Sustainability of Inland Fishery Resources against the ASEAN Economic Community Backdrop: Challenges and Opportunities

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The Southeast Asian Fisheries Development Center (SEAFDEC) has been playing the leading role in promoting sustainable fisheries development for food security in Southeast Asia. In so-doing, SEAFDEC has been implementing programs that aim to "enhance the awareness of stakeholders on the contribution of inland fisheries to food security and sustainable livelihoods", in accordance with the Resolution on Sustainable Fisheries for Food Security for the ASEAN Region adopted in June 2011. In a Keynote Address delivered by SEAFDEC Secretary-General *Dr. Chumnarn Pongsri* during the 4th International Conference on Inland Capture Fisheries organized in Palembang, Indonesia in September 2014, he spelled out the importance of inland fisheries for local food security in the Southeast Asian region, especially when the ASEAN Economic Community (AEC) shall be unified by 2015. He also recognized the Conference as timely considering the importance which is currently being directed towards the conservation and sustainable utilization of inland water resources for food security. Such direction has paved the way for SEAFDEC to craft programs and activities that would address important emerging issues related to the sustainable development of inland fisheries in the Southeast Asian region.

The effort of the Southeast Asian region to collectively move towards a united and harmonized ASEAN Economic Community by 2015 is an important milestone since the region would then have a single market and production base. However, such development could also have repercussions on the fisheries sector, making it necessary for the sector to adjust to the significant changes as fisheries and aquaculture activities could be severely affected, particularly those activities that are closely linked with economic development and trade. Nevertheless, in the inland fisheries sub-sector more particularly in inland capture fisheries, inland fishers would awaken in 2015 and continue to live normal lives, without even realizing that their activities could, in one or another way, be impacted by the trending developments, particularly the stiff competition among resource users for limited land and water resources. Therefore, national fisheries-related authorities should secure the sustainability of their respective inland fishery resources to ensure that the contribution of inland fisheries to food security, poverty alleviation and economic development could be sustained in the midst of such anticipated challenges.

Characteristics of Inland Capture Fisheries of Southeast Asia

The region's inland capture fisheries could be considered very unique in a way that it is different from the other fisheries sub-sectors due to various reasons (Chumnarn, 2014). Firstly, the inland capture fisheries sub-sector comprises large number of small-scale fishers, who are mostly subsistent and engaged in only part-time fishing activities. Most of those engaged in fishing activities are doing other occupations like farming or perhaps livestock-raising, and as such, many of them could not be categorized as fishers as they prefer to be called mainly as farmers. Secondly, most activities related to inland capture fisheries are highly seasonal, which could peak during flood receding periods or at the end of the rainy season, the period when fish growing in floodplains would usually move back to rivers and streams, enhancing the fish stocks but risking to be caught by readily-installed stationery fishing gears. Thirdly, production from inland capture fisheries is highly diversified, where most of the catch although large in number and quantity, could be small in size and with high species diversity. In addition to fish, other aquatic animals could also be caught, like frogs, turtles, mollusks, and others, which are also utilized as food. Fourthly, in rural areas, there are no designated fishing ports, especially for non-commercial activities. Thus, inland fishery resources are not only freely accessed at any time but production could also be landed anywhere without any recording. Finally, inland fisheries production goes to various channels, although a large portion is meant for household

Table 1. Production from inland capture fisheries (2008-2012) in metric tons (MT)

Southeast Asian countries	2008	2009	2010	2011	2012
Brunei Darussalam	-	-	-	-	-
Cambodia	430,600	390,000	405,000	445,000	528,000
Indonesia	497,740	494,630	344,972	368,542	393,552
Lao PDR	29,200	30,000	30,900	34,000	34,105
Malaysia	4,353	4,469	4,545	5,695	5,042
Myanmar	814,740	899,430	1,002,430	1,163,159	1,246,460
Philippines	179,491	188,444	185,406	193,698	195,804
Singapore	-	-	-	-	-
Thailand	228,600	245,500	209,800	228,500	222,500
Viet Nam	114,800	144,800	194,200	202,500	194,500
TOTAL for SEA Countries*	2,329,524	2,397,273	2,377,253	2,641,094	2,819,963
Total World Production**	10,250,225	10,476,205	11,271,565	11,124,401	11,630,320

* *Source: Fishery Statistical Bulletin of Southeast Asia 2012 (SEAFDEC, 2014)*
** *Source: Fishery and Aquaculture Statistics, FAO Yearbook 2012 (FAO, 2014)*

consumption either in fresh form or preserved in ice or brine, the remaining fish is sometimes sold in local markets. Some countries are able to export fish products from their large-scale inland fisheries activities, but market of such products could be limited mainly within the Southeast Asian region.

Production from Inland Capture Fisheries of Southeast Asia

The total production from inland capture fisheries of the Southeast Asian region as of 2012 of about 2.8 million metric tons (SEAFDEC, 2014) accounted for more than 7% of the region's total fisheries production from all sectors and about 16% of its total production from capture fisheries (**Table 1**). As a matter of fact, the region's production from inland capture fisheries in 2012 (**Fig. 1** and **Fig. 2**) contributed nearly a quarter of world's production from inland capture fisheries of about 11.6 million metric tons. This data signifies the importance and significance of inland fisheries for the food security of peoples in the Southeast Asian region.

As shown in **Table 1**, the region's top-producing country in 2012 was Myanmar followed by Cambodia and Indonesia but the other countries had also been closing in, such as Thailand, Viet Nam, and the Philippines that also consistently produced considerable amount of inland fisheries products during the past five years. For Lao PDR, the region's only landlocked country, its production data needs to be reconciled with field data considering that such production is mainly derived from the inland fisheries sub-sector. Nonetheless, inadequacy in the compilation and reporting of production data from inland capture fisheries has been widely recognized and thus should be improved, not only in terms of quantity but also in species composition of the catch. For example, in the case of Lao PDR, the country has been seeking assistance from concerned agencies and organizations for the improvement of its fisheries statistics collection and compilation systems in order to come up with the real picture of its fisheries sector.

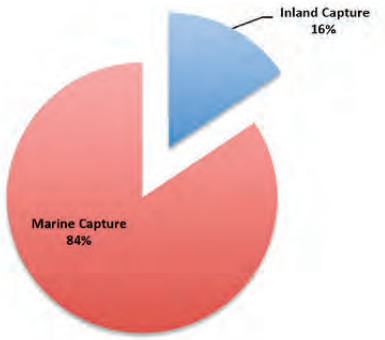

Fig. 1. Contribution of inland capture fisheries to total capture fisheries production of Southeast Asia in 2012

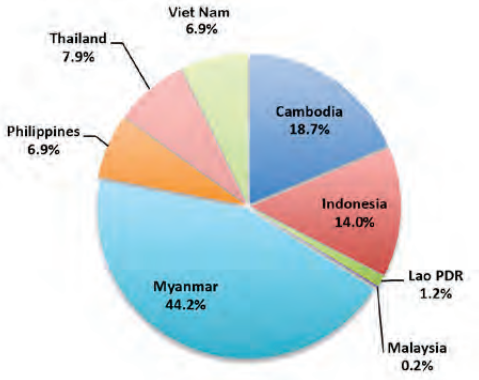

Fig. 2. Contribution of Southeast Asian countries to the region's total production from inland capture fisheries s in 2012

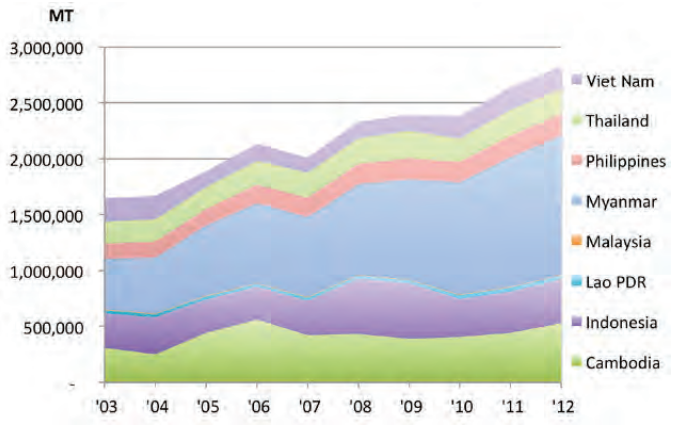

Fig. 3. Production trend of inland capture fisheries in Southeast Asian countries (2003-2012)

In spite of the impressive production figures from inland capture fisheries, there is still inadequate recognition of the value of inland capture fisheries because of its very nature where large numbers of part-time fishers including subsistent fishers are involved, and the high diversity of catch without proper landing ports. Such scenario leads to inadequate monitoring system of inland fisheries production and as a result, production data might have been under-estimated and under-represented in most of national statistics or other records. Although the graphs might have shown increasing trend of production from inland capture fisheries (**Fig. 3**), these do not give concrete reasons to believe that actual production had actually increased or efforts had been made to improve data collection.

Linkage between Inland Capture Fisheries and Other Sectors

Exploiting the water resources through inland capture fisheries is not a stand-alone activity, as it has close linkage with activities of other sectors that share the same resources, leading to competition among the resource users. Therefore, national planners and policy makers should try to strike a balance of the various development activities that exploit the same inland water resources so that the benefits gained by all stakeholders could be maximized, especially on the food security of small-scale fishers. It is a fact that major economic and development activities that also exploit the inland water resources of the region could create severe impacts on inland fisheries as elucidated in **Box 1**.

Based on the aforementioned premises, high-level policy interventions would be necessary to ensure the sustainability of inland fishery resources and for the effective promotion of inland capture fisheries. With the ASEAN Economic Community in the offing, competition for the inland fishery resources could become more serious in the near future. It is therefore important that mitigation measures are developed

Box 1. Impacts of other sectors' activities on inland capture fisheries

Irrigation and agriculture require large amount of water for their agricultural activities in order to generate products that are necessary for food security as well as for the countries' economies, but such activities clearly compete with inland capture fisheries for the same water resource. In addition, since most of their activities make use of chemicals, such practices could create negative impacts to the natural fish population especially in inland water bodies.

Inland aquaculture operations reduce the availability of water in natural habitats since considerable volumes of water are required for culture activities, affecting inland capture fisheries operations. Since inland aquaculture also discharges wastewater as outputs from its activities to inland water bodies, the poor quality of the water discharged could result in deterioration of the quality of the water and abundance of natural fishery resources in aquatic habitats. The cultured aquatic species that include both indigenous and non-indigenous species, could also impact on natural biodiversity and genetic diversity of the natural fish populations in inland water bodies.

The current trend of **hydropower development and operations** could also affect the inland fishery resources, as construction of hydropower dams could create cross-river obstacles between upstream and downstream waters, affecting the aquatic species that require upstream or downstream migration as part of their life cycles, and resulting in changes of the biodiversity or even extinction of some aquatic species. The construction of fish passages is not mandatory by law for most countries in Southeast Asia, while some existing fish passages might have been designed and operated without taking into consideration the behavior and requirements of indigenous migratory fish in affected areas. Moreover, the operation of most hydropower dams usually does not consider the possible negative impacts of dams to the natural fishery resources. For example, hydropower generation is operated mainly during the peak of electricity demand discharging large volume of water to downstream rivers, while on the contrary, during low peak periods, downstream rivers could be drained. Furthermore, hydropower generation uses water from deep layers of the upstream water column, where at such depths, the water has very low level of dissolved oxygen with accumulated toxic substrates. Therefore, the fluctuation of water levels coupled with unfavorable water quality, could affect the ability of fish to survive in downstream ecosystems.

The sustainability of inland fishery resources could also be affected by **other development activities**, such as infrastructure construction, urbanization, and water transportation. The construction of infrastructures such as roads and freeways, and the expansion of towns could create obstacles that would not allow the free flow of water or flooding required for natural reproduction and larval dispersion of several aquatic species. Since such developments do not necessarily require appropriate planning and effective mitigation measures, the natural population of many aquatic species could be drastically destroyed resulting in diminishing production in the long term. Moreover, the destruction of stationary fishing gears operated by fishers in water bodies by water transportation systems also creates conflict between water transportation and fishing activities that eventually affects inland fisheries. In addition, some accidents could happen in water bodies impacting on the inland resources, especially during the transport of goods in rivers. The incident that happened a few years ago in Chao Praya River of Thailand, when a boat carrying large shipment of sugar capsized, is only one example. Such incident had resulted in mass mortalities of various aquatic species in the River's ecosystem which could take certain period of time to recover.

in order to minimize the impacts of other development activities on the inland fishery resources and allow the inland fishery habitats and resources to generate products that could sustain food security and provide livelihoods for peoples relying on such resources.

Challenges in the Sustainable Development of Inland Capture Fisheries of Southeast Asia

Based on the aforementioned characteristics of the region's inland fishery resources, it has become imperative for countries and concerned agencies to address the various challenges emanating from economic and development activities in order that sustainability of inland capture fisheries could be attained.

Low Priority Given to Inland Fishery Resources

Timely data and information are necessary to enhance awareness on the importance of inland fisheries, particularly its contribution to food security and livelihoods creation. In many countries in the Southeast Asian region, planners and policy makers seem not to give much attention to inland fishery resources in view of the inadequacy of data and other relevant information on inland fisheries. Currently, the statistics on production from inland capture fisheries are derived through traditional or conventional data collection systems, where data on fish catches are collected from sampling sites and then converted to statistical figures. In order to come up with reliable data, it is necessary that this method and practice should be rectified and improved. However, considerable amount of resources would be necessary to improve data collection, which is quite unlikely to happen in the region where the nature of inland fishing activities and ecosystems is dispersed while large portions of catch go directly to household consumption or to other channels without proper recording.

Improvement of Data Collection and Compilation System for Inland Fisheries

The most important issue that confronts the inland fisheries sub-sector is the inadequacy of data and information that could be used to convince national planners and policy makers on the importance and contribution of inland fisheries to peoples' livelihoods, and the non-cash value of inland fishery resources in terms of biodiversity functions that balance the ecosystems including controlling widespread occurrence of pests, as well as the nutritional and health benefits of micro-nutrients that could be derived from consuming small fishes, among others. Therefore, the development of non-conventional data collection and model for inland ecosystem valuation should be considered making use of various types of existing data and

information, and interpreting these into figures that would illustrate the importance of inland fisheries. This could include for example, the number of households dependent on inland fishery resources, the livelihoods generated through the utilization of inland fishery resources, and the contribution of inland fisheries to food security.

Moreover, data available from various sources, such as censuses and statistical records, results of relevant research studies, local/traditional knowledge, and so on, should be integrated and analyzed to generate meaningful information related to inland fishery resources. Such information should be packaged and made available for planners and policy makers to enhance their awareness on the importance of inland fisheries, and help them in making fair decisions in implementing development projects that create positive impacts on the sustainability of inland fisheries.

Measures to Address Major Challenges in Inland Fisheries of Southeast Asia

The region's inland fisheries sector is also being confronted by management issues more particularly on the application of the ecosystem approach to fisheries management, considering that in most cases, ecosystem boundaries are different from management areas. Although "*catchment approach*" for particular inland water bodies could be applied, the level of management at local, national or

regional levels depends on the boundary of the ecosystems. Nevertheless, the "*holistic approach*" could also be considered since several sectors are involved in a related ecosystem and are sharing the same resources. In any case, information on the importance of inland fisheries should be collected and made available to other sectors including planners and policy makers for their decision-making processes, especially in trading-off between development projects and the need to maintain ecosystem functions to secure the contribution of inland fishery resources to food security and livelihoods, as well as to biodiversity and ecological functions.

R&D on mitigation measures should be conducted to secure ecosystem functions. Development projects, for example, construction of hydropower and water regulation dams, roads, and rural development infrastructures, could affect the ecosystem and its functions, but such developments could not be prevented for economic reasons. Nonetheless, measures should be developed to mitigate the impacts of such development projects, which could come in the form of appropriate design and integration of suitable fish passages in dam constructions, proper schemes for operating dams, implementation of stock enhancement programs, construction of roads with sufficient underpasses that would allow water and fish larvae to drift across and enter floodplains, inundated forests, and the like.

Maximum utilization of inland fishery resources involves the development of fishing gears and practices that *enhance gear selectivity* as well as boost ecological sustainability by *controlling top predator species and improving the utilization of harvested fish*. Considering that fish in inland ecosystems are multi-species, where small fishes with short life cycle could be abundant, harvested and fully utilized before reaching their natural mortalities, selective fishing gear(s) should be developed to target these small fish species. Moreover, in order to enhance ecological sustainability and diversity of low trophic species, gear(s) should also be developed to harvest these particular top predator species as their excessive presence could have negative impacts to the sustainability of inland fisheries. Therefore, the contribution of fisheries to food security and economic returns should be maximized and year-round availability of fish for consumption ensured. This is very important for inland fisheries where production is very highly seasonal and where large quantities of fish could be available only in certain short periods of time. It is in this aspect that fish harvested during high season should be preserved for all year-round consumption. Although traditional preservation methods are already practiced in fishing communities, there is a need to improve such methods especially in terms of post-harvest handling processes to ensure quality, hygiene and safety of the fish products, and to promote the development of other value-added products as necessary.

Adaptation of Inland Capture Fisheries to Climate Change

Climate change would definitely create impacts to inland water bodies and to the consistent availability of inland aquatic species for utilization by fishing communities. Looking at the impacts of climate change in a rather big picture, the effect of climate change on the changes in the overall human activities, land and water usage, and the like is very clear, which would also eventually affect inland fishery activities. Nevertheless, "precautionary approach" should be promoted as part of the measures in adapting to climate change to enable affected stakeholders to act decisively in the absence of certainty. It is therefore necessary to enhance the preparedness of fishing communities in responding to the anticipated changes and variability of the climate.

Way Forward

Fishery Resources Enhancement Programs for Inland Fishery Resources

Another equally crucial challenge in the sustainable development of inland fisheries is the implementation of various fishery resource enhancement programs, which might have been designed for different and varying objectives. In the first place, resource enhancement programs should aim for enhanced production and yield, with hatchery-bred seeds stocked in closed ecosystem to enhance the yield from inland capture fisheries. Since releasing of hatchery-bred seeds into natural open habitats could result in loss of biodiversity of various natural species or loss of genetic variation within one species, the species to be stocked should be carefully selected focusing on low trophic species that give maximum yields from stocking

activities but with minimum impacts to other species sharing the same ecosystems. The use of indigenous species could be considered for stocking activities, but should exotic species be introduced, risk assessment on their potential impacts to the biodiversity and the ecosystems should be carefully conducted as their impacts could be irreversible.

Secondly, resource enhancement programs should also target species conservation. Stock enhancement is necessary for species where their natural reproduction might no longer occur, such as those species that could not possibly migrate due to construction of cross-river obstacles or when their mature brooders are no longer available in natural habitats. In this case, indigenous species should be used for stock enhancement and conservation purposes using seeds that are produced specifically for the purpose of stock enhancement, as well as those species with high diversity and genetic variation.

Thirdly, stock enhancement programs should also aim for habitat conservation and improvement. In this case, the habitats should be made favorable for fish to enhance the availability of their stocks and promote natural reproduction. Lastly, it is necessary to develop indicators for evaluating the success of resource enhancement programs in order to justify the cost efficiency and effectiveness of the activities.

Enhanced Cooperation and Collaboration for the Sustainable Development of Inland Fisheries

Addressing the aforementioned challenges seem too gigantic to tackle with, and surely could not be done by one country or one entity acting alone. Cooperation and collaboration among countries, agencies and organizations concerned, is necessary. Considering that sustainable development of inland fisheries could be visualized in various levels depending on the boundary of particular ecosystem, therefore cooperation should be promoted at the local, sub-regional within a country, national, or even at regional levels. Thus, sub-regional or regional intervention would be necessary in crafting programs and activities related to the development and management of inland fisheries.

For example, activities that utilize the ecosystems shared by more than one country such as the Mekong River Basin which is shared by Thailand, Lao PDR in the upper part, and Cambodia and Viet Nam in the lower part, should be jointly planned and implemented by the concerned riparian countries. These could include those activities undertaken in upstream countries which could affect downstream countries, such as hydropower dam construction and operation in upstream countries. Since this could impact on the downstream countries, close consultation and collaboration among the concerned countries should be promoted to address the relevant issues and concerns.

Another example is the responsible utilization of aquatic species that are trans-boundary in nature, specifically those species that require upstream or downstream migration to sustain their life cycles. The Mekong giant catfish that moves across the upper and lower parts of the Mekong River shared by several countries, for example, would require joint conservation measures for the sustainability of its stock. The giant freshwater prawn *Macrobrachium rosenbergii*. which requires brackishwater conditions during its larval stages could be affected by the construction of cross-river obstacles resulting in possible subsequent diminishing of the species in the entire river system.

In the case of the Anguillid eels that are trans-boundary in water resources shared by several countries but migrate across marine, brackish and freshwaters in their life cycle, unsustainable fishing activities undertaken in certain countries could affect the availability of the natural population of such species as a whole. The aforementioned are only some of the examples of areas that require possible regional cooperation in inland fisheries-related activities.

Several organizations and institutions in the Southeast Asian region are working on inland fisheries development and management, such as the Mekong River Commission or MRC, which has been conducting researches and has collected valuable information specifically for the Lower Mekong Basin. MRC has also come up with several materials that could be applied by the Southeast Asian countries. Other national research agencies and institutions have also conducted relevant studies, the results of which could be shared among the countries. Recently, FAO had also conducted extensive works on inland fisheries development and published relevant results in technical reports and journals which could also be accessed through their website.

Capacity Building for the Inland Fisheries Sub-sector

Since certain technologies on inland fisheries are available in some countries in the region, sharing of knowledge and experiences on the activities that had been successfully undertaken in some settings could be facilitated through regional consultations based on agreed collaboration. Such technologies including successful application of management approaches and development of effective data collection system that gives meaningful results could be adopted in other areas in the region with similar conditions and circumstances.

SEAFDEC had conducted activities on inland fisheries but these had been rather minimal due to its limited capacity in terms of resources especially expertise in inland fisheries. The proposed establishment of the Inland Fishery Resources Development and Management Department or IFRDMD under the SEAFDEC framework which was announced by the Minister of Marine Affairs and Fisheries of Indonesia during the ASEAN-SEAFDEC Conference in 2011 was a welcome development. The launching of IFRDMD and its operationalization which was concretized during the 4th International Conference on Inland Capture Fisheries in September 2014, therefore paved the way for SEAFDEC to formulate programs and activities that focus on inland fisheries and inland fishery resources conservation and management from the regional point of view. In all these aspects, SEAFDEC would enhance cooperation and collaboration with other organizations within and outside the region that are working towards the same goal of promoting sustainable inland fisheries.

While strongly recognizing the importance of inland fisheries in view of its contribution to peoples' food security and livelihood creation, SEAFDEC foresees that inland fisheries could be considered a safety net for many people with no other livelihood opportunities. Moreover, while acknowledging the need to conserve the inland fishery resources of the region for the benefit of future generations, SEAFDEC has drawn up several recommendations during the 4th International Conference on Inland Capture Fisheries in September 2014 for the sustainability of this small but meaningful sub-sector (Chumnarn, 2014), and for its sustained development in the future for the benefit of the rural fishing communities, especially when the "borderless" ASEAN Economic Community would be fulfilled starting in 2015.

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