E. HANAK, E. BOUTRIF, P. FABRE, M. PINEIRO, (Scientific Editors), 2002. Food Safety Management in Developing Countries. Proceedings of the International Workshop, CIRAD-FAO, 11-13 December 2000, Montpellier, France, CIRAD-FAO. CIRAD CD-ROM, Montpellier, France.

Experiences in the Application of HACCP for Export and Local Markets: The Case of Thai Fisheries

S. SUWANRANGSI

Fish Inspection and Quality Control Division, Department of Fisheries, Kasetklang, Paholyothin Rd, Chattuchak, Bangkok 10900, Thailand. Email: sirilaks@fisheries.go.th

Abstract
As a result of increasing international trade in fish products and the high risk of contamination, the fisheries sector has been one of the priority industries for the introduction of HACCP systems. Thailand has successfully introduced HACCP in the industry on a wide scale, and has become one of the world's top exporters of processed fish products. Success has been possible thanks to a close collaboration between industry and the Thai Department of Fisheries. This article describes the difficulties encountered and lessons learnt since the introduction of the program in 1991, and raises questions concerning some unresolved areas – notably the extension of these quality control systems to primary production, to small-scale firms and firms focusing on the domestic market, and the need for further research to support quality control in the tropical fisheries area.

Introduction

Fish product safety is under going a period of unprecedented change, fuelled domestically by increasing consumer concern over food-borne hazards and internationally by demands for food hygiene and a food safety control system based on sound scientific information and equitable treatment. In this context, the demand for comprehensive control, from water to table is on the rise.

The international community has been seeking a common approach to maximizing quality and safety of fishery products. This includes the use of Hazard Analysis and Critical Control Point (HACCP) systems as a mean of assuring proper food handling, processing and retail sale to consumers. The use of HACCP systems in the fishery industry is now global. Since it first emerged, the concept has increased in importance, through its endorsement by Codex Alimentarius at the international level and by the European Union (EU) and the USA, two of the most important fish importers. Currently over forty countries have announced HACCP initiatives for the control of fish production, processing and distribution.

Thailand's exports of fish products increased from US$ 2.3 billion in 1990 to US$ 4.1 billion in 1999. Products are traded in fresh, frozen, canned and processed ready-to-cook and ready-to-eat forms. Major markets for Thai seafood products are Japan, the USA, the EU, Canada,

Australia, and new markets such as Eastern Europe, China, Korea, the Middle East, South Africa, Argentina and Brazil.

Since 1991, the Department of Fisheries (DOF) has been implementing a HACCP-based integrated quality assurance program addressing the entire chain (production, handling, processing, marketing). The program relies upon the cooperation of industry and all government agencies concerned. Over this period, DOF has moved away from the classic "inspection approach" to control to one focusing on auditing industry's own control programs. To date, the Thai fish processors have overcome problems related to hygiene conditions and practices, as well as HACCP documentation and records. Progress in implementation has been good, with 92% of processors now implementing HACCP effectively.

The fish inspection and control system implemented by DOF has been recognized internationally. It is a competent authority for the EU for fishery products, with an equivalence agreement on fish inspection established in 1997. DOF health certificates have been recognized by major fish importing countries including Japan, Australia, New Zealand, China, South Africa, Brazil and Argentina.

In this paper, we discuss the difficulties encountered and lessons learnt in the implementation of this HACCP-based program, and raise questions concerning some unresolved areas – notably the extension of these quality control systems to producers focusing on the domestic market, and the need for further research to support quality control in the tropical fisheries area.

Importance of International Fish Trade for Thailand

The importance of HACCP systems to the fishery industry in countries such as Thailand reflects the increasing importance of international trade in fresh fish, shellfish and fish products. In 1996, no less than 195 countries exported part of their production and some 180 countries reported fishery imports of varying amounts. International trade in fish now represents 37% of total world fish production. The value of world exports of fish and fishery products reached US$52.5 billion in 1996, with Japan accounting for 30% of imports, followed by the USA (14%). Currently developing countries provide about 15% of all fish and fishery products entering the world market.

In Thailand, the fish processing industry is economically important both for employment generation and foreign currency earnings. The government has emphasized the development of this sector in the past three National Economic and Social Development Plans. Over the past fifteen years, the industry has grown and developed. In 1993, Thailand emerged as a top exporter of fishery products, and by the end of the decade was exporting between US$ 4 and 5 billion annually. In 1999, the percentage by volume of fish products exported was canned tuna and other seafood (45%), frozen shrimp (12 %), frozen fish products (18%), frozen cephalopods (8%), frozen mollusk (4%) and fresh fish (17%).

Why are Quality and Safety so Important for the Fisheries Sector?

A number of forces drive concerns over safety in the fisheries industry:

- the rise in international trade in fish, leading to increased risks of contamination as perishable fish products are moved greater distances along more complex supply chains;
- the growing trade in fresh fish, made possible by improved transportation, with a much higher risk of contamination;
- the increasing numbers of new or re-emerging pathogens that have the potential to contaminate fish;
- more vulnerable populations with potentially lower immunity to new imported pathogens. In developed countries, this vulnerability may be increased by an aging population, whilst in developing countries, immuno-compromising diseases like AIDS may increase the risk of infection from contaminated imports.

In response to these safety concerns, fisheries has been one of the priority sectors for the introduction of HACCP systems as a mean of assuring proper food handling, processing and retail sale to consumers. For exporting countries like Thailand, this task is complicated by the fact that different importing countries impose different standards, and tend to require exporters to meet their own "tailor-made" quality control systems, rather than accepting a system which has equivalent results. This is despite WTO rulings that argue for countries to accept different measures as long as they have equivalent outputs. Another complicating factor is that both buyers in importing countries and consumers tend to impose a range of other demands besides basic safety guarantees, including other quality parameters and low prices.

Forms of Quality Control

Food control systems must, therefore, take into account food safety, quality, consumer protection and market access. The range of quality control programs include Good Manufacturing Practices (GMP), food hygiene, food standards, HACCP and other quality management systems like International Standards Organization (ISO) 9000.[1]

Currently, the Codex Alimentarius is revising the Code of Practices for fish and fishery products to a HACCP-based document, although it must be said that the harmonization of fishery products standards is a rather slow process at this level. Many countries promote quality control systems that are a mixture of ISO and HACCP – where full or selected elements of ISO are combined with HACCP principles. These standards will be promoted and insisted on by customers, governments and legislation, bankers and insurance sectors. The industry that needs to meet all those demands is under great pressure, indeed. In Thailand, some seafood processors simultaneously run a range of quality systems including HACCP (with different focuses), ISO 9002 and ISO 14000, to satisfy all parties.

The Thai Fish Inspection and Control System

The Department of Fisheries (DOF), an agency under the Ministry of Agriculture and Cooperatives, is the principal government agency interacting with the fisheries industry and is responsible for promoting the sector's development through introduction of new technologies, extension, research, regulation and inspection.

[1] See the article by L. NICOLAIDES in this collection for a description of the relationship between these different types of quality assurance systems.

DOF operates a HACCP-based fish inspection and control program involving control from raw materials to end-products. Under DOF, there are a number of divisions and institutes responsible for this overall quality control system. The Fish Inspection and Quality Control Division plays a very important role in post-harvest handling, processing development and quality control of fish and fishery products. Other groups include the Marine Fisheries Division, Fishery Conservation Division, Freshwater Fisheries Division, Brackish Water Fisheries Division. Table I provides an overview of the responsibilities of the various groups in the area of quality control. Following is a brief summary of some of the activities undertaken outside of the HACCP area.

Control of the Fish Harvesting Environment

To ensure that products are safe for consumption and further processing, DOF regularly monitors hygiene and environmental impact of harvesting waters and farms. The parameters monitored include fecal coliform, E. coli, pathogens, environment pollutants and heavy metals.

Two specific programs are conducted in this area – the shellfish sanitation program and aquaculture shrimp drug residual control program. The former covers zoning and monitoring of shellfish production zones. Shellfish products intended for export, especially for the EU market, must only come from DOF-approved zones and establishments. The latter involves regular monitoring of shrimp farm hygiene, aquaculture practices, the use of feed, and drug and chemical residue in produce.

Control of Fish Handling Hygiene and Practices

DOF together with the Fish Marketing Organization regularly monitor hygiene conditions and handling practices at fish landing places. Monitoring at commercial private landing places has also been conducted. Parameters monitored include sanitation conditions, quality of water and iced used, freshness and wholesomeness of fish, and handling temperature.

Control of Fish Processing Establishments

DOF approves fish processing establishments intended to export fish and fishery products to trading partners including the EU, Canada, China, Australia and New Zealand. Processing plants must be inspected regularly for hygiene and HACCP-based quality systems. DOF requires that all processors listed as “DOF-approved” implement HACCP. Approved processors gain access to the EU market and benefit from reduced inspection at port of entry. Full inspection is conducted 2 to 4 times per year. Inspection involves observation, taking measurements, interviews, record review and sample collections, as necessary, covering: condition and maintenance of construction and equipment; establishment sanitation and hygiene; personnel hygiene; raw material quality and traceability; processing practices; products and quality system audit.

Thailand's Experiences with HACCP

The new regulations with regard to quality control and assurance that have been adopted by major importing countries are based on the HACCP principle. They make the entrepreneur (processor, trader) fully responsible for the quality of his product All fish products sold to markets adopting this approach must come from plants with a HACCP plan. The investments needed to bring a fish processing plant up to the standards of a HACCP plan are substantial, and many companies, especially in developing countries, feel that this new regulatory requirement on fishery products is de facto a non-tariff measure against value-added products originating from developing countries.

In 1991, Thailand's DOF introduced a voluntary HACCP fish inspection program, involving pilot HACCP implementation by the industry, review of inspection procedures and training for inspectors and industry. Generic HACCP plans have been developed for major commodities, through workshops and working groups with the industry. Guidelines for development of documented HACCP programs and quality manuals have been provided and updated to meet with international guidelines and importing countries requirements. Close monitoring of the processing industry's performance in the HACCP program has been carried out by inspection of facilities, control at critical control points, record review and quality program verification. Implementation by the industry is classified into three stages: initial stage, development stage and fully implemented. In 1996, the program became mandatory for approved fish processors under DOF's jurisdiction.

To date, other food industries including poultry, milk, vegetables and fruit products have started implementing HACCP. HACCP audit for these products are performed by a range of government agencies and institutes such as Department of Livestock Development, Food and Drug Administration, Thai Industrial Standard Institute and the National Food Institute. In 2000, DOF approved 201 fish processors for hygiene and HACCP.

HACCP Approaches

The Department of Fisheries HACCP program focuses on product safety. The program is comprehensive, aiming to cover production, processing, input materials, products and personnel at critical control points. In many cases what the program demands is already being done; it can be described as a formulation of Good Manufacturing Practices. The processor must have in place basic sanitation, hygiene control and GMPs as a prerequisite to joining the program. Each processing establishment must develop a HACCP plan appropriate to their processing practice, hygiene and sanitation conditions. The processor must identify hazards associated with the products and processing environment. Hazard analysis should be conducted extensively. It is required that both the HACCP plan and the prerequisite program be documented. Guidelines for program development and documentation are also provided and handbook are available to industry in local language.

Role of the Department of Fisheries

DOF has established rules for HACCP implementation to be applied by any business seeking DOF approval. The Department has also issued guidelines for HACCP program development and documentation, and provides industry training on ad hoc basis.

DOF assesses the HACCP programs of processing plants in three ways. First, it verifies the design and appropriateness of the documented HACCP program to the processing conditions of the establishment. Second, it conducts independent inspections of products and facilities to evaluate the adequacy of the prerequisite program. Third, it audits the processors' HACCP and related activities. This latter method relies heavily on the audit of crical control point (CCP) activities and the related documents and records. The result of these three types inspections taken together will determine how effectively the plant's HACCP program is operating and this, in turn, will determine the frequency of regular inspections of the plant and its products.

The most important activity for successful implementation of HACCP is training for industries at an early stage of development. From 1991 to 1997, training for the fish processing industry has included the principles and application of HACCP. Since 1998, DOF's training focus has been on HACCP audits and advanced applications of HACCP. Various government agencies, universities and private HACCP consulting firms currently offer training on HACCP. DOF has also been focusing on developing materials in the areas of policy and procedures, guidelines, and criteria for assessment, with publications in the following areas: policy and procedures on HACCP, and guidelines on HACCP documentation, on the assessment process and on hazards and control and allowance limits or process criteria.

DOF develops HACCP audit policy and procedures for the field inspectors, and trains them in HACCP verification or HACCP system audits. It also holds harmonization meetings among regional inspectors to ensure consistency and competency. Inspectors are also offered ISO 9000 Lead Assessor Training, to build up their audit skills.

Role of Industry

Each firm must institute a prerequisite program and a HACCP program. They must also verify that regulatory requirements are being met. For each critical control point, the company must analyze the hazards and establish preventive measures, monitoring procedures, critical limits, and corrective action and also identify verification procedures. Most importantly, a system of recordkeeping must be established to indicate activities done, instances of non-compliance found, and corrective actions and verification taken.

Implementation Problems Faced by Industry

Financial Costs

The likely costs of undertaking a HACCP program need to be considered at an early stage. In practice, the main costs for Thai businesses have been in the following areas: upgrading prerequisite systems (the major source of cost), training of personnel, consultancies, external audits and setting up and maintaining documentation systems. These problems are serious for small-scale and traditional products processors.

Lack of Technical or Trained Personnel

Although the industry has experience in processing, science-based knowledge is still lacking and/or overlooked in many cases. Technical personnel is vital for all HACCP activities, in particular for conducting hazard analysis specific to process and products, for performing monitoring and audit activities and for determining and validating critical limits. The lack of in-house personnel able to carry out these tasks has resulted in the use of generic models available from government agencies, consultants or importers.

DOF has attempted to alleviate these problems through industry training (as noted above) and through guidance during the inspection process. The roles of DOF in this context include clearly explaining health and safety standards and guidelines used as references for the inspection; providing references conducive to the implementation of HACCP; providing detailed explanations of the assessment process (nature of problems and objective evidence used to determine non-compliance, but *not* advice on how to correct the non-compliance, which would run contrary to DOF's need for independence – see below); confirming industry understanding of HACCP; and encouraging the application of all 7 principles of HACCP

Differences in Agency Requirements
A particular problem facing businesses exporting to a range of markets is that they face different requirements and competing HACCP models from the various national administrations. There is, moreover, a constant stream of modifications as national regulations evolve. The problem of multiple and moving standards places a particular responsibility on government. DOF works closely with industry in defining the common minimum requirements for a HACCP system which will meet the main requirements of the company's export markets. Some companies have then developed a basic HACCP plan, which, once implemented, they have then gradually developed to meet particular national statutory requirements when necessary. Regular review, often in consultation with DOF, is required to keep up with developments in differing national jurisdictions.

Insufficient Audits of HACCP Systems
Since the first companies started to implement HACCP systems in 1996, many have not yet had the opportunity to conduct their first full internal audit. In some cases, firms have been slow to do so because they are unfamiliar with the concept. Many tend to delay auditing because they are concentrating on day-to-day production issues and ensuring that their HACCP systems are operating smoothly.

DOF has encouraged all businesses implementing HACCP systems to undertake an annual internal audit. When support and encouragement is offered, most firms try to do so. The few that resist altogether tend to be firms used to dealing with safety or quality problems reactively in response to customer complaints, rather than by analyzing their processes to anticipate problems and identify improvements. Such firms typically wait for an official inspection to pick up any problems. This type of firm has had the most difficulties in implementing HACCP successfully.

Many businesses lack the resources to fund an audit by external experts, and must rely on appointing an internal audit team. Because auditing is still not widespread, support from DOF has proved essential for many companies. The Department is able to recommend accredited courses for internal auditing. Given the pressures in dealing with day-to-day issues, it is easy for audits to slip and, therefore, particularly important to set a deadline for training auditors, planning and conducting the audit, and providing a written report.

Companies need to be confident in their HACCP systems, and to have audited them for themselves, because customer and regulatory audits can sometimes be misleading.

DOF has developed an audit procedure which takes into account businesses' particular circumstances. This entails making the reference standards and guidelines for a regulatory audit available, and agreeing on the scope and schedule of the audit in advance. Some companies, unfamiliar with the role of an audit, have taken a defensive attitude, and avoided providing information where they felt they might be weak. The Department has tried to educate

companies about the purpose and value of an audit in identifying improvements for the mutual benefit of business and regulator.

Common issues raised by audits include the poor quality of prerequisite systems, particularly in hygiene and sanitation; the inadequacy of hazard analysis; inappropriate selection of critical control points; inadequate validation of critical limits; poor monitoring methods and infrequency of monitoring; ineffectiveness of monitoring procedures; failure to take corrective action when required; and deficiencies in the company's own audit procedures.

Maintaining the System

Setting up and operating a HACCP system in the first year has proven to be a major challenge for many companies. A newer challenge is keeping HACCP systems up-to-date in subsequent years. Among the keys to success are internal and regulatory audits (which provide suggestions for improvement), regular review of customer complaints and the business's own records of safety and quality problems, a regular program of staff training, building up essential reference materials (e.g. on key hazards) and providing access to the web for the HACCP management team. Since HACCP implementation is still relatively new in Thailand, this is an area where both businesses and regulatory agencies are still building up experience and expertise.

Critical Limits and Validation

Misunderstanding and confusion often cause processors to adopt importing countries' standards as their critical limits within the production process, whereas these tend to be criteria for final product standards. In such cases, laboratory analysis of final products is unavoidable to demonstrate that critical limits have been met, even though this runs counter to the principles of HACCP. Moreover, critical limits are often not science-based, and lack validation to demonstrate that they do effectively eliminate the hazard or reduce it to an acceptable level. Validation is especially a problem for small-scale processors, who have difficulty running their own challenge tests. DOF has been able to provide some support in the use of government or university research laboratories for this purpose. However, there remain gaps in appropriate guidance on validation procedures for critical limits, and this is an area where the Department itself is still developing the appropriate technical knowledge and skills.

Documentation

Creating and managing HACCP documentation is an obvious area where businesses face difficulties. They usually err by creating too much documentation of poor quality. Fisheries Department staff responsible for regulatory audits make comments on draft documentation, and a document rating report is used to ensure consistency. Many of the problems are the result of confusion and misunderstanding of HACCP principles and poor individual document design. The DOF guidelines for HACCP documentation are intended to assist the industry to include and describe the necessary documents.

Language

Language is a major challenge to the successful implementation of HACCP in non-English-speaking countries. Even in English, translating HACCP concepts and procedures into terms that technicians and workers at the plant level can cope with is formidable enough. Translation into a foreign language can result in confusing the meaning of even the basic HACCP terms such as "hazard". A term like "newly-emerged pathogens" did not have any local language name and could not be precisely translated, making it difficult to distinguish them from other pathogens and explain their nature and dangers.

The demands of translation are compounded by the fact that, to meet export customer and market requirements, HACCP plans need to be in English whereas, to be comprehensible to company staff, they need also to be written in Thai. These problems have been resolved in part by government translation of key HACCP documentation which has then been made available to companies, often as part of initial training sessions on HACCP principles. These have provided the raw materials for developing HACCP plans in Thai. A basic error made by a number of companies was to try to undertake some of the translation works themselves, using in-house expertise, often located within the marketing department. These attempts were usually unsuccessful, resulting in inaccurate and misleading material.

Problems Faces by Regulatory Agencies

Staff Qualifications

It is easy to forget that HACCP is a new concept for regulatory agencies and their staff, too. Inspectors can make the wrong judgments, which can be successfully challenged by a business. Many official inspection regimes and their staff are still making the transition from the traditional emphasis on sampling and laboratory testing of raw materials and products and hygiene/GMP inspection to auditing the effectiveness of HACCP management. In addition, regulatory staff will inevitably have a more theoretical approach to HACCP, based on generic models for a particular sector, making some of their recommendations inappropriate and impractical for a particular business. If companies are not aware of these limitations, they may passively accept changes which complicate rather than improve a HACCP system.

Limited Resources

The number of regulatory staff is also limited, as government will not recruit more people, while HACCP audit and related activities are rather demanding. Financial support for the program has been a particular problem since the onset of the economic crisis in 1997.

One consequence of this has been DOF's decision to limit industry training to specific issues rather than providing training on general issues such as HACCP principles and audit, given that other government agencies are competent to offer such training. Furthermore, different government agencies provide HACCP audit services to the industry, so DOF can focus on audits for approved establishments. Audit results of other government agencies are accepted by DOF, to reduce duplication.

Avoiding Conflict of Interest

Since HACCP is new to both government and industry, the government has the burden of promoting its application as well as ensuring compliance and food safety. In most cases industry will request technical guidance, especially small firms with limited technical resources and understanding. DOF does have a research institute emphasizing research and development work, while its inspection service focuses on regulatory guidance and inspection activities, and should avoid giving technical advice to individual firms. However, giving advice to the small firms is unavoidable.

Non-HACCP Regulations

Many countries have regulations that contradict HACCP principles, especially those that require product testing (e.g. lot-by-lot testing), or determination of non-safety related issues.

Harmonisation of Procedures Among Different Agencies
At the national level, with many agencies providing services, harmonization of policy and procedures are necessary to minimize industry confusion.

Regulatory Support
HACCP is often only required for export, particularly for processed products. There is only limited legal support to enforce HACCP for products for domestic market and at other levels in the food chain (especially primary production).

Why Rejections Still Exist

Even though DOF has made major efforts to assure product safety and quality, both technical and non-technical problems remain in these areas. In particular, Thailand's fishery industry encounters environment-related problems (contamination by heavy metals and pollutants) and contamination by tropical indigenous bacteria in raw fresh and frozen fishery products.

To reduce these problems, application of hygiene and HACCP-based control starting at the primary level is vital. DOF is currently emphasizing primary industry hygiene, GMPs and control for safety using HACCP concepts. A nationwide seafood safety program addressing each stage of the chain, from the water to marketing, including wild caught production areas, aquaculture farms, handling, distribution and storage, processing and end-products is being expanded to identify the distribution and pathogenicity of Vibrio and other pathogens in the coastal areas of Thailand and to reduce the incidence and level of contamination in fish and fishery products originating in Thailand. Monitoring for heavy metal in seafood is continuing. Cooperation of industry, state and private enterprises involved in production, handling, processing and export is being strengthened.

In-depth research and cooperation with importing countries and international organizations such as the FAO and the WHO are planned on microbiological and chemical risk assessment. It is hope that through these efforts, the problems can be minimized and that reasonable, acceptable levels of risk for raw, fresh and frozen fishery products can be established and recognized by key import authorities.

Conclusions: The Future of HACCP

Even though the fishery industry is making headway with the application of HACCP, it is recognized that the past five years have been a learning experience for both industry and regulators.

If there is a single factor determining whether a firm will implement HACCP successfully, it is its management culture, notably management's capacity to embrace the philosophy underlying the HACCP concept. This is, perhaps, the biggest single challenge facing a business considering HACCP implementation. HACCP systems require staff at all levels to be willing to take more responsibility for and control of the business's operations, rather than relying on others to identify problems and improvements, whether they be customers, regulators or more senior managers.

The success of HACCP implementation in the Thai fisheries industry has also been dependent on close cooperation between industry and government.

A number of improvements still need to be made. First, HACCP systems are still concentrated in processing. So far they have not been extended further along the supply chain, particularly in marine capture and aquaculture. Second, HACCP take-up amongst smaller businesses and domestic producers remains poor. Third, government needs to keep abreast of changes in HACCP regulations and standards internationally, and to exert pressure for greater standardization. Forth, improved practical guidelines for hazard analysis are needed. Fifth, inspectors need to gain more expertise in documentation review. And finally, there needs to be more research on validation of critical limits.

Extension to Domestic Suppliers

In Thailand, HACCP application is mandatory for export fishery and livestock products to specific markets only. As fishery products are the main protein source for the Thai people, improving the safety and quality of fish and fishery products from primary production to processing will directly affect the welfare of domestic consumers. Most export firms produce products for local market as well. The Ministry of Public Health has initiated a stepwise mandatory program for food safety control. In the initial stages, GMP is mandatory for food processors, in preparation for mandatory HACCP. Some domestic fish processors have already voluntarily implemented HACCP.

R&D Needs

Further research and development is needed for a successful implementation of HACCP and for a better control of fish safety. DOF has emphasized research on tropical fish species, tropical indigenous bacteria and pathogens, effect of process on reduction of pathogens and risk assessment projects. This will serve the hazard identification and determination of significance and control measures and establishment of critical limits. HACCP can become more successful only if the concepts are applied to the whole supply chain, including consumer education.

However, problems will remain, as microbiological hazard can not be eliminated unless products receive appropriate heat processing. This poses problems in international trade, because many importing countries do not accept *any* microbiological contamination, whether or not the strains are pathogenic. On these issues, science-based information and consultations between tropical developing countries and major importers are urgent. Scientific research and information from research institutes and international organizations can support the developing countries in this area. Research cooperation among developing countries and institutes in developing countries and international organizations is vital for ensuring trading of safe and high quality fish products.

Table I. Fish Products Safety and Control Responsibilities within the Thai Department of Fisheries

Responsibility	Division or Institute
• Monitoring of sanitary conditions and environment conditions of waters of harvesting and aquaculture areas	Marine Fisheries Coastal Aquaculture Freshwater Fisheries Fishery Environmental
• Bivalve mollusc production and sanitation program	Marine Fisheries Coastal Aquaculture Fishery Environmental
• Aquaculture Drug and Chemical Monitoring Program • Aquaculture practices	Coastal Aquaculture Freshwater Fisheries
• Disease Control	Aquatic Animal Health Research Institute Marine Fisheries Coastal Aquaculture Freshwater Fisheries
• Aquaculture Feed Control	Feed Quality Control and Development Division
• Inspection of fish handling and processing establishment • Approval of fish processing establishment for export • Certification Services	Fish Inspection and Quality Control Division
• Research (fish technology, quality, handling and processing)	Fishery Technological Development Institute