Importance of the Global Strategy for the fishery and aquaculture sector and its implementation for Indonesian economy data collection

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I. Importance of the Global Strategy for the fishery and aquaculture sector:

I-1. Fishery and Aquaculture contribution:

Fish and fishery products supplied the world about 110 million tonnes of food fish, 81% of the world fish production of 142 million tonnes in 2008. Developing countries produce close to 80% of fish and fishery products. While fishery production has stabilized at around 94 million tonnes for more than a decade, aquaculture has steadily and rapidly increased. Relative contribution of aquaculture in food consumption has reached to 46% in recent years. About 30 millions tonnes of capture production is directed to non-food use, mainly fish oils and fish meals as feed for aquaculture, live stocks, and nutrition supplements. Currently, there is no formal tool available to separate aquaculture and capture fishery origins in markets and trades, though it is evident that markets and consumers in fact distinguish them from marketing practices including price differences.

Global fish consumption increased from an average of 10.1 kg per capita per year in 1965 to 17.0 kg in 2008, making up 15.6% of the global population's animal protein consumption. Reliance on fish and fishery product becomes more significant in low-income-food-deficit countries, where total animal protein intake was relatively low, which was estimated as 18.5 percent in 2005. This amount was considered to be underestimated due to potential largely underestimation of production by small scale and subsistence operations that are major part of operations in such countries.

An estimated 45 million people were directly engaged in fisheries and aquaculture productions either in part-time or full-time and further 6 million people was engaged on an occasional basis. This represents 3.5% of population economically active in the broad agricultural sector worldwide. A recent study indicated that an additional 85 million people are employed in the post harvest sector.

An estimated 37% of total fish production entered into international trade either as food or feed products and the value of fishery trade reached over USD 100 billion in export value in 2008. Approximately 50% of this amount originated from developing countries. Fishery net exports of developing countries (i.e. the total value of fish exports less the total value of fish imports) are higher than those of several other agricultural commodities such as rice, meat, sugar, coffee and tobacco.

Fishery and aquaculture sector does not exist and operate in isolation. The sector has many interactions with other sectors, e.g. competition over natural resources such as land and

water, economic and social dependencies, etc, especially when locating within same local areas. Agriculture and aquaculture often develop composite operations, e.g. rice-paddy aquaculture, utilization of agricultural wastes for feeding or fertilizing in aquaculture, utilization of irrigated water for aquaculture. In many cases, one household is involved multiple activities including fishery and aquaculture or employment in the sector. There are examples of seasonal use of flood areas for fishery and aquaculture. The sector is often strongly linked , with tourisms, post-harvest processing and marketing. Recreational fisheries have grown to become an important factor in economies of both developed and developing countries. For example, the recreational fishing in the European Union directly provides approximately 60 000 jobs and generates USD 33 billion per year. In addition, although fishery and aquaculture follow quite different modes of operations, there are substantial interactions between them, especially in inland waters, including stocking seeds into wild produced by hatchery (aquaculture) and utilizing wild-caught fish as seeds for aquaculture.

Many coastal and oceanic developing countries earn economic gain through access fees and licenses, port and landing services and post harvestings for landing by foreign long-distant fleets. For some countries, recreational fisheries and corresponding tourisms become major economic and social contributors.

Harvesting, culturing and trade of ornamental fish and other aquatic organisms has becomes lucrative business. Although the information on this component is extremely scarce, the world estimate of ornamental fish exports was estimated to have reached a value of USD 337 million in 2008.

Despite of significance and complexity of the sector, the information on actual contribution the sector, especially in relation to the interference with the other sectors, is very limited as reviewed in the following sections. This often causes under-representation of the sector interest in national and regional policy making and lead to marginalization of the sector, especially its small scale and subsistence component who need highest attention and support from policy.

I-2. Monitoring need for fishery and aquaculture management:

In general, the primary goal of fishery and aquaculture management is considered as ensuring sustainable development of the sector. The basic instrument for marine fisheries management is the United Nations Convention on the Law of the Sea of 10 December 1982 that addresses the rights and responsibilities of States in relation to the utilization and conservation of marine living resources. The non-binding Agenda 21 of the United Nations Convention on the Environment and Development (UNCED) in 1992 also included a chapter on protection of the oceans and seas and development of their living resources. It is noteworthy that they put emphasis on an integrated approach to sustainable development and on the application of a precautionary approach. FAO adopted the Code of Conduct for Responsible Fisheries (CCRF) in 1995. The Code is voluntary instrument that “sets out principles and international standards of behaviour for responsible practices with a view to ensuring the effective conservation, management and development of living aquatic resources, with due respect for the ecosystem and biodiversity”.

All of those instruments define adequate monitoring and data collection as primary condition to be responsible and stress the importance to achieve sustainability in integrated holistic manner, taking into account the fragility of resources, ecosystems and the needs of communities. The ecosystem approach to fisheries (EAF) and ecosystem approach to aquaculture (EAA) are developed to implement the provisions of the CCRF as holistic strategies for managing capture fisheries and aquaculture.

Data and monitoring requirements in such approaches should include:

- those monitoring fishing and aquaculture operations and their impacts, e.g. status of fishing and aquaculture operations includine production, required inputs, and other resources

utilized, status of both targeted and non-targeted biological resources, impact operations to physical environments, etc;

- those measuring the contribution of fishery and aquaculture sector to food security and safety, social and economic aspects and other community needs (e.g. fish consumption, employment,. GDP contribution and expenditure, trade, etc); and
- those measuring the interactions with other sectors, including inputs, outputs, negative and positive impacts, and competition, as well as the situation of environments supporting fishery and aquaculture sector (e.g. habitat deterioration, climate changes impacts).

In addition, the increased demand from consumers on traceability and transparency on food product has led for a requirement for producers to provide adequate information in certifying food safety of their products. It should be noted that in the case of fish and fishery products, the consumers interest is not limited in food safety but expand to caveat whether those products are produced and harvested in a responsible and sustainable manner in consistent with international agreed instruments, especially with CCRF. Many trade and products certification systems, so-called eco-labelings, have been developed in this regard and some major market chains declare that they only accept eco-labeled products.

In summary, while data required for management of fishery traditionally focused on those utilized in monitoring of fisheries operations and their impact on target resources, i.e. catch and effort data, the modernized management approaches of sector, EAF and EAA, needs information covering all aspects relating with the sector. The increased interests by consumers on transparency and the needs to prepare for climate change impacts and to mitigate them give another pressure toward enhancing holistic monitoring capacity of the sector.

I-3. Current status of monitoring in fishery and aquaculture management:

Monitoring and management of fishery sub-sector are in general placed under the responsibility of specialized agencies, such as fishery agency or natural resource management agency. This is partially due to the specific need in monitoring and managing natural resources in order to ensure sustainable operation of fisheries. Management and monitoring of aquaculture sector is more ambiguous and placed under either agriculture section or fishery section according to countries. The extent of communication and collaboration between national statistics agencies and those responsible for fishery and aquaculture sector varies greatly according to countries.

The main focus of fishery monitoring has been given to a sustainable use of fishery resources. Therefore, data collection tends to aim to gathering detailed production data that in turn would provide an indicator of removal from wild, fishery resource conditions and impacts on natural environments.

Additional monitoring efforts are placed including observers and surveillance monitoring, to enhanced evaluation of collected data and additional data collection on bycatch and discards to monitor impacts on surrounding ecosystem and other natural environments. This is often the case where are serious concerns on stock status, e.g. tunas and Patagonian toothfish, or concerns on impacts on fishery of other ecosystem components, e.g. vulnerable ecosystems such as coral reefs, mangroves, deep-sea bed, and incidental capture of turtles, sea birds. However, the monitoring efforts on the sector's impact on non-targeted resources are very much limited to either those fisheries managed under RFMO/As or those in the countries with advanced interests in ecosystem conservations.

The fishing operations under international, regional, and multi-lateral fishery management arrangements are in general well monitored with detailed information available, even at operational level. On the other hand, fishing operations occurred in coastal and inland waters within national jurisdiction tend to face a difficulty in data collection, monitoring and

management. Main causes of difficulty include scattering of operations due to their small scale and/or subsistent nature and low national priority given in resource allocation. In the same way, the monitoring of aquaculture operations that occur almost exclusively within national jurisdiction of country stays less satisfactory. Especially, in some countries, data collection system cannot keep up with rapid growth of the aquaculture sub-sector and often fails to incorporate newly developed and/or emerged production forms and categories.

The current understandings on contribution of fish and fishery product on food security are considered reasonably well but fish component is not integrated into world food model despite its substantial importance due to complexity in its marketing and utilization. The general monitoring capacity on social and economic aspects is in general very limited and in many cases, combined with other agricultural sectors. It is often not be possible to separate out the fishery and aquaculture contribution, which again becomes one of causes leading to lower recognition on the role of sector and needs of specific policy attention in the case of conflicts and competitions with other sectors, e.g. agriculture, tourism, land and water management, water front development.

Trade information is mainly collected through custom, in the same way as the other agricultural products. HS codes of World Custom Organization are determined based on species and product type and do not distinguish the origin of product whether come from aquaculture or capture production. This causes a difficulty in tracing respective contributions of fishery and aquaculture sub-sectors throughout product chains.

In general, the information on small-scale and subsistent operations of scattered distribution, typical for inland fishing but also common for coastal fishing and inland aquaculture, is considered substantially under-represented in national statistics as well as in national recognition, despite that such component would be more important in national food security and poverty alleviation prospect. It should be noted that subsistence fishing could be the last measure of livelihood for those who do not have an access to land. Under-representation of such component may lead to further marginalization in national policy making, pushing them into even harder position, rather than supporting them our.

Data collected by the fishery and aquaculture sector is not necessarily well integrated into national statistics. Information on relationship and product/economic flows with other sector (e.g. contribution to general employment, post-harvesting and marketing, composed and/or seasonal activities with agriculture and other sectors, tourism, sharing and competition in accessing land and waters, biodiversity, disease, etc) as well as the inter-relationship between fishery and aquaculture (e.g. seeds introduction, wild fish fed to aquaculture, wild caught seeds) is another area of scarcely monitored, despite the recognized importance of such information both in EAA and EAF.

I-4. Role of Global Strategy for improvement of fishery and aquaculture monitoring:

The Global Strategy to Improve Agricultural and Rural Statistics adopted at UN Statistical Commission in February 2010 promotes an enhanced linkage and integration of agriculture statistics into national data collection and statistical system. Another important aspect of the Strategy for fishery and aquaculture sector prospect is an acceptance of broad sense definition of “agriculture” including fishery and aquaculture sector as one sub-sector of agriculture, together with forestry and natural resource management. This is especially important in implementing holistic monitoring along EAA and EAF principles. The Global Strategy would provide a framework to achieve integration not only between different components within agriculture statistics but also integration of whole agriculture statistics into the National Strategies for the Development of Statistics (NSDS).

The Global Strategy proposes to establish an overarching framework to enhance linkage and comparability among different domain data by sharing a common master sample frame, i.e. geographic data and household information collected by population census.

As reviewed in I-3, fishery and aquaculture sector has generally maintained relatively good monitoring schemes on production, trade and contribution to food consumption. Gaps and weakness exist in monitoring of small scale and subsistence component as well as of social and economic aspects that largely combined with other agricultural sub-sectors. Knowledge on interaction of the sector with other sectors is extremely scarce.

The Strategy is expected to facilitate in overcoming such weakness, especially in social economic aspects and relation with other sectors. This in turn would enable to secure appropriate representation of the sector within the national statistics, and then into reflected in policy decisions. It is expected that the coordination and collaboration to be developed under the Strategy would also assist in improving efficiency of utilizing financial and human resources devoted to data collection and monitoring.

It is important for fishery and aquaculture sector to consider the implementation of the Strategy without jeopardizing the original strength in the sector monitoring. The following section provides rough ideas of possible way to proceed toward implementation of the Strategy in the context of fishery and aquaculture sector.

I-5. Implementation of Strategy to fishery and aquaculture sector in general:

Survey Framework

The Global Strategy identifies (land-based) geographic reference and households identified in population census as key axes to formulate master sampling frame.

The Global Strategy defines a farm as an economic unit and a household as a social unit, with key geographical reference with a land they occupy in natural environment. This concept may fit well to some of aquaculture activities, as well as to fishery domains especially in the case of small scale and subsistence operations when translating “farm” to boat/gear holding unit.

However, fishing is more individual-based activities than household activities and members of a household engaging in fishery and aquaculture sector are commonly found to be also involved in engaged in activities of other sectors. Common examples are that female members are engaged in agriculture, post-harvest processing, marketing, and tourism or employed as wage workers in the fishery and aquaculture sector and other sectors. Composite business models including small aquaculture and fishing activities are also commonly seen.

The geo-location of boat/gear holding unit and that of household may often differ, since the former is selected in convenience of access to suitable waters and water accessing facilities. Even the geo-location of boat/gear holding unit has less meaning in monitoring fishing activities. Fishing and aquaculture households in some countries include water-surface dwellers who may not even have fixed geographic reference. Therefore, it is necessary to reframe the reference and utilization carefully prior to applying them into designing of sampling frame including fishery and aquaculture sector.

Taking into account the less land-bound nature of fishing and aquaculture sector, the population census seems to provide the best option in establishing basic frame information of the domain. However, in order to make the census results usable for this purpose, it is essential for full population census to be able to separate engagement in fishing and aquaculture activities, regardless scale of activities, whether part-time or full-time, employed or in own-account, rural or urban, and land-based or landless. Collecting fishery and aquaculture sector frame information through population census has another benefit in effectively identifying an extent and geographical distribution of small scale and subsistent operators that are largely under-recorded in the current system.

Currently the majority of population census aggregates whole agriculture sectors into one category and does not provide breakdown to separate fisheries. One addition of category “fishery” in occupation list in the population census would be the initial most important step of implementation of the Strategy for those country with substantial amount of fishery

production especially by small scale and subsistence fishers. Once full picture of engagement into the sector is obtained in combination with that in other sectors, sampling design for the sector would be developed taking into account consistency, comparability and inter-operability with master sampling frame as well as specific needs required for the sector monitoring and management.

The practice of sample-based surveys at landing sites is a well established technique that was proven to be effective in grasping the dynamic nature of capture fisheries at a required level of details for catch composition and fishing activities with relatively limited resources. We strongly believe that this part of the sampling scheme should not be altered but integrated into the new framework under the draft Global Strategy in a way to ensuring linkage and comparability of data collected.

The master sampling frame under the Strategy would be effective in monitoring social and economic aspects of the sector, in collecting information on relation to the other sectors. Many countries have relatively rich administrative data including boat registers, fishing licenses, registration of aquaculture holdings and fishing companies, etc. Though these tend to focus on middle to large scale operators, this information when combined with census data may provide a good basis in developing a sampling framework for the sector. In addition when combining with census data and information on locations of sample-based sampling sites, such information could provide an useful links connecting data collected two different sampling schemes.

Satellite imagery is considered as another powerful tools in collecting frame information, especially on aquaculture activities. Again, census data and administrative information could provide useful link to connect this to the master sampling scheme.

All of the process establishing overarching linkage may require careful handling of personal information in accordance with any applicable confidentiality policy.

Inclusion of fishery and aquaculture components into other survey frameworks:

Guideline for Agriculture census now instructs to incorporate aquaculture sub-sector into its scope, which was great step toward integration of whole agriculture data collection system. However, fishery and aquaculture operations are sometimes closely inter-linked each other, especially in operations at inland waters. Also, some inland fishing is community-based activities, not individual-based activities, which provided shared food supply to a community.

In order to capture whole spectrum of fishery and aquaculture sector contribution, especially of small scale and subsistent activities, into local communities, it is preferable that a range of surveys based on local areas, including agriculture census, household census, food consumption survey, and rural survey, will take fishery and aquaculture sector into scope in the same way as the other agricultural activities.

Modification of concepts to support integration:

Currently, the “land use” and “land cover” classification treated whole water body as one category. However, just like land, water bodies are owned, used and managed in a quite similar way. The boundary areas between land and water bodies (e.g. flood land, inter-tidal zones, river banks etc) are especially important area for production in fisheries and aquaculture sector. Most of aquaculture farm own land unit and water unit, operating really on a boundary between and land and waters. Seasonal rotations between agriculture and aquaculture/fishery are commonly observed in flood areas.

Therefore, it is preferable to establish standard concepts and codes covering both land and water bodies in a consistent and continuous way, which may also help to develop a more consolidated view to cover whole spectrum of environmental impacts and rural activities. If this is not possible, at least for fishery and aquaculture viewpoint, it is essential to establish more detailed classification of water cover and water use.

In the same context, the concept of national territory should be expanded to include marine waters to cover the Exclusive Economic Zone, to enable to incorporate marine fisheries into national environmental account.

Implementation examples:

China first incorporated fishery and aquaculture related questions in its population census of 2006 and succeeded to adjust its production statistics based on frame information collected through the census. India and Myanmar are reported in a process to distinguish engagement in fishery and aquaculture from agriculture at the forthcoming censuses. Chile and Brazil conducted aquaculture census in comparable way as national census.

II. Implementation of Strategy to Indonesian Economy

Section II gives one example of implementation of the Strategy in collecting Indonesian economy data.

II-1 Introduction :

Indonesia is located between $6^0$08'north and $11^0$15'south latitude, and between $94^0$45' to $141^0$05' east longitude. Indonesia archipelago state and it is the fourth-world populous country after China, India, and the United States of America. Based on Indonesian Population Census 2010, population was 238 millions people. It is stipulated that the body of water surrounding, within and connecting the islands of Republic of Indonesia is inseparable part of the Republic of Indonesia territory as one united country. The concept of archipelago state is recognized in the United Nation Convention of the Law of the Sea (UNCLOS) on December 10th 1982 and ratified with Republic of Indonesia Act Number 17, in the year 1985.

More than 60% of those people are living in Java Island, even though Java island area is only 7% comparing to the whole land area in Indonesia. Java Island is a small part in terms of area, but this island is very important for Indonesian economy. More than 60% of GDP (Gross Domestic Product) is creating in this island. The whole land areas are 1,910,931 km^2; and this country has only two seasons, dry and rainy seasons. Generally dry season is April to September, and rainy season is October to March, but global climate change has made the seasons are not regularly change.

Of the whole country, around 70% area is ocean, and the rest is land, and it's consisting huge parts of around 17.504 islands. Land area is only 1.9 million km^2, and total Indonesia's waters are 5.8 million km^2 with coastal line length is 95,181 km. The Republic of Indonesia is divided administratively into 33 provinces. The provinces were further divided into more than 370 regencies, 100 municipalities, 6,548 sub-districts, and 71,918 villages. In the decentralization era, started in the year 2001, the number of regencies and municipalities are still increasing.

Agriculture sector is still dominant in the economy – its contribution to the GDP was approaching 15% -- although manufacturing industry has been almost doubled than that of agriculture. Based on the significant wide of the sea or waters, fishery is really important for the Indonesian economy. This importance needs a good fishery statistics. The paper will propose the methodology to estimate or control annual growth of fishery production in the Indonesian economy. The proposed methodology is called Fish Production Index (FPI). This index can be used to estimate whether the target of production is reached or not.

II-2 Fishery Economy

The huge sea-area is making the Indonesian economy should start rely on the sea as potential resources to feed the world (domestic and abroad) and increase the national economy. Other than various kinds of fish in the sea, Indonesia is potentially to grow seaweed that has a high economic value. Generally, the optimal fishing makes a bright future of country's sustainable economic development.

In the year 2009, contribution of fishery sector remains 3.2%, and it will be hoped to be subsequently increase to the GDP (Gross Domestic Products). Based on the optimistic prediction, no doubt that fishery statistics will play a significant role in the economic analysis. In the agriculture sector, food-crops, especially paddy is the highest contributor to GDP. The second, even though fishery is much smaller contributor to the economy than that of paddy, it is the second highest contributor to the economy. This fact needs a good data recording system and the methodology of analysis.

Fishery is divided into two main parts: aquaculture and capture fishery. Statistically, aquaculture can be developed based on households sampling technique, but capture fishery needs modern infrastructure to enhance the quality of data. Relay on households sampling frame to do censuses or surveys is not enough, because fishing activities are more based on individual person that household and much less bound with land comparing to agriculture. Fishers could explore the sea in various places within a period of time. Thus the sampling unit to be observed are located in the fixed place. Fishery harbour is a choice to be point of observation.

II-3 Fishery Business Unit

The Global Strategy defines the farm as an economic unit, and the household as a social unit. The land, it occupy in the natural environment. However, fishery domains in general are not based on household but on boat/gears holding units, though households and boat/gear holdings do often match in a case of small-scale operations along coastal and inland waters. Fishers, in many cases are landless and could be easily dropped if survey is based on land. Also, especially small-scale fishing activities are often conducted in conjunction with other agricultural activities as a household.

II-4 Fishery Institutions in the Government of Indonesia

The complexity to achieve good statistical data on fishery needs comprehensiveness work among all authorized institutions. Based on good National fishery statistical data, then it can support international institutions, such as Food and Agriculture Organization of the United Nations (FAO). This organization regularly needs data from all countries, and Indonesia is one of data suppliers.

There are two institutions dealing with fishery statistics in Indonesia: BPS–Statistics Indonesia (National Statistics Office of Indonesia) and the Ministry of Marine Affairs and Fisheries (MMAF). BPS is responsible for supplying the statistical data to the public, and MMAF is administering the sustainable and responsible utilization of Indonesia's abundance of marine and fisheries natural resources. The marine and fisheries sector is expected to be the capital of Indonesia economic growth.

BPS-Statistics Indonesia will conduct Agriculture Census at the year 2013. The government of Indonesia ask for BPS to do ten-yearly census (population, economic, and agriculture). Population census is conducted every ten years, ended with "0" (1970, 1980, 1990, 2000, and 2010), economic census ended with "6" (1986, 1996, and 2006), and agriculture census is every year ended with "3": 1983; 1993; 2003; and upcoming 2013 Agriculture Census. In this census, fishery data is also resulted, but disaggregated data are not available.

Nationally, fishery statistics was begun developed independently between the two institutions (BPS and MMAF). However, the two institutions are now struggling to develop more comprehensive National Fishery Statistics, hand in hand. Thus, in the near future, fishery statistics in Indonesia will have a significant role, nationally and internationally.

In the side of BPS, fishery data come from agriculture census and other data based on households sampling survey. MMAF has data compiled based on boat/gears holding units and modern technologies, such as remote sensing. Other than that, MMAF also compile the data from Fish Auction Spot (FAS). Almost all fish sold in the FAS come from capture

fishery. However, fishes from aquaculture tend to go the restaurants and households trough fish traders.

The collaboration between BPS and MMAF will provide better fishery statistical data. All of that, together with all countries in the world, will end up at the global availability of fishery data.

II-5 Fish Production Index

Fish Production Index (FPI) is a one of formula to short-run estimate of National fish production. The formula is very useful because to find total production in the future are complicated. Thus, the availability of FPI is inevitable. To calculate FPI, is explained in part 5.2.

II-**5.1 Fish Production Target**

MMAF is now targeting that at the end of the year 2015, fish production will become 353% as compare to 2010 production (2010 = 100%). Thus, by using the compound-rate formula $P_t=P_0(1+r)^t$, $P_t = 353$, $P_0 = 100$, $t = 5$, and Indonesia's fish production should meet average annually grow at (r) = 28.69%. The significant rate of growth may come from aquaculture rather than capture fishery (see Tables of Supplement), because the first is more controllable. Many problems are remaining exist in the second (capture fishery), such as illegal fishing as a big issue in Indonesia.

Assuming annually economic growth other than fishery commodities are average 6%, and fishery growth rate is 28.69%, thus in 2015 contribution of fishery to the GDP will be greater than 8%. Is it possible to attain the ambitious target?

Aquaculture

Aquaculture facilities can be divided into brackish water pond, freshwater pond, inland water fish growing in paddy field, and marine culture. The location of aquaculture in Indonesia is spread around some villages in the country, rivers with the system of *Karamba* (Cage), and now the government is expanding the system of aquaculture in the massive area outside Java Island, such as Kalimantan. With the expansive aquaculture, the Indonesian government hope that in the future, this country will possible to be the biggest aquaculture in the world.

Let us have a look Table 1 below. Nowadays, the usage level of potency of aquaculture is remaining low. The data below shows that the usage level of aquaculture in Indonesia is remaining low. In other words, Indonesia still has the huge area to develop capacity in enhancing fish production for economic growth. Paddy field and marine culture are the largest potency to be developed.

Table 1 Potency of Aquaculture Area and Usage Level in Indonesia (Hectares)

Type of Aquaculture	Potency	Usage	Developing Opportunities
Brackish water Pond	1,224,076	613,175	610,901
Freshwater Pond	541,100	241,891	299,209
Inland Open water	139,336	943	138,393
Paddy Field	1,538,379	127,944	1,410,435
Marine Culture	8,363,501	87,465	8,276,036

Source: MMAF

The developing opportunities shows that remain very wide, or the usage of potency is still below the capacity. All aquaculture potencies – brackish water pond, freshwater pond, inland open waters, paddy field, and marine culture -- have to be developed to enhance the capacity of food supply. This is realistic, because land area to grow food crops is becoming limited.

The areas for aquaculture for instant, especially in outside Java, such as Kalimantan, are remaining available in huge of space. In the New Order government, it had planned to create a million hectares of paddy field in this area, but the government failed to realize. Thus, the area will be reallocated to be aquaculture for *patin* fish (catfishes) or *pangasius sp*.

The government will also increase capture fishery through the law-enforcement to decrease or eliminate illegal fishing (if possible), and applying a better methodology of fishing. Regardless the composition between aquaculture and capture fishery, it needs a methodology to control the target of production. In this paper, the methodology is called Fish Production Index (FPI).

II-5.2 Outlet of Observation

To implement FPI, it needs to have some outlet to calculate the index, from aquacultures as well as capture fisheries. Assuming that all production (supply) of aquaculture are equal to demand for consumption which can be measured at the markets, and capture fishing can be measured at Fish Auction Spot (FAS), thus FPI can be calculated by using Laspeyres formula:

$$FPI = \frac{\sum_{i=1}^{n} P_0 Q_i}{\sum_{i=1}^{n} P_0 Q_0} \qquad (1)$$

FPI = Fish Production Index;
P = price;
Q = quantity;
0 = base year = the year 2010;
i = 1, 2, 3, …, n

Data of P_0, Q_0 , *and* Q_i that shows the production of aquacultures can be collected from every type of aquacultures, and MMAF is always collect it. There are data from various aquacultures, ranging from small scale to very large scale. MMAF collect monthly as well as quarterly.

To simplify the calculation of index, it only needs from larger scale of aquacultures. It is enough when it include quantum more than 60% of total production. The reason is compiling data from all aquacultures need a lot of time.

Using formula (1), it needs P_0, Q_0 , *and* Q_i of fish from places which representative the fish production from aquaculture of the whole Indonesia. The kinds of fish are various, thus the variety of fish should be represented. One can get the data from regional offices of MMAF.

Capture Fishery

P_0, Q_0 , *and* Q_i of capture fishery are obtained from Fishery Auction Spot (FAS) in each fishing ports, which many located in many parts of the whole country. Same as in the aquaculture, to obtain fishery data, one can contact MMAF, which always record data from fishing ports.

There are many fishing ports with various classes, from small-scale to very large. Table 2 below shows number of fishing ports.

Table 2 Number of Fishing Port in Indonesia by Class, 2009

Class of Fishing Port	Number of Ports
1. Oceanic Fishing Port	6
2. Archipelagic Fishing Port	13

3. Coastal Fishing Port	44
4. Fish Landing Place	926
Total	989

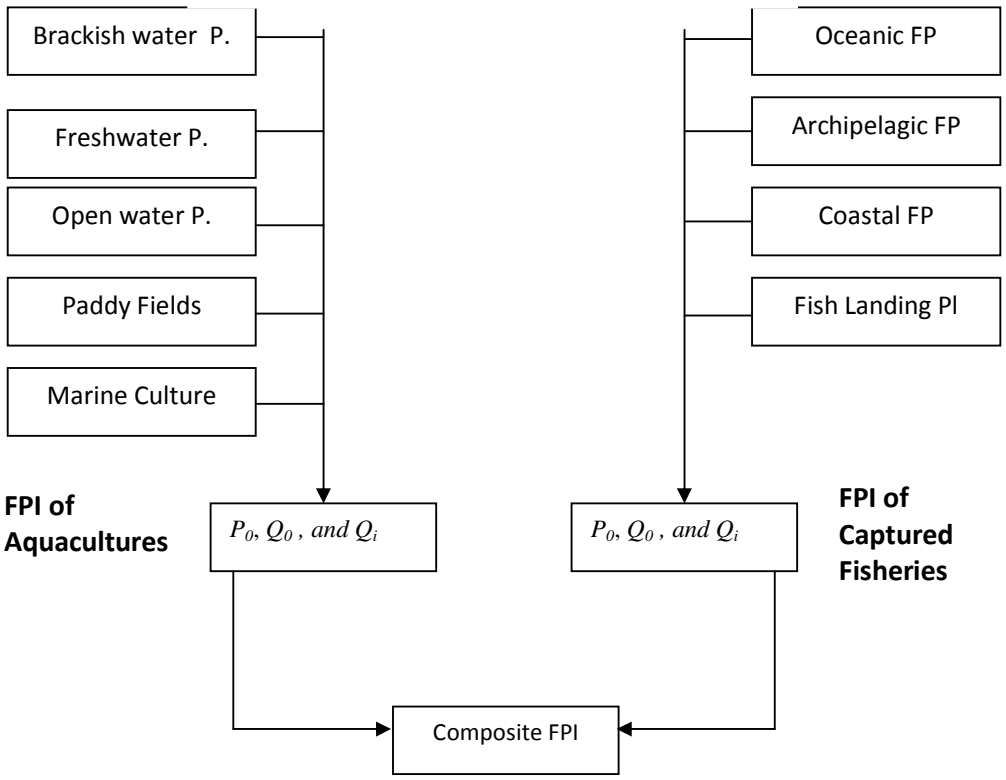
Source: MMAF

Data of P_0, Q_0 , *and* Q_i can be collected from every class of fishing ports, and MMAF is always do it. As at aquacultures, it is enough when it include quantum more than 60% of total production.

Composite Index

Using Formula (1), one may calculate the composite index which possible to be disaggregated into aquaculture and captured fisheries indices. To make easy how to understand the process of indices construction, see the diagram below.

Diagram of Constructing FPI



Constructing the Index

Following the Diagram, there three steps to construct FPI:

a. Constructing aquaculture FPI;
b. Constructing captured fisheries FPI; and
c. Constructing the composite FPI.

The Use of FPI

Following the fish production target in the year 2015, total fish production growth should meet 28.69% annually. When the production is less than that, the target will not be achieved. The production will come from aquacultures and capture fisheries. FPI, from aquacultures and capture fisheries, can be used for the indicator whether the target will be achieved or not. When annual fish production growth is more than 28,69%, the Indonesian target of fish

production at the year 2015 will optimistically be achieved. Otherwise, the target is only the utopia.

Because of aquaculture is more controllable, so the target can be evaluated annually from aquaculture and captured fisheries separately.

Using the fish production growth in the Table of Supplement, average annually growth is 10.02%, and if the growth are disaggregated, capture fisheries growth is only 2.95%, but aquaculture growth reaching 21,93%. Considering existing growth, the target will not be achieved. Thus, the government of Indonesia trough MMAF should scrutinized the problems and finding solution why the annually growth is remain low.

MMAF knows that there is still exist a illegal fishing, by Indonesian fishers as well as foreigners. This should be eliminated shortly. Marine culture is one of business should be expand.

The result of fishery research suggest that the area intended to be one million for paddy field project that has failed in Kalimantan Island, should be converted into aquaculture, especially for catfishes aquaculture. The government optimistic that the realization of the conversion project – from the failed paddy field project into aquaculture -- will make Indonesia becoming the first-world largest catfishes producers.

Calculating the Fish Production Growth (FPG)

The growth of fish production at the year *i* is then calculated with the formula:

$$FPG = \frac{FPI_i - FPI_{i-1}}{FPI_{i-1}} x100\% \qquad (2)$$

FPG = Fish Production Growth;
FPI = Fish Production Index;
0 = base year = the year 2010;
i = 1, 2, 3, …, n

As the construction process of FPI, the growth can also be calculated separately for aquacultures and captured fisheries.

As mentioned above, FPG yearly should be at least 28.69% to achieve the ambitious target of to be 353% in the year 2015.

At the real life, quantum production (Q) as well as the prices (P_0 and P_i) can be compiled from markets. There are two kinds of fish markets. First, for aquaculture fishery is more specific. Buyers, trough traders, usually come to the fishers and they sell to some restaurants. Second, Fish Auction Spot (FAS) is a place of fishers comes together to sell the fish that their caught direct from the ocean. The fishery data from fishers are usually recorded periodically (monthly and quarterly) by the regional offices of MMAF. So, the quarterly quantum data can be obtained. Analogy, quarterly quantum data can be compiled by regional MMAF. To implement the FPI, two institutions have plan Quarterly FPI. This is parallel with the publication of Quarterly GDP. BPS-Statistics Indonesia as well as the BPS at the regional office can work together with MMAF to publish FPI.

Fish Production Prospects

Nowadays, the composition between aquacultures and capture fisheries can be seen at Table 3 below. Capture fisheries look like bigger than that of aquaculture. However, MMAF optimistic that aquaculture is possible to be enlarged with the rate larger than that of capture fisheries.

Table 3 The Composition of Fish Production Between Aquaculture and Capture Fisheries (%)

	2005	2006	2007	2008	2009	Average
Capture Fisheries	68.50	64.17	61.23	57.41	52.51	60.76
Aquaculture Fisheries	31.50	35.83	38.77	42.59	47.49	39.24
	100.00	100.00	100.00	100.00	100.00	100.00

Source: MMAF

Now, capture fisheries look like greater than aquaculture fisheries production, but production of this kinds of fisheries considered as difficult to be increased. The large of Indonesia's ocean is one factor of others to be fully controlled. As seen in the table, the total captures fisheries production tended to decrease. Another factor, illegal fishing remains problems and difficult to be solved. However, some marine culture, such as seaweed, is considered as good business. Indonesia is very optimistic with the future of seaweed business. Thus, Indonesian government should increase production of both, capture and aquaculture, fisheries.

II-6 Conclusion

1. About 70% of Indonesian is sea area, thus fishery is absolutely important for the Indonesian economy.
2. The importance of fishery is to feed the world. As people know, the food will be always problems for people. Food crops are still very important, but land stock to developed agricultures is a constraint.
3. Indonesia is an archipelago containing wide area of sea, and it means that the food economy should start rely on fishery. Aquaculture, including marine culture, is more prospective business in Indonesia's fisheries.
4. To have a good administrative of fishery business, the government should supply a good statistical data system.
5. This paper supply one of formulas to estimate the growth of fish production as well as estimate future production. It is simple and applicable.

Tables of Supplement

Table A Volume of Fisheries Production, 2005 – 2009 (000 Ton)

Items		Year					Average Growth (%)	
		2005	2006	2007	2008	2009*)	2005-2009	2008-2009
Production Volume		6,870	7,489	8,238	9,052	10,065	10.02	11,20
Captured Fisheries	Sub-total	4,706	4,806	5,045	5,196	5,285	2.95	1.71
	Marine Fisheries	4,408	4,512	4,734	4,702	4,789	2,11	1,86
	Inland Openwater Fisheries	297	294	310	495	496	15,99	0,25
Aquaculture Fisheries	Sub-total	2,164	2,683	3,194	3,855	4,780	21,93	23,99
	Marine Culture	890	1,366	1,510	1,966	2,437	29,54	23,96
	Brackish Water Pond	644	630	933	959	1,181	17,97	23,05
	Fresh Water Pond	332	382	410	479	594	15,80	23,92
	Cage	68	56	64	76	94	9,75	23,93
	Floating Cage Net	109	143	191	263	336	32,46	27,79
	Paddy Field	120	106	85	112	138	5,86	23,94

Source: MMAF
*) Preliminary Figures

Table B Marine Capture Fisheries Production by Major Commodities 2005 – 2008 (000 ton)

Species	Year				Average Growth (%)	
	2005	2006	2007	2008	2005-2008	2007-2008
Total	4,408	4,512	4,734	4,702	2,20	-0,68
Shrimp	209	227	259	237	4,81	-8,52
Tunas	183	159	192	194	2,86	1,37
Skipjack Tunas	252	277	302	297	5,70	-1,58
Eastern Little Tunas	310	329	399	422	2,80	-19,22
Other Fishes	3,247	3,294	3,340	3,309	-0,74	-5,06
Others	208	225	242	243	37,99	97,99

Source: MMAF

Table C Aquaculture Production by Major Commodities 2005-2009 (000 ton)

Species	Year					Average Growth (%)	
	2005	2006	2007	2008	2009*)	2005-2009	2008-2009
Total Production	2,164	2,683	3,194	3,855	4,780	21,93	23,99
Catfish	33	31	37	102	133	55,23	29,97
Seaweed	911	1,374	1,728	2,145	2,574	30,20	20,00
Nile Tilapia	148	169	207	291	378	26,76	29,98
Giant Gouramy	25	29	36	37	39	11,23	5,09
Milk Fish	254	213	263	277	291	4,46	4,98
Catfish	69	77	91	114	200	32,41	74,87
Groupers	6	4	8	5	5	7,48	5,89
Common Carp	217	248	264	242	254	4,39	4,98
Shrimp	281	328	359	410	348	6,35	-15,01
Giant Seaperch	3	2	4	4	5	20.23	5.24
Others	216	207	195	227	553	37,43	143,27

Source: MMAF
*) Preliminary Figures