COORDINATING WORKING PARTY ON FISHERY STATISTICS

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Draft Report of the Expert Workshop for Drafting CWP Handbook on Standards of Aquaculture Statistics (Vietnam, 10-14 November 2009)

Author: CWP Secretariat

Draft Report of the

EXPERT WORKSHOP FOR DRAFTING CWP HANDBOOK ON STANDARDS OF AQUACULTURE STATISTICS

Halong City, Vietnam

10-14 November 2009

I. BACKGROUND:

1. The Coordinating Working Party on Fishery Statistics (CWP) is the institution established under the FAO to review the requirement for fishery statistics, to agree standard concepts, definitions, classifications and methodologies and to recommend for actions to collaborate for the collection and collation of fishery statistics. Responding to the long-standing request to enhance the support for collection and collation of aquaculture statistics and the following recommendation by the Workshop on Establishing a A Coordinating Working Party on Aquaculture Statistics (CWP-AS) held in Nakorn Nayok, Thailand, during 8 – 10 January 2008, the Inter-sessional meeting of CWP in Dartmouth, Canada July 8-9 2008 tentatively agreed to establish two groups, Aquaculture Group and Capture Fishery Group, which would be formalized at the forthcoming 23rd CWP Session in February 2010. It was also agreed that CWP-Aquaculture Group would initiate its activities without waiting for the formal establishment of the structure.

2. Accordingly, the CWP Aquaculture Group initiated its activity by holding two ad hoc meetings, one in Puerto Varas, Chile, 3-4 October 2008 and the other in Rome, Italy, 6 March 2009, identified the standardization of concepts, definitions and methodologies as the most urgent and high priority task and agreed to focus its initial effort toward the revision of aquaculture component of the CWP Handbook.

3. This Expert Workshop was called for developing the draft of the CWP Handbook on Standards of Aquaculture Statistics that would be tabled to the 23rd Session of CWP for its approval. The workshop was held at the Grand Halong Hotel in Halong City, Vietnam, during 10- 14 November 2009.

II. PARTICIPATION

III. Opening of workshop:

4. The CWP Secretary, Sachiko Tsuji opened the workshop by welcoming the participants and presenting a brief introduction on CWP and the objectives of the workshop. It was explained that the Handbook is expected to provide a set of standard concepts and classifications for an entire scope of data that would be required for management of aquaculture sector. The Expert Workshop was attended by 17 participants including representatives of five CWP participating organizations (i.e. FAO, NACA, SPC, SEAFDEC and EuroStat) and selected experts. The list of participants is in Annex 1. The Ministry of Agriculture and Rural Development (MARD) of Vietnam and the NACA provided the logistic support and local arrangement for the workshop.

5. The workshop did not develop a specific agenda, since it was completely devoted the drafting of the Handbook for aquaculture statistics. The workshop also accepted the CWP Secretary to act as a facilitator of discussion to ensure full participation of all participants in equal footings.

IV. Result, Conclusions and recommendations

6. The workshop reviewed and discussed the zero draft that was distributed to all participants before the meeting with focusing on the concepts. Those components that were identified as necessary to be added and/or modified were drafted by either individuals or small groups assigned. The workshop conducted the final round of review on the assembled text and agreed its content with the understandings that further clearance of English and consistency in terminologies would be applied by the CWP Secretariat. The agreed final draft is available in Annex 2.

7. The workshop realized that, although aquaculture operations are currently not undertaken in the high seas area the development of such operations at a later stage cannot be excluded. The workshop suggested for the CWP Secretary or FAO to consult with the FAO Legal Office for their advices on this aspect.

8. The workshop also noted that some of existing classifications have developed on the basis of the capture fishery statistics and are not necessarily suitable for aquaculture statistics. Especially, the workshop recommended the expansion of the ASFIS List to accommodate the sub-species, strains and hybrids which are important aquaculture development.

9. The workshop noted the need of vigorous follow-up and recommended to take appropriate action to enable (i) development of operational manual for implementation of data collection based on the new Handbook, and (ii) assessment regional needs and following activities for capacity building in aquaculture data collection.

10. The workshop was closed on 14 November, 2009.

V.

VI. Annex 1: List of Participants

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VII. Annex 2: DRAFT of HANDBOOK OF AQUACULTURE STATISTICS

CWP HANDBOOK OF FISHERY STATISTICAL STANDARDS

Section XIII: Aquaculture

1. Definition of Aquaculture and Aquaculture Production

1. 2 Aquaculture .vs. Capture fishery in production

1.3 Stages in Aquaculture
Seed Production
Grow-out

1.4 Forms of aquaculture
1.4.1 Monoculture (check existing definition)
1.4.2 Polyculture (check existing definition)
1.4.2 Integrated aquaculture

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Scale of aquaculture operations

2. Structure and locations

2.1 Attribute Ownership of cultured production

2.2 Classification based on location of aquaculture facilities

FAO major area of production

2.3 Definition of culture environments

2.4 Definition of land-use and water-use;

3. Farming system (check with other existing definition and change text, if appropriate)

3.1 Aquaculture Farming systems and their record

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4.4 Antimicrobials

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7.2 Outputs (See Section XX)

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Background and Introduction

Aquaculture, the farming of aquatic organisms, is the fastest growing food producing sector in the world, since 1990s. Aquaculture now accounts for nearly half of the world's food fish production is poised to meet the growing global demand for nutritious food fish and to contribute to the growth of national economies, while supporting to sustainable livelihoods of many communities. Aquaculture also play an important role, not only as a sector producing food, but also as a sector contributing significantly to global efforts in development by improving incomes, providing employment opportunities and increasing the returns on resource use, therefore for food security.

Aquaculture, as a sector growing at a rate of over eight percent a year needs careful monitoring and management to ensure its sustainability. One of the key requirements for effective monitoring and efficient management of aquaculture are information and data. The collection, analysis and presentation of reliable data form the basis for monitoring the current performance of the sector, analyzing trends and formulation plans for the sector.

The need for aquaculture data and information collection is embedded in the Code of Conduct for Responsible Fisheries (FAO 1996). The Code recognizes that reliable and timely data are required for national authorities to effectively promote sustainable aquaculture practices that are well integrated into rural, agricultural and coastal development.

FAO Fishery Statistics of aquaculture production is the only source for global data on aquaculture production with a continuous time series of aquaculture production data back to 1950. Those data are provided to FAO by the responsible national authorities. However, there is a growing concern that the currently available information is not adequate to support sustainable development and management of the aquaculture sector. Corresponding to rapid growth of the sector, the emerging data needs are also noted. Great diversity of practices in aquaculture raises a challenge to harmonize data collected from different countries and different practices and make it more difficult to analyze and monitor trends across different regions and different farming practices.

This first Handbook of Standards of Aquaculture Statistics is being therefore developed to provide to countries a range of basic concepts, standard classifications and corresponding codes, and some advice in developing effective and efficient data collection on aquaculture. Main focus was given to identify potential data needs to support effective management and sustainable development of the sector, to indicate a standard classifications to be used, and to advise on possible data sources and data collection procedures. Handbook also identifies the minimum requirement of national aquaculture statistics which would facilitate comparison between neighboring countries and enable regional and global analysis on trend in aquaculture.

VIII. 1. Definition of Aquaculture and Aquaculture Production

The CWP definition of "aquaculture" that is historically used is "Aquaculture is the farming of aquatic organisms[1]. Farming implies some sort of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated."

Generally, aquaculture is considered as a practice for producing food. However, it is now increasingly recognized that aquaculture also produce significant quantities of non-food products, such as ornamental fish, pearls, pharmaceuticals, carrageenan, etc, supporting many thousands of livelihoods and thereby contributing to food security.

It is also recognized that the hatchery production of seed is becoming increasingly independent activity in the aquaculture value chain, thus consideration of seed production as a separate or distinct activity within aquaculture is necessary. Regarding to seed supply, in certain species, seed are collected from the wild and in certain species seed are produced in hatcheries. Whatever the origin is, seed are used either for growing out in aquaculture systems or stocking in natural waters. This process is the same whether final product is destined for food use or non-food use.

Final product originating from stocked waters without stock ownership is considered as production from capture fisheries whilst, a final product originating from an aquaculture environment or practice is considered as production from aquaculture.

For statistical purpose, aquaculture production is defined as an increment of biomass and/or an increment in numbers of individual organisms produced during the period of farming. Therefore, in order to measure aquatic production, both input to, and output from, the farming environment are needed to monitor. Seed going into a culture-based fishery is considered as an output from aquaculture to fishery, while seed collected by fishery for aquaculture is considered an input from fishery to aquaculture (see Figure X).

Traditionally, aquaculture production was defined as biomass with live-equivalent weight. Although input and output to aquaculture can be defined as a biomass, in keeping with the traditional practice of expression and for the ease of data collection, for statistical purposes, input and output of seed and ornamental fish are defined as numbers of individuals produced. The production, in principle, should refer to quantity in live weight equivalent for food use aquatic animal products and quantity in wet weight equivalent for aquatic plants, following the same practice as before.

Aquaculture production can be measured either based on a life cycle of cultured organisms or based on a certain time period, e.g. year, quarter, months etc. While the former is especially important for monitoring and control at the farm level, the production statistics generally uses a fixed time period. The calendar YEAR, i.e. the period between 1 January and 31 December (according to the Gregorian calendar) is the most commonly used time unit in fishery and aquaculture statistics. In this case, the annual production indicates the difference as total output made during a given period subtracted with total inputs in the same period.

[1] Currently, aquatic organisms referred to fish, molluscs, crustaceans, other invertebrate, crocodiles, alligators, turtles, amphibians and aquatic plants.

A. 1. 2 AQUACULTURE .VS. CAPTURE FISHERY IN PRODUCTION

Aquaculture and capture fisheries are inter-dependant when hatchery seed are used in stock enhancement in culture-based fisheries and when wild-caught seed are used in capture-based aquaculture. An output from a capture fishery (wild-caught seed) that is used in aquaculture (capture-based aquaculture) is considered as an input to aquaculture. Similarly, seed output from a hatchery when used for stock enhancement in culture-based fishery is considered as an input to capture fishery. In this regard, aquaculture and capture fisheries demonstrate a clear inter-dependence.

Culture-based Fisheries is defined as activities aimed at supplementing or sustaining the recruitment of one or more aquatic species and raising the total production or the production of selected elements of a fishery beyond a level which is sustainable through natural processes. In this sense culture-based fisheries include enhancement measures which may take the form of: introduction of new species; stocking natural and artificial water bodies; fertilization; environmental engineering including habitat improvements and modification of water bodies; altering species composition including elimination of undesirable species, or constituting an artificial fauna of selected species; genetic modification of introduced species.

Capture-based Aquaculture: When aquaculture is practiced with seed collected from the wild (e.g. tunas, eels, certain species of groupers, etc.) the practice is called capture-based aquaculture. This concept should not be extended to spat and spore/seedlings collections in the wild.

Inter-dependency between aquaculture and capture fisheries is illustrated in the following diagram together with allocation of production either to aquaculture or capture fishery components.

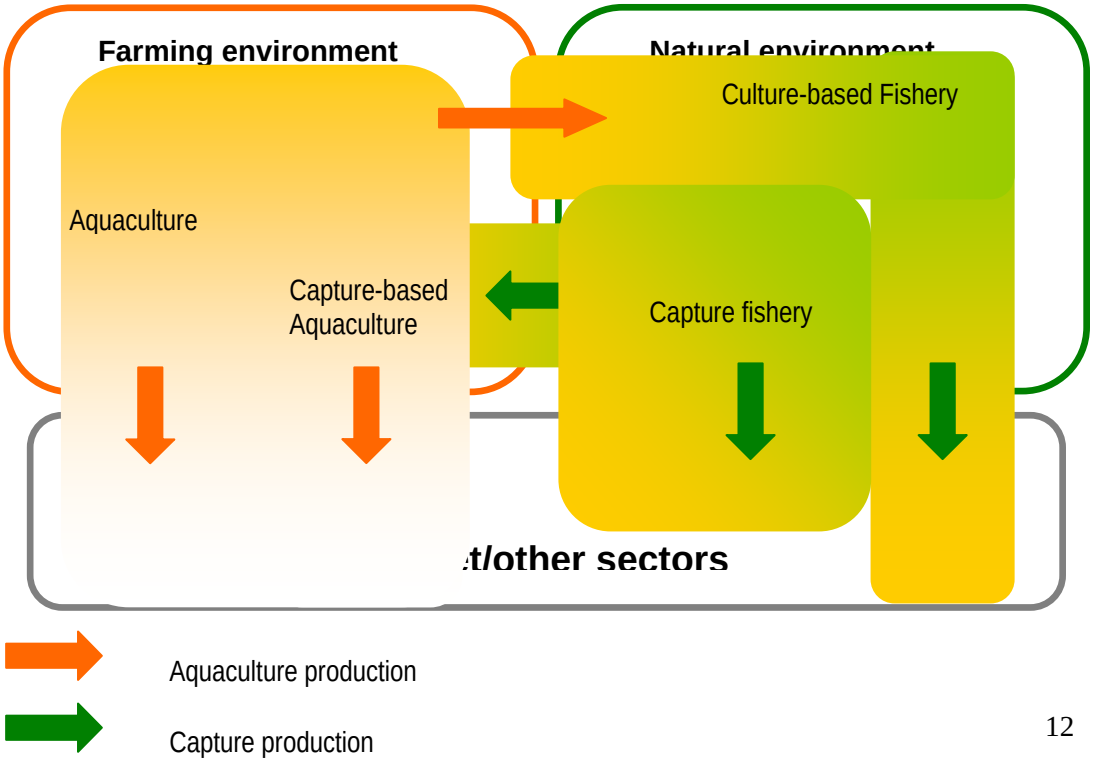

Table XX indicate a list of examples of what activities to be designated either to capture fishery or aquaculture.

Table XX

PRODUCTION FROM	DESIGNATION	
	Aquaculture	Capture
Hatcheries	*	
Ponds	*	
Tanks	*	
Raceways	*	
Cages	*	
Pens	*	
Barrages	*	
Integrated vallicoltura production	*	
Private, tidal ponds (tambaks)	*	
Stocked lakes, reservoirs and rivers		
- with other enhancement (predator control and/pr fertilization		*
- modification with “exploitation rights”		*
- no other intervention without “exploitation rights”		
Lakes, reservoirs and rivers without stocking		
- with enhancement (fertilization and/or predator control, habitat modification), with “exploitation rights”		*
Rice-fish culture:		
- from stocked rice-paddy	*	
- from rice-paddy without stocking		*
Finfish and other animals harvested from brush parks:		

- managed over time and with other enhancement rights		*
- harvested on an install and harvest basis		*
Fish and other animals harvested from fish aggregating devices and/or artificial reefs		*
Molluscs:		
- from managed grow-out site (e.g. poles, ropes, net bags)	*	
- subject to harvest with "exploitation rights"		*
- subject to open fisheries		*
Aquatic plans:		
- harvest of planted and suspended aquatic plants	*	
- harvest of natural aquatic plants		*
Aquatic organisms caught in open waters		*

B. 1.3 STAGES IN AQUACULTURE

As in any form of animal husbandry aquaculture entails many stages. In fact, aquaculture includes different life history patterns of the multitude of species/ species group cultured, and also some degree of usage of wild seed stocks and the manner these are utilized. This makes stages in aquaculture complex and possibly less straight forward than that of husbandry of terrestrial animals. The stages of aquaculture that occurs currently are schematically summarized in Figure 1 [footnote: ref].

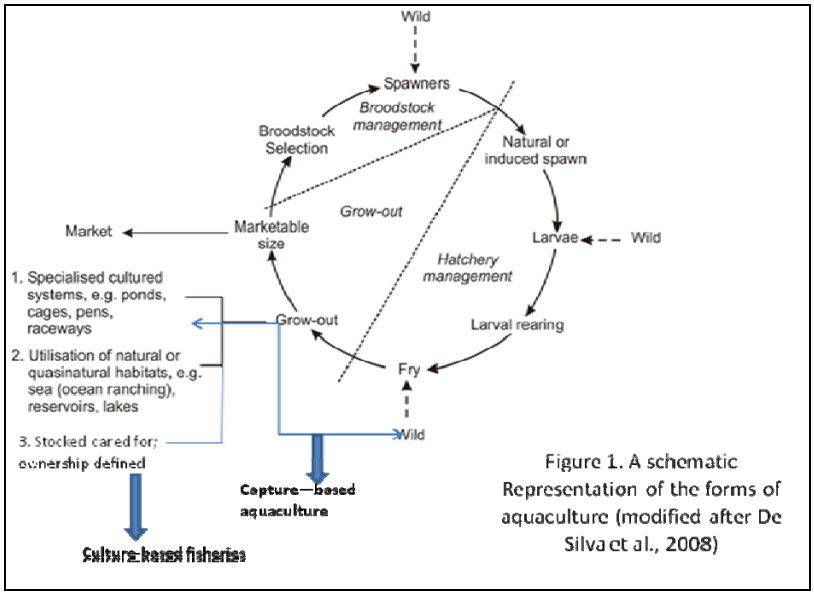

Figure-1

There are two main distinctive stages in aquaculture operations which can be summarized as follows:

Seed Production

Seed production is a multi-phased process that involves hatchery (including broodstock management) and nursery operations and production of fingerlings, seedlings and /or juveniles for ultimate use in grow-out phase that produces marketable sized food fish and/or for other commercial purpose such as caviar and other decorative or industrial use.

Hatchery production:

Hatchery production involves the production of fertilized eggs and hatchlings utilizing artificial propagation techniques under controlled conditions for ultimate use for grow-out (i.e. stage to produce marketable sized products), ranching or stock enhancement. The seedlings for seaweed culture may be also propagated artificially.

Hatcheries are limited to the production of fertilized eggs and hatchlings. First juvenile stages of aquatic animals are considered as being produced in nurseries. Seed collection from natural environments is not considered as hatchery production.

Nursery production:

Nursery production is the stage of rearing of artificially reproduced hatchlings and/or wild caught fry up to the size suitable for stocking in grow-out facilities.

Depending on species, this stage may control overall productivity of whole aquaculture cycle due to high mortality before reaching more stable juveniles or fingerling size. Nursery facilities are well prepared with necessary procedures to eliminate predators and ensure availability of natural food organisms in sufficient quantity.

Broodstock management:

Sexually matured specimens of both sexes are maintained in captivity for the purpose of controlled reproduction (independent of whether a first or subsequent generation is produced) as well as younger specimens destined to be used for the same purpose.

When the organisms are transferred from outside the monitoring unit, this is considered as an input to aquaculture. Wild fish brought into broodstock is considered as input to aquaculture from capture fishery (in the same way as wild caught seeds).

Broodstock is normally quantified by the number of individuals, and occasionally by weight.

Grow-out

Grow-out is the stage to raise juveniles, fingerlings or other seeds to a marketable size using various forms of on-growing facilities (see Section XX).

Production at grow-out stage should refer to an increment in weight (i.e. [total output in live-weight equivalent] – [total input in live-equivalent weight]) during the unit time of period.

Total period that organisms are kept in grow-out stage varies widely depending on species group. Although measuring grow-out production based on group of organisms under farming, for statistical purpose, both outputs and inputs should be measured on the basis of fixed time period, e.g. calendar year. In other words, the annual production of a certain grow-out unit implies the difference of total marketable products and total inputs to the gow-out unit in a given period.

In aquaculture statistics, the production is usually converted into live-equivalent weight, in order to standardize quantities that may be collected through different type of processing (e.g. simply gutted, gutted and headed, filleted, frozen, etc). Direct measurement of outputs in live-weight equivalent at the time of harvest is ideal. When monitoring is only possible after processing of harvest, the supplementary survey with small but regular samplings is useful to determine conversion factor from processed weight to live-equivalent weight specifically applicable to individual monitoring unit. Some of established conversion factors for converting product weight to live-weight equivalent for major fishery commodities are available in Table XXX.

When multiple products are produced from the harvest of one organisms (e.g. peals and shell meat, caviar and sturgeon meat), the caution is needed not to double-count the production by applying conversion factors to both products.

C. 1.4 FORMS OF AQUACULTURE

Although aquaculture practices take many forms they can be classified into three basic forms of aquaculture, monoculture, polyculture, and integrated aquaculture.*)*

1.4.1 Monoculture (check existing definition: FIMA)

Monoculture refers the culture of single species of aquatic organisms in the water confinement, in which optimal environment conditions would be created for the target species.

1.4.2 Polyculture (check existing definition: FIMA)

Polyculture refers the concurrent rearing of two or more non-competitive aquatic organisms in the same water confinement, to achieve better utilization of water space, material inputs, production efficiency and economic return.

1.4.3 Integrated aquaculture (check existing definition: FIMA)

Integrated aquaculture is a very old traditional, rural farming activity that has evolved to generate synergies between aquaculture and other farming activities such as animal husbandry, crop farming, horticulture and sericulture etc. These include different types and degrees of integration in which reutilization of waste products from different farming activities

that would enhance the utilization of resources, ecological benefits and economic returns to the farmer.

1.4.3 Rice-fish culture

Rice cum fish culture is a unique traditional integrated aquaculture system seen in many countries. It is characterized by concurrent or rotating culture of aquatic animals and rice cultivation in the same field. In the modern era, aquatic animals reared in the system have expanded from traditionally used species to a much diversified, relatively higher valued group of finfish and crustaceans.

D. 1.5 OTHER CONSIDERATIONS

In view of the large range in form and function of aquaculture practices, some aspects, which may not be clearly definable, come into consideration in planning and development. Foremost amongst these considerations are the degree of intensity of farming and scaling of practices.

Intensity of culture practices:

Aquaculture systems can range from an intensive indoor system monitored with equipment through to the simple release of fry and fingerling to aquaculture facilities, but all with the same aim, of improving production. Some of the simplest production systems are the small family ponds in tropical countries for domestic consumption. At the other end of the scale are high technology systems, such as the intensive indoor closed units used in North America for the rearing of striped bass or the sea cages used in South America and Europe for growing salmon and bream.

Since this is in continuum, it is difficult to explicitly define categorization to demarcate one from the other. The followings are indicative definition of **extensive**, **semi-intensive** and **intensive** aquaculture.

- Extensive culture: the cultured stock obtains all the nutrition required from the natural food produced in the containment where it is reared and/or through the water supplied to the containment,

- Semi-intensive culture: the cultured stock is provided a part of nutrition required externally, mostly through supplementary feeding, (The culture where only the chemical to enhance production including fertilizers and pesticides are provided is considered as “Extensive culture”, and

- Intensive culture: all the nutrition that the culture stock requires is provided externally.

Scale of aquaculture operations

Anthropogenic endeavours, such as industrial and primary production are often categorised based on the scale of activities. Such a scaling may not necessarily be very explicit nor entail quantification but is often considered a useful tool/ measure from a development view point with a socio-economic slant. Some of the common scaling used in the primary production sector is small holding, small- scale, large scale, industrial and so forth.

Aquaculture practices are a continuum to **small scale**, **medium**, **large** to **very large**. Small scale may be defined as farmer/ family owned/ leased, operated and managed farming systems, as opposed to others which may be defined as systems singly and or corporately owned but operated through a permanent labour force.

The above definition of small scale nullifies variations in size of the farming system, production and income.

IX. 2. Structure and locations

A. 2.1 ATTRIBUTE OWNERSHIP OF CULTURED PRODUCTION

For statistical purpose, the aquaculture production belongs to the nations within whose territories and/or Exclusive Economic Zones where the culturing facilities are located, regardless the nationalities of owners of facilities. It should be noted that this is not exactly comparable with the attribute of capture production, where the United Nations Statistical Commission decided in 1954 that the fish catches should be assigned to the country of the flag flown by the fishing vessel, regardless the location of catch, which the CWP is in principle in support.

Although aquaculture operations is currently not undertaken in the high seas area the development of such operations at a later stage cannot be excluded. Appropriate criteria to indicate attribute production in such cases needs to be established.

B. 2.2 CLASSIFICATION BASED ON LOCATION OF AQUACULTURE FACILITIES

Aquaculture facilities can be classified as follows based on the location of facilities and main source of waters:

- Inland :
- Coastal : inshore, inter-tidal area
- Marine : offshore

[Definition will be provided by FAO/FIMA, with drawing]

Definition of Marine Water and Inland Water:

The CWP has decided that it is for the national authorities to decide on the boundaries between marine and inland areas appropriate to the national situation. As a general principle:

Marine Water The term "MARINE WATERS" is intended to refer to oceans and seas including adjacent saltwater areas.

Inland Water The term "INLAND WATERS" may be used to refer to lakes, rivers, brooks,

streams, ponds, inland canals, dams, and other land-locked (usually freshwater) waters (such as the Caspian Sea, Aral Sea, etc.).

Modify corresponding to the final UNCLOS. Article 8 of the Informal Composite Negotiating Text / Revision 2 (A/CONF.62/WP.10/Rev. 2, 11 April 1980) of the United Nations Third Conference on the Law of the Sea assigns a specific meaning to the term "INTERNAL WATERS" as part of the sea. This UNCLOS article considers INTERNAL WATERS as those waters of the sea on the landward side of the baseline used by the national authorities of the coastal country to measure further seawards the width of the territorial sea and any adjacent marine waters, whether salt, brackish, or fresh in character. Such "internal" marine waters will be found, for instance, when the baselines are drawn across the mouths of bays or along a "curtain" of islands lying close off the coast. Japan's well-known "Inland Sea" is not part of that country's inland waters but is one of the internal waters of Japan and forms part of the truly marine fishing areas of that country.

C. FAO MAJOR AREA OF PRODUCTION

FAO major areas are defined and used to indicate global geographical distribution of fish production for primarily capture fisheries. They provide separation of production among large marine areas and inland waters of each continent as well as separation between inland waters and marine waters production. The whole description of FAO major areas is in Section 9.3. Currently, theses codes are requested at FAO questionnaire and EU **.

Separation between inland water and marine water is defined according to whether farming facilities are located in the inland waters or in the marine waters. In the case of on-land facilities, this should be determined based on the origin of water mainly supplied to the facilities. This separation has no relevance with the salinity level of waters used.

In general, this information is not relevant to aquaculture sector, except to identify production from different oceans (e.g. production from Pacific coast and Atlantic coast for the US). Such countries facing to multiple FAO major areas include Australia, Canada, China, France, Portugal, Spain, South Africa, Thailand, and USA [check: Xiaowei].

D. 2.3 DEFINITION OF CULTURE ENVIRONMENTS

Culture environments are defined according to water that is mainly utilized at the farming facilities, noting that a utilization of multiple types of water within a single farming unit is not unusual.

Freshwater Culture By freshwater culture is understood the cultivation of aquatic organisms where the end product is raised in freshwater, such as ponds, reservoirs, rivers, lakes, canals etc., in which the salinity does not normally exceed 0.5‰. Earlier stages of the life cycle of these aquatic organisms may be spent in brackish or marine waters.

Brackishwater Culture By brackishwater culture is understood the cultivation of aquatic organisms where the end product is raised in waters of fluctuating salinity in a range between 0.5‰ and full strength seawater. Culture utilizing relatively high salinity water originated from inland water bodies should be considered as brackishwater culture. If these conditions do not exist or have no effect on cultural practices, production should be recorded under either

"Freshwater culture" or "Mariculture". Earlier stages of the life cycle of these aquatic organisms may be spent in fresh or marine waters.

Mariculture By mariculture is understood that the cultivation of the end product takes place in seawater, such as fjords, inshore and open waters and inland seas where salinity is generally high and is not subject to significant daily or seasonal variations. Earlier stages in the life cycle of these aquatic organisms may be spent in brackishwater or freshwater.

The breakdown in culture environment (freshwater, brackishwater and marine water) is not easy in some cases and is often left to the subjective judgment of reporters. Many farming located in the inland have high salinity even exceeding 20‰, while some farming located in coastal areas and internal waters are actually using freshwater. There are many areas where the salinity levels fluctuate over the year.

E. 2.4 DEFINITION OF LAND-USE AND WATER-USE;

At this moment, there are no internationally agreed classifications of land use and land cover, including water use and water cover. Land (and water) cover is defined as the observed (bio-) physical cover of the earth's surface and the definition embraces vegetation, man-made features, bare rocks, bare soils and water areas. On the other hand, land (and water) use can be considered to reflect the degree and types of human activities directly related to land and water, making use of its resources, or having impacts on them.

In the framework of establishing the System of Integrated Environmental and Economic Accounting (SEEA), FAO is proposing the definitions and classifications of the land (and water) use, based on the land use databases including FAOSTAT, the World Programme for the Census of Agriculture, and the Global Forest Resources Assessment Program. Those databases mainly focus on land use and treat all inland waters as one category. Also, they do not include marine water in the concept. To accommodate the needs in Fishery (including Aquaculture) component of SEEA, additional classifications of land and water uses are incorporated into the proposal developed in April 2009. The CWP reviewed this proposal and modified further as table XX, which is still in development phase.

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L1	L2	L3	L4	L5	L6	Proposed LU Classification
						Country area
100000						Land area
	110000					Agricultural area
				111110		Land under temporary crops
					111111	Cereals
					111111a	Rice-fish culture area
				111120		Land under temporary meadows and pastures

					111122	Land under temporary meadows and pastures with aquaculture facilities
	130000	131000				Land with aquaculture facilities
				131110		Hatcheries
				131120		Managed grow-out sites
					131121	Fish
					131122	Crustaceans
					131123	Molluscs
					131124	Others (including poli-culture of different organism groups)
	140000					Other land
		141000				Land temporarily submerged under water
			141100			Agriculture area temporarily submerged under water with aquaculture facilities
			141200			Non-agriculture area temporarily submerged under water with aquaculture facilities
200000						Inland water area
		211000				Areas with aquaculture or holding facilities
					211121	Fish
					211122	Crustaceans
					211123	Molluscs
					211124	Others (including poli-culture of different organism groups)
		212000				Other inland water areas
				212100		Enhanced areas
				212200		Open access waters without enhancement
300000						Marine water area
		311000				Areas with aquaculture or holding facilities
					311121	Fish
					311122	Crustaceans
					311123	Molluscs
					311124	Others (including poli-culture of different organism groups)
		312000				Other marine water
				312100		Enhanced areas
				312200		Open access waters without enhancement

*** Supplement notes should be further improved:

Category	**Definition**

Country area	The total of areas under “Land area” and “Inland water,” excluding offshore territorial waters.
Land area	The total of areas under “Agricultural area,” “Forest or other wooded land,” “Land with aquaculture facilities” and “Other land.”
Land with aquaculture facilities	Land used for aquaculture facilities including supporting facilities. Aquaculture refers to the farming of aquatic organisms: fish, molluscs, crustaceans, aquatic plants, crocodiles, alligators, turtles, and amphibians. Farming implying some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Aquaculture facilities include ponds and tanks (artificial units of varying sizes constructed above or below ground level capable of holding and interchanging waters), raceways and silos (artificial units constructed above or below ground level capable of high rate of water interchange in excess of 20 changes per day) and hatcheries (housing facilities for breeding, nursing and rearing seed of fish, invertebrates or aquatic plants to fry, fingerlings or juvenile stages).
Other land	Land not classified as “Agricultural land”, “Forest area and other wooded land,” and “Land with aquaculture facilities”, including land occupied by buildings, parks and ornamental gardens, built-up areas, roads or lanes, open spaces needed for storing equipment and products, barren land, wasteland, land under permanent ice, and any other land not reported under previous classes.
Inland water areas	Area occupied by lakes, reservoirs, rivers, brooks, streams, ponds, inland canals, dams, and other land-locked (usually freshwater) waters (such as the Caspian Sea, Aral Sea, etc.)..
Marine water areas	Oceans and seas including adjacent saltwater areas including internal waters, within national exclusive economic zone. Internal waters is considered as those waters of the sea on the landward side of the baseline used by the national authorities of the coastal country to measure further seawards the width of the territorial sea and any adjacent marine waters, whether salt, brackish, or fresh in character, following the Article 8 of the Informal Composite Negotiating Text/Revision 2 (A/CONF.62/WP.10/Rev.2, 11 April 1980) of the United Nations Third Conference on the Law of the Sea.
Areas with aquaculture or holding facilities	Water surface areas above, on or below which are used for aquaculture facilities including supporting facilities. Surrounding areas that is required to keep for exclusive use of aquaculture by regulations and/or other requirement should be also included. Aquaculture refers to the farming of aquatic organisms: fish, molluscs, crustaceans, aquatic plants, crocodiles, alligators, turtles, and amphibians. Aquaculture facilities include enclosures and pens (water areas confined by net, mesh and other barriers allowing uncontrolled water interchange), cages (open or covered enclosed structure constructed with net, mesh or any porous materials allowing natural water interchange), barrages (semi-permanent or seasonal enclosures formed by impervious man-made barriers and appropriate natural features), and rafts, ropes, stakes (raft, long lines or stakes used to culture shellfish and seaweeds).
Enhanced Area	Areas with enhancement including stocking, fertilization, engineering, predator control, habitat modifications, and/or access limits, including Marine Protected Area.
Open access waters without enhancement	Area without any enhancements and access limitation.

Information on land use and water use in relation to aquaculture sector can be collected through administrative information including registers of aquaculture holdings, the agriculture census and aquaculture census, satellite imageries, and combination of those.

X. 3. Farming system (check with other existing definition and change text, if appropriate:FIMA)

A farming system in aquaculture is defined as any form of improvise or devise that is utilized to contain the cultured organisms, irrespective of the stage of its life cycle, in a given space. Very diverse containments are used in each of aquaculture operations depending on types of aquatic organisms cultured and the stage of its life cycle. These could range from land based ponds, pens and cages, in respect of finfish and crustacean culture in general, and molluscs and seaweed culture which use a range of substrates, with in a localized area.

Size of containments implies indicator of holding capacity and is to be used to standardize production efficiency and utilization of waters, fertilizers, feeds and other resources. This information when utilizing together with production will also provide an indicator on culturing intensities.

There is no consensus view on which of surface area under culture or water mass within containment would be more appropriate standard measure of farming capacity. Due to easiness to collect information, majority of existing data collection adopt surface area under culture as a standard measurement. The area under culture can change considerably during the year and it is recommended to measure the area at their [XXX].

A. 3.1 AQUACULTURE FARMING SYSTEMS AND THEIR RECORD

i) Ponds

Ponds are natural and/or artificial structures, on land, that are capable of retaining water for rearing of stock. Ponds often consist of some form of banks or dykes. Under this category ditches, flood plain depressions, derelict mining pools and the like are included. Pond culture is usually carried out in stagnant waters with periodic water exchange or water flushing is done through the pond inlets and outlets.

The measurement unit should refer to number of ponds, water surface area and water volume.

ii) Tanks

Tanks are artificial units of structure capable of holding and interchanging water which are generally built above ground level and can be made of various materials (e.g. bricks, cement, concrete, fiberglass, plastics, wood, asbestos and metal), in various shapes and sizes. They are generally used in hatchery and nursery operations. The measurement unit should refer to surface area and water volume, and water turn over rate is important parameter to collect.

iii) Pens

Pens refer to areas of a water body (e.g. in shallow lagoons, but also inland e.g. in lakes, reservoirs) that is fenced using structures (nets, wooden/ bamboo) fixed to the bottom permitting free water exchange. A pen generally encloses a large volume of water. The measurement should refer to surface areas and information on setting environments (whether in flowing water, still water, or marine water) may be important.

iv) Cages

Cages refer to open or covered enclosed structured with net, mesh or any porous material allowing natural water interchange. These structures may be floating, suspended, or fixed to the substrate but still permitting free water interchange. Cages are either supported by frameworks made of metal, plastic, bamboo or wood, or are suspended by stakes at its four concerns in open water bodies or in ponds. Cages use both for seed and grow-out production. The measurement unit should refer to surface area and volume, and information on setting environments (whether in flowing water, still water, or marine water) may be important.

v) Raceways

Raceways are long and narrow rectangular tanks usually constructed with bricks and concrete and artificial material above ground, that permits a rapid flow of water. To water turnover rate is generally in excess of 20 changes per day. The measurement unit should refer to surface area and water turn over rate is important parameter to collect..

vi) Enclosures

Enclosures refer to natural water areas (e.g. natural bay), where the shoreline forms all but one side, confined by a net mesh and other barriers allowing free water interchange and distinguished by the fact that enclosures occupy the full water column between substrate and surface. The measurement unit should refer to surface areas and information on setting environments (whether in flowing water, still water, or marine water) may be important.

vii) Lakes, Reservoirs, Flood plains

This refers to lakes, reservoirs and flood plain where stocking of aquatic animals are conducted on the regular basis, the stocked animals are confined in the stocked water bodies with management interventions; the products are harvested exclusively within the people with entitled ownership of the stocked stock. Stocked stock should compose the significant proportion of the total fish production from the water body. The measurement unit is the area of water surface in hectare for such purpose.

viii) Barrages

Barrages are semi-permanent or seasonal enclosures formed by impervious man-made barriers and appropriate natural features. The measurement unit should refer to surface areas and information on setting environments (whether in flowing water, still water, or marine water) may be important.

ix) Irrigation channels and ditche

Irrigation channels and ditche refers to water bodies that are used for fish aquaculture but their primary function was for converting water for irrigation purpose such as channels and ditches excavated or constructed with concrete in the ground. The measurement unit should refer to surface area.

x) Rice-fish paddies

Rice-fish paddies refer to paddy fields used for culture of fish and other aquatic animals, including both concurrent culture of aquatic animals with rice plantation and seasonal rotation of fish and rice crop farming in the same paddy field. The measurement unit should refer to surface area.

xi) Suspended/hanging systems

Suspended/hanging systems are floating structures as rafts built of wood, bamboo and long lines with seaweed nets or hanging lantern nets, growth ropes, pearl nets, net bags or trays, normally equipped with floats and safely anchored in a sheltered coastal area. This system

may be used for the suspended culture of seaweed, molluscs and other animals such as holothurian (sea cucumbers). The measurement unit should refer to the number of farming structures, surface areas and linear length (in the case of long-lines) .

xii) Off-bottom systems

Off-bottom systems are structures like trestles and long lines installed on stakes impaled in the seabed. Culture nets, lantern nets, growth ropes, pearl nets, net bags or trays are usually used in these structures to farm seaweed and mollusks. The measurement unit should refer to the number of farming structures, surface areas and linear length (in the case of long-lines)

xiii) On-bottom systems

On-bottom systems refer to the farming of molluscs like clams and oysters, and sea weeds, and holothurian directly seeded on muddy or sandy areas in the inter-tidal zone. The measurement unit should refer to farming surface area..

B. 3.2 STANDARD CATEGORIZATION FOR STATISTICAL PURPOSE

For statistical purpose, the followings grouping of farming system can be used:

- Ponds;
- Cages;
- Tanks and raceways;
- Pens, enclosures;
- Lakes, reservoirs, barriages, irrigation channel, flood plains, and other water bodies in the similar utilization;
- Rice-fish paddies;
- Suspended/hanging systems and off-bottom systems; and
- On-bottom systems.

XI. 4. Inputs to aquaculture

Better monitoring, management, development and planning of the aquaculture sector largely depend on the availability of accurate information on the input requirements for practicing aquaculture. Although there is an array of inputs is used in aquaculture, for statistical data collection purposes for monitoring the sector performance, several key inputs are considered essential. This includes:, (i) seed and brodstock, (ii) water (iii) feed and fertilizer, (iv) antimicrobials and therapeutants, (v) other chemicals and (vi) energy. Although labor is an important input to aquaculture, all human aspects are discussed under Section XX.

A. 4.1 SEEDS AND BROODSTOCKS

Seed is an essential input for aquaculture. Seed represents many different early life stages of cultured organisms ranging from fertilized eggs to post-larvae (shrimp), spat (mollusks), glass eels/elvers (eels), smolts (salmon), fry and fingerling (finfish), spores/seedlings (sea weeds) depending on the type of species cultured. Seed could come from either hatcheries (artificially propagated) or from the wild (naturally occurring). Seed is the primary input for aquaculture production. Therefore, it is imperative to collect accurate information on seed input for monitoring the performance of the aquaculture sector. The components that are required for monitoring of the sector include not only quality and quantity of seed but also their origin and genetic status.

The suitable level of information required to identify of origin is considered the separation between locally produced or imported for both broodstock and seed. Depending on data requirement, the same concept can be applied to, for example, to province level within a country: i.e. distinguishing those originated in one province of a country and used in another province from those produced and used in the same province.

Seed and broodstock from the wild is input to aquaculture but at the same time, output from capture fishery, i.e. capture production. The information on quantity of this input is important for both aquaculture and capture fishery sectors. Although this quantity in biomass is negligible in most cases, when the quantity is substantial (e.g. broodstock) and/or target organisms are commercially important, concerned in their stock conditions and/or ecologically sensitive species (e.g. tunas, eels, some groupers), quantity in both number and biomass should be collected.

For statistical purposes, the statistics to be collected for seed input include quantity in number and purchase value by species and separated between those locally produced and those imported. In the case of wild-caught seed, especially for tunas, eels and groupers, quantity in biomass should be collected in addition to the normal statistics described above. Statistics of broodstock input should be collect separately from seed input. Data to be collected are quantity in number, quantity in biomass, and purchase value by species by origin.

B. 4.2 WATER

Water is an important input to aquaculture production. In many areas of the world, there is a limited, and potentially expensive, supply of fresh water. Therefore there will be the possibility of resource competition among various food-producing sectors as well as other users of water. It will become increasingly important for aquaculture to be able to quantify its use of water resources in order to justify its use relative to other potential uses. The data elements necessary to measure this use remain to be developed but it is expected that this will be an issue of increasing importance in the future. Furthermore, the environmental impacts of the use of water for aquaculture through the discharge of effluents into common waters will also need to be considered.

For farming facilities including ponds, tanks, and raceways, the standing stock of water in use at farming facilities, turn-over rate, specification of inlets and outlets (e.g. directly from and to wild water body, irrigated waters etc), and physical, chemical and biological water quality of discharged waters (e.g. COD, BOD, concentration of N and P etc) should be monitored. In the case of farming facilities which rely on uncontrolled water exchange including enclosures, pens, cages, rafts, ropes, stakes and bags, it would be more appropriate to establish regular monitoring and assessment systems of ambient waters with a specific focus on gross effects on nutrients and their potential impacts on surrounding environments and ecosystems.

[Insert paragraph on currently reported data on water: Rohana. Depending on the result, statistics requirement may be further developed: FAO/CWP.]

C. 4.3 FEEDS AND FERTILIZERS

Feed is also a primary input to aquaculture. Feed could be natural and in some extensive aquaculture practices there is no supplementary feeding is practiced. Aquaculture feeding practices range from non-fed extensive practices to nutritionally wholesome feeds used for intensive practices. They range from live feed (Artemia, rotifers, algae, etc.), fresh plant material (grass, macro algae, etc.), simple supplementary feeding material (kitchen waste, various agricultural byproducts such as livestock waste, poultry waste, etc.), farm made feeds, and commercial feeds. Both farm-made feeds and commercial feeds are formulated, using different combinations of ingredients (maize, corn, fishmeal, fish oil, soya bean, etc.), offering a range of compositions of nutrients to satisfy the nutritional requirements of the species under culture.

When a culture practice relies on natural food, either fully or partially, fertilizers may be used to enhance productivity in ponds. Globally a large quantity of fertilizer is used in aquaculture production.

Although the information on the origin and utilization of feeds are extremely important for aquaculture development and planning, particularly in the view of strategic planning of effective utilization and distribution of locally available ingredients, the current level of knowledge is not adequate to establish standard procedure of monitoring of this component. In the interim, further enhancement of the regional and national knowledge of actual practice through occasional surveys, censuses, and case studies would be strongly encouraged.

For statistical data collection and information requirements on feeds and fertilizers, for the purpose of monitoring the sector, considering the complexity of feeds and fertilizers used in aquaculture, the following categorization is considered to be important:

- Farm-made feeds (volume and value)
- Commercial feeds (volume and value)
- Aquatic animals from the wild (volume and value)
- Aquatic animals from culture (volume and value)
- Aquatic plants from the wild (volume and value)
- Aquatic plants from culture (volume and value)
- Fertilizers (volume and value)

D. 4.4 ANTIMICROBIALS

As modern intensive aquaculture practices are generally prone to disease outbreaks many farmers opt to use antimicrobials as treatments. Inappropriate use of antimicrobials often lead to problems related to increased frequency of bacterial resistance possibly extending to human pathogens. Injudicious use of antimicrobials has also resulted in the occurrence of their residues in aquaculture products, resulting to commodity bans by importing countries and associated economic impacts, including market loss. Considering the increasing usage of antimicrobials in aquaculture, the potential human health and food safety implications of irresponsible usage, and the increasing regulatory requirements of controlled antibacterial usage at national levels for international trade in aquatic animal and animal products, monitoring the use of antimicrobials is considered important.

All events of utilization of banned antimicrobial (see XXX [List of relevant antimicrobial to be inserted as Annex]). Statistics of total amount of approved antimicrobials in terms of weight may be of importance for the sector management.

E. 4.5 BIO-MEDIATING AGENTS, WATER AND SOIL TREATMENT AGENTS [CONTINUED CONSULTATION WITH FIMA/MIAO]

In modern aquaculture, more and more chemicals and bio-mediating agents are used for improving the environment conditions for good living conditions and reduced disease occurrences in the production process. They have become an important inputs and composing the increasing significant proportion of production costs. They are recommended to be included in the statistic data collection for aquaculture in the country. Two categories, chemicals and bio-mediating agent are recommended to be used and measured by quantity (kg).

F. 4.6 ENERGY

The energy required for aquaculture operations is another important input. As described in the section on water (4.2), the use of energy for aquaculture will need to be quantified so that the use of energy can be justified relative to other food producing and non-food producing sectors. The data elements for this exercise remain to be developed. However, studies should be initiated to study the energy requirements of various production systems with the hope of identifying more energy efficient methods of fish production. Environmental impacts of energy use will need to be considered.

XII. 5. Outputs from aquaculture

Outputs from aquaculture reflect the contribution of the aquaculture to food security, economy and social wellness of countries. Final products from the sector and human contribution including employments and wages are considered as major outputs. This section mainly describes statistics to monitor final products and socio-economic aspects are discussed under Section XX. Loss due to diseases, natural disasters, and environmental impacts are considered in this section.

A. 5.1 AQUACULTURE PRODUCTS

This handbook considers three general categories of aquaculture products – namely, production for food, production for non-food uses, and production of seed for further aquaculture practices or for release to the wild environment. This section mainly describes the necessary statistics to quantify the production in each category.

5.1.1 Output products for food

The vast majority of aquaculture production is destined for human consumption. Statistics quantifying aquaculture production for food is in principle quantity in biomass by species, in terms of live weight equivalent. Thus, for molluscs and crustaceans, the weight of the shell should be included in the production weight. Suitable conversion factors can be used to convert meat weight to live weight equivalent and vice versa.

Aquatic plant production should be reported as wet weight. List of indicative conversion factors is in XXX.

However, the final products as output from aquaculture sector are often in processed products, with which the value of products is linked and more accurate statistics can be obtained. Statistics of quantity in processed weight by commodities by species is considered to be also important to collect in addition to above. International Standard Statistical Classification of Fishery Commodities is in XXX.

All statistics of quantity of products should be reported together with farm-gate value. This indicates the amount that the farmer would expect to receive for the product before any transportation costs are included. This concept is widely accepted but often quite difficult to collect in actual situation. Thus, it is useful to maintain and report brief explanation on what is exactly measured by the farm-gate value.

All statistics of quantity and value of products should be stratified by species, environment (i.e. freshwater, brackish water or marine water), by farming systems (see Section XX), and by destinations. Here, the destination is categorized into two: i) for domestic market, and ii) for export. If possible the destination country should be included.

5.1.2 Output products for non-food use

Non food aquaculture products can further be classified as follows: [check with consistency with WCO HS codes and when necessary modify]

1. Ornamental (or aquaria) organisms. This can be finfish, other aquatic animals such as live rock and corals or aquatic plant. Usually these are reported in numbers but live rocks and some live corals occasionally may be reported as weight.
2. Raw materials for jewelry, apparel, handicraft etc. This would include cultured pearls, shells, corals, skins etc.
3. Industrial use. This includes raw material intended for further processing, whether for pharmaceutical, food processing, or production of chemicals.
4. Others

In principle, the same standard statistics mentioned in 5.1.1 should be collected for the products for non-food use. However, properly quantifying non-food aquaculture production presents some special circumstances. In particular, ornamental fish and pearls are traded and reported by numbers and not by weight.

Statistics to be collected include quantity in either number or products weights, and farm-gate value. Where applicable, standard unit of quantity used in WCO should be referred. WCO-HS standard unit is in XXX. All statistics should refer to stratifications by commodities, by species, environment (i.e. freshwater, brackish water or marine water), by farming systems (see Section XX), and by destinations, in the same way as those for food-use.

5.1.3 Output of seed product

Seed production includes eggs, juveniles, and broodstock. Seed production is measured by numbers and not by weight, although both may be applicable for broodstock. Since seed is used both for aquaculture and stock enhancement, not only the information and knowledge on their quality and quantity, but also the origin and the genetic status is important in monitoring and managing the sector. Statistics of seed production should include all hatchery produced seed.

Statistics to be collected for seed include quantity in number and farm-gate value, stratified by the same as for the preceding categories with the addition that the life stage of the juvenile form. The concept of the destination of the product should be expanded to include:

- Released to the wild for restocking and enhancement (culture-based fisheries)
- Released to a controlled environment for recreational purposes (e.g. a trout farm)
- Destined for domestic further aquaculture practices (on-growing)
- Exported, with destination country where available.

Statistics to be collected for brood stock include quantity in number and biomass and farm-gate value, stratified by by species, environment (i.e. freshwater, brackish water or marine water), by farming systems (see Section XX), and by destinations, in the same way as those for food-use.

B. 5.2 PRODUCTION LOSSES

Aquaculture production can be lost, full or partially, due to various reasons; mainly due to diseases, natural disasters, and other environmental impacts. Considering the significant volume of loss production in aquaculture as per above mentioned causes, and the lack of accurate information and data on the issue in question, it is important to collect data and information at national level. The following categories are proposed for data/information collection:

- Losses in cultured organisms due to disease (disease, environment, estimated biomass and value of loss by species)
- Losses in cultured organisms due to natural disaster and other environmental impacts (type of events, environment, estimated biomass and value of loss by species)

- Losses in culturing facilities/equipments due to natural disaster and other environmental impacts (type of events, environment, estimated value of loss)

XIII. 6. Socio-economic aspects of aquaculture

The socio-economic information on aquaculture sector is essential to measure and monitor the sector's contribution to food security and poverty alleviation, and to plan and manage the sector in long-term sustainable manner. Census may provide an opportunity to collect such information extensively but only with long intervals. When relying on census to obtain socio-economic information, it is necessary to establish some way to monitor changes of key indicators between census years.

A. 6.1 EMPLOYMENT

An employed person is one whose main activity during the reference year was to be in paid employment or self-employment. Currently, FAO is collecting the employment in aquaculture with the following classifications (ref. CWP Handbook of FI):

- Full-time farmers receive at least 90% of their livelihood from farming activities (including employment at farms) or spend at least 90% of their working time in that occupation.
- Part-time farmers receive at least 30% but less than 90% of their livelihood from farming activities (including employment at farms) or spend at least 30% but less than 90% of their working time in that occupation.
- Occasional farmers receive under 30% of their livelihood from farming activities (including employment at farms), or spend under 30% of their working time in that occupation.

However, it is noted that this classifications are not necessarily always suitable and/or applicable to actual employment and working situations in aquaculture sector.

Where possible, further data collection on employment, especially through full utilization of census together with follow-up surveys, will support in developing better understandings on social and economic contribution and issues of aquaculture sector.

One area of potential improvement is to incorporate additional classifications of employment as follows:

- Employee : person in paid employment,
- Own-account worker : person who is working on his/her own account, or with one or more partners, in a self-employment,
- Contributing family worker : person who is working in a self-employment in the holding operated by a member of the same household,
- Others

Statistics to be collected may include age, gender, average wage, and educational level, together with number of employment by these categories.

B. 6.2 STRUCTURE OF FARMING OPERATIONS

Currently, most of countries require registration of all aquaculture production units with required provision of a broad range of data including ownership, location of farming facilities, type and size of farming systems in operation, water access, etc. In order to understand the structure of farming operations and their changes according to time, the information on existing farming facilities by farming systems and type of production units is considered as useful initial step. Here, production unit will be defined according to individual national legislation relevant to registration and licensing for aquaculture activities and may not be consistent among countries.

The information that is considered to be useful to collect includes:

- total numbers and areas of production units, separated by household units and non-household units,
- gender, age and national/ethnic group of the production unit owner,

- tenure type of production unit,
- types and surface areas of farming systems (see section XX) within the production unit,
- water sources and main water type in use (i.e. freshwater, brackish water, marine water), and
- number of employees by gender

C. 6.3 INVESTMENT

The information on investment is essential for sustainable development and effective management of aquaculture sector, especially for small scale holdings. Such information could be available within the government. Although no standard concepts and procedure exist for aquaculture sector, the CWP strongly encourages countries to make an efforts to collate and maintain the information on investment relevant to aquaculture sector in a systematic way, where applicable.

XIV. 7. Minimum reporting requirement for national statistics

This section indicates the statistics that are considered to be essential to monitor aquaculture sector of individual countries. Those are minimum reporting requirement to ensure consistency and comparability among different national aquaculture statistics and to enable regional and global analysis. Country should enhance its monitoring capability by broadening scope and increasing level of details of data collected according to its own need.

[Summary table of minimum requirements for all components to be prepared and inserted: FIES]

A. 7.1 INPUTS (SEE SECTION XX)

In principle, annual seed production in terms of number and purchase value by species should be collected and disseminated regularly.

Quantity of seed that is imported from other countries and those taken from natural environments must be monitored as separate categories.

When seed is imported from other countries, in addition to quantity in number and value by species, the data on estimated quantity in biomass and exported countries should be kept where applicable.

For seed taken from natural environment, it is strongly encouraged to keep quantity in biomass in addition to number and value by species as much as possible. In many cases, estimated quantity in live-weight can be negligible. However, specifically for any tuna species and eels, the estimated quantity in biomass is essential. Where applicable, value of seed should be included.

B. 7.2 OUTPUTS (SEE SECTION XX)

Output products for food: Statistics to be collected is quantity in live weight equivalent and farm-gate value stratified by species, environment (i.e. freshwater, brackish water or marine water), by farming systems, and by destinations (i.e. domestic or export).

Output products for non-food use: Statistics to be collected is quantity of products either in number or product weight, and farm-gate value, stratified by commodities, by species, environment (i.e. freshwater, brackish water or marine water), by farming systems, and by destinations (i.e. domestic or export).

Seed products: Statistics to be collected is quantity in number and farm-gate value stratified by species, environment (i.e. freshwater, brackish water or marine water), by farming systems, and by destinations (i.e. domestic aquaculture, domestic wild or export).

Output products of broodstock: Statistics to be collected is quantity in number and biomass, and farm-gate value stratified by species, environment (i.e. freshwater, brackish water or marine water), by farming systems, and by destinations (i.e. domestic or export).

C. 7.3 EMPLOYMENT (SEE SECTION XX)

Statistics required here is number of employment in aquaculture sector by genders and classifications whether full-time employment or not (corresponding part-time and occasional employment).

D. 7.4 STRUCTURE OF FARMING OPERATIONS (SEE SECTION XX)

The information on structure of farming operation is expected to be obtained from administrative data including registration and licensing. As a minimum, data of total number of production units by type of water environments (i.e. freshwater, brackish water, marine water) should be collected and disseminated regularly. Here, production units refer to the unit that countries adopt for their registration and/or licensing purpose. Where possible, it is encouraged to incorporate data on number of holdings and total surface areas by different farming systems. Further stratification of those statistics by type of holdings (i.e. household sector and non-household sector) is also recommended.

XV. 8. Data collection and data sources [FAO : FIES/FIMA]

A. 8.1. FARM LEVEL REPORTING

B. 8.2. SAMPLE BASED SURVEY

C. 8.3 CENSUS (NATIONAL CENSUS, AGRICULTURE CENSUS, AQUACULTURE CENSUS)

D. 8.4 USE OF SPATIAL INFORMATION TECHNOLOGY

The Spatial Information Technology is now well developed and provides powerful tool in aquaculture statistics and data collection with low cost through:

- Mapping of farming facilities,
- Measurement of number and size of farming systems,

- Monitoring of farming activities over time such as land use change, crop cycle monitoring e.g. stages in shrimp ponds, and abandoned or active ponds identification of coastal shrimp ponds, and
- Estimating and/or predicting production through analyses and modeling of GIS data.

The recent technology allows to map even individual aerators in pond by water circulation, indicating that pond is in use. The technology is especially effective for data collection in the area where the farming facilities are scattered and/or those hard to access.

Spatial information obtained through the technology provides full enumeration of the area of target and can be used as a master sample frame. Use of mobile GIS at the sample survey on ground survey, e.g. collecting socio-economic data, greatly enhances the utility, accuracy and cost efficiency of statistical data collection. Even that high spatial resolution imagery is still expensive, the methodology based on spatial information technology can be practical and realistic and is in fact already operational in some countries (ref.).

Currently, major limitation is availability of resources with appropriate skill, i.e. those have the background on the technology, aquaculture and statisticians, to maximize the use of technology.

An attempt should be made to harness the available resources and bring about higher efficacies to the data gathering which include the agricultural developments. This will lead to a more holistic, integrated and a much needed statistics gathering that the Global Strategy to Improve Agriculture Statistics (ref) is pursuing for.

All applications relevant to aquaculture using GIS, Remote Sensing and GPS are available at http://www.fao.org/fishery/gisfish/index.jsp.

Reference: [Go to Appendix section]

Kapetsky, J.M.; Aguilar-Manjarrez, J.; Soto, D. & White, P. In press. Status and potential of spatial planning tools, decision-making and modelling in implementing the ecosystem approach to aquaculture. In. Aguilar-Manjarrez, J.; Kapetsky, J.M.; Soto, D. In press. The potential of spatial planning tools to support the Ecosystem Approach to Aquaculture. FAO/Rome. Expert Workshop. 19–21 November 2008, Rome, Italy. FAO Fisheries and Aquaculture Proceedings. No.17. Rome, FAO.

Case study: Thailand and Brazil

Web-link with NASO, FAO mapping system

E. 8.5 ADMINISTRATIVE DATA

Currently, most of countries require registration and/or licensing of all aquaculture holdings with required provision of a broad range of data including ownership, location of farming facilities, type and size of farming systems in operation, water access, etc. This provides data to monitor an operational structure of the sector. Such administrative data

can also be used to design sampling scheme on operational aspects including water use and other inputs/outputs information.

XVI. 9. Common concepts and codes to be used

Below is a text extracted from the current draft of overall handbook. Please comments on necessary amendment, revision and/or missing component, to fulfill the need for aquaculture monitoring. If necessary, it is also possible to set separate section especially for aquaculture.

A. 9.1 COUNTRY

All countries or areas have official and formal designations. These are often very long and not suitable for use in statistical databases and publications, particularly in tabulations and graphs. These designations are therefore often simplified.

For example:

United Kingdom (or UK) refers to The United Kingdom of Great Britain and Northern Ireland.

Comoros refers to The Islamic Federal Republic of the Comoros.

The designations employed and the presentation of material in publications are used simply for practical reasons, and are usually accompanied by a note that they do not imply the expression of any opinion whatsoever on the part of the publishing agency concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

Certain other terms used in statistical publications (for example, "developed" and "developing" economies) are based on standard UN definitions in this respect, and frequently bear relationship to the stage of economic development, and no relationship to the level of catch of the country concerned. The same applies to the now widely-used term "low-income food-deficit country" - LIFDC. The LIFDC classification is established by the World Bank as low-income in terms of Gross National Product (GNP) per caput, and by FAO as having a trade deficit for food in terms of calorie content.

Alpha and Digital Codes

In many tables, country or area entities are identified by alpha (or alphabetic) and/or numeric codes and this practice is frequently used in multilingual tables where the use of formal names, or even their common abbreviations is impossible because of space considerations. Such alpha and numeric codes have been developed by the UN Statistical Office, FAO, ILO, EU, ISO, etc. In the two annexes to this section are to be found lists of the more commonly used codes in fishery statistics.

The two annexes include:

a) FAO multilingual country or area code (maximum 12 characters) used for fishery statistical purposes.
b) ISO 3-alpha country or area code (International Organization for Standardization).
c) ISO 2-alpha country or area code (International Organization for Standardization). ISO codes relate to geographical entities (See reference below).

d) UN 3-digit country or area code (See reference below).
e) Country or area names in English (maximum 24 characters)
f) Country or area names in French (maximum 24 characters).
g) Country or area names in Spanish (maximum 24 characters).

Some countries or areas are further presented under territorial or other components used in fishery statistics, for example:

1- Continents
2- Economic class
3- Regions and sub-regions

Annex IVa: List of countries or area by multi-lingual name

Annex IVb: List of countries or area by ISO 2-alpha code

B. 9.2 CURRENCIES AND FUNDS

The International Organization for Standardization (ISO), recognising that the need for a universally applicable code for the identification of currencies and funds had become increasingly urgent, has developed international standard codes for the representation of currencies and funds (ISO 4217). These codes are related to those developed by the ISO for geographical entities (ISO 3166).

- recommend to keep local currency records,

- maybe better to incorporate into main text

In the following two annexes are to be found lists of currencies and funds by:

Annex VIa: List of Currencies sorted by Country or Area Multi-lingual Name

Annex VIb: :List of Currencies sorted by currency code and country or area multi-lingual name.

C. 9.3 FISHING AREAS FOR STATISTICAL PURPOSES: FAO MAJOR FISHING AREAS

For statistical purposes, 27 major fishing areas have been internationally established to date. These comprise

- eight major inland fishing areas covering the inland waters of the continents,

- - nineteen major marine fishing areas covering the waters of the Atlantic, Indian, Pacific and Southern Oceans, with their adjacent seas.

The major fishing areas, inland and marine, are identified by their names and by two-digit codes.

INLAND

01 Africa - inland waters
02 North America - inland waters
03 South America - inland waters
04 Asia - inland waters
05 Europe - inland waters
06 Oceania - inland waters
07 Former USSR area - inland waters *
08 Antarctica - inland waters

MARINE

18 Arctic Sea
21 Northwest Atlantic
27 Northeast Atlantic
31 Western Central Atlantic
34 Eastern Central Atlantic
37 Mediterranean and Black Sea
41 Southwest Atlantic
47 Southeast Atlantic
48 Atlantic, Antarctic
51 Western Indian Ocean
57 Eastern Indian Ocean
58 Indian Ocean, Antarctic and Southern
61 Northwest Pacific
67 Northeast Pacific
71 Western Central Pacific
77 Eastern Central Pacific
81 Southwest Pacific
87 Southeast Pacific
88 Pacific, Antarctic

* The fishing area 07 ("Former USSR area - Inland waters") referred to the area that was formerly the Union of Soviet Socialist Republics. Starting with the data for 1988, information for each new independent Republic is shown separately. The new independent Republics are: Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, Uzbekistan (statistics are assigned to the fishing area "Asia - Inland waters") and Belarus, Estonia, Latvia, Lithuania, Republic of Moldova, Russian Federation, Ukraine (statistics are assigned to the fishing area "Europe - Inland waters").

Annex VIIIa is the world chart showing the current FAO Major Fishing Areas

D. 9.4 IDENTIFIERS FOR AQUATIC ANIMALS AND PLANTS,

As part of the ASFIS[2)] Reference Series FAO has produced a "List of Species for Fishery Statistical Purposes". The complete list is downloadable from the FAO website at: **ASFIS List of Species for Fishery Statistics Purposes**.

This list currently comprises 10,685 species items selected according to their interest or relation to fisheries and aquaculture. As far as has been possible from statistical reports, the species items have been included down to the level of the species. However, frequently statistical reports only identify to a taxonomic position higher than the species (e.g. genus, family, order). Such items have been included in the ASFIS list. No sub-species as included in the ASFIS list.

The species of importance to fisheries and aquaculture have been mainly selected consulting the FAO Species Identification and Data Programme (SIDP) publications such as species catalogues, identification sheets and field guides. FishBase (1998) has been the main source of information on newly included fish species. For fishes, the Eschmeyer's higher classification (1998) was adopted (as in FishBase). For crustaceans the classification by Bowman and Abele (1982) was adopted and for algae that of Luning, Yarish and Kirkman (1990).

For each item the following information is recorded: For the other groups more than one source has been consulted for the higher classification. A short list of the main references used in compiling the ASFIS list of species is provided in the Bibliographical references (see below).

ISSCAAP code. This code is assigned according to the FAO "International Standard Statistical Classification for Aquatic Animals and Plants" (ISSCAAP) which divides commercial species into 9 divisions and 50 groups based on their taxonomic, ecological and economic characteristics.

In Annex XXIIa will be found the list of the 9 divisions and 50 groups of species of the ISSCAAP used up to 1999.

At the 19th Session of the Coordinating Working Party of Fishery Statistics - CWP (Nouméa, New Caledonia, 10-13 July 2001), FAO-FIES presented a proposal to revise the names and composition of ISSCAAP fish groups 33, 34 and 37 with the aim of providing the users with a new useful grouping of coastal fishes and better identification of demersal and pelagic species.

The proposal was endorsed by CWP and implemented in the FAO Yearbook of Fishery Statistics starting with volumes 90/1(2001) and 90/2 (2001).

In the new classification the species items of the former group 33 "Redfishes, basses, congers" were classified as either coastal or demersal fishes and accordingly assigned to the new groups 33 "Miscellaneous coastal fishes" and 34 "Miscellaneous demersal fishes". The pelagic species, formerly included in Group 34 "Jacks, mullets, sauries", were moved to group 37, which was renamed "Miscellaneous pelagic fishes".

In Annex XXIIb will be found the above-mentioned revised list of the 9 divisions and 50 groups of species in the ISSCAAP. This list has been in use from 2000.

2) Aquatic Sciences and Fisheries Information System

Taxonomic code. The taxonomic code is used by FAO for a more detailed classification of the species items and for sorting them out within each ISSCAAP group. The code consists of 10 digits followed in some cases by an additional three digits.

3-alpha identifier is a unique code composed of 3 letters developed by the CWP for the exchange of data between international agencies and with national correspondents. The identifier is also widely used in statistical publications where the use of the full species descriptor would be prohibitive and it is increasingly used in fisheries administration documents (e.g. fishing log-books). The wider use of the indicators is encouraged provided it does not affect the integrity of the system.

The 3-alpha identifiers are managed by FAO to whom all applications for new identifiers should be addressed. An essential feature of the identifier is that once it has been assigned it may not be reassigned to another item even if the species item to which it originally referred is removed from the ASFIS list of species.

Scientific name.

Recent taxonomic revisions have been consulted to use the correct scientific names and taxonomic classification. This allowed the identification of some scientific names and taxonomic codes that were no longer correct. However, this list obviously has no authority on taxonomic matters and to resolve uncertain cases specialized sources should be consulted.

A pragmatic and conservative approach has been applied for uncertain cases for scientific and FAO names. Changes of scientific names and creation of new species proposed in the scientific literature by taxonomists will be included in the ASFIS list only when such changes have been recognized by the majority of taxonomists and are well consolidated among people dealing with fishery matters and, in particular, fishery statistics. For the most controversial cases, the ASFA database has been consulted to verify if a newly proposed scientific name has become of current use.

FAO English name.

These are the names that have been assigned to the species items by FAO as being considered to be appropriate to those species items. They are unique to that item. Member agencies of the CWP have agreed to use these standard species names in statistical publications and questionnaires.

These names may not correspond with nationally or regionally-used common names.

Where the species item refers to a single species the name is in the singular.

Where two or more species are present, the name is in the plural form.

It has been possible to assign representative English names to only 78% of the species items in the ASFIS list.

FAO French names.

The above remarks concerning the FAO English names applies to the FAO French names though only 40% of the items have been allocated appropriate names.

FAO Spanish names

The above remarks concerning the FAO English names applies to the FAO Spanish names though only 36% of the species items have been allocated appropriate names.

Family

The taxonomic family to which the species item is assigned.

Order

The taxonomic order to which the species item is assigned.

E. 9.5 FISHERY COMMODITIES CLASSIFICATION.

Fish, as a highly perishable commodity, often undergoes treatments which prolong its shelf life and quality as food. Fish is also a very widely traded commodity. When considering statistical aspects related to fish and fish products in the fishery industry as a whole, one is faced with a wide variety of raw fishery materials, semi-processed and fully-processed commodities, crossing all the various fishery phases. The physical magnitude and value of the intake and output of the different kinds of fishery commodities can be measured in specified periods of time - days, weeks, seasons, years, etc. Statistics covering any of the above phases must be dovetailed, linked or integrated and the first indispensable step is an adequate fishery commodity classification. The classification can be used as statistical standard for more than one statistical system, e.g. the trade system, industrial censuses, censuses of commercial and service establishments, wholesale and retail price systems, etc.

The FAO International Standard Statistical Classification of Fishery Commodities (ISSCFC) has been developed for the collation of national data in its fishery commodities production and trade databases. The ISSCFC is an expansion of the United Nations Standard International Trade Classification, Revision 3 (SITC Rev.3) developed by the United Nations' Statistical Office on the basis of earlier international work on the subject. It is linked with the Harmonized Commodity Description and Coding System (abbreviated to HS) of the World Customs Organization. The ISSCFC covers products derived from fish, crustaceans, molluscs and other aquatic animals, plants and residues caught for commercial, industrial or subsistence uses, by all types of fishing units operating in all aquatic environments, in inshore, offshore or high seas fishing. Commodities produced from the raw materials supplied by all kinds of aquaculture are also included.

The original classification is presented in **Annex XXIa** and the currently used classification is presented in **Annex XXIb**

Note

To promote the monitoring of aquaculture in an internationally harmonised manner and separate aquaculture activities from capture fisheries, a classification is presented in Annex XIIIa.

Structural data on aquaculture are collected by the statistical questionnaire **FISHSTAT AQ** and aquaculture production by FISHSTAT NS AQ.

XVII. BIBLIOGRAPHY

Overview

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