CHAPTER 4

DESIRED CONDITION FOR KEEPING THE SUSTAINABILITY OF FISH RESOURCES

Fishery resources are renewable natural resources that could be sustainably utilized through rational and responsible exploitation. Enforcement of regulations by governments to fisheries activities is necessary to ensure the continued productivity of the resources in particular, and accomplish the sustainable fisheries objectives in general. Promoting the sustainable management of the fishery resources should take into consideration the availability and affordability of the fish and fishery products obtained from the fishery resources, and should also aim for the enhanced socio-economic well-being of the fisheries households, and should be environment-friendly.

As renewable natural resources, fishery resources could be exploited through rational and responsible means to ensure their sustainability. The desired ways and means of ensuring the sustainability of the fishery resources should be based on sound fisheries management options, which should be established considering the resources available, now and in the future, when people need fishes in excellent condition and at affordable prices. Such management options should also aim to enhance the economic well-being of the fishers and fisheries communities, and should be environment-friendly.

The inland fisheries sub-sector is one of the most important economic groups that tap the inland water ecosystems for development. Despite its importance to rural communities, especially in the least-developed countries, this sub-sector has been given little attention in planning and policy formulations. As a result, management of inland fisheries is insufficient and inadequate resulting in the increasing threat of the fisheries to the inland water resources, exacerbated by the irresponsible utilization of the resources by non-fishery users (Welcomme *et al*. 2014). Aside from the inland fisheries and aquaculture sub-sectors, the inland water resources are much used for varied purposes, as source of water for domestic uses, hydropower generation, and irrigation, as well as serving as natural track for water transportation (*e.g*. rivers, canals) and sites for recreational activities (*e.g*. rivers, lakes, dams).

Inland waters of Southeast Asia are among the longest and most productive waters for wild-capture inland fisheries in the world (Welcomme *et al*. 2015). FAO (1988) defined capture fisheries as an activity that refers to all kinds of harvesting of naturally occurring living resources in freshwater environments whereas aquaculture is the farming of aquatic organisms, including fish, mollusks, crustaceans, and aquatic plants. Farming implies some forms of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, and so on. Farming also implies individual or corporate ownership of the stock being cultivated.

Management of inland fisheries has always been extremely complicated owing to the spatially dispersed nature of the fisheries activities, the large numbers of persons involved in such activities, and the distance of the fisheries operations, installations and facilities from major urban centers. As a result, fisheries regulations are often not effectively enforced or when enforced, success in the implementation might be insufficient and inefficient because such regulations had been established by central authorities and promoted in a top-down manner, without taking into account the needs and priorities of the inland fishers and fisheries communities, and disregarding the very nature of the inland water resources. Moreover, the drivers of change mostly come from outside the fisheries sector, and might be unaware of the fact that the productivity of many fish populations could be affected by the environmental impacts of the irresponsible activities of the other users of the aquatic resource (Welcomme *et al*. 2014).

4.1 Ten Steps of Inland Fisheries Management

As an umbrella in managing inland fisheries, Rome Declaration on Inland Fisheries Management has been established in 2015 and can be used as a platform of inland fisheries management in Asia. The declaration mentions ten steps of inland fisheries management as follows (Taylor *et al*. 2016):

1. Improve the Assessment of Biological Production to Enable Science-Based Management

It is widely acknowledged that inland fisheries have been facing with lack data, all from local to global ecosystems. In this regards, standardizing assessment method for inland fisheries is very essential in accordance with the spirit of sciences-based inland fisheries management. (Taylor *et al*. 2016) also suggested that to implement the data collection for

inland fisheries we need at least activities such as (1) develop, promote and support standardized methods for assessment of inland fisheries harvest and aquaculture products; (2) support the development of novel approach in collect inland fisheries data; (3) incorporate inland fisheries and aquaculture into ongoing national house hold census to support inter-sectoral decision making process; (3) increase support for efforts to increase capacity of fishery resources officers to collect information and data; (4) establishment of set of minimum data requirement that would be practical for countries to collect data.

2. Correctly Value Inland Aquatic Ecosystem

Especially in Asia, it is often that the ecological, social and economic value of inland fisheries are still heavily unknown (Taylor *et al*. 2016). In this regard, application of total economic value of inland fisheries can be included in the assessment of inland fisheries in the countries. Additionally, the application of Voluntary Guidelines of Securing Small Scale Fisheries (SSF) in inland fisheries should be widely conducted (Taylor *et al*. 2016).

3. Promote Nutritional Value of Inland Fisheries

The inland fisheries can be considered as one of main sources of nutrition, especially for the poor food-insecure regions (Taylor *et al*. 2016). In this regard, it is important to maintain and improve the accessibility or availability of nutrient-rich fish coming from inland fisheries in area with traditionally high fish consumption.

4. Develop and Improve Science-Based Approaches Fisheries Management

The management arrangement can result in excessive fishing pressure, decreased catch per unit effort, and conflicts between fishers, as well as changes in the productivity of fishery resources (Taylor *et al*. 2016).

In this regard, it is important to start an Ecosystem Approach to Inland Fisheries and develop the database system for better sharing of data and information of inland fisheries.

5. Improve Communication among Freshwater

Many misconceptions exist on the needs and desires of fishing communities happened due the policy-makers, stakeholders and the general public could not access the information on the importance of the inland fishery and aquaculture sectors (Taylor *et al*. 2016). Hereof, using appropriate and accessible communication channels to disseminate information will raise the awareness of inland fisheries' values, alter human behavior, and influence relevant policy and management.

6. Improve Governance Especially for Shared Water Bodies

Many national, international, and transboundary inland water bodies do not have a governance structure that holistically addresses the use and development of the water and its fishery resources. The results in decisions made in one area were often adversely affecting aquatic resources, food security, and livelihoods in another (Taylor *et al*. 2016). On this subject, building up the capacity of existing institutions and including the agreed decision on national government policies is important to do.

7. Develop Collaborative Approaches to Cross-Sectoral Integration in Developmental Agendas

Water-resource development and management discussions very often marginalize or overlook inland fisheries (Taylor *et al.* 2016). In this connection, policymakers should be made aware of the impacts of various activities being undertaken by other sectors in inland waters

although many development projects are proposed for enhancing national economies and improving the quality of life of people, constantly mindful of consolidating the inland fisheries into the post-2015 sustainable development goals.

8. Respect Equity and Rights of Stakeholders

Lack of recognition of the cultural values, beliefs, knowledge, social organization, and diverse livelihood practices of indigenous people, inland fishers, fish workers, and their communities has often resulted in policies that exclude these groups and increase their vulnerability to changes affecting their fisheries (Taylor *et al.* 2016). Recommend the local scene; the local wisdom introduces the specific provisions governing access to fisheries, where the separate regimes of access are recognized.

9. Make Aquaculture an Important Ally

Aquaculture can complement capture fisheries, through stocking programs, by providing alternative livelihoods for fishers leaving the capture fisheries sector, and by providing alternative food resources. On the other hand, Aquaculture can also negatively affect capture fisheries, by introducing the invasive species and diseases, competing of water resources, pollution, and restrictions accessing to traditional fishing grounds (Taylor *et al.* 2016). In this regard, it is important to start an Ecosystem Approach to Fisheries and Aquaculture Management and considering the use of native species in aquaculture development.

10. Develop an Action Plan for Global Inland Fisheries

The challenges in fisheries production are to sustain and increase production by providing healthy inland aquatic ecosystems. Without immediate action, it will be jeopardized, risking social, economic, and political conflict and injustice (Taylor *et al.* 2016). The challenges can be

surmounted by building partnerships that facilitated by the Government between fisheries and the international community, governments, Civil Society Organizations, indigenous peoples groups, and private industry, and include all sectors using freshwater aquatic resources.

4.2 Policies, Regulations, and Institutions

One of the most critical challenges that confront the inland fisheries sub-sector in many countries is the competition for the use of waters and the aquatic habitats. The conflict occurs when the need for water in terms of quantity and quality, to support fisheries and sustain the aquatic habitats, coincides with the needs of the other sectors, in particular agriculture. Decisions on water management frequently do not take into account the impact of shared water utilization on fish and fisheries and on the rural livelihoods of the populations dependent on the water resources. In part, this could be because inland fisheries are significantly undervalued in water management at local, national, and basin levels (Dugan 2007). This is despite the regulations established by many countries to control, guide and monitor the optimal use of the ecosystem services, as well as the environmental and water productivity approaches to allocate sufficient amount of water for sustaining the fish and fisheries.

Nevertheless, there are several countries that have not yet developed their national policies tailored to inland fisheries since in most cases inland fisheries are placed under the policy frameworks that evolve around the coastal and marine fishery resources. It is therefore necessary that countries should establish the policy frameworks aimed at implementing the contexts specific to inland fisheries. An essential attribute of a useful inland fishery policy framework is an ecosystem approach to fisheries, which includes fisheries considerations and related environmental concerns in integrated planning, particularly for water use (Dugan 2007).

For achieving the desired condition on keeping the sustainability of fish resources, certain actions should be done. Several countries in Southeast Asia have established regulations and policies, published by local and central governments. The regulations and policies that have been compiled from the ASEAN Member States are shown as follows.

Regulations in the AMSs: A brief review

Brunei Darussalam

With the approval of His Majesty the Sultan and Yang Di-Pertuan of Brunei Darussalam, the Constitution of Brunei Darussalam 2009 includes under **Article 8313 - Part XI** a provision dealing with the inland fisheries sector for the purpose of:

a) promoting and regulating aquaculture in riverine waters and in particular, to provide for the leasing and licensing of lakes, swamps, mining pools and other pools, land and other areas for the cultivation of fish; to prescribe standards for the construction and operation of aquaculture establishments including the size and depth of ponds; and to measure for the prevention of fish diseases and controls over any particular species of fish which may be produced by cultivation;

b) regulating or prohibiting any method of fishing in riverine waters or the use or possession of certain types of traps or nets, and to prescribe minimum mesh sizes for fishing nets;

c) prescribing the minimum weights and sizes of fish which may be caught in riverine waters for sale or for the purpose of processing, consumption or sports, or to prohibit fishing for any prescribed species of fish;

d) designating the persons, by name or office, to be licensing officers and to prescribe the powers to be exercised by such officers and by any officer authorized by the Director in writing in that behalf with respect to inland fisheries;

e) for the purpose of conserving fish in riverine waters, to regulate and control the construction of any slides, dams or other obstruction, or the removal of sand or gravel or other alteration to the natural environment or habitat of fish; and

f) designating, prescribing, promoting, providing or regulating any other matter for the proper conservation, development, management and regulation of inland fisheries.

Cambodia

The Government of Cambodia through Fisheries Administration (FiA) of the Ministry of Agriculture, Forestry and Fisheries (MAFF) regulates inland fisheries exploitation through the Law on Fisheries (Preah Reach Kram NS/RKM/506/011 - year 2007) with the following provisions:

a) **Article 10:** The inland fishery domain is the water bodies that extend from the marine waters to the inland border of the Kingdom of Cambodia.

b) **Article 16:** Cambodia has the closed season for middle-scale fishing defined as follows:

   1. From 01 June to 30 September for the inland fishery domains located north of Tonle Chaktomok parallel (Latitude: 110 33' 259"N).
   2. From 01 July to 31 October for the inland fishery domains located south of Tonle Chaktomok parallel (Latitude: 11°33' 259"N).

c) **Articles 39-44**: arrangement for the Inland Fishery Exploitation, type of fishers (small-scale, middle-scale and large-scale fisher)

At the local community level, the Community Fisheries take part in the sustainable management, conservation, development and use of the fishery resources.

Fishing effort is primarily controlled through licensing. Fishing licenses are either auctioned by the Government to the highest bidder for exclusive exploitation for two-year period (Deap, Degen and van Zalinge 2003) or are allocated by the FiA for research purposes. During

the period 1938-1939, a total of 108 dai units were permitted to fish in 23 rows (Chevey and Le Poulain, 1940), but by 1962-1963 the number had been reduced to 61 units in 15 rows (Fily and D'Aubenton 1995). The mid-1980s saw an increase to 86 units followed by a decline to present-day numbers. In Tonle Sap, there are currently 64 dais in 15 rows. Fishing effort (mortality) is also controlled through the enforcement of a closed season between 1 April and 30 September. The closed season, which corresponds to the spawning period for the majority of target species, is also a technical measure designed to protect the reproductive potential of the resources.

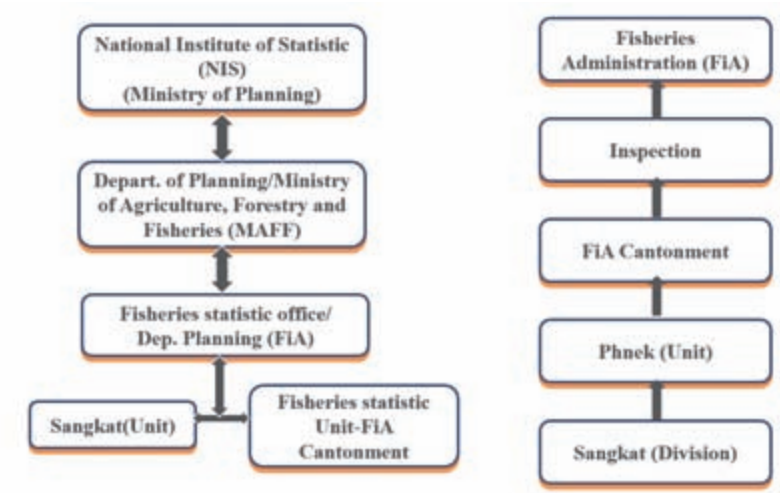

Figure 4.1 Fisheries Statistic and Information Data Collection System and Reporting

Regular monitoring by the FiA (formerly the Department of Fisheries) using logbooks began in the 1980s, supplemented by *ad hoc* surveys as described by Nguyen and Nguyen (1991). However, monitoring using the logbook was regarded as unreliable because some fishers under-reported their catch as this has an influence in the license costs. Sub-national fisheries officers/FiA Cantonment officers who are responsible for fisheries statistic were trained by fisheries statistic officer from central level on how to collect data, data entry and report writing (**Figure 4.1**).

Since 1994, catch and effort variables as well as length-frequency data have been sampled daily by the FiA using direct observation (enumerator) method with the support of the Fisheries Programme of the Mekong River Commission (MRC) providing species-wise estimates of the: (i) total annual catch; (ii) indices of abundance and biomass (CPUE), (iii) mean weight; and (iv) population size (age) structure.

Indonesia

Indonesia applies relevant regulations in homogenous communities and small ecosystems within their jurisdictions, which is widely practiced in Sumatera and Kalimantan. Considering that most of the current regulations at national levels only emphasized on marine fisheries, some district governments enacted laws related to inland fisheries for inland waters within their jurisdictions. Fisheries Law No. 31/2004 of Indonesia and revised as No. 45/2009 is the basic fisheries legislation, which stipulates provisions on utilization of the fishery resources, either for fish catching or fish breeding in the Indonesian waters, to ensure their preservation and the protection of the environment. The Ministry of Marine Affairs and Fisheries (MMAF) shall determine the provisions for regulating the fishing gear, allowable catch, fish breeding, prevention of pollution, protected fish, etc. (**Art. 7**). All individuals and companies carrying out fishing business shall be licensed, except for small fishermen and small fish breeders. The Government shall establish a court of fishery affairs authorized to examine, hear and rule criminal cases in fishery affairs.

Furthermore, in the legal plan, Fisheries Law No. 31/2004 clearly mentions that fisheries management is done under a partnership principle, as indicated in **Article 2**: *The fisheries management is done according to the benefit base, justice base, partnership base, even distribution base, integrity base, openness base, efficiency base, and continuous conservation base*. More specifically, the fisheries management should also consider the customary laws and local wisdom as provided for in the Fisheries Law No. 31/2004, **Article 6** in particular: *The fisheries*

management for fish capture and fish cultivation has to consider the customary law and/or local wisdom and also the society that partakes. These legal provisions clearly show the justice and partnership benefit, based on the local wisdom and customary law which become basis for the implementation of fisheries co-management in Indonesia (**Figure 4.2**).

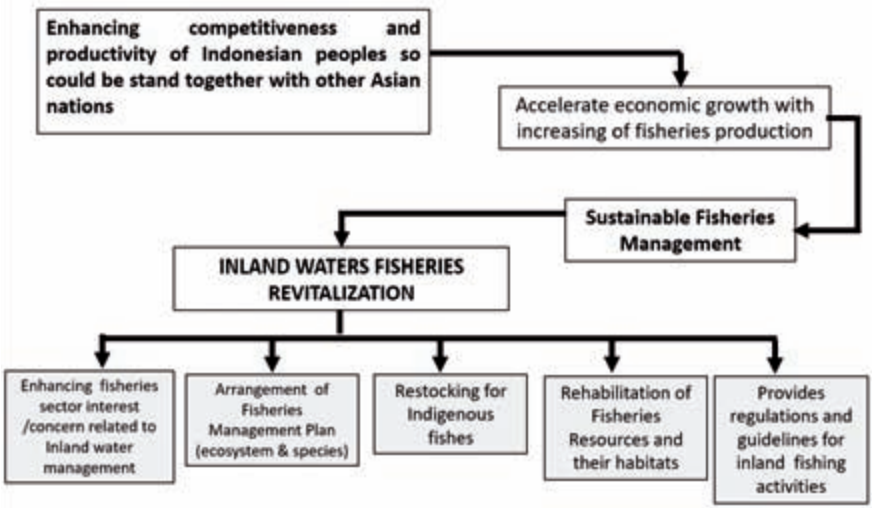

Figure 4.2 Policy and program for inland fisheries management in Indonesia (2015-2019)

There are also regulations declared by local government. For example, South Sumatra Regional Regulation No. 6 of 1978 and Decree of the Governor of the Head of Level I of South Sumatra No. 705/KPTS/II/82 concerning the auction of lebak lebung (also known as deep swamp) that contains the obligations of the leaders and winners of the lebak lebung auction to preserve the water resources and prohibit fishing with explosives, poison and others. Moreover, Ogan Komering Ilir District Regulation No. 18 of 2010 is also concerned with the management of lebak lebung. **Article 1 Item 5** is on lebak lebung and rivers as the areas that consist of lebak lebung, teluk (also known as bay), swamp, and rivers which are periodically or continuously flooded and are natural places or refuge for fish seeds or other aquatic biotas.

Indonesia had collected the data for inland capture fisheries since 1974 when Fisheries Directorate-General (under Ministry of Agriculture) established a national fisheries statistics system with assistance from FAO. In 2014, there are 320 districts (from 514) and 27 Provinces (from 33), collect and report their inland capture fisheries activities (**Figure 4.3**).

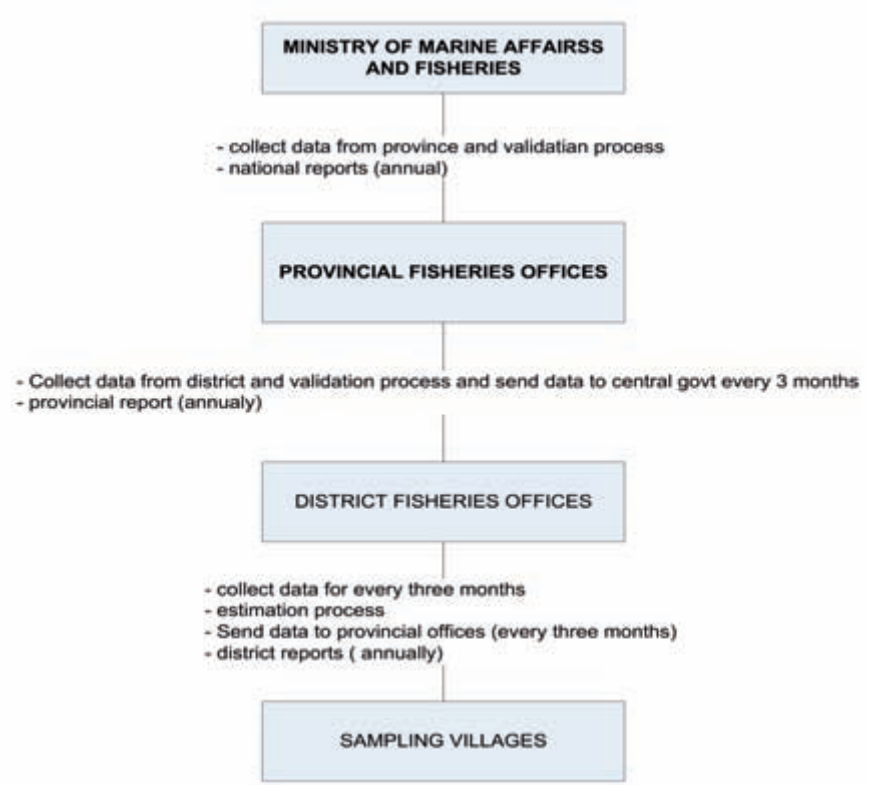

Figure 4.3 National fisheries statistics system of Indonesia

Lao PDR

In the new fishery law which was endorsed in Lao PDR in July 2009, **No. 03/NA** brings fisheries management within one cohesive framework. The fisheries law identified the principles, regulations and measures governing organizations, implementation, management, and fisheries inspection of aquaculture to promote conservation, protection,

development and sustainable utilization of aquatic resources and to ensure the food security for the Lao people. As part of the environment protection for national economic development, a measure is being taken by the Government to conserve the fishery resources as follows: establishing the closed season and conservation, regulation of the fishing nets, and the establishment of the annual plans. Under Part IX: Fish Release Day, Symbols and Stamps, **Article 69** on the National Fish Release Day provides that the Government has designated the 13th of July every year as National Fish Releasing Day for conservation, protection and development of abundant aquatic organisms.

The national strategy for fisheries management and development from present to 2020 (**Figure 4.4**) is the government's highest priority.

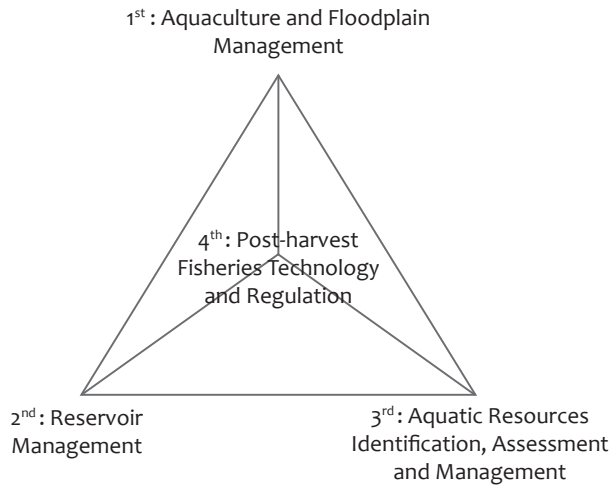

Figure 4.4 National Strategy for Fisheries Management and Development from present to 2020

The policy is to obtain food self-sufficiency both in agriculture and fish products to overcome poverty in rural areas and to improve the nutritional level as well as economic status. National agricultural and fisheries development policies will center around:

1. Meeting food security (especially the fish protein intake of the population averaging 18 kg/caput/year and projected by the year 2020 about 23 kg/caput/year;

2. Ensuring the provision of fishery products as commercial commodities for the local market and future export;
3. Supporting the rural development in the perspective of poverty alleviation and income-generating opportunity and a complementary source of cash;
4. Contributing to the gradual reduction of slash and burn shifting cultivation by integrating fish culture into the upland farming systems;
5. Adding to the sustainable use, appropriate management and protection of aquatic resources including aquatic bio-diversity;
6. Upgrading and establishing appropriate basic infrastructure required for further aquatic resources research, management and development for the country;
7. Strengthening, upgrading, and performing the technical support services in Research, Extension, Management and Development od the sub-sector such as Living Aquatic Resources Research Institute, Inland Fisheries Development Center, Aquatic Animal Health Diagnostic Network.

Malaysia

Among the legislations in Malaysia that are relevant to environmental protection and preservation, and on aquaculture development, are those included in the Fisheries Act 1985, Environmental Quality Act 1974, Environment Protection Enactment 2002, Sabah Inland Fisheries and Aquaculture Enactment 2003, and the Natural Resources and Environment (Amendment) Ordinance 2005. The Fisheries Act 1985 (FA85) focuses on relevant fisheries matters pertaining to development and management, and there are also provisions that are indirectly relevant to the preservation of the environment (Vun and Witus 2016).

A local fisheries management system is known as tagal, which prohibits anyone from catching fish in the river that has been designated by the community itself until such time (usually one year) that harvest of the fish resources is permitted. In 2002, a system of smart partnership between the community and Department of Fisheries Sabah (DOFS)

to support the protection, conservation and management of fishery resources in the rivers of Sabah. Creating a model tagal in Penampang, in collaboration with local communities, promoting the tagal system to other areas, monitoring the tagal, conduct research, and assist in terms of equipment and basic infrastructure. To develop further the tagal system, creating the sport fishing, tourist attractions and directly increase the income of local community resources.

During the 10th MP (2011-2015), the Department of Fisheries Sabah has been allocated more than RM2 million to support efforts to develop a statewide tagal system. Currently, there are 536 rivers of the area involving the 221 rivers in 20 districts throughout the state having the system the tagal that was created jointly by the local community with the DOFS. Efforts to develop the tagal system will be continued in the 11th MP (2016-2020) to achieve the target of 700 tagal system under the National Agro-Food Policy by 2020.

Myanmar

The Department of Fisheries (DOF) of Myanmar has extended the lease period of leasable fisheries for up to nine years to promote improved long-term management (3 years x 3 lease terms). The management systems of leasable fisheries are normally handled by the DOF, mainly through the auctions which are conducted in conjunction with the townships and regional authorities. Act "9" of the Fisheries Manual 1905 is concerned about regulating the leasable fisheries. The Freshwater Fisheries Law for Indawgyi Region in Kachin State has been renewed in 1905, 1991, and 2013.

Myanmar has been practiced the right-based fisheries management under the Freshwater Fisheries Law (1991) till 2011. Due to the politic and administration reforms of Myanmar, the Department of Fisheries has transferred the management power to Local Government on 16-4-2011. All local government has enacted the Regional or State Freshwater Fisheries Laws for fisheries management at present. These laws are practiced based on the particular and current situation of each state and region.

In terms of management, fisheries activities in Myanmar are grouped into three (3) parts following the rules of the Government of Myanmar. These are: leasable fisheries, tendered fisheries, and open fisheries. In leasable fisheries, management is carried out by the auction winners who automatically become the temporary owner of the auction-acquired fishery area but still the owner must follow the government regulations, including observance of the fishing season, closed fishing season, and conduct of restocking activities of fish seeds in an effort to increase the number of fish in the managed area. Outside the fishing season, the Government regulation states that the May-August period is declared as closed season. During this period, in which the fish is spawning, no fishing is allowed but restocking of fish seeds into the waters is encouraged. The types of fish stocked are generally the economically-valuable local fish species and could also include the fast-growing fish species such as Tilapia, Rohu, and Carps to dam, reservoirs, and rivers annually. There were 65.8 million numbers of fish fry released into the dam, reservoirs, and rivers in 2018.

The Philippines

The primary fisheries policies of the Philippines are provided for in the following:

a) Philippine Environment Code (1988) which provides the foundation for all measures dealing with the Philippines' natural environment, encompassing the management of air quality, water, land use, natural resources and wastes.

b) Philippine Fisheries Code (1998) that provides for the development, management, conservation and utilization of fisheries and aquatic resources.

c) Fisheries Administrative Order No 196 (2000) also known as FAO 2000, provides the detailed guidelines on the creation and implementation of the Fisheries and Aquatic Resources Management Councils (FARMCs).

Fisheries Code of 1998 of Philippines states that food security is the overriding consideration in the use, management, development, conservation, and protection of fisheries in order to address the food needs of the population. With this premise, the Philippine Government launched in the early 2000s the program known as "Agrikulturang MakaMASA," which means agriculture for the masses. Its fisheries component the "Agrikulturang MakaMASA – Fisheries" is aimed at developing and managing the country's fisheries for food security, contribute to the socio-economic upliftment of subsistence fisherfolk nationwide, and promote environmental protection for sustained aquatic productivity over a long-term period. With the implementation of the Philippines Fisheries Code of 1998, fishery law enforcement nationwide had been strengthened in close coordination with local government units and national law enforcement agencies. Generally, the main problems in the effective implementation are: lack of appropriate equipment, operating funds and trained manpower.

Regarding the data collection of inland fisheries, National Stock Assessment Program (NSAP) is the title of the Philippines' national information-gathering program for capture fisheries (in both marine and inland), started in June 1997. The objectives of NSAP are to develop and institutionalize the capability of the region on resource assessment, resource management, and development, and generate reliable data as the basis in the formulation of policies for the management and conservation of the country's marine and inland resources to attain sustainable development and exploitation. NSAP was designed to have more reliable data on the fisheries status in the Philippines and to come up with science-based policy recommendations for conservation and management of fishery resources in the country. The member of managing NSAP consists of the enumerators; data managers and analysts; NSAP regional team leaders; and policymakers. Training of the enumerators (data collection method of catch and effort data, fish identification) is also conducted in this program — survey methods used by NSAP survey landing sites. Enumerators take the samples at least

10% of the landed boats by gear. The final step of NSAP was to input the information on the database. NSAP Database System (NSAP DB) was also established to store the catch statistics and related information continuously with a standardized format. This database was designed for aiming efficient means of storing, managing, and retrieving data for analytical purposes (**Figure 4.5**).

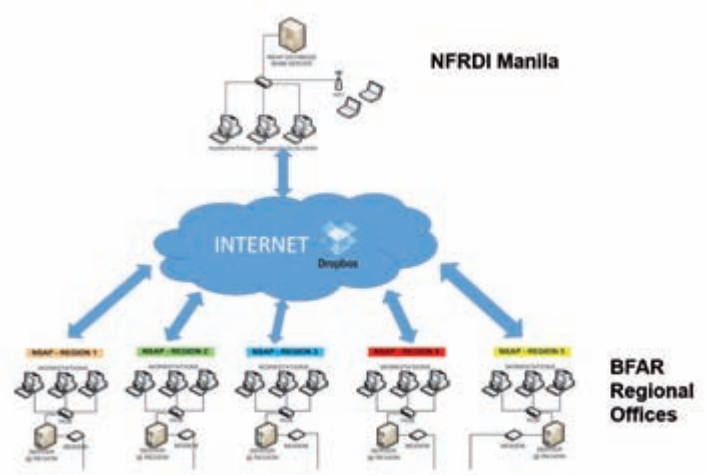

Figure 4.5 Flow chart of gathering data by (Bureau of Fisheries and Aquatic Resources), Philippines (image source: NSAP)

Singapore

The protection and conservation of fisheries, and to make provision for the control of fishing, the control of the marketing and distribution of fish, for measures pertaining to the general welfare and improvement of the fishing industry in Singapore and for purposes incidental has regulated in fisheries act (Chapter 111), Original Enactment: Act 14 of 1966 and revised in 2002.

Since limited land resources, Singapore can be developed not only to supplement Singapore's fresh-fish consumption, but also to utilize the limited land and water resources for maximum yield and economic returns efficiently. Aquaculture can play an important role in Singapore in the implementation of national policies on food production. The

activities will maintain the present status of local food production, thereby minimizing the over-dependence on external food supply (FAO 1976).

Thailand

Fisheries management in Thailand has started since B.E. 2444 (1901) when tax and tariff were collected from fishing activities to ensure sustainable fish supply for local consumption. During the reign of King Rama VII, the Department of Aquatic Animal Conservation was established on 21 September B.E. 2469 (1926). It was renamed as the Department of Fisheries since 1 January B.E. 2497 (1954).

Inland Fisheries Management under the Royal Ordinance on Fisheries B.E. 2558 (2015), Chapter 2 Fisheries Management provides policies on fisheries management by way of promoting the participation of all stakeholders in the management and conservation of aquatic animal resources. The highlights of The Royal Ordinance on Fisheries B.E. 2558 (2015) came into force on 15 November 2015, with focused on:

1. Encourage the incorporation and registration of the local fishing community.
2. The registered local fishing community has rights to proposed fisheries management measures for and eligible to be selected as the provincial fisheries.
3. Local fishing community members have been selected as an eligible, competent helper.
4. The Provincial Fisheries Committee will be determined Measures to manage fishing Development issues or fishing in the area by made following local conditions and circumstances more.

Thailand has a very extensive stocking program, mostly concentrated on reservoirs and rice-fields as well as in rivers and swamps. The NGO's and local communities are becoming increasingly more influential under the stocking programs where attention is being focused on social justice, livelihoods, biodiversity, and the environment. Co-management is promoted, as an approach to promote environmental rehabilitation.

Also mentioned in Section 56, is a provision that "no person shall catch aquatic animals in an aquatic species sanctuary except for the purposes of academic advancement or for the purposes of nurturing the aquatic animal breeds for which permission in writing has been granted by the Director-General of the Department of Fisheries. Moreover, under Section 71, the Minister or the provincial fisheries committee shall have the power to issue notifications regarding the fishing gears according to their types, fishing methods, fishing areas, and other conditions that are prohibited from engaging in fishing operations in the country's fishing grounds.

Viet Nam

In Viet Nam, the Government's fisheries policies are defined in laws, decrees, ordinances, circulars and regulations, the latter of which are often developed at provincial level. Provinces are the lowest level at which regulations can be drafted, consistent with the relevant national legislations. Since 1996, the Government has emphasized on the development of the country's market economy under the Doi Moi (renovation) Policy. A new Fisheries Law was drafted by the Ministry of Fisheries (MOFI) of Viet Nam with help from Norwegian Development Agency (NORAD) and FAO, and passed by the National Assembly in November 2003. The Fisheries Law went into effect on July 1, 2004 (Anonymous 2005).

In the case of capture fisheries, focus is on marine activities and based along the 29 coastal provinces of Viet Nam, which clearly receives the most attention and given much detailed consideration. However, aside from its marine water resources, Viet Nam has a dense river network, including nine major river basins as well as a substantial inland water surface area of (open access) its lakes and lagoons. Very little is actually known about the levels of production from these inland water resources, the profits generated, and the characteristics of those fishing activities in such inland common water resources. This could be due in part to the nature of the subsector, where data are limited as the catch is simply not reported in any systematic way. As such, just one (relatively

modest) national production number of approximately 200,000 metric tons from the country's inland water resources is published every year. Inland capture fishing is the least understood fisheries activity in Viet Nam (Anonymous 2010). In accordance with the Law of Fisheries 2003, Decree No 103/2013/ND-CP was issued by the Government of Viet Nam on 12 September 2013 stimulating the handling of administrative violations in fisheries activities. Nonetheless, for the sustainable development of the country's fisheries, the Government of Viet Nam adopted the FAO Code of Conduct for Responsible Fisheries (CCRF) 1995, especially the CCRF which defines the principles for sustainable fisheries management. In this regard, the Government of Viet Nam enacted Decision 153/QD-TTg dated 17 August 2004, promulgating a strategy for sustainable development in Viet Nam also known as Viet Nam Agenda 21 (Phuong 2010).

4.3 Management Measure

The main goal of inland fisheries management is to improve the well-being of all the people engaged directly or indirectly in the fisheries sector, especially those in the rural areas. The decided management should commit for poverty alleviation, the welfare of future generations, and environmental conservation.

However, it is also understood that, in many cases, the primary driver of the fish assemblages is not how the fishery is managed but rather the state of the environment as acted upon by other human uses. This means that mechanisms are needed to improve both management of fisheries through forms of co-management and collaboration at the national and international level between and among the agencies responsible for the control of the aquatic resources in general (Welcomme *et al.* 2014).

In the context of inland fisheries management, there are 5 challenges which are very important to be considered: (1) Identifying and quantifying the spectrum and types of ecosystem services of the aquatic waters, including fisheries; (2) quantifying the ecological, economics

and social values of ecosystem services of the inland and marine fisheries; (3) assessing the fish stock of aquatic waters; (4) determining the functional and structural connectivity within ecological system of the inland and marine fisheries; and (5) seeing the inland and marine waters as a social-ecological system (SES) unit (Suuronen 2014).

Measuring the management of fisheries, more particularly inland fisheries, could be carried out in two ways: (1) using traditional knowledge as the benchmark, and (2) compiling sufficient statistical data. Traditional knowledge refers to the knowledge, innovations, and practices of indigenous and local communities around the world. Developed from experience gained over the centuries and adapted to the local culture and environment, traditional knowledge is transmitted orally from generation to generation. It tends to be collectively owned and takes the form of stories, songs, folklore, proverbs, cultural values, beliefs, rituals, community laws, local languages, and agricultural practices, including the development of plant species and animal breeds. Sometimes it is referred to as an oral tradition for it is practiced, sung, danced, painted, carved, chanted, and performed down through millennia. Traditional knowledge is mainly practical, particularly in such fields as agriculture, fisheries, health, horticulture, forestry, and environmental management in general (Adrianto *et al*. 2009; https:// www.cbd.int/traditional/intro. shtml).

Another tool that could be used to facilitate the development planning and management of fisheries in general, is fishery statistics which comprise the data and information that describe the current and past status of the fisheries, showing the trends in the development of the fisheries sector that can be used for policy, planning and management. Statistics refers to both the methods applied to collect data and the (partially) analyzed data themselves.

During the "Workshop to Review Activities and Methodologies for Promotion of Inland Fisheries" organized by the SEAFDEC Inland Fishery Resources Development and Management Department (IFRDMD) in Palembang, Indonesia on 8-10 August 2016, information

from the Southeast Asian countries on how much attention is given by governments on the compilation of fisheries catch statistics was reported. The results showed that most countries in the region have established their respective catch statistics on inland fisheries, which is updated annually. In most countries, their respective government agencies take on the responsibility of compiling the catch statistics. Therefore, collection of fishery statistical data should be supported by the governments.

Nevertheless, in many Southeast Asian countries, the collection of the fishery statistical items and data set could differ, as such activities always take into account their respective priority needs, objectives and requirements. In most cases, inland fishery statistics are generally very poor, and as a result information on the actual contribution of the sector to food security is not generally known. Considering that inland fisheries employ millions of people directly or indirectly, the state of the fish stocks of inland waters is still not known because of the low level of research across the rivers, floodplains, reservoirs and lakes. The use of fishery statistics is not only for national purposes but also for regional and international actions where comparable analysis of fisheries status and trends could be deduced and used for planning and management in a broader scope (Pornpatimakorn and Ananpongsuk 2013).

Without applying statistics, the raw data collected could not be changed into something that the managers, planners and policy makers could understand, let alone the data trends. Indeed, statistical analysis can be very complex, but for most purposes the statistical tools required for fisheries are rather straightforward and easy to understand.

Considering that seasonality is an important characteristics of inland capture fisheries, this should be taken into consideration when collecting and analyzing the statistics at national level. Moreover, statistics on inland capture fisheries production by species by fishing gears is very useful for management even if the current framework still does not accommodate the compilation of inland capture fisheries production by species by fishing gear, and thus should be collected.

Fishing activities in reservoirs and even rivers or in the main river channels are quite obvious, including in fixed fishing grounds, thus for better monitoring and reporting of data and information, fisheries data should also be collected in landing sites, and the adoption of some forms of license systems could also be promoted to improve fishery statistics compilation. In general, the amount of subsistence fishing is far more significant in inland waters, especially where floodplain fisheries (including rice-fish 'culture') exist or the seasonality of fishing activities (intensity) and involvement of them is of greater importance. This is especially true for the highly productive floodplain fisheries that still form a significant contribution to the fisheries sector in Cambodia, Viet Nam and Myanmar, and to a lesser extent in Lao PDR, where fishing operations are spread out over a vast area, without fixed landing sites. Because the water-land interface available for fishing activities in inland areas is enormous, especially where extensive floodplains exist, the amount of people involved in inland fisheries is far higher than in coastal fisheries.

Compared with coastal fisheries, the commercial inland fisheries consist mainly of small-scale one-person fishing operations, while the catch from this commercial sector is only a small part of the total fishing production. Due to the inherent dynamics of inland waters, the heavy dependence on floodplains in river fisheries, either directly (floodplain fisheries) or indirectly (much of the catches, *i.e.* biological production, in rivers and reservoirs is actually produced on the floodplains), there may be considerable fluctuations in production from one year to another, but are mostly unrelated to the fishing pressure. The complex relationships between habitats, fish, and flooding create a far more complex fisheries system in inland areas than in coastal fisheries. Participation, gear use, and catches fluctuate between seasons and years, depending on the influence of economic factors. Although this generally holds true for both inland and coastal fisheries, many more people are involved in inland fisheries in a far larger area.

Inland fisheries are far more complex, dynamic and more challenging to monitor and care has to be taken not to merely transpose marine methodologies and concepts to inland fisheries, as has been done so often in the past. This places specific requirements on the data that have to be met, and this has implications for the data collection system. Although stock assessment works well in marine environments, and can also be applied to lakes and reservoirs without too many problems, it needs a trial to be used in riverine habitats, especially rivers with extensive floodplains, where the fish migrates during the low or high-water level. Therefore, some of the variables that are routinely collected, *e.g.* length-weight composition of the catch may be particularly useful for most inland fisheries.