

The Making of a Center of Excellence in Science and Technology on Inland Fisheries Management: The SEAFDEC/IFRDMD

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As the global attention that focuses on the development of inland fisheries escalated in the early 2000s, the ASEAN-SEAFDEC Member Countries became concerned about the actual valuation of the Southeast Asian region's inland fisheries considering the major role that it plays in supplying food fish to the growing population of the region, especially to those in the rural communities. Given such a scenario, the ASEAN-SEAFDEC Member Countries adopted the "Resolution and Plan of Action on Sustainable Fisheries for Food Security in the New Millennium" during the ASEAN-SEAFDEC Conference on Sustainable Fisheries for Food Security in the New Millennium "Fish for the People" in November 2001 that includes provisions encouraging the ASEAN Member States (AMSs) to consider the importance of inland fisheries in policy formulations to improve food security and secure livelihoods of rural people. Ten years later, the subsequent ASEAN-SEAFDEC Conference on Sustainable Fisheries to Food Security Towards 2020 "Fish for the People 2020: Adaptation to a Changing Environment" in June 2011 also adopted the revitalized "Resolution and Plan of Action on Sustainable Fisheries for Food Security for the ASEAN Region towards 2020" including a provision for the AMSs to enhance their understanding and awareness of the potentials of inland fisheries, specifically, its contribution to food security and sustainable livelihoods in the Southeast Asian region.

Against such backdrop, the then Minister for Marine Affairs and Fisheries of Indonesia proposed to establish a Regional Center for Inland Fisheries under the umbrella of SEAFDEC, and offered Indonesia as host of such Regional Center. After reviewing the proposal of Indonesia and recognizing the role that inland fisheries would play in enhancing the contribution of fisheries to food security, the SEAFDEC Council during its Forty-fourth Meeting in 2012 considered the proposed establishment of the said Regional Center to be hosted by Indonesia. Thus, the Regional Center renamed as the Inland Fishery Resources Development and Management Department (IFRDMD) of SEAFDEC, was officially established on 2 September 2014 in Palembang, Indonesia. With such development, the core activities of SEAFDEC had expanded from the sustainable development of marine capture fisheries, aquaculture, and fisheries post-harvest technology to the development and management of inland capture fisheries. Only on its sixth year of operation since its establishment, IFRDMD continues to undertake its major task of developing policy recommendations and formulating guidelines for the sustainable development and management of inland fisheries in Southeast Asia, by unraveling the potentials for development of the region's inland fishery resources to enhance the contribution of fisheries to food security and economic stability of the region.

The SEAFDEC Inland Fishery Resources Development and Management Department

Established in September 2014 in Palembang, Indonesia, the SEAFDEC/IFRDMD (Figure 1) is tasked to serve as the center for establishing guidelines for the proper development

and management of the inland fishery resources of the Southeast Asian region, which is endowed with bountiful inland water systems that consist of freshwater, saline water, a mixture of them, and distributed throughout land in the form of rivers, lakes, floodplains, reservoirs, wetlands, estuaries, as well as inland saline systems (Pongsri *et al.*, 2015). The properties and utilization of such water systems are dominated by the permanent, seasonal or intermittent occurrence of flooded conditions. Nevertheless, these resources have the potentials to be tapped for fisheries development in order that there would be steady supply of food fish for the peoples in the region, especially those in the rural areas.

Fisheries Production of Southeast Asia

In 2016, the total fisheries production of the Southeast Asian countries amounted to a total of about 45.4 million metric tons (MT) increasing by about 13 % over the five year period from 2012 to 2016, and contributing about 23 % to the world's total fisheries production of about 202.2 million MT (FAO, 2016). From 2012 to 2016, Indonesia was the highest producer of fish from among the Southeast Asian countries, accounting for more than 51 % of the region's total fisheries production (Table 1) and about 12 % of the world's total fisheries production.



Figure 1. SEAFDEC/IFRDMD in Palembang, Indonesia

Table 1. Total fisheries production of Southeast Asia (in metric tons (MT)), 2012-2016

	2012	2013	2014	2015	2016
Brunei Darussalam	5,979	3,431	3,947	4,353	14,114
Cambodia	728,000	728,000	745,310	731,889	808,550
Indonesia	18,763,893	19,245,632	20,600,772	22,154,423	23,172,872
Lao PDR	136,000	164,228	150,592	158,600	166,880
Malaysia	1,760,840	1,749,314	1,988,302	1,998,439	1,987,984
Myanmar	4,417,676	4,715,840	5,040,311	5,316,950	5,598,003
Philippines	4,865,678	4,695,369	4,681,418	4,645,871	4,350,761
Singapore	6,202	7,210	6,695	8,161	7,347
Thailand	2,991,623	2,822,084	2,567,800	2,429,856	2,425,901
Viet Nam	5,816,100	6,019,700	6,332,500	6,549,700	6,803,900
TOTAL	39,491,091	40,150,808	42,117,647	43,998,242	45,336,312

Source: SEAFDEC (2018)

Fisheries production of Southeast Asia, by sub-sector (2012-2016)

As shown in **Figure 2**, the fisheries production during 2012-2016 by sub-sector, *i.e.* marine capture fisheries, inland capture fisheries, and aquaculture, had been dominated by aquaculture that increased by 16% over the five-year period and accounted for 55% of the region's total production in 2016. This is followed by marine capture fisheries which increased by

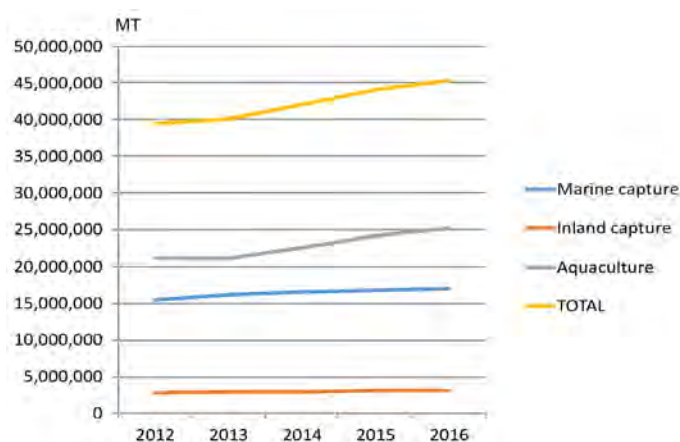


Figure 2. Total fisheries production of Southeast Asia by sub-sector

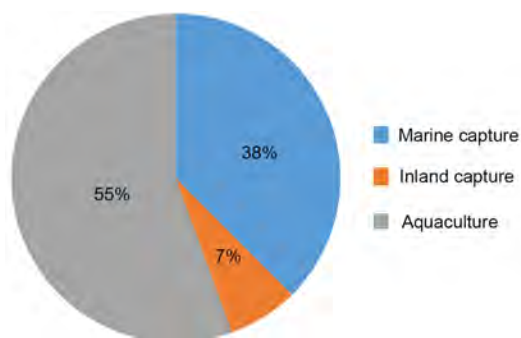


Figure 3. Fisheries production of Southeast Asia in 2016, by sub-sector (Source: SEAFDEC (2018))

9% for the same period and contributed about 38% to the region's total fisheries production. Although the production from inland capture fisheries also increased (**Figure 3**) by about 10% during the five-year period, it accounted for only 7% of the region's total fisheries production.

It should be noted however that the data on production from inland fisheries is very limited considering that inland fisheries operations are small-scale, very seasonal, and mostly carried out by part-time fisheries, and where production is meant for domestic consumption and thus, is usually not recorded at landing sites (SEAFDEC, 2017). Nevertheless, the countries have been trying to exert efforts in improving their systems of compiling the data and information on inland fisheries as the sub-sector has the potentials to enhance the food sufficiency of the region in the future.

Production from the inland capture fisheries of Southeast Asia (2012-2016)

Although the fisheries production from inland capture fisheries of the Southeast Asian countries (SEAFDEC, 2018) had been slightly increasing (**Table 2**), in 2016, it contributed about 7% to the region's total fisheries production (**Figure 3**). The highest producing country is Myanmar, where its inland fisheries production in 2016 accounted for about 51% of the region's total production from inland capture fisheries, and about 4% of the region's total fisheries production. However, the production data provided by Myanmar is indicated only as Osteichthyes or freshwater fishes *nei* and not by species. The next highest producing country is Cambodia, but its production was likewise not segregated by species. For Indonesia which was the third highest producing country, its production in 2016 comprised mainly the striped snakehead (*Channa striata*), Asian redbtail catfish (*Hemibagrus nemurus*), freshwater fishes *nei*, Nile tilapia (*Oreochromis niloticus*), snakeskin gourami (*Trichogaster pectoralis*), and other freshwater fishes.

Table 2. Inland fisheries production of Southeast Asia (in metric tons (MT)), 2012-2016

	2012	2013	2014	2015	2016
Brunei Darussalam	...	...	...	...	...
Cambodia	528,000	528,000	505,005	487,905	509,350
Indonesia	393,552	391,324	446,509	455,270	426,874
Lao PDR	34,105	40,143	60,237	62,635	70,915
Malaysia	5,042	5,641	5,611	5,924	5,848
Myanmar	1,246,460	1,302,970	1,381,030	1,463,120	1,580,670
Philippines	195,804	194,615	211,941	203,366	155,509
Singapore	...	...	...	...	...
Thailand	219,428	210,293	181,757	184,101	187,300
Viet Nam	194,500	196,800	208,100	196,500	189,700
TOTAL	2,816,891	2,869,786	3,000,190	3,058,821	3,126,166

Source: SEAFDEC (2018)

Unfortunately, the rest of the producing countries could not also report their production by species which are just indicated as freshwater fishes *nei* (SEAFDEC, 2018). Moreover, few countries had also reported their inland fisheries production in 2016 by type of water bodies, such as Cambodia of which more than 68 % of its production came from reservoirs, about 29 % from floodplains and rice fields, and the rest from rivers

(SEAFDEC, 2018). As for the other countries, the source of inland fisheries production in terms of water bodies had not been segregated, although Malaysia indicated that 65 % of its inland fisheries production in 2016 came from rivers, and the rest from reservoirs, lakes, floodplains and rice fields, and other inland water bodies.

Table 3. Inland fisheries production of major groups of species of the Southeast Asian region (metric tons: MT)

Major groups of species	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Thailand	Viet Nam	TOTAL	Percent of inland capture fisheries production
Asian redbtail catfish	...	43,023	...	...	...	...	...	...	43,023	1.38
Climbing perch	...	25,822	...	...	...	2,068	7,900	...	35,790	1.14
Common carp	...	11,228	...	...	...	...	4,300	...	15,528	0.50
Cyprinids <i>nei</i>	14,662	...	...	14,662	0.47
Freshwater fishes <i>nei</i>	509,350	39,575	70,915	5,383	1,580,670	9,333	97,700	189,700	2,502,626	80.05
Freshwater mollusk <i>nei</i>	53,982	...	...	53,982	1.73
Freshwater prawn <i>nei</i>	...	8,499	...	465	...	...	1,000	...	9,964	0.32
Giant river prawn	...	10,908	...	...	...	1,297	...	...	12,205	0.39
Glass cat-fishes	...	21,084	...	...	...	...	...	...	21,084	0.67
Indonesian snakehead	...	18,442	...	...	...	...	...	...	18,442	0.59
Kissing gourami	...	10,232	...	...	...	...	...	...	10,232	0.33
Mozambique tilapia	...	13,163	...	...	...	...	...	...	13,163	0.42
Nile tilapia	...	35,551	...	...	...	...	20,700	...	56,251	1.80
<i>Pangasius djambal</i>	...	20,508	...	...	...	...	...	...	20,508	0.66
Silver barb	...	10,548	...	...	...	...	21,300	...	31,848	1.02
Snakeskin gourami	...	26,564	...	...	...	4,286	2,900	...	33,750	1.08
Striped snakehead	...	45,873	...	...	...	8,829	16,100	...	70,802	2.27
Three-spot gourami	...	13,187	...	...	...	...	...	...	13,187	0.42
Tilapias <i>nei</i>	41,677	...	...	41,677	1.33
Torpedo-shaped catfishes <i>nei</i>	...	14,492	...	...	...	5,735	8,400	...	28,627	0.91
Others	...	58,175	...	...	...	13,740	7,000	...	78,915	2.52
TOTAL	509,350	426,874	70,915	5,848	1,580,670	155,509	187,300	189,700	3,126,166	100.00

Source: SEAFDEC (2018)

Tapping inland water bodies of Southeast Asia for sustainable development

Many of the Southeast Asian countries have vast areas of natural and man-made inland water bodies that could be tapped for fisheries and aquaculture development (Pongsri *et al.*, 2015). For example, Indonesia has the largest total area which is dominated by floodplains (33.3 million ha), dams (26.5 million ha), wetlands (20.1 million ha), and river deltas that could expand to about 1.9 million km². Myanmar has floodplains of about 6.0 million ha, reservoirs dams of about 1.8 million ha, river systems that could provide about 0.7 million km² area, and others of about 1.3 million ha. As for Cambodia, its inland water bodies comprise mainly wetlands of about 2.4 million ha, floodplains at about 0.7 million ha, and others at 0.3 million ha. Lao PDR, the land-locked country of Southeast Asia has floodplains of about 0.16 million ha, reservoirs of about 0.13 million ha, and river system of about 0.12 million km². The other countries are also endowed with vast areas of inland water bodies, which have huge potentials for fisheries development, and are reported to be under-utilized.

In terms of production of major groups of species, only Indonesia, Malaysia, Philippines, and Thailand reported their respective data by species, while Cambodia, Lao PDR, Myanmar, and Viet Nam reported their respective production data as freshwater fishes *nei*. Nonetheless, the major species caught include: striped snakehead, Nile tilapia, freshwater mollusks *nei*, Asian redtail catfish, tilapias *nei*, climbing perch, snakeskin gourami, silver barb, and others (Table 3). Based on such information, it can be gleaned that regional expertise on the identification of freshwater species remains inadequate. Considering therefore the significant contribution that the inland fisheries sub-sector could provide, if properly valued, capacity building activities should be promoted in the Southeast Asian countries, specifically in the aspects of production data compilation and species identification by major species groups. Notwithstanding the need to also enhance the capacity of the countries in strengthening their systems and mechanisms of collecting data to make sure that the information on inland fisheries are properly recorded as this could lead to the accurate valuation of the inland fisheries sub-sector in ensuring food security in the future.

Ensuring Sustainable Development of Inland Fisheries in Southeast Asia: Role of SEAFDEC/IFRDMD

Recognizing therefore that inland fisheries could play the major role of enhancing the region's socio-economic development which is crucial for the region's food security by sustainably utilizing the vast inland resources that are available for sustainable development as well as the numerous indigenous fish species existing in the region, the SEAFDEC

Council agreed to establish SEAFDEC/IFRDMD, which is being hosted by Indonesia. Thus, IFRDMD has been given the main tasks of developing the guidelines on basic data collection for routine monitoring of different types of inland habitats; establishing and promoting the tools for assessment and management of inland fishery resources; monitoring the state and levels of exploitation of inland fishery resources; providing scientific basis for the proper development and management of inland fishery resources to the Member Countries; and serving as the regional forum for cooperation and consultation on research, conservation and management of the region's inland fishery resources (Pongsri *et al.*, 2015).

Conservation and management of tropical anguillid eels

At the very outset after its establishment, IFRDMD has been monitoring the state of exploitation and utilization of inland fishery resources in order to come up with scientific basis for their sustainable development and management. Therefore, as it continues to promote the responsible utilization of the inland fishery resources in Southeast Asia through meetings and consultations among the ASEAN Member States (AMSS), it has also become imperative for IFRDMD to coordinate the project "Enhancement of the Sustainability of Catadromous Eel Resources in Southeast Asia," the implementation of which had been endorsed during a series of SEAFDEC meetings.

The need to address the concern on the conservation and management of the tropical eel resources has been considered urgent as a proposal to list the Asian eel species under Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) is in the offing, and would possibly make impacts on this economically important species of the Southeast Asian region. In response to the recommendation for SEAFDEC to consider the development of appropriate measures for the sustainable management of eel resources to support the establishment of common position of the region if eel species, especially *Anguilla bicolor* (Figure 4) would be proposed for listing in the CITES Appendices, the SEAFDEC Secretariat convened regional meetings and consultations among the ASEAN-SEAFDEC Member Countries with funding support from the Japanese Trust Fund (JTF), and came up with the Regional Policy Recommendation on the Conservation and



Figure 4. Tropical anguillid eel (*Anguilla bicolor*)

Management of Eel Resources and Promotion of Sustainable Aquaculture. Upon its endorsement by the SEAFDEC Council during its Forty-seventh Meeting in April 2015, the said Regional Policy Recommendation enables SEAFDEC to initiate the conduct activities on the sustainable utilization and conservation of the tropical eel species.

After being fully organized, IFRDMD took on the responsibility of implementing the eel project in collaboration with the SEAFDEC Secretariat and with the cooperation of eel producing AMSs. With additional funding support from the Japan-ASEAN Integration Fund (JAIF), baseline and regular surveys have been started in the eel-producing AMSs, namely: Cambodia, Indonesia, Myanmar, Philippines, Thailand, and Viet Nam. Through a series of meetings and consultations and making use of the initial results of the surveys, the Information Document on the “Status and Resources Management of Tropical Anguillid Eels in Southeast Asia” was finalized. Describing the current progress of the regional initiative for tropical anguillid eels in Southeast Asia and containing the results of analysis of the status of exploitation of eel resources through fisheries and aquaculture, the said Information Document (SEAFDEC, 2018a) was submitted for review during the 30th Animals Committee Meeting in Geneva, Switzerland in July 2018, and during the subsequent 18th Meeting of the CITES Conference of Parties (CITES CoP18) in May 2019 in Colombo, Sri Lanka.

Promotion of responsible utilization of inland fisheries in Southeast Asia

Taking into consideration the two most important factors for the better management of inland fishery resources, *i.e.* improved data collection, and enhanced governance through the application of the ecosystem approach to fisheries management and co-management, IFRDMD has embarked on a project that generally aims to establish and strengthen the networking for the improvement of fisheries management and conservation of fishery resources in the inland waters of Southeast Asia. The project comprises three major activities, *i.e.*, investigation of the activities and methodologies for promoting inland fisheries in the AMSs that includes compilation of information on the current status of inland fisheries in the region; promotion of effective inland fisheries management measures by making use of the results of the analysis of the current status of the region’s inland fisheries; and development of habitat conservation and resource enhancement measures suitable for the region through capacity building.

With funding support from JTF, IFRDMD has initiated field surveys in Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Thailand, and Viet Nam, specifically compiling data on fishing activities and related fisheries socio-economic aspects, and also studying the biology of the indigenous inland fishes. With the information compiled



through the surveys, the picture of current situation of the region’s inland fisheries could be established and the key issues could be taken in consideration during the development of the measures that are appropriate for the management of the inland capture fisheries in the AMSs.

Strengthening effective inland fisheries management through GIS and RS

For the sustainable management and utilization of inland fishery resources, IFRDMD with funding support from JAIF would be embarking on a project that would monitor the environmental changes of the habitats that affect the inland fishery resources through the use of Geographical Information System (GIS) and Remote Sensing (RS) technologies, and establish effective management of inland fisheries and aquaculture based on the analysis of the causal relationship between the amount of catch/production and the environmental data obtained through GIS and RS. Wanchana and Sayan (2018) listed down relevant aspects that could be derived from the information obtained through GIS, which include: clear picture on the condition of the fishery resources that could be used for applying better harvesting strategies; and status of fishing effort to be used as basis for controlling harvest/fishing effort levels especially in highly exploited fishing grounds. From the RS applications, forecasting the fishing grounds could reduce the inefficiency of fishing activities; and with real-time information through the RS-obtained data, the origin of fish and fishery products in the supply chain could be traced.

Fish stock assessment and production potentials of fisheries from inland waters: Indonesia in focus

With funding support from the Indonesian Government, IFRDMD has implemented a Departmental Program that deals with an assessment of the fishery resources in Indonesian inland waters, considering that Indonesia embraces the most extensive inland water bodies in Southeast Asia (Pongsri *et al.*, 2015). As a matter of fact, Indonesia has the enormous potentials, viewing not only from the aspect of area but also in terms of biodiversity, especially fish. Nevertheless, in terms of the total catch by area, the information is still underestimated due to insufficient statistical data.

With Indonesia as the pilot site, stock studies would be carried out using analytical methods (more detailed and more reliable data) and holistic methods (simpler data), *i.e.* the ‘swept area’ method which is based on “catch per unit area” to estimate biomass and maximum sustainable yield (MSY), and the “surplus production model” method making use of the information on catch per unit effort. The results could be a compilation of information related to the potentials of and production from inland waters as well as national inland fisheries. Moreover, Indonesia has established a management tool used to delineate its inland fisheries areas. Known as the Fisheries Management Area KPP-PUD (FMA/KPP-PUD), it adopts the ecosystem approach in the management of inland capture fisheries and is meant to determine the amount of fish stocks, production potential, maximum sustainable yield (MSY), and total catch that can be used as a basis for fisheries management in the Indonesian inland waters. Results from the stock studies could then be disseminated to the other AMSs, especially those with vast inland water bodies that could be tapped for sustainable development.

Way Forward

The foregoing major projects and activities are aimed to prepare IFRDMD to be transformed into a Center of Excellence for Inland Capture Fisheries Management of Indonesia as well as of Southeast Asia. With such an objective, the Government of Indonesia had provided the necessary funds for the harmonization of the activities of IFRDMD and the Research Institute for Inland Fisheries and Extension (RIIFE), and for these centers to be able to jointly carry out ‘implementative’ research activities that could be used as reference in addressing the concerns on inland fisheries development and management, especially through the development of policies, capacity building, networking, and technology verification and dissemination. It is the goal of the Government of Indonesia to utilize the results from such research activities in enhancing the prosperity of coastal communities through an integrated inland fisheries management (IIFM) which would be implemented through

the establishment of a data center for science and technology on inland fisheries in Indonesia; establishment of sustainable management measures for inland fisheries resources; and the enhancing the cooperation among stakeholders for the development of pilot areas for sustainable management of inland fisheries. Although IFRDMD is still at the early stage of development, the Government of Indonesia supports the vision that IFRDMD should be slowly developed and established into a center of excellence in science and technology for inland fisheries management with national and international standards, not only for the benefit of the whole country but also for the Southeast Asian region.

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