SIRIM QAS, Malaysia, initiated the Products Certification scheme which involves HACCP and SSOP to assist companies take the first steps towards HACCP implementation. To date (2003), two fish processing companies which are involved in export have obtained product certification and are in the process of implementing HACCP in their establishments.

***Competent authority**: Department of Fisheries (DOF) (Quality Control Section, Processing Development and Quality Control Division), MIPR, issues Letters of Attestation as a form of Health Certification - based on Codex Alimentarius guidelines as well as specific requirement by various countries.*

CAMBODIA

The fish processing industry in Cambodia is made up entirely of small, household enterprises except for three commercial fish processing establishments (as of 2003) involved in export. DOF of Cambodia has set up a HACCP team to look into implementation of HACCP and establishing legislation for GMP and HACCP. Since 1999, one of the commercial establishments which is located in Phnom Penh and exports to the US, has implemented HACCP plans for its products such as frozen shrimp, freshwater fish, fillets, IQF cooked freshwater snail meat. The government in cooperation with an NGO has conducted three training workshops on seafood safety especially with regards to parasitic infection. In addition, DOF has also taken efforts to educate fish processors and fishermen about HACCP application, which emphasize hygiene and sanitation.

***Competent authority**: DOF, Ministry of Agriculture, Forestry and Fisheries (MAFF).*

INDONESIA

HACCP implementation started in 1991 and is mandatory for all processors since February 1998. Approved processors must have HACCP programmes implemented, documented and verified. As of mid-2003, there are around 12,500 registered fish processing establishments of which 339 are export-oriented, with 263 having implemented HACCP. 578 have also implemented GMP & SSOP.

Legislation supporting implementation of

HACCP-based Integrated Quality Management System for Fishery Products was established in 1998. Improvement of infrastructure, facilities and human resource in the stages of pre-harvesting, harvesting, post-harvesting, marketing has been taken in conjunction with implementation of HACCP.

Competent authority: *Directorate General of Capture Fisheries, Sub-Directorate of Fish Inspection and Quality Control*

LAO PDR

Lao PDR is a landlocked country with no direct access to the sea and fisheries resources are entirely from freshwater sources such as ponds, swamps, rivers, wetlands, paddy fields, and reservoirs. Fish is mostly consumed fresh with some low quality or low value fish being processed largely on a household scale into fermented, smoked and dried products. There are no significant exports of fish or fisheries product. Temperatures of refrigerated trucks carrying fish imported from Thailand are regularly checked upon entry by Department of Livestock and Fisheries, Ministry of Agriculture and Forestry. The food standards in Lao PDR are being established based mostly on Codex Alimentarius guidelines and also includes GMP and HACCP for fish products. Though HACCP is relatively new in Lao PDR, the government has made efforts to introduce HACCP to fish processors and fishermen via public education and technical assistance. In addition, the government also conducted training for its fish inspectors and established up a small laboratory for product analysis.

Competent authority: *Department of Livestock and Fisheries, Ministry of Agriculture and Forestry*

MALAYSIA

HACCP was initially introduced and adopted by the low acid canning industry in the 1990's. With the imposition of mandatory HACCP requirements on fish and fish products by EU in 1996 and US in late 1997, the fish processing industry especially the export-oriented sector have implemented HACCP to comply with the requirements of the importing countries. However, implementation of HACCP is on a voluntary basis. To promote HACCP implementation, DOF of Malaysia has conducted HACCP awareness campaign for fish processing establishments in 1999 - 2000. Various HACCP courses are also conducted on a regular basis by the Malaysian Agricultural Research and Development Institute (MARDI). Financial and technical assistance are available to fish processing establishments that are taking initiatives to adopt HACCP in their premises As of Jan 2002, there about 238 medium and commercial sized fish processing establishments of which 48 are HACCP-certified by the Ministry of Health (MOH). 45 are also approved for export to EU.

Competent authority: *Ministry of Health (MOH). MOH has introduced the National HACCP Certification Scheme based on Codex Alimentarius and is the competent authority recognized by EU. In September 2001, MOH officially introduced The Malaysian Certification for HACCP which allows certified establishments to use the MOH logo on their products. DOF plays an active role to promote HACCP implementation through its training and education programmes to the fish processing industry.*

MYANMAR

HACCP concept was introduced to the fish processing establishments in 1998. Since then, DOF has conducted training on HACCP, GMP and SSOP for its fish inspectors and fish processors. Training for fish processors are conducted in the states and divisions where the fish processing establishments are located.

DOF requires the fish processing establishments to be inspected twice a year. Inspection related to HACCP audit is also conducted once a year. Fish processing establishments are rated A, B, C, D, and E based on compliance with DOF directives. A and B-rated establishments are

allowed to export their products to EU, US, Australia, Canada and Japan. To date, there are 134 registered fish processing establishments in Myanmar, 48 of them are graded as A and B.

Competent authority: *DOF of the Ministry of Livestock and Fisheries.*

PHILIPPINES

HACCP implementation started in 1994. Since then, the government has conducted a series of training on HACCP principles, concept and application, HACCP plan development, HACCP auditing and verification for fish inspectors, quarantine officers, technical personnel and industry personnel nationwide. HACCP implementation, however, is still voluntary except for fish processing establishments which export to EU and the US which have to comply with a mandatory accreditation programme for HACCP implementation. Nevertheless there is an encouraging trend of increasing number of establishments that are HACCP-certified, most of which are export-oriented establishments. From only 9 HACCP-certified establishments in 1995, to date (mid-2003), there are now 67 HACCP-certified establishments.

Competent authority: *For US: 3 government agencies - Bureau of Fisheries and Aquatic Resources (BFAR) of the Department of Agriculture (DA), Bureau of Food and Drugs of the Department of Health, and Food Development Center of the National Food Authority. For EU: BFAR-DA.*

SINGAPORE

HACCP was introduced in the mid 1990s in response to EU requirements. Since then, the Agri-Food and Veterinary Authority, Singapore (AVA) has been actively communicating the basic principles and necessary information required for its effective implementation to the fish processing industry. HACCP implementation has been mandatory for establishments which export to EU since early 1995, and the US since 1997. It is still voluntary for all other establishments although the Wholesome Meat and Fish Act enacted in Dec 1999, has mandated HACCP requirement for all fish processing establishments. However, the HACCP concept is better-accepted and integrated in export-oriented establishments than in the domestic-oriented ones. Various technical and financial schemes are available to assist fish processors to implement HACCP. AVA currently licenses about 90 fish processing establishments of which 15 are approved for export to EU. 9 establishments have also obtained third-party HACCP certification.

Competent authority: *Agri-Food and Veterinary Authority, Singapore (AVA)*

THAILAND

HACCP was first introduced to the Thai seafood industry in 1991 and became mandatory for all fish processing establishments approved for export since 1996 - approved establishments must have HACCP programme implemented, documented and verified. Guidelines for development of documented programme have been provided and updated to meet international standards. Currently, 222 of the 244 (91%) approved export establishments have successfully implemented HACCP and the rest are being verified. Traditional product processors producing fermented fish, fish sauce, shrimp paste, for example, are the latest group in the industry to implement HACCP. Currently, there are 40 traditional product processors registered for export of which 31 (78%) have fully implemented HACCP in their establishments. The rest are in the process of improving their controls and having re-assessment from the DOF.

Competent authority: *DOF, Thailand*

VIETNAM

HACCP implementation for the fish processing industry was started in Vietnam in 1991. HACCP is mandatory for EU registered fish processing establishments from Nov 1999 and has become

mandatory for all establishments from Jan 2001. Presently, there are 335 registered fish processing establishments, of which 147 have successfully implemented HACCP and are HACCP-certified by the National Fisheries Quality and Veterinary Department (NFQVD), mostly export-oriented frozen and canned fish processing establishments. NFQVD inspects the fish processing establishments and grades them from A to D based on compliance with hygiene and HACCP requirements. Only A and B-rated establishments are allowed to export. 94 establishments have also been approved for export to EU. The accreditation of HACCP implementation is mainly conducted NFQVD by although some have obtained third party accreditation from international companies such as SGS from UK and Surefish from US, which is more costly.

Competent authority: *National Fisheries Quality and Veterinary Department (NAFIQAVED) - formerly (before May 2003), National Fisheries Inspection and Quality Assurance Center (NAFIQACEN) of the Ministry of Fisheries (MOFI).*

CONCLUSION

Application of HACCP in the Fish Processing Industry in Southeast Asia 2000-2003

CONCLUSION

The 4-year period (2000-2003) of the programme has seen much progress and developments in the application and implementation of HACCP in all the SE Asian countries. All countries have introduced the HACCP concept and implemented HACCP in their fish processing industry albeit to varying degrees. Mandatory HACCP implementation is a requirement for all fish processing establishments in Indonesia and Vietnam, and for all establishments approved for export in Thailand. In the other SE Asian countries, HACCP implementation is on a voluntary basis and is imposed only on those plants which require approval for export to EU and US. Malaysia and Philippines have also established national HACCP certification schemes to accredit plants.

Although there are still issues and challenges to be overcome by both industry as well as government in HACCP implementation, some of which may be specific to a particular country while some may be common to a few or all countries, but on the bright side, all the Southeast Asian countries are responding positively to the challenge. The general idea in HACCP is to direct energy and resources to those areas where they are needed most which makes HACCP an ideal tool where resources are scarce, as is the case in many Southeast Asian countries. By using the HACCP concept, it is possible to identify where the necessary changes and improvements must be introduced to improve product safety and quality. A very strong commitment to improve safety and quality has developed with industry and government working in collaboration to upgrade the industry. The prize is the maintenance of international markets and the possibility of better prices and new markets through higher quality and safer products.

The country coordinators and participants at the final 4th regional workshop held in Bangkok have affirmed that the 4-year programme has achieved its objective to document HACCP application in the fish processing industry in the region and has also provided a platform for cooperation and information sharing on HACCP application among the Southeast Asian countries. It has contributed not only to a better but also a common understanding of HACCP concepts and principles among the countries which may lead to harmonization or equivalence of HACCP-based inspection systems in the region.

What's next ?

In the initial years of HACCP application, the emphasis was on HACCP implementation in the export-oriented industry to ensure that their products are safe for consumption in the importing countries. However, many countries in this region are now beginning to turn their attention to HACCP implementation in the traditional fish products industry such as fish sauce and dried fish in Thailand; fish sauce, shrimp cracker, fish and shrimp paste in Vietnam; "bagoong alamang"

(cooked salted shrimps) in the Philippines; and fish balls and fish cakes in Singapore. HACCP implementation in this industry has hitherto been largely neglected as these traditional products are largely produced for domestic consumption and do not bring in foreign exchange. The traditional fish products industry would generally require greater assistance to implement HACCP as it comprises mainly of small and medium enterprises (SME) which lack the technical and financial resources of the larger export companies. There is a need therefore for a regional program to provide assistance for the implementation of appropriate HACCP-based systems in the traditional fish products industry.

The MFRD, on its part, will continue to provide the technical support to all countries in the region in their efforts to implement HACCP through its research and training programs on HACCP implementation, auditing and verification. The MFRD has proposed a regional project under the ASEAN-Australia Development Cooperation Programme to assist the implementation of appropriate HACCP-based systems in the traditional fish products industry. The project will include development of a HACCP training course for SME, a hazards and control guides for Southeast Asian fish products and a HACCP auditing and verification training course for the industry.