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COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

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Fourteenth Regular Session
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SCOPING POLICY ANALYSIS: GAPS AND OPPORTUNITIES RELATED TO AQUATIC GENETIC RESOURCES

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I.   INTRODUCTION

1.   The Commission, at its Thirteenth Regular Session, in revising its Multi-year Programme of Work (MYPOW), decided to review at this session a scoping policy analysis with the aim to identify gaps and opportunities related to aquatic genetic resources (AqGR).[1] The scoping policy analysis aims to assist countries in the preparation of Country Reports on the basis of which FAO will prepare the first report on *The State of the World's Aquatic Genetic Resources for Food and Agriculture* which, according to the Commission's MYPOW, is to be launched by FAO at the Commission's Sixteenth Regular Session in 2017.

2.   Aquatic genetic resources comprise the DNA; genes; gametes; wild, farmed and research populations; species; and genetically altered forms - selectively bred strains, hybrids, polyploids, and transgenes - of all exploited and potentially exploitable finfish and aquatic invertebrates, as well as aquatic plants[2]. In view of the limited information on aquatic genetic resources below the species level policy and legislation are often directed at AqGR at the species level.

3.   The scoping policy analysis provided in this document should help countries to analyze their legal and policy frameworks as well as and the main drivers of change that policies will need to address with respect to the conservation and sustainable use of aquatic genetic resources. The document provides a brief overview of drivers, followed by an overview of the current state of international legal and policy frameworks and gaps in those frameworks. General approaches of national legal and policy frameworks are examined, although national legal and policy frameworks are extremely diverse depending on specific conditions and national priorities. The document concludes with a discussion of gaps and opportunities regarding AqGR.

4.   The document addresses AqGR in both capture fisheries and aquaculture and may assist countries in developing or improving policies and practices that promote the responsible use of AqGR for food and agriculture. The Commission may wish to consider the document with a view to also guide countries in the preparation of their Country Reports.

II.   DRIVERS OF CHANGE IN AQUATIC GENETIC RESOURCES

5.   There are drivers that will impact AqGR for food and agriculture positively and other drivers that may have a negative effect. For the last decade, concern has centered on the following drivers that have adversely impacted or have the potential to adversely impact AqGR (the order of the listed drivers is not meant to signify relative severity of impact; the drivers will affect AqGR differently depending on the local situation):

- Fishing;
- Aquaculture;
- Habitat alteration and loss;
- Hydroelectric development;
- Introduced species;
- Climate change; and
- Pollution.

6.   On the other hand, there are positive drivers that will help the conservation and sustainable use of AqGR :

- Improved conservation strategies for both *in situ* and *ex situ* conservation;
- Better fishing and farming technologies that minimize impacts on AqGR, including those resulting from wastes and carbon production;
- Increased understanding of genetics both at the molecular and population levels;
- Improved information technologies and data storage capacity;
- The increasing role of aquaculture in producing food may also relieve pressure on wild fisheries and AqGR.

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[1] CGRFA-13/11/Report, *Appendix F*.
[2] CGRFA-11/07/15.2

7.   Some of the above drivers may have more than one impact, e.g. the introduction of a new species may have a positive impact on a specific ecosystem and a negative on other ecosystems. Policies for the conservation and sustainable use of AqGR should take into account both potentialities.

8.   The following factors have a major impact on AqGR:

- **Fishing** affects AqGR mostly at the population level by exerting selective pressure on fish stocks by removing certain individuals from the gene pool. Destructive fishing practices can also destroy or degrade habitat.

- **Aquaculture and culture-based fisheries**[3] can have general environmental effects on wild AqGR (such as pollution or spread of diseases and pathogens) as well as direct and indirect genetic effects caused by deliberate release of hatchery fish or by inadvertent escapes of farmed fish from aquaculture facilities that breed with wild relatives. However, well designed aquaculture breeding programs for conservation purposes may assist in the recovery of a threatened species or population.

- **Habitat degradation and loss can arise** from *inter alia* pollution, hydro-electric development, and introduced species. Habitat degradation affects AqGR through a variety of modalities including fragmentation (which can interfere with reproduction or migration, or isolate segments of a population) and changing habitat attributes that are hazardous to the organism or that reduces its overall fitness.

- **Climate change** will have many impacts on aquatic systems, including increased water temperature, changes in stream flow, changes in lake size and thermal layering, a rise in sea levels and consequent loss of estuarine habitat, and problems for organisms that are impacted by acidification. Whether a given aquatic species can persist in a changed climate depends to a great extent on its inherent ability to withstand a broad range of conditions, its ability to adapt to the new conditions and its ability to move to new conditions.

III.   THE INTERNATIONAL LEGAL AND POLICY FRAMEWORK

9.   The main instrument governing the world's marine environment is the United Nations Convention on the Law of the Seas (UNCLOS) that established a 'Constitution' that lessens the risk of international conflict and enhances stability and peace in the international community. The UNCLOS specifies how the inner and outer boundaries of coastal state maritime zones must be drawn. It applies to the entire marine environment, all its living and non-living resources and all human activities occurring within it (e.g. marine capture fisheries) as well as those occurring outside but negatively affecting it (e.g. land-based marine pollution). Even though the UNCLOS does not explicitly mention the terms 'biodiversity' or 'genetic resources', its obligations on the protection and preservation of the marine environment in Part XII are relevant for the management of AqGR.

10.   When UNCLOS was drafted, specific consideration was given to mineral resources in areas beyond national jurisdiction (ABNJ), e.g. the deep seabed. However, negotiators in the early 1980's did not anticipate that AqGR, and specifically marine genetic resources (MGR), would become a valuable commodity for bio-prospecting. At present, there is no comprehensive and specific mechanism that governs bioprospecting for MGR in ABNJ.

11.   For inland water bodies, there is no single global instrument comparable to UNCLOS. Several international and trans-boundary water bodies have specific treaties and conventions governing the exploitation and conservation of their resources, including AqGR.

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[3] Fisheries on resources for which the recruitment originates or is supplemented from cultured stocks (the process is called stocking) raising total production beyond the level sustainable through natural processes. Culture-based fisheries may therefore involve the introduction of new species or strains, altering species composition or genetic pools. Garcia, S.M. (Comp.). 2009. Glossary. In Cochrane, K. and S.M. Garcia. (Eds). A fishery managers' handbook. FAO and Wiley-Blackwell:473-50

12.   The FAO Code of Conduct for Responsible Fisheries (CCRF, 1995),[4] complements the UNCLOS, and is supported by a number of instruments, such as the Compliance Agreement and the Fish Stocks Agreement with more practical guidance on a broad range of fisheries management issues, including aquaculture development. It applies to marine as well as inland fisheries and is addressed to other key players besides states (e.g. fishers (Art. 1.3). Article 9 of the Code specifically addresses aquaculture, including genetic resources.

13.   The Ecosystem Approach to Fisheries (EAF) and to aquaculture (EAA) support the practical and comprehensive implementation of the Code, to more explicitly take into account the impacts of fisheries and aquaculture, respectively on aquatic biodiversity.

14.   Species-specific or habitat-specific instruments often contain obligations that apply across sectors. For example, obligations to conserve coastal habitats such as mangrove forests may constrain aquaculture development, and obligations to conserve sea turtles may require specific fisheries regulations. Sector-specific measures exist, e.g. measures adopted by regional fishery bodies (RFBs) to manage or provide advice on specific fisheries, areas or sub-sectors.

The international legal and policy framework for specific drivers of change in aquatic genetic diversity

Fishing

15.   Numerous global, regional, sub-regional and bilateral instruments have been developed which relate to governance, conservation and sustainable use in capture fisheries for fish[5], molluscs, crustaceans, sedentary species (e.g. oysters, clams, sea-cucumbers, sponges and corals) and marine mammals and reptiles. The global instruments on marine capture fisheries have primarily been developed under the auspices of the UN General Assembly (UNGA) and FAO, whereas managing fisheries for whales are within the mandate of the International Whaling Commission[6].

16.   The provisions on marine capture fisheries in the UNCLOS and the Fish Stocks Agreement have a so-called 'framework' character. They contain overall objectives and basic rights and obligations for states but not the key substantive standards of actual fisheries regulations. Actual fisheries regulation is carried out by states individually or collectively, including through RFBs.

17.   The FAO, guided by its Committee on Fisheries (COFI), has adopted a wide range of fisheries instruments, both legally binding and non-legally binding. The two legally binding instruments are the Compliance Agreement (1993)[7] and the Port State Measures Agreement (2009).[8] Prominent among FAO's non-legally binding instruments is the Code of Conduct for Responsible Fisheries (CCRF, 1995)[9].

18.   Global fisheries instruments depend on implementation by states individually and collectively through (sub-) regional and bilateral cooperation. Over 40 RFBs have been established to cover the world's marine and inland aquatic environments and have helped to create a large number of instruments. These instruments are not specifically targeting AqGR, but are nevertheless impacting them by e.g. regulating the use of specific fishing gear, introducing fishing quota or by regulating minimum retention sizes.

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[4] Code of Conduct for Responsible Fisheries. <www.fao.org/fi>.
[5] For brevity, in the remainder of the document the term 'fish' includes the entire variety of aquatic organisms fished or farmed.
[6] http://iwcoffice.org/
[7] Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas, Rome, 24 November 1993. In force 24 April 2003, 33 International Legal Materials 969 (1994); <www.fao.org/legal>.
[8] Agreement on Port State Measures to Prevent, Deter and Eliminate Illegal, Unreported and Unregulated Fishing, Rome, 22 November 2009. Not in force; <www.fao.org/Legal>.
[9] Code of Conduct for Responsible Fisheries. Adopted by the Twenty-eight Session of the FAO Conference, Rome, 31 October 1995, <www.fao.org/fi>.

Aquaculture and culture-based fisheries

19.   There is currently no legally binding global instrument specifically dedicated to aquaculture, let alone the conservation and sustainable use of aquatic genetic resources in aquaculture. FAO's efforts in aquaculture are extensive even though they are not based on legally binding instruments. Article 9 of the 1995 CCRF is devoted to 'Aquaculture development' and canvasses a wide range of issues, including the need for environmental sustainability, environmental impact assessment and avoiding transboundary impacts. It also pays specific attention to genetic diversity. These relatively concise and general provisions are elaborated in considerable detail in Technical Guidelines for Responsible Fisheries devoted to 'Aquaculture Development'[10].

20.   The mandates and work of several of the RFBs also extend to sustainable aquaculture development and management. Apart from two exceptions, none of these is empowered to impose obligations on how its members should manage aquatic genetic resources.

Habitat degradation and loss

21.   UNCLOS contains obligations on the prevention, reduction and control of pollution of the marine environment from all possible sources, including from land-based pollution and pollution from or through the atmosphere. Habitat conservation is a goal of the Ramsar Convention and pursued by many regional environmental protection instruments and bodies[11], e.g. United Nations Environment Programme's Regional Seas Programme. The most significant overall habitat change in inland ecosystems is the construction of dams. In 2000, the World Commission on Dams (WCD) proposed a new framework for decision-making based on recognition of rights of and risks to all parties affected by dam construction.

Climate Change

22.   The major international instrument addressing climate change is the UN Framework Convention on Climate Change[12]. Humans and a changing global climate are impacting and will continue to impact aquatic ecosystems and AqGR. Policies directly relating AqGR to climate change mitigation and adaptation are scarce and there is limited awareness of the impact of climate change on fishery and aquaculture. A recent report by the High Level Panel of Experts on Food Security and Climate Change addressed AqGR only with the recommendation that aquaculture start breeding species tolerant to salt to adapt to rising sea-levels; the report did not mention the capture fishery sector.[13]

23.   The prospect of significant impacts of climate change on ecosystems and habitats is forcing a shift toward development and assessment of future scenarios[14] Policies for habitat protection and restoration need to take into account the likelihood that species' geographical distribution will shift and change with climate change. Species that were previously suited for aquaculture or fishing may be less suited whereas non-native species, stocks or breeds may be better candidates for fishing or farming under new climatic conditions. Thus, aquaculture diversification, is seen as an important climate change adaptation approach[15] and deserves more attention as a source than this is currently the case.

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[10] FAO. 2008. *Aquaculture development. 3. Genetic resource management.* FAO Technical Guidelines for Responsible Fisheries. No. 5, Suppl. 3. Rome, FAO. 2008. 125p

[11] For example, 1992 Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR Convention), which established, *inter alia* 'Network of Marine Protected Areas' and adopted the 'OSPAR List of Threatened and/or Declining Species and Habitats'.

[12] http://unfccc.int/2860.php

[13] http://www.fao.org/fileadmin/user_upload/hlpe/hlpe_documents/HLPE_Reports/HLPE-Report-3-Food_security_and_climate_change-June_2012.pdf

[14] Redford, K.H. & Fleishman, E. 2011. Introduction. *Conservation Biology*, 25(6): 1072-1074.

[15] De Silva, S.S. and Soto, D. 2009. Climate change and aquaculture: potential impacts, adaptation and mitigation. In K. Cochrane, C. De Young, D. Soto and T. Bahri (eds). Climate change implications for fisheries and aquaculture: overview of current scientific knowledge. *FAO Fisheries and Aquaculture Technical Paper*. No. 530. Rome,FAO. pp. 151-212.

IV.   THE NATIONAL LEGAL AND POLICY FRAMEWORK

Summary of existing national legal and policy approaches

24.   National policies and legislation are extremely diverse and vary widely depending on specific circumstances and priorities. Some of the many national instruments are described in the document, ***Scoping Policy Analysis for Aquatic Genetic Resources Management***.[16]

25.   Since the CBD came into force in 1993 and the CCRF in 1995, countries around the world have generally taken steps to implement responsible fisheries and aquaculture, and an ecosystem approach to the development, management and conservation of biodiversity. To ensure ample supplies of fish protein for global food security in the future, national governments need to move beyond a general biodiversity framework to a more specific focus on AqGR. With a few exceptions, countries have not yet implemented coordinated national programmes for the conservation and sustainable use of AqGR.

26.   One exception is Germany's National Technical Programme on the Conservation and Sustainable Use of Aquatic Genetic Resources[17] which notes the lack of information on marine AqGR and states, *that "it is therefore imperative to close these informational gaps through own research [sic] programmes so that departmental research can provide sound advice in this field."*

Fishing

27.   National policies regarding capture fisheries are often focussed at the species level; by maintaining healthy populations, genetic level diversity can also be maintained. However, several countries have afforded certain stocks of fish 'species status' and are managing fisheries based on genetic stock identification, as in the Pacific salmon fisheries of North America or the cod in the north Atlantic.[18]

28.   Canada's most valuable commercial fishery is the Pacific salmon fishery. In 2005, the Department of Fisheries and Oceans (DFO) announced a Wild Salmon Policy[19] to "restore and maintain healthy and diverse salmon populations" by meeting three primary objectives: safeguarding genetic diversity, maintaining habitat and ecosystem integrity, and managing fisheries for sustainable benefits.

29.   The ecosystem approach to fisheries (EAF) can include assessing genetic stock structure and impacts of fishing on genetic diversity. National governments tend to take a more general approach to the implementation of the EAF, pursuant to FAO's guideline that an EAF helps implement the Code of Conduct for Responsible Fisheries by providing a way "to plan, develop and manage fisheries in a manner that addresses the multiple needs and desires of societies without jeopardizing the options for future generations to benefit from the full range of goods and services provided by marine ecosystems" (FAO 2003); very few national policies address genetic resources specifically.

Aquaculture and capture-based fisheries

30.   The rapid growth of aquaculture and expansion of the number of cultivated species make it necessary to have national policies in place to ensure the availability of quality seed and feed, especially in developing countries. Aquaculture is the main reason for the deliberate introduction of alien species and culture-based fisheries regularly release farmed-raised organisms into natural environments. National policies are rarely in place to ensure that these activities do not compromise native aquatic genetic resources.

31.   One of the few areas that specifically address this risk is the Canadian province of New Brunswick, whose Fish Stocking Policy prohibits stocking "where stocked fish could harm other

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[16] CGRFA-14/13/Inf.24

[17] Federal Ministry of Food, Agriculture and Consumer Protection. 2010. Aquatic Genetic Resources. Available at: http://www.genres.de/fileadmin/SITE_GENRES/downloads/publikationen/national_programme_agr_eng.pdf

[18] Shaklee, J.B. , Beacham, T.D., Seeb, L., and White, B.A. 1999. Managing fisheries using genetic data: Case studies from four species of Pacific salmon. Volume 43, Issue 1-3: 45-78

[19] http://www.pac.dfo-mpo.gc.ca/fm-gp/species-especes/salmon-saumon/wsp-pss/index-eng.htm

species at a population level".[20] Germany's National Technical Programme on the Conservation and Sustainable Use of Aquatic Genetic Resources notes that, because of the poor state of knowledge of the genetic differentiation of stocks, stocking with material of unclear origin should not take place.

32.   National policies often favour use of improved breeds and alien species when they contribute to increased production as in the case of small-scale shrimp farmers in Thailand. The Thai government supported technical know-how among local farmers in addition to providing free seed of non-native *Penaeus vannamei* from Hawaii. The programme further assisted the development of a code of conduct and a good aquaculture practice certification system, under which several hundred hatcheries and backyard hatcheries have been certified[21].

33.   National policies controlling aquatic species introductions (which can be deliberate or accidental) are typically weak or inconsistent, and most governments are reluctant to prevent introductions that might enhance or stabilize aquaculture production. Only a small number of (primarily developed) countries routinely undertake remediation and controlling actions on introduced non-native fish.

34.   New Zealand is one of few countries to have enacted specific laws aimed at the comprehensive prevention and management of non-indigenous species: the 1993 Biosecurity Act, which seeks to manage unintentional introductions and sets standards for creating pre-border quarantine systems and post-border incursion response, and the 1996 Hazardous Substances and New Organisms Act, which focuses on intentional introductions of new species and genotypes and is enforced by the Environmental Risk Management Authority.

35.   Whereas some countries control import of non-native species, very few have policies directly relating to genetic improvement or hybridization of aquatic species. The USA state of California requires special permits to hybridization fish for use in aquaculture. California also passed a bill making it illegal to spawn, cultivate or incubate transgenic (GMO) fish in Pacific waters under state jurisdiction[22].

36.   All contracting parties of the CBD are required to put access and benefit-sharing laws in place, but progress has been slow. Aquaculture sector stakeholders generally continue to have little awareness of or interest in ABS issues, with notable exceptions such as in Norway, where, partly to address concerns about the export of Atlantic salmon genetic resources to Chile and other countries establishing competing industries, the Norwegian government has moved to adopt legislation to capture the value of improved salmon for breeders while still allowing farmers, who may be in other countries, to raise genetically improved breeds. However, lack of ABS legislation does not appear to have resulted in denial of benefits to providers of AqGR[23].

37.   Aquatic genetic resources in both capture fisheries and aquaculture are influenced by numerous drivers from both within and outside the fisheries and aquaculture sector. National policies exist that indirectly impact AqGR by addressing fishery management including use of protected areas, habitat protection and good farming practices. Certification and ecolabelling

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[20] http://www2.gnb.ca/content/dam/gnb/Departments/nr-rn/pdf/en/Publications/FWB0192006.pdf

[21] Kongkeo H. & Davy, F.B. 2010. Backyard hatcheries and small scale shrimp and prawn farming in Thailand. In S.S. De Silva & F.B. Davy, eds. Success stories in Asian aquaculture, pp. 67-83. Springer Science & Business Media B.V.

[22]Lombardo, P.A. & Bostrom, A. 2008. Swimming upstream: regulating genetically modified salmon. In B.A. Lustig, B.A. Brady & G.P. McKenny, eds. *Altering Nature*, pp. 321-335. Springer Science & Business Media.

[23] Bartley, D.M., Nguyen, T.T.T., Halwart, M. & De Silva, S.S. 2009. Use and exchange of aquatic genetic resources in aquaculture: information relevant to access and benefit sharing. *Reviews in Aquaculture* 1(3-4); 157-162. CGRFA . 2009. The use and exchange of aquatic genetic resources for food and agriculture, by D.M. Bartley, J.A.H. Benzie, R.E. Brummett, F.B. Davy, S.S. De Silva, A.E. Eknath, X. Guo, M. Halwart, B. Harvey, Z. Jeney, J. Zhu, U. Na-Nakorn. T.T.T. Nguyen & I.I. Solar.

programmes are being developed to promote sustainability and to improve access to markets; although AqGR are not specifically included in most of their standards.

Possible reasons for lack of appropriate policies or frameworks and suggested actions

38.   A comprehensive and coordinated national approach to the development and management of AqGR is needed, but lacking. However, national institutions are often not designed to implement such an approach; responsibilities for management of AqGR are typically spread among a variety of government departments or levels of government that may not communicate effectively with one another.

39.   The precautionary approach and the ecosystem approach are keys to national implementation of relevant policies. Despite long-standing international commitments and widespread discussion of how best to implement both approaches, more progress has been made above the species level; many AqGR management agencies continue to struggle with how to implement the approaches at the genetic level, especially in the absence of guidelines from their governments.

40.   Efforts to implement international instruments and general principles at the national level frequently suffer from inadequate scientific understanding, an absence of political will, and lack of public awareness of the vital role AqGR are poised to play in global food security.

41.   Regarding access and benefit sharing measures many countries have little more than vague policy statements or address only a fragment of the issue[24]. One of the main challenges in designing ABS measures is the lack of clarity about the legal status of aquatic genetic resources in many jurisdictions.

42.   The weakest links in establishing policies for the management of AqGR have been governance and science. Informed government policies about the management of AqGR are impossible in the absence of a strong scientific foundation, and scientists are unable to build an information base in the absence of government support. A national AqGR strategy can provide the opportunity to bring good governance and science together in a mutually beneficial partnership.

43.   For policy makers and legislators charged with creating instruments for aquatic genetic resources, assessing available information and stakeholder needs are crucial first steps. One of the main challenges to national implementation is the lack of information on and capacity to develop, characterize and monitor AqGR.

V.   GAPS AND OPPORTUNITIES IN THE LEGAL AND POLICY FRAMEWORK

44.   Policies promoting food security will need to ensure the ready availability of fish as well as conservation of AqGR. The endorsement of the Convention on Biological Diversity (CBD) by virtually every country in the world owed much to its sustainable use objective as well as to its objective on conservation. Implementation of both objectives, as well as the CBD's objective of the fair and equitable sharing of the benefits from genetic resources, will require countries to develop laws and policies addressing the management of AqGR. Most national governments are a long way from developing a comprehensive approach.

Gaps

45.   The global and regional instruments discussed largely focus on the conservation and sustainable use of the (mostly marine) environment and on the conservation of species and habitats. In general, global policies and laws do not address issues below the species level, i.e. at the level of sub-populations, varieties, genes or DNA. The Cartagena Protocol of the CBD is one mechanism specifically addressing genetic modification below the species level, but at present,

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[24] Greer, D. & Harvey, B. 2004. *Blue genes: Sharing and conserving the world's aquatic biodiversity.* London, Earthscan. 231 pp.

there are no aquatic GMOs or LMOs for fisheries and aquaculture available. In the precautionary approach and the ecosystem approach there are few agreed reference points at the genetic level, whereas reference points, such as Maximum Sustainable Yield and Total Allowable Catch, exist for higher taxonomic levels. There is an increasing awareness of distinguishing between the species level and lower level of biodiversity.

46.   The global legally binding fisheries instruments developed under the aegis of the UNGA and FAO apply in principle only to the marine environment. Global coverage of inland fisheries is only ensured by the non-legally binding 1995 CCRF, its 1997 Technical Guidelines on inland fisheries, its 2008 supplement No. 1 on 'Rehabilitation of inland waters for fisheries' and the 2010 Guidelines for the Ecolabelling of Fish and Fish Products from Inland Capture Fisheries. There are regional river basin authorities and RFBs that include inland fishery issues in their mandate, but many do not implement the mandate and most do not address genetic resource issues.

47.   There is no dedicated global instrument - legally binding or non-legally binding - on aquaculture and culture-based fisheries. Global coverage of aquaculture is only ensured by the non-legally binding 1995 CCRF, its 1997 Technical Guidelines and supplements (see specifically supplement 3 – Genetic Resource Management[25]) on aquaculture development and by the 2012 Aquaculture Certification Guidelines[26].

Opportunities for AqGR

48.   AqGR have only recently begun to receive the level of attention devoted in recent decades to plant, animal and forest genetic resources and therefore at the genetic level lack the kind of management systems and conventions that have developed for their terrestrial counterparts. However, the network of over 40 Regional Fishery Bodies provides a tremendous opportunity to develop and implement policies for the responsible use of AqGR.

49.   Recent comprehensive and coordinated approaches on how to develop, manage and conserve AqGR provide guidance and opportunities for developing policies and legislation for AqGR:

- *The Precautionary Approach*
    - o *The precautionary approach* provides a framework for decision-making in the presence of uncertainty and has been operationalized for fisheries and species introductions[27]. Genetic reference points need to be established however.
- *The Ecosystem Approach*
    - o *The ecosystem approac*h to fisheries and aquaculture (EAF EAA or EAFA)[28] are strategies that facilitate the practical adoption and implementation of the CCRF by considering impacts of an activity on all interdependent target and non-target species, and by considering stakeholders' input and the costs and benefits to society in the short and long term as part of the decision-making process. The EAF and EAA utilize a risk-based management approach that can be used also in situations characterized by high uncertainty/scarcity of data. The EAF and EAA facilitate the inclusion of fisheries and aquaculture in the broader integrated planning and management of coastal zones and waterways.

- *Integrated resource management*
    - o Integrated resource management (IRM) as relevant to AqGR includes integrated coastal zone management, marine spatial planning, and integrated watershed management.

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[25] FAO. 2008. *Aquaculture development. 3. Genetic resource management.*
FAO Technical Guidelines for Responsible Fisheries. No. 5, Suppl. 3. Genetic Resource Management in Aquaculture Rome, FAO. 2008. 125p

[26] FAO. Technical Guidelines on Aquaculture Certification. Rome, FAO. 2011. 122 pp.

[27] FAO. Precautionary approach to capture fisheries and species introductions. *FAO Technical Guidelines for Responsible Fisheries.* No. 2. Rome, FAO. 1996. 54p.

[28] "Putting into practice the ecosystem approach to fisheries and aquaculture" FAO 2012. State of the World Fisheries and Aquaculture 2012 pp 135-141. http://www.fao.org/docrep/016/i2727e/i2727e00.htm

- *Ownership and benefit-sharing*
  - o   The number of cultured aquatic species is growing and so is the number of exchanges of aquatic genetic material around the globe posing questions of access and benefit-sharing. Unlike domesticated plants and animals, the improvement of AqGR through selective breeding and other technologies has generally not been the result of traditional knowledge[29] , but the result of relatively recent technical and financial input from private industry. The private industry can be a powerful ally in developing policies that promote livelihoods, conserver AqGR and further enable the industry.

- *Certification and ecolabelling*
  - °   Using market forces is becoming a popular approach to help conserve AqGR and provide livelihood opportunities. After FAO issued guidelines for fisheries product certification[30] the EU introduced labeling requirements requiring all products (except some processed products) to carry labels stating the production method (captured or farmed), catch area of wild species (FAO fishing area), country of production in the case of farmed fish products, Latin name and commercial name. The EU's General Food Law, which entered into force in 2002, requires all food operators to implement traceability systems that clearly identify the origin and destination of products. Modern molecular genetics is being used to identify fish and fish products in order to combat mislabeling, consumer fraud and illegal fishing.[31]

50.   Policy developers wishing to take advantage of these opportunities should consider the following guidelines when crafting laws and policies:

(i)   *Improve the scientific knowledge base and information sharing for AqGR.* Sound and durable decisions begin with sound information about the biology, genetic makeup and status of both wild and farmed aquatic species.

(ii)   *Coordinate the responsibilities of agencies with mandates relevant to AqGR conservation or sustainable use.* Steps should be taken to facilitate cooperation and coordination between different levels of government (national, regional, local) that may have overlapping mandates in the management of AqGR.

(iii)   *Consistent with the ecosystem approach, facilitate community involvement in decision-making through participatory planning processes or devolution of decision-making authority.* Management decisions made with the approval or at least input of affected local communities are likely to be more stable than 'top-down' decisions made in isolation of local concerns. Local communities with a lengthy historical involvement in the use of AqGR are also important sources of traditional knowledge that can help fill information gaps when adequate scientific data are unavailable.

(iv)   *Ensure coordinated and strategic approaches related to the positive drivers such as: i)* structured approaches to AqGR characterization and monitoring; ii) information management; iii) capacity building and awareness raising; and iv) gene banking.

(v)   *Ensure policies are in place to address rights of ownership of AqGR and sharing of benefits derived from their use.* To complement policies regarding the conservation and sustainable use of AqGR, national governments also need to attend to the fair and equitable sharing of benefits arising from the use of genetic resources. As the demand for AqGR continues to increase countries legal certainty regarding access and benefit-sharing may facilitate the exchange of AqGR.

(vi)   *Ensure long-term availability of adequate resources for effective enforcement of AqGR laws and monitoring progress towards achievement of objectives.* Policy-makers should incorporate provisions to enforce and monitor implementation of policy directives.

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[29] Bartley, D.M., T. T. Nguyen, M. Halwart, and S. De Silva. 2009. Use and exchange of aquatic genetic resources in aquaculture: information relevant to access and benefit sharing. Reviews in Aquaculture 1, 157–162.
[30] FAO. 2001. Ecolabelling of Fish and Fish Products from Marine Capture Fisheries. FAO, Rome.
[31] https://fishpoptrace.jrc.ec.europa.eu/

(vii) *Adopt a flexible approach to the design of legislation and policies that permits practical solutions to unpredictable AqGR management challenges.* AqGR planners may wish to make provision for adaptive management that enables flexible responses based on monitoring results and in case of unexpected consequences that undermine achievement of objectives.

(viii) *Learn from and draw upon successful legislative and policy examples from other jurisdictions.* Countries with successful legislation and policy models can proactively share useful information with other governments regarding their legislation and policy formulation processes and challenges. FAO can continue to provide a forum for discussion and exchange of information on sustainable use of AqGR.

(ix)   Adopt appropriate valuation methods for aquatic genetic resources (e.g., coral reefs, floodplains, wetlands, various aquatic animals and plants) so that their value is more explicitly considered in natural resources management.

VII.   GUIDANCE SOUGHT

51.   The Commission may wish to request FAO:

- To provide in *The State of the World's Aquatic Genetic Resources for Food and Agriculture* examples of relevant international and national policies and legislation that specifically address the conservation and sustainable use of aquatic genetic resources, in particular at the genetic level;

- To provide in *The State of the World's Aquatic Genetic Resources for Food and Agriculture* an overview of the drivers that influence the status and trends of AqGR for food and agriculture.