



COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

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IMPLEMENTATION OF THE GLOBAL PLAN OF ACTION FOR THE CONSERVATION, SUSTAINABLE USE AND DEVELOPMENT OF AQUATIC GENETIC RESOURCES FOR FOOD AND AGRICULTURE

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I. INTRODUCTION

1. At the initiative of the Commission on Genetic Resources for Food and Agriculture (Commission),¹ the Council, at its 168th Session in December 2021, adopted the Global Plan of Action for the Conservation, Sustainable Use and Development of Aquatic Genetic Resources for Food and Agriculture (Global Plan of Action).²
2. The Committee on Fisheries Sub-Committee on Aquaculture (COFI:AQ), at its Eleventh Session, welcomed the adoption of the Global Plan of Action and highlighted the need for wider adoption of selective breeding for the genetic improvement of species in aquaculture.³ The Committee on Fisheries, at its Thirty-fifth Session, appreciated FAO's work on the Global Plan of Action and supported the implementation of the associated global information system to ensure the effective and sustainable use of aquatic species.⁴
3. This document summarizes the activities undertaken by FAO since September 2021, in collaboration with its partners, in support of the implementation of the Global Plan of Action and seeks the Commission's guidance as to future activities.

II. RAISING AWARENESS ON AQUATIC GENETIC RESOURCES AND THE GLOBAL PLAN OF ACTION

4. At its Eighteenth Regular Session, the Commission requested FAO to continue distributing *The State of the World's Aquatic Genetic Resources for Food and Agriculture* (SoW-AqGR) and communicating its key messages widely, including through regional and subregional workshops.⁵ The Global Plan of Action represents the critical response to the needs and challenges identified in the SoW-AqGR and thus represents a key component of FAO's communication on aquatic genetic resources for food and agriculture (AqGR).
5. The Global Plan of Action has been published in all UN languages and is available on the FAO website and in printed form.⁶ Print copies are being distributed to key stakeholders including National Focal Points and regional FAO offices.
6. FAO has presented the SoW-AqGR and the Global Plan of Action on various occasions, including at:
 - the International Symposium on Fisheries and Aquatic Sciences (keynote address), September 2021, Ismir, Türkiye;
 - the Global Conference on Aquaculture, September 2021, Shanghai, China;
 - Aquaculture Europe, September 2022, Rimini, Italy;
 - the International Symposium on Genetics in Aquaculture (keynote address), November 2022, Puerto Varas, Chile; and
 - regional fora in East Africa (October 2022 and March 2023) and national fora in India (December 2021), Indonesia (June 2022) and Chile (December 2022).
7. FAO has published multiple articles referring to the SoW-AqGR and the Global Plan of Action, as listed in *Annex 1*. Furthermore, a number of communication activities have been conducted in the context of FAO's work in support of the implementation of specific strategic priorities of the Global Plan of Action as outlined in this document.

¹ CGRFA-18/21/Report, paragraph 58.

² CL 168/REP, paragraph 38a.

³ CGRFA-19/23/11.2.1/Inf.2, paragraph 8.

⁴ CGRFA-19/23/11.2.1/Inf.1, paragraph 17(i).

⁵ CGRFA-18/21/Report, paragraph 55.

⁶ FAO. 2022. *Global Plan of Action for the Conservation, Sustainable Use and Development of Aquatic Genetic Resources for Food and Agriculture*. FAO Commission on Genetic Resources for Food and Agriculture. Rome. <https://doi.org/10.4060/cb9905en>

8. FAO's activities to support countries in the implementation of the Global Plan of Action were also presented at the Twelfth Session of the Committee on Fisheries Sub-Committee on Aquaculture (COFI:AQ).⁷

III. FAO'S ACTIONS FACILITATING THE IMPLEMENTATION OF THE GLOBAL PLAN OF ACTION

Terminology for the description of aquatic genetic resources for food and agriculture

9. At its Eighteenth Regular Session, the Commission requested FAO to make available the key terminology from the report (e.g. as a stand-alone glossary) and integrate relevant terms into FAO's Term Portal.⁸ In response to this request and in support of strategic priority 1.1 of the Global Plan of Action, FAO is coordinating a process of standardization of AqGR-related terminology across a range of FAO-hosted platforms.

10. FAO is currently finalizing an updated glossary of terms used in the SoW-AqGR and considered to be essential for the description of AqGR.⁹ The terminology will also be used for the description of farmed types in the Aquatic Genetic Resources Information System (AquaGRIS).¹⁰ The glossary is being developed with reference to definitions already developed for AquaGRIS and definitions used in the scientific literature and in the current FAO Term Portal, which contains multiple collections of terms relevant to different sectors and disciplines. To the extent possible, terms used in the glossary will be harmonized with those used in the FAO Term Portal and AGROVOC thesauri. AGROVOC is a multilingual and controlled vocabulary designed to cover concepts and terminology under FAO's areas of interest.

11. In preparing the glossary, FAO is developing a protocol for analysis of terminology used in scientific literature for descriptions of AqGR, utilizing the search engine functions of the Aquatic Sciences and Fisheries Abstracts (ASFA), which can be used as an indicator to monitor changes in terminology use over time, including the adoption of new FAO-introduced terms, such as those used in AquaGRIS, in the aquaculture literature.

Aquatic Genetic Resources Information System

12. According to the SoW-AqGR, monitoring and reporting of AqGR are currently insufficient, especially AqGR below the level of species. While countries monitor, and report to FAO, aquaculture production by species or species groups, there are inconsistencies in these reporting systems. When reporting for the SoW-AqGR, for example, many countries listed farming of species that they do not record in the country production data routinely reported to FAO, and vice versa. As a result, access to standardized and authoritative information on AqGR is difficult. One of the key priorities of the Global Plan of Action is therefore to maintain and/or develop, promote and institutionalize national, regional and global standardized information systems for the collection, validation and monitoring of, and reporting on, AqGR below the level of species.

13. As reported to previous sessions of the Commission,¹¹ AquaGRIS has been developed to address the recognized lack of information on AqGR. The information system makes critical information available for key stakeholders, including policymakers, resource managers, researchers, aquaculturists and international/regional organizations. AquaGRIS provides the user with access to a searchable registry of primary and secondary farmed types that will include information on more than 600 aquaculture species across six taxonomic categories. Users of AquaGRIS can analyse the diversity of farmed types at national, regional and global levels and identify the status of management of these resources.

⁷ COFI:AQ/XII/2023/2, paragraphs 18–23.

⁸ CGRFA-18/21/Report, paragraph 55.

⁹ CGRFA/WG-AqGR-4/23/3/Inf.3.

¹⁰ FAO. 2020. What are "farmed types" in aquaculture and why do they matter? *FAO Aquaculture News*, 61: 40–42. Rome. <https://www.fao.org/3/ca8302en/ca8302en.pdf#page=40>

¹¹ CGRFA-18/21/8.3/Inf.1.

14. With support from the Government of Germany, FAO continued, during the reporting period, the development of AquaGRIS in support of strategic priorities 1.2 and 1.3 of the Global Plan of Action. A prototype of AquaGRIS,¹² launched in May 2022, enables access to information entered by species' level experts covering 114 species with data from over 41 different countries.

15. The work on AquaGRIS will be completed by September 2023. AquaGRIS will then reflect feedback received from experts who have been testing the prototype system. It will include, for the first time, data on wild stocks in addition to farmed types of cultured species, in line with recommendations provided by an expert workshop held by FAO in July 2022.¹³ AquaGRIS will also allow for the collection and generation of data related to indicators for monitoring the status of AqGR and the implementation of the Global Plan of Action.¹⁴

16. For data entry, AquaGRIS will utilize a new bespoke web-based data-entry interface; it will also include an MS Excel-based tool that can be used for offline data collection. AquaGRIS, once completed, will also include an expanded data verification interface and an updated data query interface that will enable the generation of expanded reports and fact sheets enabling output of all data contained in the AquaGRIS database, including the generation of indicators on the status of AqGR at national, regional and global levels. At the time of preparing this document, FAO has already finalized both the new bespoke web-based data-entry interface and the Excel-based interface.

17. As part of the above-mentioned development of AquaGRIS, training in the use of AquaGRIS will be conducted in a series of virtual and, where feasible, in-person webinars/workshops in 2023. FAO will also identify at least one or two countries per region that will be supported in uploading data on their AqGR into AquaGRIS and that will test the revised questionnaire for data collection (particularly questions related to wild stocks). FAO has recently started discussions with some countries that expressed interest in building national registries for AqGR.

18. The full version of AquaGRIS will be used over the coming intersessional period to assist National Focal Points in developing national registries of genetic resources. Subject to the availability of funding, AquaGRIS will be further refined and National Focal Points will be trained to report on resource indicators.¹⁵

Guidelines facilitating the implementation of the Global Plan of Action

19. As recommended by the Intergovernmental Technical Working Group on Aquatic Genetic Resources for Food and Agriculture (Working Group)¹⁶ and in support of strategic priorities 2.1, 2.3, 2.4 and 2.5 of the Global Plan of Action, FAO is developing guidelines on genetic management in stocking programmes. These will identify best practices and provide practical genetics-related advice to hatchery, fishery and resource managers on how to responsibly and sustainably use AqGR in stocking programmes for recreation, ecosystem rehabilitation and conservation. Stocking programmes, whereby hatchery-reared seed, juveniles or adults are introduced into the natural environment, are carried out in support of capture fisheries management and conservation, or to create or improve ecosystem services, and can have the objective of stock establishment, restocking, stock enhancement or ranching. The different rationales and objectives for these stocking practices have differing risks and benefits and thus somewhat differing implications for genetic management of the stocked genetic material. The draft guidelines will also include case studies and identify best practices to follow. They provide a decision-support tool to inform the correct choice of genetic management strategy depending on the different stocking scenarios. An outline of the guidelines has been made available to the Working Group, for its information.¹⁷

¹² <https://www.fao.org/fishery/aquagris/home>

¹³ FAO. 2023. *Report of the Expert Workshop on "Incorporating information on wild relatives of aquaculture species into an information system for aquatic genetic resources" – Virtual Workshop*, 2–3 August 2022. FAO Fisheries and Aquaculture Report No. 1394. Rome. <https://doi.org/10.4060/cc3026en>

¹⁴ See CGRFA-19/23/11.2.2.

¹⁵ CGRFA-19/23/11.2.2.

¹⁶ CGRFA-17/19/8.1, paragraph 25.

¹⁷ CGRFA/WG-AqGR-4/23/3/Inf.1.

20. In support of strategic priority 2.4 of the Global Plan of Action, FAO is also in the process of developing guidelines for *ex situ in vitro* gene banking with a significant focus on cryopreservation of various life-cycle stages of a range of aquatic species. *Ex situ, in vitro* gene banking is used far less extensively in aquaculture than in terrestrial agriculture and practical application of such techniques is mainly focused on cryopreservation of gametes (principally sperm) of fish and shellfish, for conservation or for supporting genetic management in aquaculture breeding, and gene banking of farmed types of macro- and microalgae. The guidelines will present the current state of the art and best practices for practical application of *ex situ in vitro* gene banking in aquatic species. An outline of the guidelines has been made available to the Working Group, for its information.¹⁸

21. Both guidelines are being further developed in consultation with experts in the respective fields. FAO intends to initiate broad consultations to allow Members to provide inputs to and comments on the draft guidelines. The Working Group, at its Fourth Session, recommended that a finalized version of both guidelines, incorporating feedback from Members, be presented at the next session of the Working Group for its information.¹⁹

Management of aquatic genetic resources for food and agriculture

22. In support of strategic priority 3.2 of the Global Plan of Action, and as part of its awareness-raising efforts, FAO commissioned three case studies to illustrate critical issues in relation to the management of AqGR. These case studies, which were developed under the auspices of a regional aquaculture platform and were prepared in both full and summary versions, covered:

- a. *Genetic management of Indian major carps* illustrating the pitfalls of not paying due attention to genetic management within important seed supply systems.²⁰
- b. *Lessons from two decades of tilapia genetic improvement in Africa* illustrating the challenges of developing breeding programmes in a developing country context.²¹
- c. *Proactive approach proved key to survival for the Australasian Pacific oyster industry* illustrating the benefits of an industry-driven breeding programme.²²

23. Also in support of strategic priority 3.2 (capacity building), FAO, in partnership with the Norwegian Institute of Food, Fisheries and Aquaculture Research (Nofima), has developed an online training course on *Management and Development of Aquaculture Genetic Resources*. The content development for this course is complete and has been reviewed by relevant experts and stakeholders and FAO is now developing a platform to make this training widely available to a range of different stakeholders. The Working Group at its last session recommended that FAO make the online training course widely available to countries and stakeholders in all official UN languages.²³ More details on the 18 modules of this course, which includes lectures and supporting information material, are provided in *Annex 2*.

Draft guidelines on sustainable aquaculture

24. At the request of the Ninth Session of COFI:AQ,²⁴ FAO carried out a global process to consult its Members, partners and stakeholders including representatives of farmers, civil society organizations (CSOs), governments, regional organizations and academia, to develop Guidelines for

¹⁸ CGRFA/WG-AqGR-4/23/3/Inf.2.

¹⁹ CGRFA-19/23/11.1, paragraph 17.

²⁰ Full version: Lal, K.K., Kumar, A., Kumar, S., Charan, R., Mohindra, V., Lucente, D., Singh, R.K. *et al.* 2023. *Genetic management of Indian major carps – Genetics in aquaculture: a case study*. Rome, FAO. <https://www.fao.org/documents/card/en/c/cc5193en>; Brief version: <https://www.fao.org/documents/card/en/c/CC3598EN/>

²¹ Full version: FAO. 2022. *Lessons from two decades of tilapia genetic improvement in Africa*. Rome. <https://www.fao.org/documents/card/en/c/cc4618en>; Brief version: <https://www.fao.org/documents/card/en/c/CC3600EN>

²² Full version: FAO. 2023. *Proactive approach proved key to survival for the Australian Pacific oyster industry – Genetics aquaculture. A case study*. Rome. <https://www.fao.org/documents/card/en/c/cc4389en>; Brief version: <https://www.fao.org/documents/card/es/c/CC3596EN>

²³ CGRFA-19/23/11.1, paragraph 16.

²⁴ CGRFA-17/19/8.2/Inf.3.

Sustainable Aquaculture. The draft Guidelines were presented to the Eleventh Session of COFI:AQ, which recommended their review by Members with a view to their finalization. A virtual meeting of a Members' Task Force was convened in January 2023. The Task Force reviewed the draft Guidelines and requested FAO to finalize and submit them to the 12th Session of COFI:AQ, held from 16 to 19 May 2023 in Hermosillo, Mexico.²⁵ The draft Guidelines were endorsed by COFI:AQ.

25. Section 5.3 of the draft Guidelines on the conservation of aquatic biodiversity, genetic resource management and sustainable seed supply is based on and makes reference to the Global Plan of Action. The draft Guidelines are thus a good example of the mainstreaming of the management of aquatic genetic diversity with a view to conserving this diversity in the wild and exploiting its huge potential to enhance the productivity of domesticated farmed types through improved genetic management within aquaculture seed-supply systems and the accelerated uptake of genetic improvement.

IV. FAO SUPPORT TO COUNTRY IMPLEMENTATION OF THE GLOBAL PLAN OF ACTION

26. FAO is providing technical support to two countries in the implementation of specific elements of the Global Plan of Action. FAO provides technical support to a Technical Cooperation Project in Indonesia: *Technical assistance in developing a national strategy for sustainable management of aquatic genetic resources*, and to the project *Development of a strategy to implement in Chile the Global Plan of Action for the conservation, sustainable use and development of aquatic genetic resources for food and agriculture in aquaculture and fisheries*, funded by the Government of Chile.

27. Discussions have been initiated with a number of national and regional organizations in relation to the use of AquaGRIS for the development of national registries of AqGR that would facilitate the needs-based implementation of the Global Plan of Action based on national information on AqGR.

V. GUIDANCE SOUGHT

28. The Commission may wish to:

- (i) take note of the actions taken by FAO to facilitate and support the implementation of the Global Plan of Action and provide guidance to FAO on further activities in this regard;
- (ii) welcome the publication of the Global Plan of Action and the activities undertaken by FAO in support of its implementation;
- (iii) recommend that FAO continue supporting the implementation of the Global Plan of Action;
- (iv) welcome the development of AquaGRIS and recommend that FAO finalize the development of the full version, taking into account the importance of the interoperability of AquaGRIS with other operational information systems on AqGR in order to avoid duplication of efforts and to facilitate the smooth exchange of information;
- (v) recommend that FAO finalize the AqGR glossary and standardize AqGR-related definitions across FAO term directories and thesauri;
- (vi) take note of the ongoing development of guidelines on genetic management in stocking programmes and *ex situ in vitro* gene banking of aquatic species, and request its Working Group to review them;
- (vii) invite countries to make every effort to implement the Global Plan of Action, including through the use of AquaGRIS for the development of national inventories; and

²⁵ COFI:AQ/XII/2023/INF.8.

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- (viii) invite Governments and donors to support the implementation of the Global Plan of Action and recommend that FAO continue mobilizing extra-budgetary resources to support the national implementation of the Global Plan of Action.

ANNEX 1
LIST OF SIGNIFICANT FAO PUBLICATIONS RELATED TO AQUATIC GENETIC RESOURCES FOR FOOD AND AGRICULTURE IN 2021–2022

Mair, G. & Lucente, D. 2022. FAO Resources for Strategic Planning. <i>Indian J. of Plant Genet. Resour.</i> , 35(3): 285–288.
Mair, G.C. & Lucente, D. 2022. FAO Council adopts a Global Plan of Action for enhancing the management of aquatic biodiversity used for aquaculture. <i>FAO Aquaculture News</i> , 65 (Special Issue): 35–37. Rome, FAO. https://www.fao.org/3/cc0158en/cc0158en.pdf#page=35
FAO. 2022. <i>Global Plan of Action for the conservation, sustainable use and development of aquatic genetic resources for food and agriculture</i> . FAO Commission on Genetic Resources for Food and Agriculture. Rome. https://doi.org/10.4060/cb9905en
FAO. 2021. <i>Report of the African Regional Workshop on Development of a Global Information System for Farmed Types of Aquatic Genetic Resources (Incorporating a Review of Strategic Priorities for a Global Plan of Action)</i> , Addis Ababa, Ethiopia, 2–4 December 2019. FAO Fisheries and Aquaculture Report No. 1325. Rome. https://doi.org/10.4060/cb2343en
FAO. 2021. <i>Report of the Regional Workshop for Asia and the Pacific Region on the Development of a Registry of Farmed Types of Aquatic Genetic Resources (Incorporating a review of strategic priorities for a Global Plan of Action)</i> , Virtual Workshop, 8–12 June 2020. FAO Fisheries and Aquaculture Report No. 1324. Rome. https://doi.org/10.4060/cb3412en
FAO. 2021. <i>Report of the Regional Workshop for Europe and Central Asia on the Development of a Global Information System of Farmed Types of Aquatic Genetic Resources (Incorporating a Review of Strategic Priorities for a Global Plan of Action)</i> , Virtual Workshop, 5–8 October 2020. FAO Fisheries and Aquaculture Report No. 1329. Rome. https://doi.org/10.4060/cb2359en
FAO. 2021. <i>Report of the Regional Workshop for Latin America and the Caribbean and for North America on the Development of a Registry of Farmed Types of Aquatic Genetic Resources (Incorporating a review of strategic priorities for a Global Plan of Action)</i> , Virtual Workshop, 21–24 September 2020. FAO Fisheries and Aquaculture Report No. 1328. Rome. https://doi.org/10.4060/cb3413en
FAO. 2021. <i>Report of the Regional Workshop for the Near East on the Development of a Registry of Farmed Types of Aquatic Genetic Resources (Incorporating a review of strategic priorities for a Global Plan of Action)</i> , Virtual Workshop, 7–8 December 2020. FAO Fisheries and Aquaculture Report No. 1344, Rome. https://doi.org/10.4060/cb4763en
Lucente, D., Sims, S., Lei, G. & Mair, G. 2021. Conservation of farmed aquatic species: an opportunity we must not miss! <i>FAO Aquaculture News</i> , 63: 51–53. Rome, FAO. www.fao.org/3/cb4850en/cb4850en.pdf#page=51
Mair, G.C., Lucente, D., Viparthy, K. & Ellenbroek, A. 2021. FAO releases a prototype of a new global information system for aquatic diversity. <i>FAO Aquaculture News</i> , 64: 47–49. Rome. FAO. www.fao.org/3/cb8047en/cb8047en.pdf#page=47

ANNEX 2
MODULE TITLES FOR ONLINE COURSE CONTENT FOR THE
FAO/NOFIMA TRAINING RESOURCE ON MANAGEMENT AND
DEVELOPMENT OF AQUATIC GENETIC RESOURCES

Module	Topic
1	Needs and challenges in genetic management in aquaculture
2	Status, benefits and scope of aquaculture selective breeding
3	Aquaculture species as breeding animals
4	Defining breeding objective/goals for aquaculture species
5	Recording of phenotypes and pedigrees, DNA sampling for genotyping
6	Mating designs for fish species
7	Design of simple and more advanced breeding programmes
8	Estimation of breeding values and selection of breeding candidates
9	Inbreeding and control of the rate of inbreeding
10	Genotype by environment interactions in aquaculture
11	Dissemination and measuring of genetic gain
12	Introduction to the application of genomic information in selection (marker-assisted selection and genomic selection)
13	Molecular genetic tools and chromosome manipulation as genetic improvement tools
14	Application and governance of gene editing
15	FAO framework of sustainable use and development
16	The Global Plan of Action for Conservation, Sustainable Use and Development of AqGR for aquaculture
17	Terminology usage
18	AquaGRIS global information system for aquatic biodiversity