

It is therefore important to conduct studies that aim to investigate and mitigate the impacts of water barrier construction and operation to the population of important aquatic species in the ecosystems. Conservation and improvement of habitats favorable for the aquatic species such as establishment of fish conservation areas or fishery *refugia*, artificial habitat improvement, deployment of materials and shelters to create nursery and feeding grounds for juvenile and broodstock, could also be undertaken to enhance the populations of various aquatic species. In addition to habitat conservation and rehabilitation, stock enhancement activities could be practiced to improve fish yield particularly for areas where the fishery resources had deteriorated and fallen below the ecosystems' carrying capacity. In an ideal case, stocking should consider the use of indigenous species or low trophic species, with seeds produced specifically for the purpose of stock enhancement.

In using seeds produced from aquaculture for stock enhancement, caution should be made as this approach could create negative impacts on the biodiversity of the ecosystem. Specifically in closed ecosystems such as lakes and reservoirs, the impacts from stocking of hatchery-bred seeds are localized and thus, may not be very substantial. However, the release of hatchery-bred seeds into natural open habitats could result in irreversible damage to the broad ecosystems, which could include loss of biodiversity where exotic species could dominate over the native species or loss of genetic diversity of the species. In general, releasing hatchery-bred seeds should be undertaken in a precautionary manner. Since the nature of inland fisheries and ecosystems are very diverse and could be different from place to place, different approaches should be considered in coming up with appropriate conservation and management measures for particular areas, taking into account the resources as well as the relevant social and economic dimensions. In addition, appropriate indicators should also be identified and used to evaluate the success of stock release and enhancement programs.

Furthermore, considering the wide-range of stakeholders in the fishery and non-fishery sectors involved in the utilization of inland fishery resources and the ecosystems, integrated water resources management approach as well as enhanced coordination and communication among the various agencies sharing the same water resources should be promoted. This could prevent if not minimize the impacts of one to the other sector, while the importance of inland fisheries should be made known and publicized particularly for policy makers and relevant management authorities in order to appropriately mainstream the requirements of inland fisheries into the overall development plan of the countries. Data collection on inland fisheries should be enhanced in order to

appropriately value the inland aquatic resources. Routine and non-routine data and information as well as data collected through non-conventional methods such as fish consumption survey, and local knowledge should also be fully utilized for this purpose.

Responsible fishing technologies and practices should also be promoted, with due consideration given to the sustainable utilization of the resources especially the highly abundant but short life-cycle species, and top predator species. To effectively harvest these species without creating impacts to the other non-targeted species, selective fishing gears and practices should be developed and investigated as to their effectiveness and efficiency. In this regard, consideration must be given to relevant ecological and biological parameters, and traditional knowledge of local fishers in harvesting and utilization of the species. In order to reduce pressure to the inland fishery resources and enhance the livelihoods of fishers and the fishing communities, alternative fishery-related livelihoods could also be introduced such as production of value-added products from the catch, promotion of eco-tourism and recreational fishing, and aquaculture including rice-fish culture.

In addition, participatory approach should be considered and promoted for the effective management of inland fisheries. This could include the concepts of co-management, community-based fisheries management, and rights-based fisheries as appropriate as well as the Ecosystem Approach to Fisheries (EAF). Where appropriate, such schemes as granting of fishing rights, application of fishery licensing and registration, could also be promoted to replace open access with limited access to fisheries to ensure the effectiveness of the management measures.

Activities that aim to enhance the awareness of fishers and other resource users of the inland water ecosystems should also be undertaken, focusing on the need to conserve and manage the resources, adopt responsible practices. Moreover, efforts should be exerted to enhance the involvement and participation of fishers in community activities related to the resource conservation and management as well as in MCS activities, and ensure the long-term sustainable utilization of the inland fishery resources.

### 3. UTILIZATION OF FISHERY RESOURCES

Fishing activities, fish utilization and post-harvest technology in the Southeast Asian region are extremely varied. While fishing activities could range from commercial to small-scale and from marine to inland waters, and using modern and traditional capture techniques, fish utilization and post-harvest technology

depend much on the capability of a certain country, its development and on how and where the fish species are caught and processed. For marine capture fisheries in the region, most of the fish caught is landed, and for most part, discards are negligible. This pattern of catch retention is different from other areas of the world which could be due to technological changes as well as economic and marketing pressures particular to the Southeast Asian region. High value fish is well looked after in this region but low-value fish is not. Although all the fish landed is utilized but some volumes of low-value fish catch may contain juvenile fish of high-value species. In addition, some high-value fishes could be reduced to low-value fishes because of poor handling onboard the fishing vessels.

Significant improvements in post-harvest technology of fish as food have taken place over the past decades, which is notable in major fish producing and exporting countries. Improved facilities include cold storages and ice plants as well as infrastructures for fish handling distribution and marketing, and techniques for improved fish handling onboard to maintain the quality of the catch while at sea. Modern fish processing factories have been established in many countries mainly for processing high-value and high-quality fish and crustaceans including tuna and shrimps as frozen, filleted or canned products, with increasing volume destined for export. Concurrently, many new fish products have been developed mainly for export although certain quantities are available in local supermarkets in urban centers such as fish balls, fish cakes, imitation crab sticks, breaded squid rings, breaded fish or shrimp, fish crackers, and other products (Goh and Yeap, 2007; Goh *et al.*, 2008).

In the last two decades, the utilization and processing of fish products have significantly diversified, particularly into high-value fresh and processed products, fuelled by the changing consumer tastes and advances in technology, packaging, logistics and transport. Improved processing technology generates higher yields and results in a more lucrative products derived from the available raw materials from fish for human consumption. Nonetheless, some of these developments have also been driven by the demand in domestic retail industry or by a shift in cultured species. Improved processing technologies are also important in the utilization of fish wastes generated by the fish-processing industry.

Most of these improvements have revolved around high-value or “luxury” fish and an industrialized fishery or larger aquaculture enterprises, and account for a small portion of fish used for food in the region. Food fish, especially in rural areas, may come from small-scale fisheries, aquaculture and inland fisheries. In the Southeast Asian region, over 50% of fish is consumed fresh and/or processed into high-value products, 8% to 65% (mostly

between 30 and 45%) are converted into traditional products, and another varying percentage is used for direct feeds for livestock or high-value species aquaculture or indirect feeds by converting fish to fishmeal or fish oil. These traditional labor-intensive fish-processing methods provide livelihood support to large numbers of people in coastal or inland water areas in many developing countries. For this reason, such methods are structured to promote rural development and poverty alleviation and are likely to continue to be important components in rural economies (Kato, 2009).

Improvements in processing, packaging, and distribution have facilitated the movement of fish products from local consumption to international markets (Yeap and Chung, 2011). The role of fish trade varies among the countries and represents a significant source of foreign currency earnings, in addition to the sectors’ role in employment, income generation and food security. However, it has become imperative for the countries to address the issues related to the requirements of consumers and importing countries in trading of fish and fishery products, which are getting more and more stringent. In the last decades, changes in global dietary patterns had become very notable with a shift towards more protein. This is brought about by rising living standards, population growth, rapid urbanization, increased trade and transformations in food distribution. People in urban areas tend to eat out more frequently, and large quantities of fast and convenient foods are purchased. Supermarkets are also emerging as major force, particularly in developing countries offering consumers a wide choice of safe food with reduced seasonal fluctuation and availability. Supermarkets are not only targeting the higher-income consumers but also lower- and middle-income clients. There is also a greater focus on marketing with producers and retailers attempting to anticipate market expectations in terms of quality, safety standards, variety, and value addition, especially for the more affluent markets. It is in this aspect that consumers increasingly require high standards of food freshness, diversity, convenience and safety, including quality assurances such as traceability, packaging requirements and processing controls.

### **3.1 Status, Issues and Concerns**

#### **3.1.1 Onboard Post-harvest Technologies**

Poor handling of catch onboard fishing vessels results in poor quality raw materials, particularly for low-value fishes. Currently, there are new requirements for exporting fish and fishery products that need to be complied with, particularly to the EU such as the requirements for traceability of the products to ensure that fishes are not caught by IUU fishing, as well as fulfill the requirements for food/fish safety. In addition, it has also become imperative

for countries to address the issue of by-catch management and reduction of discards. As noted earlier, most fish caught are utilized in the region but unfortunately, many fisheries in the region also capture ecologically important species and juveniles of economically valuable species. Many studies have been conducted to minimize post-harvest losses but issues other than the actual quantity of catch should also be considered as equally important, especially the socio-economic impacts of utilizing by-catch instead of decreasing its capture. Furthermore, the quality and utilization of the catch should be improved, especially the small fishes caught by trawl that turn into mush when landed and which could only be useful as aquafeeds, and small fishes caught by gillnet, by converting such small fishes into high-value traditional products.

In fact, due to supply pressure and the expansion of aquaculture, low-value fishes although giving low economic returns per fish could provide higher returns per volume landed, since low-value fish has a ready market in aquaculture areas and can be sold easily in many localities at higher prices. As reported, the money derived from low-value fishes is one of the main reasons why many fishing vessels continue to be economically viable and remain stable in the fishing industry. Even if the fishery catch comes from short-lived highly productive species, such fisheries could still be sustainable, except when the catches contain large amount of juveniles of economically important species. However, given the many conflicting uses of low-value fish, it is difficult to envisage an appropriate management system that could optimize the utilization of low-value fish supply for human consumption and livestock/aquaculture uses without giving due consideration to the catch of juvenile fish.

Nonetheless, considerable amount of fish that could be marketed as higher value fish are landed as lower value fish because of poor handling on-board fishing vessels. As reported in Vietnam, such volume could come to about 20-60% from offshore trawlers because of poor storage onboard the vessels. It is obvious that with high demand and good economic gain from low-value fish, many fishers could forgo the importance of and need for careful handling and chilling onboard fishing vessels.

Even if it would be theoretically possible to improve the products, lack of chilling equipment and necessary onshore infrastructures limit the small-scale and artisanal fishing vessels from accessing the high-value urban or export markets. Hence, it is not always easy for the vessels to land high quality products for the human consumption market without improving the infrastructures and such approach would entail substantial costs. However, with proper handling on-board fishing vessels, landing and supply of quality fish to local markets would still be possible, especially where fishing grounds are close to ports. On

the other hand, industrial vessels with better-trained crew and proper equipment on-board should be better in terms of ensuring high quality catch, but the economic gains of doing so must outweigh the gains of landing fish on low-value markets. As long as the low-value fish market is vibrant, fishers will not exert much effort to improve the overall quality of their landed catch. Thus, as far as the quality of low-value fish destined for reduction is concerned, the very low quality of raw materials would result in low quality of the fishmeal produced.

### **3.1.2 Onshore Post-harvest Technologies**

Advanced post-harvest technologies have always existed in many places and countries, particularly for export oriented products and products destined for urban markets. Nevertheless, for small-scale fisheries, trading in inland fish and fishery products has always been constrained by lack of infrastructures especially in terms of hygienic landing centers, roads, electric power supply, and potable water as well as facilities needed to establish and operate cold chains including ice plants, cold rooms, and refrigerated trucks, that often results in high post-harvest losses, especially in the aspect of quality.

Small-scale fisheries contribute more than one-half of the world's marine and inland fish catch, and nearly all of this is used for direct human consumption. This sub-sector employs more than 90% of the world's fishers and supports about 3 times the number of fishers in jobs associated with fish processing, distribution and marketing, and almost one-half of such workers are women. Moreover, on the average, each jobholder provides three dependant- or family member-ancillary workers. FAO studies have indicated that fish landed for food provides 1.5 man-years/MT of landed weight. Nonetheless, in spite of the contributions of fisheries to the economy, poverty remains widespread for millions of fishing people, thus the reasons which are complex must be tackled in many fronts including strengthening the capacity of those working in various jobs related to post-harvest and marketing.

Inland fisheries could be special case because being extremely small-scale, inland fisheries are usually very individual labor intensive providing small incomes. However, due to the large numbers of people involved, this sub-sector provides significant contribution to rural food security and income generation, and diverse set of livelihood benefits related to food security and poverty alleviation especially to the poorest households in the rural sector. Inland fishery activities employ labor-intensive harvesting, processing and distribution technologies conducted full-time or part-time, mostly supplying fish and fishery products to local and domestic markets as well as for subsistence home consumption. It has been recorded that there are more people involved in inland

fisheries than marine fisheries, of which more than 50% are women. Since inland fishers catch less fish per individual than the marine fishers, inland fishery sector is therefore a predominantly component of a mixed livelihoods strategy. As a result, most of the catch goes for domestic consumption and most of the processing is done in small-scale or medium-scale units, where handling and hygienic practices are often inadequate. Owing to the remoteness and isolated nature of many inland fishing communities and the high abundance of fish on a seasonal basis, large amounts of fish from inland capture are cured, and in the Southeast Asian region, a significant portion of the catch from inland fisheries goes into fishery products such as fish sauce and fish paste. In many cases however, food safety issues become a serious concern because the presence of parasites in raw or slightly fermented fish or fish products, or in products that have been improperly frozen, put the well-being of the consumers at risk.

The stakeholders should therefore be made well aware that live parasites could rarely stay alive in well-fermented fish, and parasites do not usually survive when fish are properly frozen. Addressing the above deficiencies requires more capacity building and training in good hygienic practices, focusing more efforts on research work such as for example in systematic loss assessment to develop sustainable loss-reduction strategies, and aspects related to live fish handling, and improved processing including value addition. Many of the aforementioned facts also apply to marine small-scale fisheries, particularly in countries that comprise large numbers of islands. Even if there are commercial and industrial inland and marine fisheries as well as modern small-scale fisheries, these sub-sectors should be made economically efficient especially in providing high-value products, that are meant for international markets. Such scheme would often require specialized catch preservation and distribution, and access to markets.

In all aspects therefore, the promotion of value-added technologies and improved traditional products should be intensified to foster demand, obtain higher economic returns and more fish and fishery products for human consumption, which could also include new non-traditional products. It is also imperative to boost improved packaging or marketing of traditional products to enable such fishery products to gain access to high-end retail outlets and export markets. A number of activities needs to be done to alleviate the situation, including the need to encourage governments through their respective national development activities to improve fishery infrastructures where appropriate. There is also the need to develop guidelines for infrastructure requirements of small-scale fisheries especially in landing areas. Overall, efforts of the governments should give more focus on the development

of guidelines for handling live fish, conduct of baseline studies on post-harvest losses, continued work on the development of value-added products particularly for low-value fish using low-cost methods as appropriate, investigating the quality and safety of freshwater fish, conduct of training programs on post-harvest technology which could be used by extension workers, and conduct of training for both government and industry officers and workers on critical aspects of handling, processing, distribution and marketing in the fish supply chain, and provision of cold chain at all levels.

### ***3.1.3 Utilization of New Fishery Resources and Waste Products***

Post-harvest technological development has changed the utilization patterns practiced in the past especially during the surimi era, where new products which are equally important for food security in the future could now be developed. However, efforts are still necessary on waste reduction and recovery, taking into consideration the environmental impact of fish waste products. R&D activities could emphasize on the aspects of increasing by-product utilization for human consumption, alternative use of waste products for bio-fuels, utilization of wastewater from production sources including from on-board facilities, and pharmacological use of by-products. Moreover, increased utilization of under-utilized species, by-products, and recovery of wastes processing plants should also be explored through continued research on optimum utilization of under-utilized species. Furthermore, studies on waste reduction and recovery, and environmental impact of fish waste products, and on by-product utilization, should be pursued.

### ***3.1.4 Traditional Products and Post-harvest Technologies***

Traditional fish processing is part of a “dual economy” in which traditional small-scale activities co-exist with the modern industrialized sub-sector. Traditional industry is characterized by the application of low-level technology, producing relatively poor quality and low-value products. Modern processing which includes proper icing of fish and post-harvest handling had been developed in response to the growing export market and rising living standards, especially in urban communities and markets, with the technology which generally caters to the demand of importing countries. Generally, traditional processes require minimal investments but products turned-over should meet most of the domestic food needs. Hence, the poor sector of society usually undertakes these activities, many of which are women. Value adding in this aspect tends to be very small and such products are usually inexpensive but are unable to enter world markets.

Nevertheless, traditional products that are of good quality would be able to access the urban and international markets, and command very high prices. Among the major problems in traditional products include poor quality and limited supply of raw materials because of the increasing competition for alternative use of raw materials. The other problems are poor infrastructure and insufficient knowledge in processing and preservation technologies, as well in packaging the products and the high costs involved in packaging. However, the biggest problem could be the large numbers of traditional processors that makes it difficult to deal with all of them on an individual basis. For example, Indonesia alone turns over 6.4 million MT/year of fishery products and exports 0.86 million MT/year (mostly shrimp, tuna, and seaweeds), through some 422 export processing plants. Another 59,345 registered traditional processing units take care of the rest of the capture fishery products.

In some countries, fish processing centers or zones have been established to facilitate the acquisition of the necessary equipment, and to ensure that human resource development would be in place for packaging and other relevant aspects in processing. In order to improve the technological problems related to traditional products, work on diversification of raw materials should be intensified to assess the different types of raw materials that can be used for the same traditional products as well as on different materials to generate 'improved' traditional products. There is also a need to enhance community cooperation in producing raw materials and endemic or indigenous ingredients. Training programs on handling, processing, distribution and marketing of traditional products at all levels should be conducted. The appropriate methods of reducing insect infestations should be explored including the use of biological insecticides, and the use of non-food grade additives/preservatives. The development of traditional and value-added products particularly using low-cost methods should be investigated as well as improvement of the efficiency of processing equipment and facilities, and promotion of the use of alternative energy sources. Finally, research on traditional and/or indigenous materials for packaging and use of modern technology to reduce the cost of packaging and better preserve the products should be conducted. Governments should be encouraged to establish fish processing centers to reduce the costs of processing and packaging individual traditional products.

### **3.1.5 Post-harvest Technologies and Livelihoods**

A very proper place to start discussion on this concern is to know the definition of food security. The most recognized definition is the one endorsed by the International Conference on Nutrition (Rome, December 1992) which states that it is "a state of affairs where all people at all

times have access to safe and nutritious food to maintain a healthy and active life". It is generally recognized that the root cause of food insecurity is poverty, where people who are susceptible to food insecurity are predominantly those living in rural areas, especially in fishing and fish farming communities. In Southeast Asia, majority of the fisherfolks who are the primary producers of food fish, are still underprivileged and live a very poor life. Eradication of poverty and the maintenance of food security to ensure food for all are now being given high priority by almost all of the governments of the region.

Trade is innate to fisheries, so that the moment a fisher has more than three or four fish for personal consumption, there is pressure to exchange the 'surplus' for money or other goods. Food security from fish has a direct and indirect dimension to it. Fish as food on the plate, that is direct while fish as source of livelihood and income, is indirect. Therefore, in assessing the food security implications of fish trade and processing, these dimensions should be looked at considering the wide diversity of fish. For example, some commodities like tuna and shrimps are for 'luxury consumption' while others like anchovies and other low-value fish are for 'nutritional consumption'. For direct food security issues, the latter should be taken into consideration. Fish contributes importantly to direct nutritional food security in countries where staple crop is particularly low in protein. Even a small quantity of fish can contribute to increasing staple consumption by improving its overall palatability and adding micronutrients to its nutritive value. However, the need for food does not adequately translate fish into food security because this need must be backed by effective demand in the form of purchasing power, a factor which is lacking among many potential consumers of fish in developing countries.

Moreover, even if fish were accessible and affordable, there are other factors that limit food security. People living in adverse environmental surroundings that give rise to poor health conditions cannot absorb such rich proteins. Therefore, people must have the ability to always access, afford and absorb the food they wish to eat, the three basic conditions that must be satisfied in order to achieve genuine direct food security.

The relationship between fish trade and improved fish products and food security is more complex than being thought of and is not necessarily always positive. Production of fish for the high value market can substantially enhance the incomes of poor fishers, and also raises their purchasing power to attain food security. However, in a country where fish is an integral part of the culturally conditioned diet of the domestic population, fish product improvement could reduce the direct food security of the poor domestic consumers. In such cases,

the demand is likely related to the inelastic price because if supply is less than the effective demand by even a very small margin, the price of fish would sharply increase. This can lead to undesirable nutritional consequences especially for the poor fish consumers. Therefore, such product improvements would still have an adverse impact on food security for this segment of the population.

There are several issues concerning the production and use of low-value fish in relation to food security. Firstly, the continued expansion of aquaculture in the Southeast Asian region which is dependent on the low-value fish from capture fisheries for feeds. Although the use of low-value fish as direct feeds or for the production of fishmeal for aquaculture is economically viable, which is reflected in the increasing prices of low-value fish, there is also an increasing conflict between the use of low-value fish for feeds and for human consumption. This demand from aquaculture makes the price of low-value fish higher than the price that traditional fish processors could afford in order to generate processed products that many consumers can afford. Even if it has been argued that it would be more efficient and ethical to divert more of the limited supply of low-value fish for human food through value-adding, because the low-value fish as food for domestic consumers is more appropriate than supplying fishmeal plants for export, the income oriented aquaculture industry has to produce high-value commodities for the export market to improve the economies of the countries. Meanwhile, improving the abilities of poor people to generate income can also increase food security especially that large numbers of people are employed in both fishing and aquaculture activities, and thus would eventually get the beneficial effects. However, most value-added products are directed for the higher income and not to the poor income groups where low-value fish was supposed to supply them with affordable fish for consumption.

Secondly, technological innovations, value-adding, and improving the quality of fish have always been beneficial to the peoples and the economies but such measures would require funding in order to get the much needed products, and in the end there would be winners and losers. As a whole, a country could benefit through earnings from export or by supplying more fish to the newly affluent urban population while the fisherfolk and those engaged in processing such new products would also gain some benefits. Value-adding creates employment especially to the young women who are engaged in these jobs and who are from poorer rural areas where other job opportunities are scarce, thus, these new jobs could enhance the food security of many people.

In some countries, a significant number of women earlier involved in fish processing for the domestic market have already been adversely affected since they could

no longer get fish as raw materials for their traditional processing activities because of their inability to pay for the high price offered to fishers by alternate processors. This results in loss of income and food security for these groups of women. Furthermore, the perspective of the general consumers on food security could be detrimental to the food security of poor consumers. Many consumers perceive that as export trade and value adding increases, the volume of fish available for local consumption would decrease, which could be valid. However, contextualizing this within the real situation of a country, could give different scenarios with different winners and losers, and thus, there is a need to analyze further such perception.

Lastly, it is a fact that improved quality, technological innovations, value-adding, national marketing systems, and aquaculture as well as regional and international trade, are bound to increase in the future. Although such situation could contribute greatly to food security, but just the same the gains could be skewed to the left or to the right. In one way, these could enhance food security and on the other, could reduce food security at the same instant for different segments of the population. Therefore, it is only through poverty reduction programs that the situation of the poor segments of the society could be improved. Many governments and organizations have been undertaking programs to activate rural fisheries communities and improve their economic status. SEAFDEC for example, had introduced an approach through a program known as "One Village, One Fisheries Product" (FOVOP), which called for fisheries communities to identify a unique and differentiated traditional product, and develop a marketing strategy for such product. However, it was established that such programs would not work without technical assistance, infrastructure support, and in some cases financial incentives. Other management systems such as the ecosystem approach to fisheries (EAF) has post-harvest dimensions incorporated into the human aspects of the system and plays a role in determining the economic "push" and "pull" mechanisms in fishing activities, and also in the social, economic and institutional aspects. Such factors should therefore be considered and should not be left out from any fishery management equation.

Addressing these issues would need a number of activities which could include many of the earlier recommendations as well as those related to marketing, namely: assessment of the marketing strategies that promote fresh and traditional fish products in urban communities; finding ways and means for rural communities to gain better market access for their products; promoting the FOVOP scheme, and developing products and marketing strategies for this scheme; establishment of a joint platform to improve international trade competitiveness of traditional products; harmonizing data collection and reporting systems for traditional products; and conduct of studies

on the distribution and marketing of fish and establishing the means of redistributing the benefits along the supply chain towards the primary producers.

Additionally, there is a need to improve the use of incentives/credit schemes to promote the industry and alleviate poverty by: promoting greater access to credit for post-harvest activities and greater support for the development of marketing cooperatives and/or the small and medium enterprises (SMEs), particularly in fishing communities as well as for FOVOP or similar schemes; evaluating the incentives that would foster demand for higher economic returns and more fish for human consumption; and investigating the ways and means for traditional processors to get better access to credit or micro-credit schemes. In essence, the governments should as much as possible, decide and take action to alleviate poverty and improve food security in their respective jurisdictions.

### **3.1.6 Post-harvest Quality, Safety and Control Systems**

Quality, safety and control systems are crucial to every aspect of fisheries from capture to consumption, and apply to government and industry catering to both domestic and export markets. The whole industry needs quality and safety management systems to operate, whether through intuitive knowledge or formal control system or something in-between. Governments generally operate fish inspection and control systems through relevant agencies to ensure that all products meet the export market requirements, but most agencies do not have much control over domestic production except those agencies that take charge of controlling the areas of supply to export processing plants.

Several government agencies including fisheries, health, commerce and trade, state, municipal, and local authorities are currently providing services related to the safety and quality of fish products. However, in some countries there is still lack of coordination among the relevant agencies, thereby creating confusion, and setting conflicting standards and carrying out duplicating roles because different procedures are applied in different areas of responsibilities of the different agencies.

Furthermore, importing countries are becoming more and more demanding in their requirements. In the beginning, importing countries require exporters to meet only the safety requirements under the World Trade Organization's Agreement on the Application of Sanitary and Phytosanitary Measures (SPS Agreement) through verification of industry's Hazard Analysis and Critical Control Point (HACCP) control systems, which can be audited by the concerned governments. While adapting to a new global trade environment, new emerging issues

with respect to import requirements have developed, which should be dealt with to enable the industry to access the export market, such as traceability and certification of products for safety, sustainability, combating IUU fisheries, social issues, and environmental responsiveness of products from sea, inland waters or from aquaculture. Additionally, there are other issues that should be addressed under the new requirements such as testing the waters and the products for contaminants, toxins, residuals or for genetically modified organisms (GMOs).

Meeting the requirements of the export market is also a food security issue considering that increased foreign exchange contributes to the welfare of the country and to all workers involved in the industry through income generation. In the ASEAN Economic Plan, all ASEAN food inspection agencies including fisheries would be harmonized by 2015, but would require more work on the technical aspects of harmonization, specifically in the harmonization and verification of laboratory testing methodologies, laboratory procedures and practices, and developing Good Laboratory Practices (GLP) in the Southeast Asian region. A system of proficiency testing for regional laboratories should be developed, while additional work is still necessary to harmonize procedures between inspection agencies in the region, and establish equivalency with inspection systems in importing countries. There are also other certification issues especially those related to Halal and organic products. Recently, such harmonization has been initiated under the ASEAN mechanism, although slowly, and addressing some of the foregoing concerns could support efforts in achieving the goal in a shorter time.

Safety of domestic fish products is vitally important to food security by ensuring that consumers eat safe products. During the last decade, much work has been done in adapting HACCP to SMEs that export traditional products and to develop improved operating practices for domestic SMEs like the Traditional Processing Establishments (TPEs) and Pre-Processing Establishments (PPEs) by incorporating Good Manufacturing Practices (GMP) and Standard Sanitary Operating Practices (SSOP). At this point of time, it is not yet practical to apply HACCP to these industries, but instead GMP/SSOP should be applied since it is a prerequisite to HACCP. Up till now, the implementation of GMP/SSOP is still inadequate in source suppliers, processors, and transporters due to high costs involved and lack of encouragement and support even if there is the need for its implementation to be fast-tracked. The aquaculture industry has also been confronted with problems due to the inability of small-scale producers to meet the quality requirements of foreign consumers.

Some other major issues concerning international trade in fishery products in the past biennium, and which continue to affect international trade include the introduction of

private standards such as those for environmental and social purposes which have been endorsed by major retailers; certification of aquaculture in general; concern of exporting countries about the impact on their fish exports due to the introduction in 2010 of new traceability requirements in EU markets; process and margins throughout the fisheries value chain; the need to enhance competitiveness of fish products compared with other food products; and perceived risks and benefits from fish consumption. For some products and in some countries, requirements for traceability systems do exist, because many of these systems are privately adopted and are not all-inclusive. However, there is a need for the varying systems to be harmonized within a country and in the Southeast Asian region. In view of the strengthening of the requirements of retailers for selling fish in developed countries, private standards and certification schemes in fisheries and aquaculture are becoming significant features in the international fish trade and marketing.

Nonetheless, the proliferation of these standards and schemes causes confusion on the part of consumers and producers, therefore, a mechanism for judging the quality of the schemes is necessary. Overall, traceability systems that could be applied to the whole supply chain for the region should be developed and which could include regulations, enforcement systems, and certification management mechanisms.

### **3.2 Challenges and Future Direction**

In summary, a number challenges need to be worked out in order to address the aforementioned issues. These could include the development of training materials, conduct of training programs for trainers, and training of the industry in the implementation of GMP/SSOP; and investigating the ways and means for the industry to access to funds for the incorporation of GMP/SSOP in their activities. In addition, there is also the need to improve the methodology for traceability and capacity to deal with new emerging export requirements by investigating the various traceability systems that currently exist, and develop a mechanism to harmonize such systems at the national and regional levels; and investigating new emerging issues, and finding the ways and means of incorporating these into the harmonized certification management mechanism. There is also the need to harmonize the inspection systems and standards in the region by: investigating the certification and accreditation issues related to Halal and organic products; continuing the promotion of the ASEAN laboratory accreditation system, developing methodologies and mechanisms for proficiency testing, and promoting GLP; continuing the process of harmonizing food/fish inspection systems and standards for common products; building capacity in risk assessment and its implementation; investigating how

private certification schemes could be incorporated into the national or regional certification management mechanisms; and providing a platform for the sharing of information among the countries in the region on the implementation of harmonization activities within the fisheries sector. Lastly, there is also the need to improve internal regulatory control systems and technical manpower by developing National Plans of Action in conjunction with the need for coordination and control of all aspects of fish handling, processing, distribution, and marketing, by all regulatory agencies; and encouraging the recruitment and training of quality management personnel.

## **4. FISHERIES MANAGEMENT**

In the Southeast Asian region, there is a growing problem of overfished fish stocks and excessive fishing capacity, which could be a result of the number of fishing vessels and increased efficiency of fishing technologies. This together with high levels of Illegal, Unreported and Unregulated (IUU) fishing are generally recognized as important factors that obstruct all efforts of the region to conserve and maintain fish habitats and stocks for long term sustainability. MRAG (2009) estimated that the global economic impact due to IUU fishing could be between US\$ 9 billion and US\$ 24 billion annually or about 11 million MT and 26 million MT of fish. Attempts have been seriously made by countries in the Southeast Asian region, in seeking ways to improve fisheries management with the objective of reducing IUU and destructive fishing activities. The number of important international instruments, binding or voluntary that have been developed and agreed upon globally are providing guidance to countries on what measures to take and restrictions to apply in order to achieve sustainability in resource utilization. Such important conventions and other instruments include the 1982 UN Law of the Sea Convention (UNCLOS 1982), the United Nations Fish Stocks Agreement (UNFSA), FAO Compliance Agreement 1993, 1995 FAO Code of Conduct for Responsible Fisheries, and the 2009 FAO Agreement on Port State Measures.

### **4.1 Management of Fishing Capacity and Combating IUU Fishing**

In response to the global requirements and the rapidly increasing regional concerns to enhance sustainable exploitation of fishery resources, senior officials and other decision makers of the ASEAN countries have increasingly strengthened their commitment to improve management of fishing capacity and efforts to combat Illegal, Unreported and Unregulated (IUU) fishing. The issue on management of fishing capacity and combating IUU fishing has been seriously addressed by the ASEAN Sectoral Working Group on Fisheries (ASWGF), the ASEAN Fisheries Consultative Forum (AFCF), the SEAFDEC Council,