

Managing the sustainable utilization of marine fishery resources

- The AMSs should consider establishing their respective management schemes to ensure the sustainable utilization of the marine fishery resources based on the best scientific evidence and appropriate reference points, *e.g.* maximum sustainable yield, total allowable catch, total allowable effort, closed season or closed areas during spawning seasons, which should be backed up with awareness-building programs for concerned fishers and other stakeholders. Management recommendations should also consider the nature of several fishing gears that target the multi-species resources, *e.g.* purse seines, trawls, and so on.
- The existing frameworks such as the “Regional Plan of Action on Sustainable Utilization of Neritic Tunas in the ASEAN Region (RPOA-Neritic Tunas)” and the “Regional Action Plan (RAP) for Management of Short Mackerel (Indo-Pacific Mackerel) in the Gulf of Thailand Sub-region” should be promoted to enhance regional cooperation for sustainable utilization of the marine resources shared by more than one country.

Developing aquaculture technologies to reduce pressure on marine fish resources

- Appropriate aquaculture technologies for some marine species, *e.g.* marine shrimps, reef fishes, should be developed and promoted with a view to reducing the threats to natural populations and increasing production of marine species to commensurate the increasing demand. Large-scale aquaculture of seaweeds is another area that should be explored considering that this could contribute to multi-faceted benefits, *e.g.* providing products for a variety of food and non-food uses, serving as shelters and habitats for aquatic animals, and reducing carbon absorption to mitigate the impacts of climate change, among others.

2. Inland Fishery Resources**2.1 Status, Issues, and Concerns*****2.1.1 Contribution of Inland Fisheries to Food Security and Poverty Alleviation***

Inland fisheries play a very important role in providing food and income, particularly in developing countries, and as a source of animal protein for local communities. Inland fish is usually more affordable than the other animal food sources and is often available even in remote areas. Fish contains high essential vitamins and minerals that are important for alleviating micronutrient deficiencies, childhood stunting, and some health conditions (Bennett *et al.*, 2018). Thus, the sustainable development of inland

fisheries ensures that people in the rural areas could access affordable fish as a source of their protein requirements.

Inland capture fisheries are practiced in various scales, from artisanal and subsistence, to small-scale and large-scale fisheries. This sub-sector also engages a large number of persons who work in the processing, marketing, transport, and related industries. It is estimated that about 4 million people are engaged, full- or part-time, in the primary activities of inland capture fisheries or in fish farming. Four to five times that number are employed in secondary industries such as processing, distribution, and trade (FAO, 2000).

Despite its importance, inland fisheries are usually underrepresented in national and international policy discussions, and more often than not, the role of this sector is overshadowed by the higher-profile interest in marine fisheries issues (Funge-Smith & Bennett, 2019). Due to environmental degradation, heavy fishing pressure, and conflicts with other land and water users, it is possible that the production from inland capture fisheries is on the declining trend (FAO, 2000; Funge-Smith & Bennett, 2019). This is contrary to published statistics on inland capture fisheries which show an increasing trend over the past 15 years, as such reported production volumes may not be accurate because of the deficient systems of collecting and compiling statistics especially from small-scale inland capture fisheries of the respective Southeast Asian countries.

Nonetheless, there is a need to sustain the production of inland capture fisheries, as well as improve the systems of data collection on inland fisheries in general. Future attention should therefore be directed towards protecting and rehabilitating the inland aquatic habitats in order that these could continue to provide the enabling environment for sustaining fish production for the rural populace. The profile of inland capture fisheries should also be raised by sharing information and data with the other relevant sectors that compete for the utilization of the same resources and also by providing the best information to policymakers and planners.

In the Southeast Asian region, efforts are being made to establish and promote the priority actions that would ensure the sustainable contribution of inland capture fisheries to the socioeconomic development of rural communities, especially on their food security and poverty alleviation. These are specified in the adopted Plan of Action for Sustainable Fisheries for Food Security for the ASEAN Region Toward 2030, such as:

Plan of Action No. 45 to “*Monitor and assess the impacts of the construction/operations of man-made structures that could alter the waterways and affect migration and spawning of aquatic animals,*

particularly those at risk of overexploitation, and develop mitigating measures and appropriate conservation and management measures for such impacts through consultative processes that may involve collaboration with regional organizations”;

Plan of Action No. 46 to “*Encourage coordinated planning and management on the use of inland water bodies including rivers, floodplains, wetlands, etc. through (i) resource enhancement programs; (ii) inland fisheries management programs; (iii) environmental impact assessment of structures on the aquatic resources; and (iv) restocking of indigenous and/or commercially-important aquatic animals species taking into consideration concerns on genetic diversity; and build/improve the capacity of human resources and institutions in the implementation of such programs”;* and

Plan of Action No. 47 to “*Formulate guidelines to promote the use of practical and simple indicators for inland/floodplain fisheries within the national inland fisheries management framework, to facilitate (i) timely local level fisheries management decisions with due respect to the large number of people/farmers that take part in fishing; (ii) dialogues to ensure that the inter-connectivity of fish migration path is kept as a tool for management/conservation measures; and (iii) adaptation to the effects of climate change within water bodies”*

The AMSs are therefore enjoined to mainstream the abovementioned action plans that were adopted by the authorities of the ASEAN and SEAFDEC, in the respective countries’ plans and programs in order that the inland capture fisheries would continue to provide food fish and incomes to the rural fishing communities. Thus, this sub-sector could continue to contribute to food security and poverty alleviation in the AMSs.

2.1.2 Data Collection on Inland Fisheries

Data and information are the basis for proper management, while information on fish and fishers is the essential component of any fisheries. In the case of inland capture fisheries, data collection is usually weak while the compiled data are generally insufficient for generating the kinds of decisions needed. Furthermore, the catch statistics on inland fisheries are fragmented and discontinuous, contributing to the poor picture of the status of the inland fishery resources around the world.

The inland fisheries sub-sector is very complex, comprising many small-scale fishers with catches that vary not only in size but also in species which could be multiple. Meanwhile, fishing gears used are also multiple, and fishing is highly seasonal (Fitzgerald *et al.*, 2018; Muthmainnah *et al.*,

2020). The majority of activities in inland fisheries are not licensed, operated at semi-commercial or subsistence level, and widely dispersed along with the numerous water bodies (FAO, 2010a). Most of the catches of inland fish are unrecorded as sometimes the catch is bought directly from landing spots or informal local markets. The existence of inland landing sites or major markets is very rare, making it difficult to collect the necessary data and information. Moreover, the importance of inland catch statistics is less valued by most authorities in many countries.

In the Southeast Asian region, some nations have established their national strategies and tools with respect to gathering information on inland capture fisheries, *e.g.* inland fisheries databases had been developed in the Philippines and Indonesia. The National Stock Assessment Program (NSAP) of the Philippines makes use of a standardized method of data collection to come up with science-based policy recommendations for the conservation and management of the fishery resources in the Philippines. While for Indonesia, the One Data Policy (ODP) is the database system used for integrated data compilation. The ODP uses data processors (or enumerators) assigned to visit the respondents and to record and input the data collected (Muthmainnah *et al.*, 2017b).

Another issue with regard to the collection of inland capture fisheries data and information is the high cost that could be incurred as this requires people who would be paid for their services, and expenses for the cost of transportation and communication system to be effective (FAO, 1997b). Nevertheless, SEAFDEC/IFRDMD is currently establishing a mobile application known as “Data Collection for Fishery Activities” or DACOFA for short, designed to make sure that fishers or users input the necessary data quickly and efficiently. An android system was chosen considering its convenience and ease of running the application as well as the affordability of the phones. One of the main advantages of using the data collection application is that the data could be gathered easily. The enumerators who are on the go or in a location where internet connection could be unreliable can still input the data. Offline modes would allow the fishers to store a backup of their data on their mobile devices and upload it once an internet connection is available. Automatically, the data will be recorded in the database system. By using this mobile system of data collection compared to paper-based forms, the number of data collected had been enhanced in quality and increased in quantity. This gives the option for the data collectors to use as it suits best their purposes (Muthmainnah *et al.*, 2020).

Improving data collection on inland capture fisheries

Strengthening the system of collecting capture fisheries data from inland fisheries has become essential, especially in terms of information on fishery household and production. The availability of complete and valid fisheries data would