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It is well recognized that in the ASEAN region, the fisheries sector contributes significantly to food security. Food security according to FAO/UNDP (**Box 1**) is attained when “people at all times have access to sufficient and safe food they need.” But considering their present state, the region’s marine and inland fishery resources may not be able to continue providing food sufficiency. Although aquaculture may have the potentials for increased fish production, its fast development is constrained by environmental impacts as alleged by some sectors of the society. Nevertheless, the region is making strides in the management and conservation of its marine and inland fishery resources while putting environment-friendly and sustainable aquaculture in its proper perspective, in order that these sectors will be able to provide food security through increased fish production.

Some prospects and alternatives to achieve food security are not lacking in the ASEAN region. A very important alternative but oftentimes not given much attention is the development of sustainable post-harvest technologies, which could supply the people’s needs for safe and nutritious fish products. Peoples of the ASEAN region are producers and at the same time also consumers of traditional fish products.

ASEAN and SEAFDEC organized in November 2001 the “Conference on Sustainable Fisheries for Food Security in the New Millennium”. As a consensus and awareness-building exercise on various fisheries issues, it was designed to help develop regional fisheries policies and plans of activities for achieving sustainable fisheries through increased supplies of fish and fishery products in the region. Specifically, the “Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region”, which the Conference adopted include among others the need to “promote the maximum utilization of catch, including the reduction of discards and post-harvest losses to increase fish supply and improve economic returns” (**Resolution 11**).

The ASEAN-SEAFDEC Conference also recognized that maximum utilization of fish catch, improving fish quality, and production of culturally important fish products are among the concerns that should be addressed in order to help prevent future shortage of food supply in the region. Towards this end, the SEAFDEC Marine Fisheries Research Department (MFRD) has been tasked to promote the sustainable development of fisheries post-harvest technologies through its R&D activities, and to transfer the technologies to the fish processing industry in the ASEAN region.

Box 1: Definition of Food Security by FAO/UNDP

Food security is defined as “when all people at all times have both physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life.” Achieving food security requires that the aggregate availability of physical supplies of food is sufficient, that households have adequate access to those food supplies through their own production, through the market or through other sources, and that the utilization of the food supplies is appropriate to meet the specific dietary needs of individuals.”

Sustainable development of fisheries post-harvest technology

The development of sustainable fisheries post-harvest technology is vital in advancing the production of fish and fishery products in the region in terms of safe and good quality standards. As a result, this would help place the ASEAN fish and fishery products in the world market, and eventually boosting the flow of foreign exchange into the region’s economies. Finally, this could lead to increased availability of fish and fish products for human consumption. Sustainable development in fisheries post-harvest technology can therefore, be achieved through maximizing the utilization of fish catch; and at the same time minimizing wastage of the fishery resources by reducing post-harvest losses and ensuring safe and quality fish and fish products.

Maximum utilization of fish catch

Technological approaches on the use of the small demersal fish species (also called “trash fish”) as raw materials for making frozen surimi and fish jelly products are already available for adoption in the region. For the production of frozen surimi, trash fish such as small demersal fish species like the big eye snapper (*Priacanthus* spp.), threadfin bream (*Nemipterus* spp.), lizard fish (*Saurida* spp.), etc. could be utilized. The technology of using frozen surimi to produce fish jelly products was easily picked up by the region’s fish processing industries. This breakthrough has led to the dramatic growth of the surimi industry in the region (Goh and Yeap, 2005). In fact the number of surimi factories in the ASEAN region has since then increased from 32 in 2003 to 60 in 2006 (Figure 1).

The utilization of small pelagic fish species often regarded as low economic value due to their poor quality resulting from poor handling by fishermen and the lack of on-board and on-shore processing facilities, has also been promoted in the region. Since these small pelagic fishes are under-utilized contributing to post-harvest losses, R&D on the production of surimi from such species as the scads

(*Decapterus* spp.) and mackerel (*Rastrelliger* spp.) were conducted. Through this R&D, a range of pelagic fish surimi-based products have been produced such as fish sausages, fish nuggets and fish tofu as well as minced fish products such as sweet meat and fish floss. Singapore with its booming fish processing industry is one of the biggest importers of surimi from the region (Figure 2).

Recently, under-utilized freshwater fish species for development into value-added products for domestic consumption as well as for the export market was also promoted. Value-added products such as fish murukku and fish satay were developed from the soldier river barb (*Cyclocheilichthys enplos*) (SEAFDEC, 2005), while fish siew mai, fish crackers, fish bak kwa (sweetmeat) and fish tofu were developed using the featherback fish (*Notopterus* spp.) and snakehead fish (*Channa* spp.).

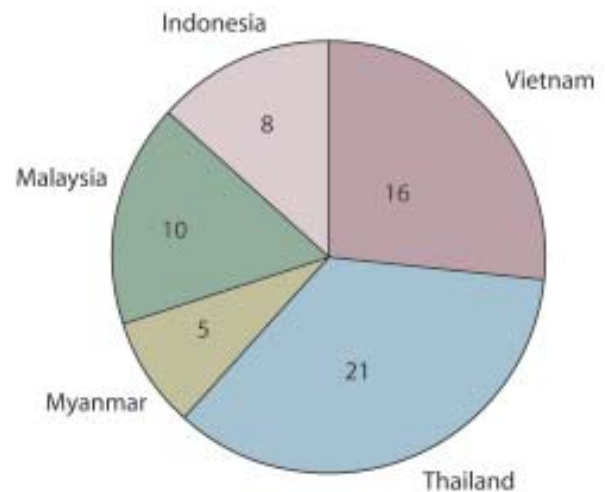


Figure. 1. Number of surimi factories in the ASEAN as of 2006

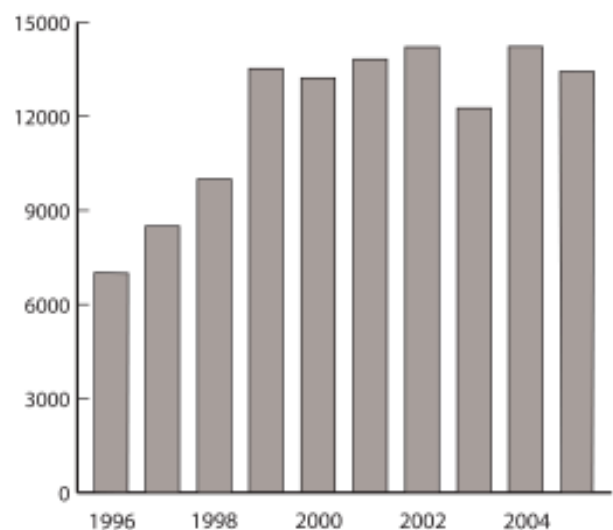


Figure. 2. Annual import of surimi into Singapore (in metric tons (mt))



Tonle Sap (Cambodia)

It has been reported that in Cambodia's Tonle Sap, there is abundance of small freshwater fishes (considered as trash fish) during the lunar cycle in December to February. Production is so much (nets could burst if not lifted every 20 minutes) that the fishes are discarded and left to rot on the lake side. Attempts were made by Cambodia to manage this small freshwater species (e.g., Trey Kangchanchras, Trey Riel, Trey Knongveng, Trey Kroh, Trey Changva, etc.),

through post-harvest means but since their catch is very seasonal this was found not very sustainable. Some fishers however, transport their trash fish catch to Vietnam for processing into fish meal for livestock and aquaculture feeds as well as fertilizers.

It is therefore necessary that countries should identify their under-utilized fish resources as well as identify the resources that are used for non-food products, e.g. fish meal, and explore the possibility of converting these fishery resources into value-added fish products for human consumption. With technological approaches, value-added products from low value small demersal and pelagic fishes and under-utilized freshwater fishes could be developed. Maximizing the utilization of fish catch (marine and freshwater low-value fish species) could eventually address the issue on sustainable fisheries and food security.



Surimi-based products developed and promoted by MFRD in the region (left to right): fish balls/prawn balls, fish cakes, chikuwa and imitation crab sticks

Minimizing waste of fishery resources

While efforts are made to maximize the utilization of fish catch, it is also necessary to minimize wastage of such resources. Staples and Funge-Smith (2005) noted that there is high demand and good economic gains from “low-value/trash fish” for processing into fish meal and fish oil. The absence of chilling facilities in most small-scale fishing vessels is turning high value fish into low-value catch. The irony is while trash fish species are considered important as source of food and income for the region's poor, some high value fish are turned into low value catch (trash fish)



to supply the high demand for raw materials in the fish meal and fish oil processing industries. Thus, many fishers have lost the initiative of applying proper handling and chilling technologies on-board since their “low value fish” catch are also needed to supply the huge demand of the fish meal and fish oil products sector.

Even if some fishers want to improve the quality of their catch, many vessels are not well equipped with good chilling and storage facilities on-board while on-shore storage facilities in the landing areas are also not available.

Considering that some technological approaches have already been developed, the countries in the region should take advantage of such technologies, e.g, improved on-board fish handling technology to reduce post-harvest losses (SEAFDEC, 2007) such as the modified fish hold on a medium sized trawlers (25-50 m long) and the low cost but effective refrigeration system for small-scale fishing boats that have been verified and found very useful (SEAFDEC, 2002). These techniques have been continuously improved and published by SEAFDEC in On-Board Fish Handling and Preservation Technology (SEAFDEC 2005a).

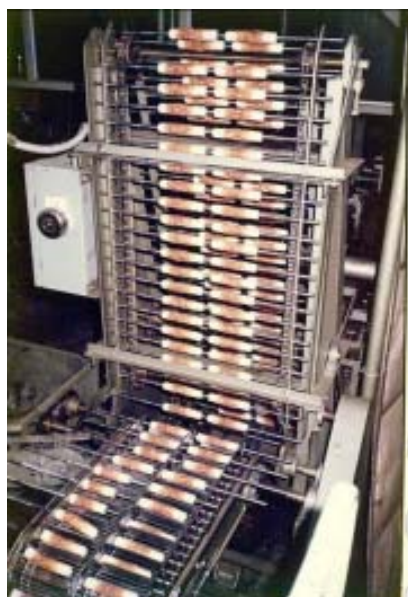


Some examples of low-cost fish processing equipment (left to right): meat-bone separator, silent cutter, fishball forming machine

The utilization of tuna trimmings and by-products from the fish processing industry has also been promoted in the region. Since the ASEAN region is a major exporter of tuna, which are processed as fresh, frozen or chilled or canned, some amount of trimmings and other by-products could be considered discards. FAO FishStat Plus 2006 indicated that in 2004, the value of the region's export of canned tuna amounted to about USD1.0 billion, of which Thailand accounted for about 82%, Indonesia about 10%, the Philippines about 8%, while the rest was provided by Malaysia and Vietnam. In terms of fresh or chilled or frozen tuna, the ASEAN's export in 2004 amounted to about USD 170.00 million of which Indonesia accounted for 69%, Philippines about 18%, Thailand about 11%, and the remaining 2% were from Myanmar, Malaysia and Vietnam. MFRD has developed the tuna trimmings and by-products into value-added products for human consumption such as tuna chunk sausage, tuna burger, tuna loaf, tuna *piko*, barbecued tuna, etc.

Upgrading the fish processing industry

In order to upgrade the fish processing industry, efforts should be made by the countries to adopt mechanization and promote automation of the industry. Many low-cost equipment, facilities and systems could be put up locally such as the meat-bone separator, silent cutter, fish ball forming machine, fish cake forming machine, etc. The use of these machines will ensure increased productivity by the fish processing industry. In addition, there are also automated systems such as automated fish ball processing line, imitation crab stick processing line, automated battering and breading line, chikuwa processing line, etc. The adoption of these automated systems ensures not only increased productivity but also clean and safe fishery products.



Implementing HACCP-based quality assurance programs is also an important means of upgrading the industry, as this leads to the road to ISO certification of the processing plants, a plus factor in the foreign trading arena. Since most of the fish processing plants in the region are small and medium-sized establishments and could not easily comply with the requirements of importing countries due to technical constraints, efforts are now made by SEAFDEC through the MFRD to assist the region's SMEs in meeting safety and quality assurance requirements. The ability of the SMEs to apply HACCP-based programs (i.e. good manufacturing practices or GMP and standard sanitation operating procedure of SSOP) is necessary to improve the safety and quality of the fish products from the region thus, towards food security. A related article on Assisting ASEAN SMEs Meet Quality Assurance Requirements in this Volume explains such efforts of SEAFDEC.

Future Direction

SEAFDEC through the MFRD is committed to driving ASEAN's efforts towards sustainable development in fisheries post-harvest technology. Thus, MFRD will continue to develop integrated fisheries post-harvest technologies that would address sustainable development of fisheries in the region such as optimizing limited resources, development of value-added products, and reducing post-harvest losses



Automated systems for fish processing: chikuwa processing (above), imitation crab stick processing (right top), and fish ball processing (right)



and wastage. MFRD will also promote the harmonization of analytical methods and testing capabilities to evaluate the freshness and quality of fish and fish products in the region with the ultimate aim of upgrading the region's fish processing industry and meeting the requirements of importing countries on the fishery products from the region.

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