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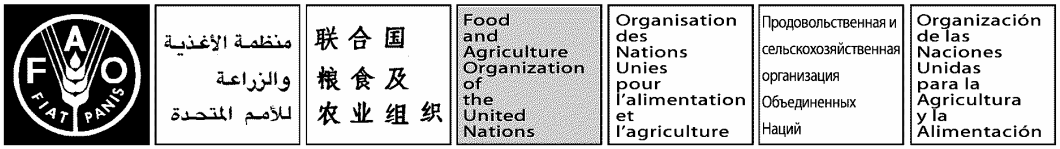

Item 4 of the Provisional Agenda

COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

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IMPROVING COLLECTION AND SHARING OF INFORMATION ON AQUATIC GENETIC RESOURCES (AqGR) FOR FOOD AND AGRICULTURE[1]

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I. INTRODUCTION

1. The present report provides a summary review of existing information bases and sharing systems for aquatic genetic resources and outlines the gaps and opportunities for improvement through networking and collaboration with special reference to the role of FAO and partners. The present work is part of a larger framework that will help implement the Multi-Year Programme of Work (MYPOW) of the CGRFA; it focuses on improving the collection and sharing of information on aquatic genetic resources with respect to developing:

i. a sound report on the State of the World's Aquatic Genetic Resources for Food and Agriculture (SoWAqGR); and

ii. a framework for suggested action towards improving the collection and sharing of information on aquatic genetic resources, identified by the Commission as being of high priority.[1]

II. AQUATIC GENETIC RESOURCES (AqGR): SCOPE AND DEFINITION

2. The Convention of Biological Diversity (CBD) defines genetic resources as genetic material of actual or potential value and genetic material as any material of plant, animal, microbial or other origin containing functional units of heredity: in which case aquatic genetic resources (AqGR) comprise all water-dwelling genetic resources.[2] Aquatic genetic resources for food and agriculture could be understood to be genetic resources derived from aquatic organisms for human consumption as food, nutraceuticals and pharmaceuticals, or for use in food production, from the wild or from culture, including stock enhancement, recreation fisheries and the production of ornamentals, shell, pearls or biofuels. This definition would include aquatic species, subspecies, populations, live whole organisms in the wild or in culture, viable tissues, cells, gametes or genes.

3. Established practice has treated certain aquatic species under other categories. For example, water birds such as ducks and geese have been recorded historically as farmed animals,[3] rice has been recorded as plant genetic resources,[4] and mangroves have been recorded historically under forest products.[5] Therefore, the definition of AqGR used in this document has the broad scope of any resource derived from aquatic organisms for human consumption as food, nutraceuticals and pharmaceuticals, for use in food production, including stock enhancement, recreation fisheries and production of ornamentals, shell, pearls or biofuels, excepting those already recorded by established practice as either microbial, forest, animal or plant genetic resources.

III. THE IMPORTANCE OF AqGR AND THEIR ASSESSMENT

4. The wild harvest of aquatic plants (mainly seaweeds), fish, and invertebrates (mainly molluscs and crustaceans) has provided human populations across the globe with important sources of nutrition from ancient times. Today aquaculture and capture fisheries directly employ over 180 million people, supporting the livelihood of 8 percent of the world's population, and each sector provides about 50 percent of the world's aquatic food supply.[6] Aquatic plants, aquatic invertebrates (molluscs, crustaceans and insects) and finfish are important sources of food and nutrients for human nutrition. There are more than 31 000 species of finfish, 85 000 species of mollusc, 47 000 species of crustacean and 13 000 species of seaweed,[7] with more than 5000 species accessed in wild fisheries and about 400 species used in aquaculture.[8] Aquatic genetic resources underpin the productivity and sustainability of world aquaculture and capture fisheries, and the essential services provided by aquatic ecosystems in marine, brackish and freshwaters. Aquatic biodiversity and genetic variability is the basis for further evolution and adaptation required to meet future challenges like climate change.[9]

5. The increase in the human population projected over the next 30 years suggests a doubling in demand for food and materials from aquatic sources and it is likely that novel requirements e.g. renewable energy sources such as biofuels will further increase demands for materials from AqGR.[6] The static or declining supplies from wild catch means the demand can only be met through improved fisheries management, habitat restoration and increasing responsible aquaculture production in line with the Code of Conduct for Responsible Fisheries (CCRF) and in possible partnership with other food sectors. This will most likely require the wide application of genetic improvement techniques and biotechnologies[10] to aquaculture which have been used to great effect in terrestrial agriculture to achieve improved production on global scales.

6. The Commission categorizes aquatic genetic resources primarily as that of the fish (used in the broad sense; i.e. finfish, crustaceans, molluscs and other invertebrates) which are farmed or fished, together with that of the aquatic biota in the ecosystems that provide goods and services for fish production.[6] However, the genetic resources used for aquaculture also include those organisms used as live feeds, such as cyanobacteria, microalgae, protozoans, rotifers, artemia, copepods, cladocerans, invertebrate larvae and baitfish.[11] Low value fish and industrial fish species provide fishmeal and fish oils and there is a long established use of seaweeds and plant products as human food or food additives. Novel approaches include the use of seaweeds as feeds for aquaculture as part replacement for fishmeal.[12] AqGR are also used in the aquarium trade and in cultural or religious activities.[6] Not only are wild genetic resources used to feed or supply young to cultured stocks, but aquaculture hatcheries are used to provide large numbers of young for ranching, restocking and stock enhancement of wild populations in order to sustain recreational and local commercial fisheries.[13]

7. Microalgae are used as sources of micronutrients for human health and bacteria as probiotics in aquaculture production.[10] Microalgae are also a potential source of biofuels, and may play a role in providing essential micronutrients and replacements for fish oils in aquaculture and agricultural feed stocks. AqGR are sources of nutraceuticals and pharmaceuticals. The productivity and resilience of ecosystems supporting aquaculture and fisheries depend upon many species of micro-organisms in the water column and in detritus food webs: including microalgae; cyanobacteria; heterotrophic bacteria; fungi and protozoans.[14] Management of micro-organisms responsible for fish spoilage are important in the post-harvest handling, processing and marketing of fish products and controlled fermentation by aquatic bacteria and yeasts is used to produce a wide diversity of fish sauces and pastes.[15]

8. Trade in food products is extensive worldwide, including live organisms used for further farming, the establishment of new cultured stocks and for introduction to provide new recreational or capture fisheries[16]. The movement of AqGR has been as live adults, juveniles, embryos, gametes, tissue explants, microbial cultures, from wild stocks and derivatives from domesticated populations and all the major production species have been moved extensively either regionally or globally.[16] *Ex-situ* living collections of strains other than microbes or microalgae are rare, although live breeding populations of aquatic species are maintained in zoos, aquaria and in specialist centres for rare breeds, or for validated strains used in culture (e.g. cultured carp strains in Central and Eastern Europe and salmonids in Canada).[17] Molecular genetics resources are increasing as a mean of identifying species, varieties, strains, hybrids and fisheries stocks and populations; as reliable markers for product traceability and food security; identifying candidate genes useful in aquatic organism production and in improving the efficiency of genetic improvement programmes.[8] Direct gene transfers have already been made experimentally in several fish and invertebrates with one transgenic ornamental fish being traded.

9. There is increasing recognition of the vulnerability of wild fisheries under direct and indirect threats from overfishing, habitat destruction, pollution and environmental change, that increased production through wild capture fisheries is unlikely and that improved management will be required even to maintain vital production from this source.[8, 17] There is increasing recognition that more efficient methods of farming AqGR need to be developed and this means selecting appropriate stocks, creating improved genetic resources, disseminating these on industrial scales and minimising impacts on wild resources. Issues concerning the ownership of

AqGR, access to and benefit sharing from these resources arising from the recent Nagoya Protocol[18] (a formal mechanism outlining processes of access and benefit sharing of genetic resources arising from the world's biodiversity) will also require sound information of the nature and distribution of AqGR.

10. It is critical that reliable information on the nature, distribution and use of AqGR is obtained and assessed using standardized methods, in order to enable effective planning and implementation of methods for increased sustainable production of these vital resources, regionally and globally, over the next few decades and into the future.

11. Expected outcomes of improved reliable and accessible information on the nature, distribution and use of AqGR will include:

- More effective management of wild fisheries resources to maintain production, other ecosystem services, and reduce adverse impacts of fisheries.
- Reduced impact on, and more effective conservation of, natural AqGR.
- More efficient, responsible and sustainable production from aquaculture.
- Enhanced food security, more effective national control of AqGR, improved trade capability traceability, more open trade greater access to market.
- Provision of an evidence based capability to analyse past events and to predict future scenarios.
- Basis for a plan of action of AqGR.

IV. TYPES OF INFORMATION REQUIRED TO UNDERSTAND, MONITOR AND MANAGE THE SUSTAINABLE USE OF AqGR

12. Initial assessments of plant genetic resources for food and agriculture (PGRFA)[4] and animal genetic resources (AnGR)[3] have focused on domesticated strains and improved varieties and breeds, with limited consideration of wild populations. However, there is recognition of the need to conserve and access genetic resources of wild relatives of species used in agriculture (e.g. Crop Wild Relative project[18]), and indeed the recently released second and updated edition of the State of the World on Plant Genetic Resources addresses these. *Ex-situ* genebanks of seeds, tissues, culture collections, cells and gametes are a major resource for PGRFA and a significant resource for AnGR.

13. AqGR differ in that *ex-situ* collections are as yet rare but it is important to record the few resources available in aquaria, cryobank, live strain and in vitro collections.[17] A large proportion of food production comes from wild harvest or access to wild young to stock aquaculture operations and the sources and uses of these is important to record.[13]

14. All such sets of information require identification and cataloguing of the nature of the resource [wild population, collection, source], its identity [species, population strain, nature of genetic improvement], distribution [geographical, temporal], and useful additional information may include legal status [ownership, accessibility], method of production or harvest [e.g. habitat, cage, pond, fisheries stock, capture method], or resources available for improvement [e.g. strains, cell cultures, genes, biotechnologies] and the nature of the product traded [e.g. live, fillet, processed food, biochemical].

15. For fisheries, information on species distribution and abundance and key aspects of biology such as habitat use, migration, the nature of any threats to the population will be of importance. Given the concerns raised about the potential negative impacts of introduced species, strains and genetic material from restocking programmes, details of their introductions are important to record and monitor, to be able to assess any impact.

16. Stocking of aquatic organisms has been a widespread method used to replenish fisheries and to introduce new or preferred species for anglers or commercial fisheries.[13] Useful data to assess impacts include monitoring key aspects of the ecosystems concerned [e.g. habitat change,

community composition, food web alterations] to measure ecological impact, and information on the genetic structure of the wild and introduced populations to assess genetic impact [e.g. the levels of gene flow among populations, levels of introgression of introduced gene variants into native populations]. Basic information required would be the number and date of the introductions, volume and type [age, size, sex] of resource introduced, the method of introduction, the sources of the AqGR and subsequent measures of outcome, methods for monitoring restocking programmes, scientifically based baseline information, temporal and spatial information of the introduction, and the extent and type of monitoring undertaken.

17. For aquaculture, strain ownership and nature of genetic improvement will be of more importance.[16] Records of the existence and status of breeding programmes, including where possible information on the number, source and characteristics of broodstock, the type of genetic improvement [e.g. pedigree status, selection process, cross breeding strategy, use of hybrids, key characters selected] and recording relevant biotechnologies [e.g. genomic data, gene sequences, molecular markers, tools for genetic manipulation] are critical to monitor the use and impact of advanced production methods in aquaculture.

18. It is clear that some types of information required will depend on the processes and goals of the activity undertaken. The capability to obtain, process and store information will also vary between institutions and jurisdictions and priorities will need to be set to determine minimum levels of information needed, and how these could be enhanced. The standardization of methods of data collection and treatment will be critical to the ability to use the data for meaningful global comparisons and analysis.

V. PRESENT MECHANISMS AND TOOLS FOR THE COLLECTION, STORAGE AND DISSEMINATION OF INFORMATION ON AqGR

19. Information on the production of fisheries and aquaculture has been collected by the FAO for several decades, through national fisheries and/or trade agencies, and databases have been developed to document the diversity and harvest or aquaculture production of aquatic organisms of economic importance.[6] There are a few key larger scale databases which specialise in taxonomic groups that have a focus on AqGR such as FishBase,[20] SealifeBase[21] and AlgaeBase[22] and these provide a major source of information in these groups for the global data integrating platforms. Global platforms have been developed and are being actively improved, to provide Web-based digital access to information on the world's biodiversity, aggregating information available from museum collections, national and international archives.[23]

20. Thus, information on the taxonomic identity, distribution and abundance of aquatic organisms has been accumulated from national and international surveys, by museums, universities, environmental agencies, fisheries agencies, aquaculture or agricultural agencies, non-governmental organizations and individuals over the last two or three centuries. More recently, information on primary production and environmental factors has been gained by remote sensing through satellite imagery provided by space agencies.[24] Early in the development of molecular biology and sequencing programmes it became the norm to require the deposition of raw sequence information in international databases prior to publication of results, and this practice has been extended to other forms of molecular information including proteomic data and data on gene expression, whether from transcriptomic analysis or expression data from microarrays.[25]

21. Efforts over the last two decades to link various databases and to link information on biodiversity with that on environmental information to enable meaningful global analyses have demonstrated the technical challenges and considerable financial investment required to achieve these effectively.[23] Visualization tools for rapid production of information of distribution of aquatic species (e.g. AquaMaps[26] and other distribution models) and for statistical analysis of global fisheries and aquaculture data (FishStat[27)] are assisting the ability to undertake some analysis of current distributions of AqGR and changes or trends in distributions, usage or value over time.

22. Information is stored in both paper and electronic archives in private, national and government agencies, and disseminated in a range of paper and electronic outputs reporting variously aggregated information on natural populations, fisheries resources and production, aquaculture production and conservation-related topics and in the academic literature. The latter includes much information that is not aggregated and synthesized for general use but many journals are open to sophisticated bibliographic search tools such as [e.g. ISI, SCOPUS, Science Direct][28] but these are often not fully public access as are many academic journals, which require paid subscription. National, regional and global fisheries and/or aquaculture agencies, professional societies or industry sector associations often provide excellent means of sharing information including material not otherwise recorded.

VI. INFORMATION SYSTEMS AND DATABASES[2]

Fisheries and aquaculture production and utilization

23. The primary database on fisheries and aquaculture production is that of FAO itself, the world fisheries and aquaculture statistics, compiled from FAO Member Countries' reports on annual production and value of aquaculture and production and consumption data from capture fisheries (in 2008 from 240 countries and territories) starting from 1950.[6] FAO has a process that allows continuous improvement of reports through the "Strategy for improving information on status and trends of capture fisheries" (STF)[29] and a similar strategy for aquaculture (STA).[30] Nevertheless, the reporting includes many categories which aggregate information for more than one species, making it impossible to track the use of an AqGR even at species level. FAO also continues a long established programme of work on accurate identification of fish species which greatly improved the consistency of reporting at the species level,[31] but was introduced largely prior to development of detailed knowledge of intra-specific stock identification, and the development of aquaculture strains and focuses primarily on commercial marine fish species. There is a lack of information on minor marine stocks and inland fisheries.[32] No data below species level [strain, fishery stock] is collected. There is a strong need to improve and update the CWP statistic standards to be used by national and global data collection processes to better reflect the status and utilization of AqGR, at the species level and to include information below the species level.

24. National and regional fisheries and aquaculture bodies also hold the data for their jurisdictions and in many instances more detailed information concerning local AqGR than are reported to FAO.

Specialist AqGR programmes

25. There are three significant large-scale databases focused on aquatic species: FishBase[20] (31 600 species), AlgaeBase[22] (16 700 species) and SealifeBase[21] (105 900 species), the last of which holds information on a range of marine invertebrates and so is complementary to FishBase and AlgaeBase. AlgaeBase also includes information on sea grasses. All these programmes are largely based at the species level: the easiest level of discrimination of genetic resources and while they may have fields for genetic or resource use data, these have not been completed for many species. These three programmes have the structure, programming flexibility and access to expert assessment for appropriate validation of data to add information on AqGR not achieved to date and to create new fields for additional information if required. They have linkages to the global initiatives described below, the databases for molecular information. Established information on many aspects of the biology of the species they track would automatically link to information on AqGR below species level if this was recorded.

[2] Full listing in Appendix I.

26. National and regional databases exist on specialized topics such as commercially important strains [e.g. strain registries for catfish, trout and sturgeon exist in the USA and Europe][33].

AqGR conservation programmes

27. Major initiatives providing specialist information on the conservation, use of wildlife and the impacts of alien aquatic species include the International Union for Conservation of Nature and Natural Resources (IUCN) red list,[7] the Convention on International Trade in Endangered Species of wild flora and fauna (CITES) list[34] and the Global Invasive Species Information Network.[35, 36] Core resources for analysis of genetic diversity and fast robust methods of data access and analysis tools using the GBIF platform are being developed by LifeWatch,[37] and to the species level molecular identification database Consortium for the Barcode of Life (CBOL).[38] Databases on aquatic protected areas, important repositories of AqGR, exist nationally and globally [e.g. those under The Convention on Wetlands of International Importance (Ramsar Sites)[39]].

Molecular and genomic programmes

28. Molecular information such as gene sequence, or other measures of genetic variation at the molecular level (e.g. microsatellite or allozyme variation), has proved very useful for establishing stock structure in wild populations, providing mechanisms for effective traceability in production chains, and for identifying useful genes in selection programmes.[8,17] There are large and well-supported databases such as GenBank (which now has many millions of sequences).[40] GenBank is part of the International Nucleotide Sequence Database Collaboration, which comprises the DNA Databank of Japan (DDBJ), the European Molecular Biology Laboratory (EMBL), and GenBank at NCBI which exchange data on a daily basis. The primary responsibility of these databases is the recording of the molecular information and the quality controls on the taxonomic information could be improved. There are a number of specialist access databases on individual AqGR species subject to sequencing or large scale transcriptomic projects. CBOL is an international initiative devoted to developing DNA barcoding as a global standard for the identification of biological species.[38] Pattern of distribution of genetic diversity among populations are not reflected in GenBank and as yet there is no large scale molecular database for population genetic data on AqGR. However, there are some resources on genetic markers [e.g. the Molecular Ecology Resources microsatellite allele data base[41]] information on some exploited fish at population level in Fish-Pop-Trace[42] and for particular species (see Appendix I).

Large global information systems

29. The relevant major global initiatives designed to address the need for a clear and accurate inventory and continued monitoring of global genetic resources is the Global Biodiversity Information Facility (GBIF).[23] Global databases such as GBIF and others such as Tree of Life, were developed to aggregate information on all living organisms. It is important to understand that these large programmes, which appear to attract the bulk of recent funding, aggregate information from smaller specialist databases and are crucially dependent upon these for quality information. In the case of AqGR, the major ones are those listed above such as FishBase, AlgaeBase and SealifeBase. The complexities of aggregating dispersed information is illustrated by the fact that GBIF required an investment of about US$500 million and more than a decade,[43] to develop an effective means to aggregate information and provide access to many different smaller data collections held by a large number of institutions. Additional initiatives such as LifeWatch are planned to develop the tools to allow meta-analysis of species distributions, abundances and interactions with environmental variables to meet key goals of monitoring and analysing global biodiversity.[44] To achieve full capacity, these initiatives are likely to require investments of several hundred million dollars and decades of work. Similar levels of investment have been required to set up and maintain databases focused on gene sequence, genomic and proteomic data and similar time periods (decades) have been required for their development.

Linkages and information sharing among agencies and user groups[3]

30. Larger, better funded databases are increasingly linked to others in order to make better use of scarce resources.[43] Examples of this process include the linkages made between major global databases of biodiversity including, GBIF, Tree of Life, CBOL and more recently Census of Marine Life (CoML) and LifeWatch. FishBase and SealifeBase are strongly linked to FAO, which is one of the several consortium members which guides their development. The ASFIS List of Species for Fishery Statistic Purpose used by FAO as the international standard to classify the statistic data is linked to global AqGR species lists such as World Register of Marine Species (WoRMS).[44] There are also linkages to environmental of ecological databases such as Seas Around Us, Ecopath and Ecosym and to microbial databases (WDCM and WFCC). The major molecular databases are strongly linked through the International Nucleotide Sequence Database Collaboration, which comprises the DNA Databank of Japan (DDBJ), the European Molecular Biology Laboratory (EMBL), and GenBank at NCBI among others.

31. These collaborations have highlighted issues concerning inter-operability such as coding methodologies (controlled vocabularies), IT specifications, nomenclatures, how to enable quality control on the initial data and more general issues concerning ownership of the data, rights to access, rights to disseminate and mechanisms to ensure protection of sensitive data. They have also highlighted the need for substantial investment to achieve the level of integration, scale and scope of coverage of these databases and the ultimate ability to analyse biodiversity data globally in the way that environmental data is currently enabled in the physical sciences.

32. Extremely important and effective means of aggregating a wide range of information on fisheries and aquaculture issues, including information on production and AqGR at subspecies scale and more details of production and use of AqGR are national industry, governmental associations and regional networks. These include National and regional professional societies and industry associations (e.g. Asian Fisheries Society, European Aquaculture Society, International Council for the Exploration of the Sea, World Aquaculture Society), regional fisheries aquaculture networks and so on. They have not only allowed the aggregation of highly dispersed information, and information not suitable for the scientific, technical or grey literature, but have also provided effective pathways for the dissemination of information from these sources to local extension groups, researchers and farmers. These groups have also facilitated the exchange of information using a larger range of local or regional languages than those normally used by formal Inter-governmental groups or in internationally published media. However, some networks are still at a very early stage and will need support to provide all desirable functions.

VII. GAPS IN DATA COLLECTION AND VALIDATION

33. Data collection on biodiversity and environmental variation is carried out by many agencies, institutions, governmental and non-governmental groups and is of variable quality and scope. There is also considerable variation in the methodology, reliability and degree of aggregation of data on fisheries and aquaculture production in quantity and value.

34. Information on AqGR is highly scattered and there is a need to develop effective mechanisms to identify the existence of small collections of data on AqGR and to enable their integration in larger information systems; for that reason, there is a need to identify the existence of small physical collections of AqGR [e.g. collections of key organisms held by individual specialists] to allow their integration into larger collections and prevent their future loss.

35. Information on aquatic genetic resources is held in a range of information systems and databases. The scope, quality and depth of this information are limited in most of these, and all have gaps with respect to the information required to assess and manage AqGR. There are major gaps where information of a given type does not appear to exist for a particular species or major commodity group (e.g. genetic information is still limited to relatively few aquatic species).

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[3] Basic Information on Regional Fisheries Bodies sorted by type is listed in Appendix II.

However, some types of information are available in the primary scientific, technical or grey literature but have not been assimilated by established databases, or otherwise aggregated (e.g. whether a species is cultured or not, production levels for a particular species or strain, some population genetic or stock data). Extremely useful information pertinent to assessing the state and use of AqGR is often fragmented and scattered in nature. Processes by which these are aggregated include technical reviews, collections and databases held by individual experts, institutions and collations of information by national industry, fishery or aquaculture national or regional networks.

36. The primary collation of global information on fisheries and aquaculture production, the FAO global statistics on fisheries and aquaculture, includes many categories which aggregate information for more than one species, making it impossible to track the use of an AqGR even at species level. There is a lack of information on minor marine stocks and inland fisheries. No data below species level [strain, fishery stock] is collected. There is a strong need to improve and update the CWP statistic standards to be used by national and global data collection processes to better reflect the status and utilization of AqGR, at the species level and to include information below the species level. The principal source of information for the FAO global statistics on fisheries and aquaculture are data collected annually from national reporting offices through specially designed questionnaires, data retrieved from the national statistics products and data estimated by FAO.

37. Data are often aggregated above the species level and can provide accurate information for a particular commodity. However, opportunities exist to extend the questionnaire to species and subspecies level in the future.

38. Mechanisms for reporting resources such as specialized strains, clones, lines and different forms of both *in vivo* and *in vitro* genetic material such as genes, DNA, cell cultures, algal and micro-algal cultures, gametes, *ex-situ* (aquariums, collections etc.), live captive populations and *in-situ* population conservation are limited, and ways of possible integration with the existing FAO reporting systems will be assessed by the State of The Worlds' Report, particularly for countries where the information is already collected, but not necessarily provided to FAO at present. There are considerable differences in the capability of different countries, as recognized by FAO and further capacity building would be required to achieve these goals (aggregation, species level). This may range from developing basic capacity for species identification, to methods of standardised data collection, database entry or providing links and skills to input information to international databases.

39. The major information systems with key data on AqGR and their use (AlgaeBase, FishBase and SealifeBase) often do not have information on the use of particular species for food and agriculture, or information at subspecies level, or detailed genetic information, recorded. However, these databases are best placed to incorporate further information either not collected to date, or inadequately collected to date, concerning the nature, distribution, use and status of AqGR and would provide a cost-effective means of achieving these outcomes. These three programmes have the structure, programming flexibility and access to expert assessment for appropriate validation of data to add information on AqGR not achieved to date and to create new fields for additional information if required. It is important to assess the precision and accuracy of all the information incorporated and where possible record this in the database to ensure consistency, quality control and comparability of data, together with date on the collector, and the legal status of the sample [e.g. ownership, permissions provided or restrictions on transfer or Intellectual Property (IP) associated with the sample]. All these databases have the capacity and access to expertise to achieve these goals. These databases are linked to the major molecular databases and global information systems to which they provide the key summary data used by these concerning most AqGR. Mechanisms to improve the availability of dispersed material and assessment of its quality may be achieved through commissioning of thematic or sector reviews by experts to identify and provide lists primary sources and interpretive guidance to database operators.

40. Attempts to organize and calibrate information on biodiversity are being undertaken by the large international programmes on biodiversity are not focused on AqGR *per se* and significant time and monetary investment will be required before strong analytical platforms suitable for the assessment AqGR. However, these programmes provide useful Web access and have the capability to integrate many different systems and so are important platforms with which specialist AqGR systems need to interface. The increasing awareness of the complexity of interactions between genetic diversity and environment, and increasing sophistication of scientific tools to investigate these interactions, has also been paralleled with an increasing realization of the practical difficulty and scale of investment required to adequately integrate data at this level and to provide tools for the global analysis of biodiversity and its interactions with the environment (e.g. GBIF, LifeWatch). While large global information systems provide the ultimate mechanisms for analysing information on this scale, the time scales and investment levels required to achieve global integration are likely to exceed those available for an initial assessment of AqGR. More important, the large global integration programmes depend on smaller groups or databases for the critical roles of data collection and verification accessing expert knowledge. Therefore, while there has been a trend towards a few larger databases absorbing the information contained in smaller or less well-funded operations the initial steps to accessing information on AqGR are most likely best achieved through strengthening those smaller programmes which have specialised in AqGR.

41. While there are issues concerning the access and use of specific data, there are established mechanisms to deal with this and it does not appear that this is a major impediment to obtaining information on AqGR. However, continued work needs to be undertaken to ensure high levels of quality control and improved access to information in the private sector. This may be best achieved through interaction with national and regional networks, as well as through professional and industry associations.

VIII. ACTIONS TO IMPROVE THE COLLECTION AND SHARING OF INFORMATION

42. The MYPOW of the CGRFA recommended a review of existing information sharing systems and databases, as well as the present methods of collection and sharing of information, on AqGR and to identify how these could be strengthened and improved.[46] The gaps identified in the databases and information collection systems can be addressed by a series of actions, some of them are listed below. These will require additional financial resources to be achieved and in some cases this may also require new legal or formal agreements to implement. However, the suggestions to improve established data collection and information sharing systems on AqGR provide potentially highly cost-effective ways to improve collection and sharing of information on AqGR.

43. Lack of data and information, as well as inadequate standardization, has resulted in poor understanding of the status and trends of AqGR to support sound management of the resources, which has resulted in unsustainable practices in some instances. There is however, growing recognition that genetic information will be increasingly important to support more efficient, responsible and sustainable production from aquaculture and fisheries, as well as for enhanced food security and to ensure increased national control of AqGR and improved traceability. There is also an increasing body of information on genetic resources for aquaculture and on genetically distinct fish stocks and cryptic species and an increasing need for more information to underpin sound management. At the same time, the technical difficulty and costs associated with collecting information on genetic diversity need to be recognized. The additional burden on the often over-loaded capacity in developing countries must also be taken into account; and clear procedures for sustainable development set and implemented.

44. Key objectives regarding FAO data collections:

- Strengthening the capacity of the countries to collect, compile, validate and share national information on AqGR, in order to improve their own national management plans and the

information officially reported to FAO[29,30] and other information sharing systems. Specific targets would include:

- Introduction of national and international standard operating procedures;
- Training on standard operating procedures;
- Improvement of FAO databases (e.g. decreasing the high level of data aggregation in certain countries);
- Improvement of AqGR resource identification: at species level and through standardized taxonomical classification;
- Review and link to the ongoing efforts[29,30] to improve the FAO fisheries and aquaculture questionnaires.

For the accomplishment of these key objectives it would be necessary to take into account existing fisheries and aquaculture networks, for both capacity building and technical transfer activities and for the collection and compilation of data at regional level.

45. Key objectives regarding non-FAO databases:

- Provision of additional resources to key databases for AqGR to allow update of fields not currently completed (e.g. inclusion of information on key stocks, strains, their production systems), the addition of new fields and completion through searching the primary literature. This process could be linked to additional capacity *in-situ* building opportunities in data handling, archiving, collation and dissemination.
- Compilation of scattered information on AqGR through expert consultancies covering specific disciplines, specific resources (wild, cultured or *in-situ* or *ex-situ* collections) or production methods; compilation of case studies. These should be designed to identify and collate primary literature and information from the field to feed into information systems.
- Standardization of the collection of primary and secondary data on AqGR in the actions suggested above, for comparability of information, effective integration of databases and maintenance of links to major global databases to assist dissemination of the information.
- Development of key targets and indicators necessary to determine the effectiveness of actions and to monitor progress in tracking the State of the World's AqGR and their sustainable use [e.g. indicators of status of resources; area under culture; diversity levels; number of threatened stocks; proportion of fisheries assessed at species level; the proportion of genetically improved stocks used in aquaculture; extent of improved production efficiency; number and/or proportion of AqGR protected].

46. Many of these actions may take some time to complete in depth in every country for all species. It is likely that a number of priority actions will be needed to have sound information for a report on the State of the World's AqGR. These may include:

- Specific actions to collate information in areas for which information in existing databases is inadequate. This could be done through consultancies, the development of small specialist databases for later inclusion in larger programmes, or focused addition of specific information to existing databases.
- Targeted introductions of changes to data collections to industry sectors or countries of particular importance (e.g. because of the volume of production or trade, the threatened nature of the resource, or particular lack of information).

47. The achievement of these goals will require additional financial resources and a clear strategy for obtaining these will also need to be developed.

IX. SUMMARY

48. The present assessment of existing information sharing systems and databases on aquatic genetic resources has identified that the existing FAO data collections and a few information

sharing systems that targeted fish, algae and general marine resources, are the key source of information on AqGR and their use for food and agriculture. The majority of these are focused at the species level, although they may variously contain some information related to population, stock or subspecies structure, as well as DNA sequence. Small, local databases recording intra-specific variation, fish stocking histories or breeds and varieties of fish exist, but they are not easily accessed and the scope is highly limited.

49. Information is scattered, not easily accessible and insufficient regarding the scope and the aim proposed for the future State of the Worlds' Report.

50. Large databases aimed at recording global diversity, at the ecosystem or species level, or focused on gene sequence or molecular level include aquatic species as part of their effort but are not necessarily focused on them. There are major gaps in recording of aquatic genetic variation at levels below that of the species and for different kinds of resource (such as gene variants, gametes, aquaculture strains).

51. Lack of data and information and inadequate standardization have resulted in poor understanding of the status and trends of AqGR to support sound management of the resources, which has resulted in unsustainable practices in some instances. There is however, growing recognition that genetic information will be increasingly important to support more efficient, responsible and sustainable production from aquaculture and fisheries, as well as for enhanced food security, and to ensure increased national control of AqGR and improved traceability. There is also an increasing body of information on genetic resources for aquaculture and on genetically distinct fish stocks and cryptic species and an increasing need for more information to underpin sound management. At the same time, the technical difficulty and costs associated with collecting information on genetic diversity need to be recognized. The additional burden on the often over-loaded capacity in developing countries must also be taken into account; and clear procedures for sustainable development set and implemented.

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APPENDIX I

LIST OF INFORMATION SYSTEMS AND DATABASES

When considering Biodiversity Information Systems (BIS), there are several dimensions or domains [A-E] (underlined in the list below) to take into account considering the relevance of the BIS to the various sub domains or levels [1-n]:

A complete information system would include a database, analytical tools, and a Web site, the latter possibly being or including a portal serving as an aggregator of various independent databases.

For listing the principal sources of relevant information for the SoWAqGRFA, we have retained only the subdomains in bold in the following extensive list:

(A) Biodiversity: (1) **Gene**, (2) **Species**, (3) Ecosystem

(B) Data integration level in DIK(U)W hierarchy : (1) **Data**, (2) **Information**, (3) Knowledge, (4) Wisdom / Management

(C) Information systems: (1) **Database**, (2) Analytical tools, (3) **Portal,** (4) Web site

(D) Dissemination: (1) **Informational**, (2) Patrimonial / Cultural, (3) Educational

(E) Targeted public: (1) **Specialists**, (2) **Scientists**, (3) **Professionals**, (4) **Students**, (5) General public

Obviously, some of the BIS listed below address other subdomain issues, e.g., FishBase targeting the general public. The domain E is not detailed below.

Primary sources with original data (C1)

Gene level (and population level) (A1)

Data level (B1)

Fish-Trace [fishnet.jrc.ec.europa.eu/fishtrace_int]: Sequences of exploited marine European fishes, sequences at species level & information at species level.

Fish-Pop-Trace [fishpoptrace.jrc.ec.europa.eu]: Sequences of exploited marine European fishes, sequences at population level.

BOLD (Barcode of Life Data Systems) [www.boldsystems.org]: CO1 sequences for identification purposes & information at species level.

Fish and Chips [www.fish-and-chips.uni-bremen.de/]: DNA chips for vertebrates and invertebrates, zooplankton and phytoplankton of European Seas.

FinE [www.iiasa.ac.at/Research/EEP/FinE]: Prevalence of fisheries-induced evolutionary changes in life-history traits of exploited fish stocks in European and North American waters.

UNCOVER [www.uncover.eu]: Stock recovery in European waters.

Diatom EST Database [avesthagen.sznbowler.com]: Genes (EST).

Nematostella vectensis [www.nematostella.org, nematostella.bu.edu/stellabase]: Cnidaria (anemome) genomics.

DataBase of Tunicate Gene Regulation [dbtgr.hgc.jp]: Genes.

HERGEN [www.hull.ac.uk/hergen]: Herring population genetics.

CODTRACE [www.ucd.ie/codtrac]): Cod population genetics and spawning areas.

ZFIN (The Zebrafish Model Organism Database) [www.zfin.org]: Zebrafish genomics.

Fugu Genome Project [www.fugu-sg.org]: Genomics; several other Web sites.

Medakafish [biol1.bio.nagoya-u.ac.jp:8000]: Genomics; several other websites.

Complete mitochondrial sequences: in GenBank, Myia's group in Japan.

Marine Genomics [www.marinegenomics.org]: Genes (EST).

Database of fish chromosomes (Klinkhardt et al., 1995) [not available on the Web]: Included in FishBase, maybe not maintained anymore.

Fish Chromosome of the World [www.nbfgr.res.in/Databases/FISH]: Only 126 spp. Included in FishBase, maybe not maintained anymore, last updates to check if in FishBase.

Tetraodon Genome Browser [www.genoscope.cns.fr/externe/tetraodon]: Genomics.

Trans-NIH *Xenopus* Initiative [www.nih.gov/science/models/xenopus]: Genomics.

Species level (A2)

Data and information level (B1, B2)

- FAO Fisheries and Aquaculture Statistical collections: FAO is mandated to collect and disseminate fisheries and aquaculture related statistics globally. The FAO Fisheries and Aquaculture Department provides this objective information to member countries and other stakeholders in order to promote responsible aquaculture and fisheries development planning and policy making as well as monitoring and management of the sector with field-based scientific information. To fulfill this role, the department compiles, analyses and disseminates world capture and aquaculture data structured within "data collections" on:
    - Capture Fisheries
    - Aquaculture
    - Commodity production and international trade
    - Consumption (food balance sheet)
    - Fishing vessels
    - Employment (fishers & farmers)

PescaBase [www.pescabase.org]: Fish traceability in the Canary Islands and European Union.

The 95 databases included in Catalogue of Life [www.catalogueoflife.org/info/databases]: about a third of them contain aquatic organisms; most are only taxonomic but a few record other information; many of them are aggregated under WoRMS, see below. Examples:

- FishBase [www.fishbase.org]: Fishes.
- SeaLifeBase [www.sealifebase.org]: Non-fish aquatic organisms.
- AlgaeBase [www.algae.org]: Algae.
- Hexacorallians of the World [hercules.kgs.ku.edu/hexacoral/anemone2]: Hexacorals.
- Recent and fossil Bryozoa [www.bryozoa.net]: International Bryozoology Association.
- Phoronid@ [paleopolis.rediris.es/Phoronida]
- TIGR Reptile Database [www.reptile-database.org]
- Etc.

Acoelomorpha [devbio.umesci.maine.edu/styler/turbellaria/turb2.php?action=1&code=12275]: Plathelminthes, taxonomy/nomenclature.

Myxozoan network [www.myxozoa.org]: Myxozoa (fish parasites).

Priapulida, Kynorhyncha, Loricifera, Nemathelmintha [wwwuser.gwdg.de/~clembur]: taxonomy, nomenclature.

CephBase [www.cephbase.utmb.edu]: cephalopods, not maintained anymore, included in SeaLifeBase.

AmphibiaWeb [amphibiaweb.org]

There are various resources on other aquatic vertebrates that are included in SeaLifeBase.

Secondary sources as portals (C3)

Gene level (and population level) (A1)

Data level (B1)

GenBank [www.ncbi.nlm.nih.gov/genbank]: Sequences.

Fish-BoL [www.fishbol.org]: Barcode of Life part for fishes.

MarBoL [www.marinebarcoding.org]: Barcode of Life part for marine organisms.

Pre Ensembl [pre.ensembl.org]: Sequences, e.g. for Lampreys, and a few others.

Animal Genome Size Database [www.genomesize.com]

Secondary sources as portals (C3)

Species level (A2)

Data and information level (B1, B2)

CoL (Catalogue of Life) [www.catalogueoflife.org]: names of all species [incomplete].

WorMS (World Register of Marine Species) [www.marinespecies.org]: taxonomy of all marine species [incomplete].

PESI (Pan-European Species directories Infrastructure) [www.eu-nomen.eu/pesi]: Includes Fauna Europaea, European Register of Marine Species (also in WoRMS), Euro&Med PlantBase.

ToL (Tree of Life) [www.tolweb.org]: phylogenetic tree of all species [incomplete].

EoL (Encyclopedia of Life) [www.eol.org]: mashed up information from many sources on all species.

BioFresh [data.freshwaterbiodiversity.eu]: datasets on freshwater biodiversity including population level (mainly European); a metadatabase containing information about 50 relevant databases.

oneFish Community Directory [www.onefish.org]: A fishery projects portal and participatory resource gateway for the fisheries and aquatic research and development sector.

WCMC (United Nations Environment Programme World Conservation Monitoring Centre) [www.unep-wcmc.org]: Biodiversity atlases.

IUCN (International Union for Conservation of Nature) [www.iucn.org]: Endangered species.

And various websites for conventions on and conservation of biodiversity (CBD, WWF, Conservation International, RAMSAR, GISIN, etc.).

APPENDIX II

BASIC INFORMATION ON REGIONAL FISHERIES BODIES SORTED BY TYPE (MANAGEMENT, ADVISORY)[4]

MANAGEMENT BODIES

Bodies with a management mandate

CACFAC

Central Asian and Caucasus Regional Fisheries and Aquaculture Commission. The objectives of the Commission are to promote the development, conservation, rational management and best utilization of living aquatic resources, as well as the sustainable development of aquaculture in the region. The areas of competence are the inland waters and areas within the territorial boundaries of the States of Central Asia and of the Caucasus. The Commission was established in 2009.

CCBSP

Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea. The objectives of the Convention on the Conservation and Management of Pollock Resources in the Central Bering Sea are to establish an international regime for conservation, management and optima utilization of pollock resources in the Convention Area. The Convention applies to the high seas area of the Bering Sea beyond 200 nautical miles from the baselines from which the breadth of the territorial sea of the coastal States of the Bering Sea is measured. The Convention was established in 1994. http://www.afsc.noaa.gov/REFM/CBS/Convention_Contacts.htm

CCSBT

Commission for the Conservation of Southern Bluefin Tuna. The objective of the Commission for the Conservation of Southern Bluefin Tuna is to ensure, through appropriate management, the conservation and optimum utilization of the global Southern Bluefin Tuna fishery. The area of competence is the entire geographical range of Southern Bluefin Tuna. The Convention was established in 1994. http://www.ccsbt.org

GFCM

General Fisheries Commission for the Mediterranean. The purpose of the Commission shall be to promote the development, conservation, rational management and best utilization of living marine resources, as well as the sustainable development of aquaculture in the Region. The area of competence is the Mediterranean Sea, Black Sea and connecting waters. It entered into force in 1952. http://www.gfcm.org/gfcm/about/en

IATTC

Inter-American Tropical Tuna Commission. The overall objective of this Inter-American Tropical Tuna Commission (IATTC) is to ensure the long-term conservation and sustainable use of the fish stocks covered by the Convention, in accordance with the relevant rules of international law. The area of competence is the Eastern Pacific Ocean. It was created in 1949. http://www.iattc.org

ICCAT

International Commission for the Conservation of Atlantic Tunas. The International Commission for the Conservation of Atlantic Tunas is responsible for the conservation of tunas and tuna-like species in the Atlantic Ocean and adjacent seas. The area of competence is the Atlantic Ocean and adjacent seas. It was established in 1966. http://www.iccat.int

IOTC

Indian Ocean Tuna Commission. The objective of the Commission is to promote cooperation among its members with a view to ensuring, through appropriate management, the conservation and optima utilization of stocks covered by this Agreement and encouraging sustainable

[4] As listed on FAO Web site http://www.fao.org.fishery.rfb/search.en

development of fisheries based on such stocks. The area of competence is the Indian Ocean and adjacent seas, north of the Antarctic Convergence. It was created in 1993. http://www.iotc.org

IPHC

International Pacific Halibut Commission. The main objective of the International Pacific Halibut Commission is the preservation of the halibut fishery of the Northern Pacific Ocean and Bering Sea. The area of competence is the North Pacific Ocean, including the Bering Sea. It was established in 1923. info@iphc.int

IWC

International Whaling Commission. The main objective of the International Whaling Commission is to establish a system of international regulations to ensure proper and effective conservation and management of whale stocks. The area of competence is global. The IWC was set up in 1946. http://www.iwcoffice.org

LVFO

Lake Victoria Fisheries Organization. The Lake Victoria Fisheries Organization is a regional organization under the East African Community responsible for coordinating and managing fisheries resources of Lake Victoria. The LVFO was formed through a Convention signed on 30 June 1994. http://www.lvfo.org/index.php

NAFO

Northwest Atlantic Fisheries Organization. The Northwest Atlantic Fisheries Organization is an intergovernmental fisheries science and management body. The NAFO was founded in 1979. The NAFO's overall objective is to contribute through consultation and cooperation to the optimum utilization, rational management and conservation of the fishery resources of the Convention Area. http://www.nafo.int/

NASCO

North Atlantic Salmon Conservation Organization. The objective of the North Atlantic Salmon Conservation Organization is to contribute, through consultation and cooperation, to the conservation, restoration, enhancement and rational management of salmon stocks subject to the Convention taking into account the best scientific evidence available to it. The area of competence is the Atlantic Ocean north of 36°N throughout the species' migratory range. It was established in 1983. http://www.nasco.int/convention.html

NEAFC

North East Atlantic Fisheries Commission. The objectives of North East Atlantic fisheries Commission are to ensure the long-term conservation and optimal utilization of the fishery resources in the Convention Area, providing sustainable economic, environmental and social benefits. The area of competence is the Northeast Atlantic. It was established in 1980. http://www.neafc.org/

NPAFC

North Pacific Anadromous Fish Commission. The main objective of the North Pacific Anadromous Fish Commission is to promote the conservation of anadromous stocks in the Convention Area. The area of competence is the waters of the North Pacific Ocean and its adjacent seas. It was established in 1992. http://www.npafc.org

RECOFI

Regional Commission for Fisheries. The purpose of the Regional Commission for Fisheries is to promote the development, conservation, rational management and best utilization of living marine resources, as well as the sustainable development of aquaculture within its area of Agreement. The Commission carries out its functions and responsibilities in the region, bounded in the south by the following rhomb lines: from Ras Dhabat Ali to Ras Al-Fasteh. The Agreement for the establishment of the Commission was concluded in 1999. FAO-RNE@.fao.org

SEAFO

Southeast Atlantic Fisheries Organization. The objective of the Convention is to ensure the long-term conservation and sustainable use of the fishery resources in the Convention Area through the effective implementation of this Convention. The area of competence is the high seas. The Convention was established in 2003. http://www.seafo.org/

SIOFA

South Indian Ocean Fisheries Agreement. The objective of the South Indian Ocean Fisheries Agreement is to ensure the long-term conservation and sustainable use of fishery resources other than tuna in areas that fall outside national jurisdictions. The area of competence is the high seas. It was established in 2006.

SPRFMO

South Pacific Regional Fisheries Management Organisation. The International Consultations on the Proposed South Pacific Regional Fisheries Management Organisation have concluded with the adoption of the Convention on the Conservation and Management of the High Seas Fishery Resources of the South Pacific Ocean in 2009.When the Convention enters into force, the gap that exists in the international conservation and management of non-highly migratory fisheries and protection of biodiversity in the marine environment extending from the most eastern part of the South Indian Ocean. http://www.southpacificrfmo.org/

WCPFC

Western and Central Pacific Fisheries Commission. The objective of the Convention is to ensure, through effective management, the long-term conservation and sustainable use of highly migratory fish stocks in the western and central Pacific. The area of competence is the high seas. It was established in 2004. http://www.wcpfc.int/contact

ADVISORY BODIES

Bodies with an advisory mandate (scientific and/or management)

APFIC

Asia-Pacific Fishery Commission. The main objective of the Asia-Pacific Fishery Commission (APFIC) is to promote the full and proper utilization of living aquatic resources of the Asia-Pacific area by the development and management of fishing and culture operations and by the development of related processing and marketing activities in conformity with the objectives of its members. The area of competence is the Asia-Pacific area. In 1999, the functions of the former Indian Ocean Fishery Commission (IOFC) in the Bay of Bengal were merged into the APFIC (approved by FAO Council Resolution 1/116). APFIC was established in 1948. http://www.apfic.org.

BOBP-IGO

Bay of Bengal Programme Inter-Governmental Organization. The Bay of Bengal Programme (BOBP-IGO) is an intergovernmental organization mandated to enhance cooperation among member countries, other countries and organizations in the region and provide technical and management advisory services for sustainable coastal fisheries development and management in the Bay of Bengal Region. The objectives of the Organization are to enhance cooperation among member countries, other countries and organizations in the region and provide technical and management advisory services for sustainable coastal fisheries development and management in the Bay of Bengal Region. The area of competence is the Bay of Bengal Region. The organization was established in 1999. http://www.bobpigo.org

CECAF

Fishery Committee for the Eastern Central Atlantic. The purpose of the Committee is to promote the sustainable utilization of the living marine resources within its area of competence by the proper management and development of the fisheries and fishing operations. The area of competence is the Eastern Central Atlantic between Cape Spartel and the Congo river. CECAF was established in 1967. http://www.fao.org/fi/body/rfb/CECAF/cecaf_home.htm

CIFAA

Committee for Inland Fisheries and Aquaculture of Africa. The main objective of the Committee for Inland Fisheries and Aquaculture of Africa (CIFAA) is to promote the development of inland fisheries and aquaculture in Africa. The areas of competence are inland waters of Member Countries. It was established in 1971. http://www.fao.org/fi/body/rfb/CIFA/cifa_home.htm.

COMHAFAT

The Ministerial Conference on Fisheries Cooperation among African States bordering the Atlantic Ocean. The main objectives of ATLAFCO are as follows: the promotion and strengthening of regional cooperation on fisheries development; and the coordination and harmonization of efforts and capacities of stakeholders for the conservation and exploitation of fisheries resources. It was established in 1989. http://www.atlafco.org/def.asp?codelangue=23&info=1172.

COPESCAL

Commission for Inland Fisheries of Latin America. The general objective of the Commission is to promote programmes of research and development leading to the rational utilization of inland fisheries resources; assist Member Governments in the Region in establishing the scientific basis for regulatory and other measures for the conservation and improvement of inland fishery resources; support the development of aquaculture, and; encourage education and training to reach these objectives. Areas of competence are the inland waters of member countries. COPESCAL was established in 1976. http://www.fao.org/regional/lamerica/organos/copescal/default.htm.

COREP

Regional Fisheries Committee for the Gulf of Guinea. The main objectives of COREP are: to harmonize fisheries policy and legal frameworks of parties; to determine a concerted attitude towards the activities of foreign fishing vessels and to give priority to the needs of the fishing vessels originating from member countries; to preserve and protect aquatic ecosystems, both marine and inland waters; to harmonize members' national regulations with a view to having a unified regulation fixing the conditions of fishing and the control of fishing operations in the area covered by the Convention; to assess the status of shared or transboundary stocks; to collect, analyze and make available scientific data as well as information and techniques for fisheries and aquaculture. The area of competence is the Gulf of Guinea and inland waters of parties. COREP was established in 1976.

CPPS

Permanent Commission for the South Pacific. The objectives of CPPS are to secure for the people of the States Parts of CPPS food supplies and provide the means of developing their economy through the sustainable exploitation of marine resources. The areas of competences are the 200nm of national jurisdiction of CPPS Member Countries from the Pacific coast, including around islands. CPPS was established in 1952.

CRFM

Caribbean Regional Fisheries Mechanism The Caribbean Regional Fisheries Mechanism (CRFM) was established in 2002 by the Conference of Heads of Government of the Caribbean Community (CARICOM) as a regional fishery body serving the Caribbean Region. The overall objective of the CRFM is "to promote and facilitate the responsible utilization of the region's fisheries and other aquatic resources for the economic and social benefits of the current and future population of the region". Internal waters, territorial seas and exclusive economic zones (EEZs) of Member States.

EIFAAC

European Inland Fisheries and Aquaculture Advisory Commission. The objectives of the EIFAAC are: promote sustainable development, utilization, conservation, management, protection and restoration of European inland fisheries and aquaculture resources based on the best available scientific advice and the application of an ecosystem approach, the precautionary approach and the need to safeguard biodiversity; identify and address strategic issues for European inland fisheries and aquaculture and provide advice and recommendations on future

policies, measures and related actions needed to address the issues in a rapid and accountable manner as requested by Members; provide advice to managers/decision makers of inland fisheries and aquaculture as requested based on scientific, social, economic, legal and other factors; and serve as a forward-looking international platform for the collation, validation dissemination and consideration of information on common challenges and opportunities to European inland fisheries and aquaculture. The area of competence covers inland waters of Member Countries. It was established in 1957. http://www.fao.org/fishery/rfb/eifac

FCWC

Fishery Committee of the West Central Gulf of Guinea. The objective of the Fishery Committee for the West Central Gulf of Guinea (FCWC) is to promote cooperation among the contracting parties with a view to ensuring, through appropriate management, the conservation and optimum utilization of the living marine resources covered by the Convention and encouraging sustainable development of fisheries based on such resources. The area of competence comprises all marine waters under national jurisdiction of the contracting parties. The FCWC was established in 2006.

FFA

Forum Fisheries Agency. The main objective of the Forum Fisheries Agency (FFA) is "to enable Member Countries to manage, conserve and use the tuna resources in their Exclusive Economic Zones and beyond, through enhancing national capacity and strengthening regional solidarity". The FFA's competence is exerted in the South Pacific region, and its geographical coverage coincides mainly with FAO Statistical areas 71 and 81. FFA was established in 1979. http://www.ffa.int

ICES

International Council for the Exploration of the Sea. The International Council for the Exploration of the Sea coordinates and promotes marine research on oceanography, the marine environment, the marine ecosystem, and on living marine resources in the North Atlantic.The areas of competence are: for fisheries advisory: North East Atlantic; for scientific advice: Atlantic Ocean and its adjacent seas and primarily the North Atlantic. It was established in 1964. http://www.ices.dk

MRC

Mekong River Commission. The Mekong River Commission Member Countries have agreed to cooperate in all fields of sustainable development, utilization, management and conservation of the water and related resources of the Mekong River Basin. The area of competence is the Mekong River Basin. The MRC was established in 1995. http://www.mrcmekong.org/

NAMMCO

North Atlantic Marine Mammal Commission. The main objective of the North Atlantic Marine Mammal Commission is to contribute through regional consultation and cooperation to the conservation, rational management and study of marine mammals in the North Atlantic. The areas of competence are National waters. It was established in 1992. http://www.nammco.no

OLDEPESCA

Latin American Organization for Fisheries Development. The main purpose of the organization is to meet Latin American food requirements adequately, making use of Latin American fishery resource potential for the benefit of Latin American peoples, by concerted action in promoting the constant development of the countries and the permanent strengthening of regional cooperation in this sector. The areas of competence are national waters. It was established in 1984. http://www.oldepesca.com/

PICES

The North Pacific Marine Science Organization. The North Pacific Marine Science Organization, an intergovernmental scientific organization was established in 1992 to promote and coordinate marine research in the northern North Pacific and adjacent seas. The areas of competence are national waters. http://www.pices.int/about/convention.aspx

SEAFDEC

Southeast Asian Fisheries Development Center. The Southeast Asian Fisheries Development Center is a regional treaty organization established in December 1967 to promote fisheries development in Southeast Asia. The area of competence is the marine and inland waters of member countries in Southeast Asia and contiguous high sea areas. ftp://ftp.fao.org/FI/DOCUMENT/seafdec/AgreementEstablishingSEAFDEC.pdf

SPC

Secretariat of the Pacific Community. The main objective of the Agreement is to encourage and strengthen international cooperation in promoting the economic and social welfare and advancement of the people of the South Pacific Region. The areas of competence are national waters. It was established in 1947. http://www.spc.int/mrd

SRFC

Subregional Fisheries Commission. The main objectives of the Subregional Fisheries Commission (CSRP/SRFC) are: to harmonize the long-term policies of member States in the preservation, conservation and exploitation of the fisheries resources for the benefit of the respective populations and; to strengthen cooperation among member States. The areas of competence are the Eastern Central Atlantic ocean off the coast of SRFC Member Countries. The Convention was established in 1985. http://www.csrpsp.org/reglements/reglements.html

SWIOFC

Southwest Indian Ocean Fisheries Commission. The main objective of the Commission is to promote the sustainable utilization of the living marine resources of the South West Indian Ocean region, by the proper management and development of the living marine resources, without prejudice to the sovereign rights of coastal States and to address common problems of fisheries management and development faced by the Members of the Commission. SWIOFC was established in 2004. The areas of competence are National waters.

WECAFC

Western Central Atlantic Fishery Commission. The general objective of the Commission is to promote the effective conservation, management and development of the living marine resources of the area of competence of the Commission, in accordance with the FAO Code of Conduct for Responsible Fisheries, and address common problems of fisheries management and development faced by members of the Commission. It was established in 2006.

REGIONAL AQUACULTURE NETWORKS

NACA

Network of Aquaculture Centres in Asia-Pacific. NACA is dedicated to rural development and poverty alleviation through sustainable aquaculture and aquatic resource management in the Asia pacific Region. It was established in 1988. http://www.enaca.org

ANAF

Network for Aquaculture Development in Africa. It is devoted to rural development and poverty alleviation through sustainable aquaculture and aquatic resource management in African countries. It was established in 2006. http://www.anafaquaculture.org

NACEE

Association of Central and Eastern European aquaculture institutions. The objective is to promote and enhance aquaculture development in the region. Activities are coordinated by the Research Institute for Fisheries, Aquaculture and Irrigation (HAKI) of Hungary. It was established in 2003. http://www.agrowebcee.net/nacee

RAA

Red de Acuicultura de las Américas. RAA is dedicated to the development and promotion of sustainable aquaculture practises and aquatic resource management in the Latin-American Region. It was established in 2009. http://www.racua.org/index.php?lang=ES