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COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Item 8.2 of the Provisional Agenda

Eighteenth Regular Session

27 September – 1 October 2021

REPORT OF THE THIRD SESSION OF THE INTERGOVERNMENTAL TECHNICAL WORKING GROUP ON AQUATIC GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Note by the Secretariat

The Commission, at its last session, requested its intergovernmental technical working groups to meet prior to its Eighteenth Regular Session. The Third Session of the Intergovernmental Technical Working Group on Aquatic Genetic Resources for Food and Agriculture (Working Group) was held virtually from 1 to 3 June 2021. The Working Group considered, *inter alia*, the finalisation of the report on *The State of the World's Aquatic Genetic Resources for Food and Agriculture*, the draft Global Plan of Action for Aquatic Genetic Resources for Food and Agriculture and the development of a global information system for farmed types of aquatic genetic resources for food and agriculture. The Working Group also explored cross-sectoral issues, including access and benefit-sharing, digital sequence information, the role of aquatic genetic resources in the mitigation of and adaptation to climate change, work on biotechnologies for the sustainable use and conservation of genetic resources for food and agriculture and the possible re-organization of the Commission's future intersessional work. The report of the Third Session of the Working Group is contained in this document, for consideration by the Commission.

Food and Agriculture Organization of the United Nations

COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

CGRFA/WG-AqGR-3/21/Report

Third Session of the Intergovernmental Technical Working Group on Aquatic Genetic Resources for Food and Agriculture

1–3 June 2021

CGRFA/WG-AqGR-3/21/Report

COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

REPORT OF THE THIRD SESSION

OF THE

INTERGOVERNMENTAL TECHNICAL WORKING GROUP ON

AQUATIC GENETIC RESOURCES FOR FOOD AND AGRICULTURE

1–3 June 2021

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2021

The documents prepared for the Third Session of the Working Group on Aquatic Genetic Resources for Food and Agriculture of the Commission on Genetic Resources for Food and Agriculture are available on the Internet at the following address:

http://www.fao.org/aquatic-genetic-resources/activities/itwg/third-session-documents

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I. INTRODUCTION

1. The Third Session of the Intergovernmental Technical Working Group on Aquatic Genetic Resources for Food and Agriculture (Working Group) of the Commission on Genetic Resources for Food and Agriculture (Commission) was held virtually from 1 to 3 June 2021. The Members and alternates of the Working Group are given in *Appendix D.* The list of delegates and observers is available on the meeting website.[1]

2. The meeting was convened virtually, on an exceptional basis, in light of the global COVID-19 pandemic and the associated public-health concerns and constraints, following consultations by the Commission's Bureau on the arrangements for virtual meetings. Prior to the beginning of its deliberations, the Working Group endorsed these arrangements.

3. The Working Group confirmed that the virtual meeting constituted a formal regular session of the Working Group. The Working Group agreed to apply its normal rules and practices to the conduct of the meeting and to suspend any rules that may be incompatible with the virtual mode used for the purposes of the meeting. The Working Group also agreed to the application of any special procedures or amended working modalities as may be required for the efficient conduct of the meeting.

II. OPENING OF THE SESSION AND ELECTION OF THE CHAIR, VICE-CHAIRS AND *RAPPORTEUR*

4. Ms Ingrid Olesen (Norway), Chair of the Second Session of the Working Group, welcomed delegates and observers.

5. Mr Manuel Barange, Director, FAO Fisheries Division, welcomed delegates and observers and noted the opportunities and challenges of the virtual meeting arrangements and the strong attendance for this session. He underlined the long-term importance of conservation, sustainable use and development of aquatic genetic resources for food and agriculture (AqGR), as reflected by the Commission's decision to upgrade the Working Group, originally established as an ad hoc group, to a regular subsidiary body of the Commission. Mr Barange recalled that FAO's work on AqGR had achieved several milestones in recent years, including the publication of *The State of the World's Aquatic Genetic Resources for Food and Agriculture* (Report).[2] Based on the needs and challenges identified in the Report, the Commission had requested FAO to prepare the draft Global Plan of Action (GPA) for AqGR for consideration of the Working Group at this session. The GPA once adopted would provide an important framework for the conservation and sustainable management of AqGR. Mr Barange informed the Working Group that Mr Graham Mair had been appointed as Secretary of the Working Group, replacing Mr Matthias Halwart. He wished Mr Mair well in his new role and thanked Mr Halwart for his service to the Working Group.

6. Mr Dan Leskien, Senior Liaison Officer, Secretariat of the Commission on Genetic Resources for Food and Agriculture, welcomed delegates and observers. He recalled that 14 years ago the Commission, in recognition of the importance and vulnerability of aquatic genetic resources, had decided to include AqGR in its Multi-Year Programme of Work (MYPOW). He stressed that with the launch of the Report and the adoption of the GPA, the work of the Commission on AqGR had just started and that the real challenge, the implementation of the GPA, was still lying ahead of the Commission and its Members. He assured the Working Group that the Commission was looking

[1] http://www.fao.org/aquatic-genetic-resources/activities/itwg/third-session-documents/en/
[2] http://www.fao.org/3/CA5256EN/CA5256EN.pdf

forward to receiving its advice on all matters on the agenda of the session, including the cross-sectoral matters, and stressed that 2021, with the upcoming meetings of the Commission and the Conference of the Parties of the Convention on Biological Diversity, presented major opportunities for action on biodiversity and genetic resources.

7. Mr Matthias Halwart, Senior Aquaculture Officer, FAO Fisheries Division, and outgoing Secretary of the Working Group, noted that AqGR will be one of nine thematic sessions at the forthcoming Global Conference on Aquaculture (GCA+20) to be held in Shanghai, China, 22–27 September 2021, and extended an invitation to all participants to attend. In closing, he noted that the Fisheries Division has strengthened its staff capacity in AqGR ensuring consistent progress and delivery of key outputs. In handing over his responsibilities as Secretary of the Working Group, he wished his colleague Mr Graham Mair well and pledged to maintain a strong interest in the future work of the Working Group.

8. The Working Group, in consultation with the regions, and in line with Article III of the Statutes of the Working Group, replaced absent Members of the Working Group: Thailand (instead of India) for the Asia Region; Kuwait (instead of Egypt) and Lebanon (instead of Syrian Arab Republic) for the Near East Region; Madagascar (instead of Chad) and Zimbabwe (instead of South Africa) for the Africa Region.

9. The Working Group elected Mr Alexis Peña (Panama) as Chair. The Working Group elected Mr Colin McGowan (Canada), Ms Malika Chlaida (Morocco), Ms Ingrid Olesen (Norway), Mr Lupino Lazaro (the Philippines) and Mr Rafat Bin Khaled Samar Ali (Saudi Arabia) as Vice-Chairs. Mr McGowan was elected *Rapporteur*.

10. The Working Group adopted the Agenda, as given in *Appendix A*.

III. *THE STATE OF THE WORLD'S AQUATIC GENETIC RESOURCES FOR FOOD AND AGRICULTURE*

11. The Working Group considered the document *The Finalization of The State of the World's Aquatic Genetic Resources for Food and Agriculture.*[3] It welcomed FAO's Report and its In Brief[4] representing a snapshot of the current status of AqGR and constituting a valuable technical reference document that provides standardized terminology and concepts, as well as an excellent framework for further action including a future GPA.

12. The Working Group underlined the importance of establishing protocols for monitoring of AqGR in order to achieve their sustainable use. The Working Group further noted the need for inventory and accurate characterization of AqGR and for improved data collection and information sharing among national key stakeholders and noted that the Report can act to promote global cooperation and enhanced understanding of AqGR. It recommended that the Commission request FAO and other relevant actors to strengthen capacity development and communication efforts in this regard. The Working Group also noted the importance of the engagement with the private sector, especially for the secondary farmed types of commercially important species.

13. The Working Group noted the lack of specific policies on AqGR and law enforcement in some countries, and the importance of creating an enabling environment to ensure the effective conservation, sustainable use and development of AqGR.

[3] CGRFA/WG-AqGR-3/21/2.
[4] http://www.fao.org/3/CA5345EN/CA5345EN.pdf

14. The Working Group recommended that the Commission welcome the Report and take note of its key findings, including the needs and challenges synthesized in Chapter 10. It further recommended that the Commission request FAO to continue distributing the Report and communicating its key messages widely. It requested the Report be translated into all languages, as appropriate.

IV. DRAFT *GLOBAL PLAN OF ACTION FOR AQUATIC GENETIC RESOURCES FOR FOOD AND AGRICULTURE*

15. The Working Group considered the document *Status report on the preparation of the draft Global Plan of Action for the Conservation, Sustainable Use and Development of Aquatic Genetic Resources for Food and Agriculture*.[5] It also took note of the information documents *Draft Global Plan of Action for the Conservation, Sustainable Use and Development of Aquatic Genetic Resources for Food and Agriculture – Submissions by Members,*[6] and the reports of the *Regional workshops 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): Africa,*[7] *Asia and the Pacific,*[8] *Europe and Central Asia,*[9] *Latin America and the Caribbean and North America*[10] *and Near East.*[11]

16. The Working Group reviewed and revised the draft GPA, as given in *Appendix C* for consideration by the Commission at its next session.

17. The Working Group noted that the GPA is a voluntary, non-binding framework to support the conservation, sustainable use and development of AqGR, and should be implemented in line with existing national legislation and international agreements.

18. The Working Group highlighted the need to strengthen capacity building, especially in developing countries, and mobilize financial resource to facilitate the implementation of the GPA by Members. The Working Group recommended that the Commission call for a platform to support the sharing of good practices and new techniques to further the conservation and sustainable use of AqGR. Moreover, it recommended that the Commission invite FAO and donors to support the implementation of the GPA.

19. In recognition of the crucial importance of monitoring, the Working Group recommended that the Commission request FAO to develop a system for monitoring the implementation of the GPA. It further recommended that indicators be developed and incorporated into the information system under development by FAO.

V. DEVELOPMENT OF A GLOBAL INFORMATION SYSTEM FOR FARMED TYPES OF AQUATIC GENETIC RESOURCES FOR FOOD AND AGRICULTURE

20. The Working Group considered the document *Progress report on the development of a global information system for farmed types of aquatic genetic resources for food and agriculture*[12] and acknowledged the progress made.

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[5] CGRFA/WG-AqGR-3/21/3.
[6] CGRFA/WG-AqGR-3/21/Inf.3.
[7] CGRFA/WG-AqGR-3/21/Inf.7.
[8] CGRFA/WG-AqGR-3/21/Inf.8.
[9] CGRFA/WG-AqGR-3/21/Inf.9.
[10] CGRFA/WG-AqGR-3/21/Inf.10.
[11] CGRFA/WG-AqGR-3/21/Inf.11.
[12] CGRFA/WG-AqGR-3/21/4.

21. The Working Group recommended that the Commission request FAO to proceed, subject to the availability of funds, with the transformation of the prototype into a fully-functional global information system. It noted that the information system would be used by countries, on a voluntary basis, for regular submission to FAO of information on the status of conservation, sustainable use and development of farmed types and wild relatives of aquaculture species.

22. The Working Group further recommended that the development of the global information system take into account feedback received from the initial users of the prototype. It noted that the global information system may include indicators for monitoring progress in the implementation of the GPA, as referred to in paragraph 19 of this report. The information system would facilitate informed decision-making and provide essential information to relevant bodies and stakeholders.

23. The Working Group recommended that the Commission invite countries and their National Focal Points on AqGR to contribute to the further development of the global information system for AqGR, and to prioritize the collection and provision of data on AqGR for this purpose, including pilot studies on the development of national inventories. It further recommended that the Commission encourage donors to support these processes. It further noted the need for capacity-building activities for National Focal Points and other users of the global information system.

24. The Working Group recommended that the Commission request FAO to consider, where possible, the integration of the global information system with other existing information systems and data sources in order for countries to avoid multiple reporting on AqGR.

25. The Working Group also recommended a communication and awareness-raising campaign targeted to relevant actors (including *inter alia* breeders, farmers and researchers) on the existence, intended use and potential value of the global information system.

VI. ACCESS AND BENEFIT-SHARING FOR AQUATIC GENETIC RESOURCES

26. The Working Group considered the document *Access and benefit-sharing for genetic resources for food and agriculture: Review and outlook*[13] and took note of the information documents *Draft survey of ABS country measures accommodating distinctive features of genetic resources for food and agriculture and associated traditional knowledge*[14] (Draft Survey) and *Inputs by Members on access and benefit-sharing for genetic resources for food and agriculture*.[15]

27. The Working Group commended the Commission's work on access and benefit-sharing for genetic resources for food and agriculture and took note of developments under other international agreements and instruments relevant to access and benefit-sharing (ABS). It emphasized the need to avoid duplication of work and ensure consistency with the work in other relevant fora.

28. The Working Group took note of the Draft Survey as a comprehensive and useful compilation of existing ABS measures accommodating the distinctive features of genetic resources for food and agriculture (GRFA). It noted that further comments on and inputs to the Draft Survey may be provided to the Secretariat in writing after the completion of the Working Group session.

[13] CGRFA/WG-AqGR-3/21/5.
[14] CGRFA/WG-AqGR-3/21/Inf.12.
[15] CGRFA/WG-AqGR-3/21/Inf.13.

29. The Working Group recommended that the Commission request the Secretariat to develop an annex to the ABS Elements[16] reflecting specific examples of ABS country measures that accommodate the distinctive features of GRFA and/or traditional knowledge associated with genetic resources for food and agriculture (TKGRFA), including measures that address "digital sequence information", for review by the Working Groups and the Commission.

30. The Working Group also recommended that the Commission request the Secretariat to prepare, based on a country questionnaire, a report on the application of ABS country measures to the different subsectors of GRFA in practice, with a view to identify the effects of ABS measures on the utilization and conservation of the different subsectors of GRFA and TKGRFA and the fair and equitable sharing of benefits. It further recommended that the same questionnaire include questions on the usefulness of the ABS Elements for the development and implementation of ABS measures for the different subsectors of GRFA, with the aim of identifying and addressing gaps and weaknesses and recommending activities for consideration by the Working Groups and the Commission.

31. The Working Group further recommended that the Commission encourage regional networks and collaborative partnerships to raise awareness of and enhance capacity to deal with matters related to ABS, to share information on and experiences with ABS and to consider regional arrangements facilitating access to AqGR and the sharing of benefits arising from their use for research and development.

VII. "DIGITAL SEQUENCE INFORMATION" ON AQUATIC GENETIC RESOURCES FOR FOOD AND AGRICULTURE

32. The Working Group considered the document, *"Digital sequence information" on genetic resources for food and agriculture: Innovation opportunities, challenges and implications*[17] and reviewed the actual and potential applications of "digital sequence information" ("DSI") for the conservation and sustainable use of aquatic genetic resources given in Table 2 of the document. It noted that some of the applications listed are relevant to all subsectors of GRFA and could therefore be compiled in a general section of the table. It also noted that various applications identified for animal genetic resources were also relevant to AqGR. The Working Group noted that Members could still submit comments and inputs to Table 2 of the document in writing after the completion of the Working Group session and requested the Secretariat to revise and consolidate the table in the light of comments received, for review by the Commission at its next session.

33. The Working Group recommended that the ABS Elements[18] be complemented by an annex or accompanying document presenting examples on how existing national ABS measures address "DSI".

34. The Working Group recommended that the Commission request FAO to support countries, in particular developing countries, in building the necessary technical, institutional and human capacity to generate and utilize "DSI" on GRFA for research and development. It further recommended that the Commission request FAO to hold an intersessional workshop, in collaboration with relevant organizations and with reference to relevant instruments, to raise awareness among relevant

[16] FAO. 2019. *ABS Elements: Elements to Facilitate Domestic Implementation of Access and Benefit-Sharing for Different Subsectors of Genetic Resources for Food and Agriculture with Explanatory Notes.* Rome. 84 pp. Licence: CC BY-NC-SA 3.0 IGO. (also available at http://www.fao.org/3/ca5088en/ca5088en.pdf).
[17] CGRFA/WG-AqGR-3/21/6.
[18] FAO. 2019. *ABS Elements: Elements to Facilitate Domestic Implementation of Access and Benefit-Sharing for Different Subsectors of Genetic Resources for Food and Agriculture with Explanatory Notes.* Rome. 84 pp. Licence: CC BY-NC-SA 3.0 IGO. (also available at http://www.fao.org/3/ca5088en/ca5088en.pdf).

stakeholders of the role of "DSI" in research and development related to genetic resources and of the challenges to access and make full use of "DSI".

35. The Working Group recommended that the Commission continue monitoring developments relevant to "DSI" in other fora and consider the implications of these developments, including of the different regulatory options currently being considered for ABS and "DSI", with a view to identifying, as appropriate, key aspects that should be taken into consideration in addressing "DSI" on GRFA.

VIII. THE ROLE OF AQUATIC GENETIC RESOURCES FOR FOOD AND AGRICULTURE IN MITIGATION OF AND ADAPTATION TO CLIMATE CHANGE

36. The Working Group considered the document *Climate change and genetic resources for food and agriculture*[19] and took note of the information documents *FAO activities on climate change*[20] and *The role of genetic resources for food and agriculture in climate change adaptation and mitigation*.[21]

37. The Working Group welcomed the scoping study on the role of GRFA in adaptation to, and mitigation of, climate change. It noted that Members may submit comments on and inputs to the study in written form after the Working Group session. It further recommended that the Commission request FAO to publish a revised version of the study incorporating this input. The Working Group welcomed the draft revised MYPOW work stream on climate change, as contained in *Appendix I* to the document CGRFA/WG-AqGR-3/21/7.

38. The Working Group welcomed the country survey on climate change and GRFA, as contained in *Appendix II* to the document CGRFA/WG-AnGR-11/21/8. However, it noted the complexity of the information requested and the already heavy reporting burden on countries and the necessity to streamline reporting processes. It recommended that a shorter version of the survey, taking into consideration the similarities and differences across the different sectors, be developed and tested. The Working Group recommended that a shorter version of the survey be included in the reporting process on sectoral GRFA. The Working Group noted that the Commission might consider specificities of sectoral GRFA in its future work on climate change.

39. The Working Group emphasized that the future work of the Commission on climate change should build on the current work on GRFA and be complementary to the work of other organizations, such as the Koronivia Joint Work on Agriculture.

40. The Working Group recommended that the Commission request FAO to review the *Voluntary Guidelines to Support the Integration of Genetic Diversity into National Climate Change Adaptation Planning*, for consideration by the Working Groups and the Commission.

41. The Working Group recommended that the Commission request FAO to develop a common approach, for all sectors of GRFA, on how climate change will be addressed in future assessments and policy instruments, for consideration by the Working Groups and the Commission. It further recommended that the Commission request FAO to fully consider biodiversity for food and agriculture and GRFA in its future work on climate change.

[19] CGRFA/WG-AqGR-3/21/7.
[20] CGRFA/WG-AqGR-3/21/Inf.14.
[21] CGRFA/WG-AqGR-3/21/Inf.15.

IX. REVIEW OF THE WORK ON BIOTECHNOLOGIES FOR THE CONSERVATION AND SUSTAINABLE USE OF AQUATIC GENETIC RESOURCES FOR FOOD AND AGRICULTURE

42. The Working Group considered the document *Review of the work on biotechnologies for the sustainable use and conservation of genetic resources for food and agriculture*[22] and took note of the information document *Recent developments in biotechnologies relevant to the characterization, sustainable use and conservation of genetic resources for food and agriculture.*[23] It recalled that many so-called "low" or "traditional" biotechnologies continue to be used extensively, and that the application of biotechnologies such as selective breeding is generally concentrated in higher-value species. It highlighted the potential of biotechnologies for aquaculture development and for application to the management of aquatic organisms, but noted that the uptake of biotechnologies is relatively slow, especially in developing countries, where aquaculture production is concentrated. It also noted that despite the ubiquity of molecular tools used to characterize genetic resources, there remains a paucity of information on aquatic genetic resources, particularly below species level.

43. The Working Group recommended that the Commission request FAO to develop and strengthen capacities of developing countries to apply and develop appropriate biotechnologies for the characterization, conservation and sustainable use of AqGR, taking into consideration relevant benefits and risks, as well as relevant national laws, regulations and regional and international instruments, including those related to risk assessment.

44. The Working Group further recommended that the Commission request FAO to regularly assemble and disseminate updated factual information on the role of biotechnologies in the characterization, conservation and sustainable use of GRFA, and on infrastructure and capacity requirements for the implementation of such biotechnologies, through its existing databases, networks and newsletters. It further recommended exploring mechanisms for future cooperation with relevant international organizations, including for fostering North–South, South–South and triangular cooperation, in promoting appropriate biotechnologies for the characterization, conservation and sustainable use of GRFA.

45. The Working Group noted the need for undertaking research and innovation using biotechnologies. Countries may wish to conduct socio-economic analyses of the value and potential impacts of biotechnological applications prior to their deployment, as appropriate and in coherence with relevant multilateral environmental agreements, such as the Cartagena Protocol on Biosafety to the Convention on Biological Diversity.

X. OPTIONS FOR THE ORGANIZATION OF THE COMMISSION'S FUTURE INTERSESSIONAL WORK

46. The Working Group considered the document *Possible re-organization of the Commission's future intersessional work.*[24] It welcomed the progress made in the Commission's intersessional work, based on contributions from Members, the subsidiary bodies, Bureaus and the National Focal Points/Coordinators. It expressed its satisfaction with the current setup, which allows the Working Group to make recommendations to the Commission specifically addressing AqGR, and noted that, given the wide range of organisms used in aquaculture, some of these organisms may also fall under other subsidiary bodies of the Commission. It stressed the need to address, in a coherent, integrated

[22] CGRFA/WG-AqGR-3/21/8.
[23] CGRFA/WG-AqGR-3/21/Inf.16.
[24] CGRFA/WG-AqGR-3/21/9.

and consistent way, biodiversity for food and agriculture (BFA) and micro-organism and invertebrate genetic resources (MIGR) and to enhance coordination and communication among the Commission's Working Groups.

47. The Working Group welcomed the potential for holding informal virtual and hybrid webinars, consultations and regional workshops for National Focal Points/Coordinators, contributing to information sharing and capacity development.

48. The Working Group provided guidance on the future organization of the Commission's intersessional work. It recommended that the Commission consider, in its deliberations on the re-organization of its intersessional work, the limited resources available to countries and the Secretariat.

49. The Working Group considered the advantages and disadvantages of the different options for the re-organization of the Commission's subsidiary bodies. The Working Group did not recommend a specific option but recommended that the different options be further analysed and discussed before a decision is made; it stressed the need to formalize the Commission's intersessional work on MIGR[25] and await the Commission's decision on the policy response to the report on *The State of the World's Biodiversity for Food and Agriculture*.[26] The Working Group noted the possibility of addressing both MIGR and BFA within the existing sectoral working groups, while improving working methods to increase the efficiency in addressing cross-sectoral matters in the Intergovernmental Technical Working Groups, as well as the exchange of information among them on these items.

50. The Working Group welcomed the initiative to harmonize the expected core tasks of National Focal Points/Coordinators, noting that the implementation is subject to national priorities, capacity and institutional setup. It stressed the need to enhance coordination and communication among National Focal Points/Coordinators within and across sectors and countries.

XI. CLOSING STATEMENTS

51. Mr Dan Leskien congratulated the Working Group for the very rich and fruitful discussions. He noted that the GPA was reviewed at a remarkable pace, guided by the spirit of cooperation and informed by the outcomes of the regional consultations. He further noted that the Commission will consider the draft GPA as revised by the Working Group at its next regular session and expressed his hope that the Conference would mandate the Council to adopt it at the end of the year. He underlined that the information system's success will depend not only on funding but also on the full participation of National Focal Points and countries as both providers and users of the data. In concluding he thanked the Governments of Germany, Spain and Switzerland for their ongoing support.

52. Mr Xinhua Yuan, Senior Aquaculture Officer, FAO Fisheries Division congratulated the Working Group on its accomplishments. He noted that the professionalism and enthusiasm of the delegates had contributed to the smooth running and overall success of this third Session. He highlighted that the adoption of the report and in particular the support for the GPA marked an important milestone for the future management of AqGR and their contribution as the basis of sustainable aquaculture development. He noted that the new virtual format allowed for a high level of

[25] CGRFA-17/19/Report, paragraph 95.
[26] FAO. 2019. *The State of the World's Biodiversity for Food and Agriculture*. J. Bélanger & D. Pilling, eds. FAO Commission on Genetic Resources for Food and Agriculture Assessments. Rome. (also available at http://www.fao.org/3/ca3129en/CA3129EN.pdf), http://www.fao.org/cgrfa/meetings/nfpbfa/en/

participation from delegates across multiple time zones, which illustrated the strong commitment among Members to the topic of AqGR.

53. Mr Graham Mair, Senior Aquaculture Officer, FAO Fisheries Division, and Secretary to Working Group, echoed Mr Leskien's and Mr Yuan's remarks in thanking all delegates. He highlighted that the decision to recommend that the GPA move forward is an important step and noted the support for the global information system as a key resource to underpin the implementation of the GPA. He reaffirmed FAO's commitment to delivering real change on the ground and the importance of working with Members to enhance the role that AqGR plays in food production systems and in meeting the Sustainable Development Goals. He thanked the past and present members of the Bureau of the Working Group.

54. The Chairperson thanked all delegates and the *Rapporteur* for their contributions to the success of the session and noted that the Working Group had accomplished a great deal. He concluded with hoping that this meeting has inspired all to redouble their efforts in the management of AqGR and noted that both the GPA and information system stand to be landmarks in this sector.

APPENDIX A

AGENDA OF THIRD SESSION OF THE INTERGOVERNMENTAL TECHNICAL WORKING GROUP ON AQUATIC GENETIC RESOURCES FOR FOOD AND AGRICULTURE

1–3 June 2021

1. Election of the Chair, Vice-Chair(s) and *Rapporteur*
2. Adoption of the agenda and timetable
3. *The State of the World's Aquatic Genetic Resources for Food and Agriculture*
4. Draft *Global Plan of Action for Aquatic Genetic Resources for Food and Agriculture*
5. Development of a global information system for farmed types of aquatic genetic resources for food and agriculture
6. Access and benefit-sharing for aquatic genetic resources for food and agriculture
7. "Digital sequence information" on aquatic genetic resources for food and agriculture
8. The role of aquatic genetic resources for food and agriculture in mitigation of and adaptation to climate change
9. Review of the work on biotechnologies for the conservation and sustainable use of aquatic genetic resources for food and agriculture
10. Options for the organization of the Commission's future intersessional work
11. Other business
12. Adoption of the Report

APPENDIX B

LIST OF DOCUMENTS

Working documents

Document symbol	Title
CGRFA/WG-AqGR-3/21/1	Provisional agenda
CGRFA/WG-AqGR-3/21/1 Add.1	Provisional annotated agenda and timetable
CGRFA/WG-AqGR-3/21/2	The Finalization of *The State of the World's Aquatic Genetic Resources for Food and Agriculture*
CGRFA/WG-AqGR-3/21/3	Status report on the preparation of the draft Global Plan of Action for the Conservation, Sustainable Use and Development of Aquatic Genetic Resources for Food and Agriculture
CGRFA/WG-AqGR-3/21/4	Progress report on the development of a global information system for farmed types of aquatic genetic resources for food and agriculture
CGRFA/WG-AqGR-3/21/5	Access and benefit-sharing for genetic resources for food and agriculture: Review and outlook
CGRFA/WG-AqGR-3/21/6	"Digital sequence information" on genetic resources for food and agriculture: Innovation opportunities, challenges and implications
CGRFA/WG-AqGR-3/21/7	Climate change and genetic resources for food and agriculture
CGRFA/WG-AqGR-3/21/8	Review of the work on biotechnologies for the sustainable use and conservation of genetic resources for food and agriculture
CGRFA/WG-AqGR-3/21/9	Possible re-organization of the Commission's future intersessional work

Information documents

Document symbol	Title
CGRFA/WG-AqGR-3/21/Inf.1	Information note for participants
CGRFA/WG-AqGR-3/21/Inf.2	Statutes of the Intergovernmental Technical Working Group on Aquatic Genetic Resources for Food and Agriculture, and Members and Alternates elected by the Commission at its Seventeenth Regular Session
CGRFA/WG-AqGR-3/21/Inf.3	Draft Global Plan of Action for the Conservation, Sustainable Use and Development of Aquatic Genetic Resources for Food and Agriculture – Submissions by Members

CGRFA/WG-AqGR-3/21/Inf.4	Report of the Third Session of the Committee on Fisheries Advisory Working Group on Aquatic Genetic Resources and Technologies
CGRFA/WG-AqGR-3/21/Inf.5	Report of the Tenth Session of the COFI Sub-Committee on Aquaculture
CGRFA/WG-AqGR-3/21/Inf.6	Report of the Thirty-fourth Session of the Committee on Fisheries
CGRFA/WG-AqGR-3/21/Inf.7	Report of the regional workshop 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): Africa
CGRFA/WG-AqGR-3/21/Inf.8	Report of the regional workshop 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): Asia and the Pacific
CGRFA/WG-AqGR-3/21/Inf.9	Report of the regional workshop 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): Europe and Central Asia
CGRFA/WG-AqGR-3/21/Inf.10	Report of the regional workshop 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): Latin America and the Caribbean and North America
CGRFA/WG-AqGR-3/21/Inf.11	Report of the regional workshop 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): Near East
CGRFA/WG-AqGR-3/21/Inf.12	Draft survey of access and benefit-sharing country measures accommodating distinctive features of genetic resources for food and agriculture and associated traditional knowledge
CGRFA/WG-AqGR-3/21/Inf.13	Inputs by Members on access and benefit-sharing for genetic resources for food and agriculture
CGRFA/WG-AqGR-3/21/Inf.14	FAO activities on climate change
CGRFA/WG-AqGR-3/21/Inf.15	The role of genetic resources for food and agriculture in climate change adaptation and mitigation
CGRFA/WG-AqGR-3/21/Inf.16	Recent developments in biotechnologies relevant to the characterization, sustainable use and conservation of genetic resources for food and agriculture
CGRFA/WG-AqGR-3/21/Inf.17	List of delegates and observers
CGRFA/WG-AqGR-3/21/Inf.18	List of documents

Other documents

The State of the World's Aquatic Genetic Resources for Food and Agriculture

The State of the World's Aquatic Genetic Resources for Food and Agriculture - In brief

The State of World Fisheries and Aquaculture 2020. Sustainability in action

APPENDIX C

DRAFT *GLOBAL PLAN OF ACTION FOR AQUATIC GENETIC RESOURCES FOR FOOD AND AGRICULTURE*

LIST OF ACRONYMS/ABBREVIATIONS

ABS	access and benefit-sharing
AqGR	aquatic genetic resources for food and agriculture
ASFIS	Aquatic Sciences and Fisheries Information System
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
COFI	Committee on Fisheries
COFI Working Group	COFI Advisory Working Group on Aquatic Genetic Resources and Technologies
COFI/AQ	COFI Sub-Committee on Aquaculture
Commission	Commission on Genetic Resources for Food and Agriculture
EAF	ecosystem approach to fisheries
EBM	ecosystem-based management
EIFAAC	EIFAAC - European Inland Fisheries and Aquaculture Advisory Commission
ICES	International Council for the Exploration of the Sea
IPLC	indigenous peoples and local communities
ITWG-AqGR	Intergovernmental Technical Working Group on Aquatic Genetic Resources for Food and Agriculture

PART I – INTRODUCTION

1. Global production of aquatic animals (fish, crustaceans, molluscs and other aquatic animals) reached an all-time high in 2018 at approximately 179 million tonnes, valued at USD 401 billion. In addition, 33.3 million tonnes of aquatic plants, mainly marine macroalgae (seaweeds), were produced. Of this production, 46 percent of aquatic animal production and 97 percent of seaweed production came from aquaculture. Aquaculture has been the fastest growing sector of food production in this century, increasing at 5.3 percent annually from 2001 to 2018. Overall, aquaculture production and value now exceeds that from capture fisheries. This production confirms the long-term transition from wild harvest to farming for many aquatic species. Harvest from capture fisheries has plateaued over recent decades and there is an indication that yields from capture fisheries are unlikely to increase significantly from current levels and thus that the continuing increase in demand for aquatic food must be met from sustainable growth of aquaculture.

2. Global aquaculture is regionally imbalanced and occurs primarily in developing countries, with the Asia-Pacific region responsible for 92 percent of production, and with the greatest diversity of species under culture. China alone produces over 60 percent of global aquaculture production. Over 60 percent of aquatic animal production comes from inland aquaculture and one-third of production is of finfish (molluscs represent just over 20 percent and crustaceans 7 percent). FAO records production of seaweeds but production of freshwater aquatic macrophytes and microalgae is generally not recorded by countries.

3. Many millions of people around the world find a source of income and livelihood in the aquatic sector, with about 59.5 million people engaged in the primary sector (34 percent in aquaculture). The highest numbers were found in Asia (85 percent), followed by Africa (9 percent), the Americas (4 percent), and Europe and Oceania (1 percent each). The total engagement of women across both fisheries and aquaculture was about 14 percent of the workforce in the primary sector. In 2017, global apparent per capita fish consumption was estimated at 20.3 kg (projected to increase to 21.5kg by 2030), with aquatic foods accounting for about 17.3 percent of the global population's intake of animal proteins and 6.8 percent of all proteins consumed. Globally, fish provides about 3.3 billion people with almost 20 percent of their average per capita intake of animal protein, and 5.6 billion people with at least 10 percent of such protein. Fish and fish products are some of the world’s most traded food commodities.

4. The status of aquatic diversity has been impacted by capture fishing activities over hundreds of years with fishing pressure ever increasing globally. In 2017, over 34 percent of assessed fish stocks were considered to be fished unsustainably, with this proportion increasing from just 10 percent in 1974. Such fishing activities inevitably will impact biodiversity at all levels (including ecosystem, species and genetic diversity). Some data on biodiversity impacts are available for fished stocks but, due to its relatively recent and dramatic rise in production, similar information is rarely available regarding diversity in aquaculture, especially at the level below species.

5. Aquatic genetic resources for food and agriculture (AqGR) underpin production in this sector. Over 1 700 species are harvested from capture fisheries and nearly 700 species are farmed in aquaculture (2018 data), with this latter number increasing rapidly (from 472 species recorded in 2006). While the number of species under culture continues to increase there is also a concentration of production around a small number of species. Over 90 percent of finfish production involves just 27 species or species groups and the top ten global aquaculture species (including plants) account for around 50 percent of aquaculture production volume.

6. AqGR are the basis on which the aquaculture sector and capture fisheries will be able to exist and grow sustainably. AqGR are essential to improve growth of aquatic plants and animals, to adapt them to natural and human-induced impacts such as climate change, to resist diseases, pests and parasites, and to continue to evolve. The diversity of AqGR determines the adaptability and resilience of species to changing environments and contributes to the wide variety of shapes, colours and other characteristics of aquatic species. AqGR are crucial for human survival and well-being, given the acknowledged nutritional benefits of aquatic food. They play a vital role in supplying food from seas, rivers and lakes, providing a source of healthy diets and livelihoods for millions of people, while alleviating pressure on wild stocks. They are thus indispensable for sustainable aquaculture production. The conservation, sustainable use and development of AqGR, and the fair and equitable sharing of the

benefits from their use, are of vital international concern and the Global Plan of Action for the Conservation, Sustainable Use and Development of Aquatic Genetic Resources for Food and Agriculture (Global Plan of Action) provides, for the first time, an agreed international framework for the sector.

Development of the Global Plan of Action

7. Since 2007, the FAO Commission on Genetic Resources for Food and Agriculture (Commission) has recognized the importance and vulnerability of AqGR, their roles in an ecosystem approach for food and agriculture, and their contributions to meeting the challenges presented by climate change. From 2014, the Commission has guided a country-driven process for the preparation of the report on *The State of the World's Aquatic Genetic Resources for Food and Agriculture* (SoW-AqGR). The SoW-AqGR, published in 2019, provides the first comprehensive assessment of the status of AqGR of farmed species and their wild relatives.

8. The SoW-AqGR is based on 92 country reports, with these countries representing 96 percent of global aquaculture and 82 percent of capture fisheries production. The report provides a comprehensive global assessment of, *inter alia*, the status, use and exchange, drivers and trends, conservation efforts, stakeholders, policies and legislation, research, education, training and extension, and international collaboration, relevant to AqGR that are cultured, and their wild relatives, within national jurisdictions.

9. At its Seventeenth Regular Session, in February 2019, the Commission, recognizing the need to maintain momentum following the preparation of the SoW-AqGR, requested FAO to review the objectives, overall structure and list of follow-up strategic priorities, as presented to the second session of the Intergovernmental Technical Working Group on AqGR (ITWG-AqGR) and prepare a draft Global Plan of Action for consideration by the ITWG-AqGR and the Commission at their next sessions.

10. The Commission further agreed that the Global Plan of Action should be prepared upon consultation with the regions and in collaboration with the Committee on Fisheries (COFI) and its relevant subsidiary bodies. It noted that the Global Plan of Action should be voluntary and collaborative and be implemented in line with the needs and priorities of Members.

11. The preparation of a Global Plan of Action has been further endorsed by COFI and its subsidiary bodies, namely the COFI Sub-Committee on Aquaculture (COFI/AQ) and the COFI Advisory Working Group on Aquatic Genetic Resources and Technologies (COFI Working Group).

12. Furthermore, input to the objectives, structure and list of follow-up strategic priorities has been provided by Members through responses to a written request for feedback sent to all Members, and input provided during five regional consultation workshops.

Nature of the Global Plan of Action

13. The Global Plan of Action is voluntary and non-binding and should not be interpreted or implemented in contradiction with existing national legislation and international agreements where applicable.

14. The Global Plan of Action constitutes a rolling document that can be updated in line with any follow up that the Commission considers necessary. Its initial time horizon is ten years (concordant with the expected implementation of global assessments), with provisions for the conservation, sustainable use and development of AqGR, at national, regional and global levels.

15. The relative importance of each strategic priority and associated actions may differ significantly between countries and between regions. Relative importance may depend on the genetic resources themselves, the natural environment or production systems involved, current management capacities, financial resources or policies already in place for the management of AqGR.

Rationale for the Global Plan of Action

16. The strategic priorities for action, contained within this Global Plan of Action, propose specific measures to address the needs and challenges related to enhancing the conservation, sustainable use and

development of AqGR. The implementation of the strategic priorities for action will make a significant contribution to international efforts to promote food security and sustainable development, and alleviate poverty, in line with the Sustainable Development Goals (SDGs) and other international commitments.

17. The farming of aquatic species is, overall, a much younger production sector than the farming of crops and livestock in terrestrial agriculture. Domestication in aquaculture is relatively recent, with 97 percent of cultured aquatic species having commenced domestication only in the twentieth century. The consequence is that most present-day cultured farmed types are little different from their wild relatives and still retain high levels of genetic diversity. In contrast, many terrestrial species (both animal and plant) used for food and agriculture have been domesticated for up to 10 000 years and are thought to have lost much of the genetic diversity present in their wild ancestors and indeed many wild relatives of these species have been lost to humankind. This sectoral dichotomy generates different imperatives for AqGR relative to livestock and crop genetic resources when considering their conservation, sustainable use and development.

18. Despite the crucial role of AqGR in contributing to global food security and sustainable livelihoods, information available on AqGR, prior to the SoW-AqGR, tended to be scattered and incomplete. For example, the lineage of farmed types in some aquaculture species is often limited to a few companies which may restrict access to related information. In addition, the lack of a standardized nomenclature to unequivocally identify and report information on these resources further reduces the accuracy of the available data. The SoW-AqGR is thus a first and important step towards analysing, in a coherent and consistent manner, gaps in reporting aquaculture and fisheries data to FAO and member countries, and in the identification of knowledge gaps regarding AqGR at levels below the species. However, even information in the SoW-AqGR is affected by the relative lack of ongoing monitoring of the status of AqGR and the confusing and inconsistent use of nomenclature to describe these resources.

19. Despite the relatively recent domestication of most aquatic species used in aquaculture, there is evidence of genetic degradation of these resources, due to poor genetic management and the lack of application of basic genetic principles, in some seed supply systems. This increases the risk of inbreeding, loss of important genetic diversity and ultimately the decline of production performance. Over 200 species are farmed where they are not native. Nine of the top ten globally cultured species are farmed in more countries where they have been introduced than where they are native. These non-native species can become invasive and negatively impact local ecosystems, including indigenous biodiversity.

20. There remains a strong link between cultured AqGR and their wild relatives. All cultured species still have wild relatives occurring in nature, although some of these are under threat from a range of drivers. In many cases, aquaculture retains a dependency on wild relative resources with seed for culture or broodstock for hatcheries still being harvested from the wild. Wild relatives of farmed species (stocks and populations) can be impacted by aquaculture not only due to harvest of seed or broodstock but also through habitat change/loss and, following escapes or deliberate introductions, the interaction between genetically changed cultured farmed types and their wild relatives.

21. Conversely, well-managed fishery stocks can act as effective mechanisms for *in situ* conservation along with aquatic protected areas. There are also many *ex situ* conservation programmes, as live or *in vitro* gene banks. The SoW-AqGR reports 200 *in vivo* conservation programmes, mostly for finfish and microalgae, and nearly 300 *in vitro* gene banks, mainly of microalgal cultures and collections of cryopreserved sperm.

22. While there are many genetic improvement technologies that have been successfully applied to aquatic species, there is a relatively low uptake of genetic improvement, particularly the core technology of selective breeding, in aquaculture today. There are thus relatively few developed farmed types in aquaculture. It is estimated that little more than 10 percent of aquaculture production is derived from farmed types improved by well-managed breeding programmes. According to the SoW-AqGR, 45 percent of cultured species are currently farmed as wild-types and only 55 percent of countries reported that genetic improvement is having any significant impact on their aquaculture production. Thus, there is a largely unmet opportunity to significantly increase the productivity of sustainable aquaculture through accelerated adoption of genetic improvement across the sector.

23. Policies and institutions addressing AqGR are many and often complex because they usually deal with multiple influences and drivers. Policies addressing AqGR usually do not pay particular

attention at the level of species and below species, thus often compromising the management of these resources. Relevant policies and management plans are often ineffective for a range of reasons.

24. Overall there is a lack of awareness of the value of AqGR in fisheries and aquaculture, and key stakeholders in AqGR generally lack the capacity to fully address the complexities of their conservation, sustainable use and development. Furthermore, capacity-building needs and priorities differ among regions. There is evidence that regional or international networks dedicated to AqGR have been partially successful at capacity building and awareness raising, but have often not been sustained.

25. Improved knowledge of the status and trends of the management of AqGR will facilitate the development of more comprehensive policies, better planning and improved management of these essential resources. Loss and degradation of aquatic habitats and populations has resulted in genetic impoverishment. In light of this, the changing environmental and economic conditions, and the advancement of biotechnology, the SoW-AqGR and its follow-up actions provide a long-overdue opportunity to define strategic priorities to enhance the contribution of AqGR to food security and sustainable rural development.

26. The SoW-AqGR identifies 37 specific needs and challenges across four identified priority areas:

- Characterization, inventory and monitoring
- Conservation and sustainable use
- Development of AqGR for aquaculture
- Policies, institutions, capacity building and cooperation

Building on the momentum of the launch of the first SoW-AqGR, this Global Plan of Action provides a framework to address, in a strategic and sustainable manner, the identified opportunities, gaps and needs. Global collaboration and coordination among countries and relevant stakeholders will be essential to address capacity needs of developing countries in particular, to respond to the findings of the SoW-AqGR and to implement this Global Plan of Action.

Objectives and Strategies of the Global Plan of Action

27. The Global Plan of Action aims to address the conservation, sustainable use and development of AqGR with a view to making a significant contribution to the promotion of food security and sustainable development, and alleviation of poverty.

28. The Global Plan of Action and its strategic priorities are based on the assumption that countries are fundamentally interdependent with respect to AqGR, and that substantial international cooperation is necessary to meet the below-mentioned aims effectively and efficiently. The Global Plan of Action was developed within a broad strategic framework based on the following assumptions and principles:

- Alignment with existing policy instruments and tools, in particular, the FAO Code of Conduct for Responsible Fisheries, the Sustainable Development Goals (SDGs - particularly SDGs 2 and 14), and other international instruments, as applicable. The strategic priorities should assist countries, as appropriate, to integrate AqGR conservation and management needs into wider national policies and programmes and frameworks of action at national, regional and global levels.
- The diversity of AqGR will ensure the ability of the aquaculture sector to sustainably meet changing and expanding market and societal demands and environmental circumstances, including climate change and emerging pests, parasites and diseases. Aquaculturists require farmed types of aquatic species that meet local needs and support local, national and global food and nutritional security and provide employment, including within rural communities, and that are resilient to a variety of biotic and abiotic factors, including extreme climatic conditions, diseases and diverse and evolving production systems.
- Because of interdependence, the conservation of a diverse range of AqGR in countries throughout the world reduces risks to production and supply continuity on a global basis and strengthens global food security.

- Wild and farmed AqGR are closely interdependent and should be considered collectively with regard to the conservation, sustainable use and development of AqGR.
- The baseline characterization and inventory of AqGR, and routine monitoring of wild stocks and farmed types for variability, are fundamental to genetic management and improvement strategies and programmes, for conservation programmes, and for contingency planning to protect valuable resources at risk.
- Knowledge and monitoring of the status of AqGR are essential to inform the development of policies and guidelines for the management of AqGR and to inform decisions by producers on which AqGR to utilize within production systems.
- The conservation of AqGR requires a blended approach and, while *in situ* conservation should be prioritized for key wild relative resources, *ex situ* conservation has a role to play, and this blend will likely be the main approach for conservation of farmed types.
- The effective management of AqGR at all levels, depends on the inclusion and willing participation of all relevant stakeholders. These stakeholders, including the key stakeholders such as government resource managers, policy-makers, academia and researchers and aquaculture producers and breeders, should play a role individually and collectively in the conservation and development of AqGR. It is important to understand and support the roles of these various stakeholders and their interest in AqGR such that they share fairly and equitably in the benefits arising from the utilization of these resources.

29. The main aims of the Global Plan of Action are:

- to improve the identification, characterization and description of AqGR, and their monitoring;
- to promote access to, and sharing of, information on AqGR at global, regional and national levels;
- to ensure the conservation of the important AqGR diversity of both farmed types and wild relatives, for present and future generations;
- to promote the sustainable use and development of AqGR, for food security, sustainable aquaculture development and human well-being in all countries;
- to accelerate the appropriate genetic improvement of farmed AqGR, to deliver genetic gains to support sustainable growth in aquaculture production;
- to address the need for the development of inclusive national programmes on AqGR that engage relevant stakeholders, including policy-makers, government and other resource managers, academia and researchers, aquaculture producers, intergovernmental and non-governmental agencies;
- to stress the important role that women play in the use and conservation of AqGR and to call for special efforts to be made to include women and women's cooperatives in programmes on AqGR management;
- to build capacity in the conservation, sustainable use and development of AqGR and related information on infrastructural and financial resources, training and education to enable more countries to benefit from and sustainably use AqGR;
- to promote protection of critical habitats for all development stages of AqGR and reverse the decline in many wild relatives of farmed aquatic species, including those caused by invasive alien species, and promoting ecosystem and ecoregional approaches as efficient means of supporting sustainable use and management of AqGR;
- to promote access to and the fair and equitable sharing of benefits arising from the use of AqGR in line with relevant international instruments, as applicable;

- to raise awareness and increase knowledge of AqGR by, for example, developing case studies that demonstrate how genetic improvement and associated knowledge can be used to increase food security, economic development and conservation of AqGR;
- to assist countries and relevant institutions in the establishment, implementation and regular review of national priorities, strategies and priorities for the sustainable use, development and conservation of AqGR;
- to strengthen national programmes and enhance institutional capacity – in particular, in developing countries and countries with economies in transition – and develop relevant regional and international programmes; such programmes should include education, research and training to address the characterization, inventory, monitoring, conservation, development and sustainable use of AqGR;
- to review relevant policies and national programmes and priorities with a view to create an enabling environment and mobilize the necessary human and financial resources for the sustainable use and exchange of AqGR and associated technologies, such as selective breeding; and
- to facilitate the development of voluntary guidelines and frameworks for enhancing management of AqGR, nationally and internationally.

Structure and Organization of the Global Plan of Action

30. The strategic priorities of the Global Plan of Action are grouped under four priority areas reflecting the division of the challenges and needs identified in the SoW-AqGR, as follows:

i. Characterization, inventory and monitoring

ii. Conservation and sustainable use

iii. Development of AqGR for aquaculture

iv. Policies, institutions, capacity building and cooperation

Each priority area identifies an associated long-term goal and lists a number of strategic priorities. Under each strategic priority, a specific goal is identified along with a list of actions to meet that goal. Some strategic priorities are related and interlinked or overlapping and thus actions foreseen may be relevant to more than one strategic priority.

31. Monitoring the implementation of the GPA is crucial and efforts will be made to establish adequate indicators for this purpose. In some cases, indicators that may be used for the monitoring of the implementation of the GPA are currently available, for others indicators may need to be developed. The indicators proposed must be provable and other indicators will be developed as needed. Indicators can potentially be generated from the AqGR information system currently being developed by FAO or other sources, including stand-alone targeted surveys.

PART II – STRATEGIC PRIORITIES FOR ACTION

Priority Area 1 – Inventory, characterization and monitoring

Establish and strengthen national and global characterization, monitoring and information systems for AqGR

Introduction

32. Monitoring and reporting on the status of AqGR are essential to enable their effective and efficient conservation, sustainable use and development. According to the SoW-AqGR, monitoring and reporting of AqGR are currently insufficient, especially below the level of species. While countries do 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 and data can be completely lacking, especially at the level below species.

33. There is considerable inconsistency and confusion in the use of terms to describe farmed types of genetic resources below the level of species. In order to enable data collection, monitoring and reporting of AqGR, a greater harmonization and standardization of procedures and terminology are required.

34. A small number of countries maintain information systems on the AqGR within their jurisdiction; however, neither the structure nor the approach to the collection and classification of information follow the same standards or principles. There is an urgent need for an agreed harmonized system for recording information on AqGR that allows the comparison of information provided by different countries and ensures interoperability of information systems that are globally comparable and compatible.

35. Given the importance of non-native species in global aquaculture production and the development of improved farmed types of AqGR in some countries, introductions and transfers of AqGR across national boundaries are commonplace. While some countries record these transfers, there is no globally standardized system for recording such exchanges of AqGR.[27]

Long-term Goal

Information on AqGR made accessible for and usable by Members and stakeholders via a detailed institutionalized and sustainably resourced global information system utilizing standardized terminology.

Strategic Priority 1.1:

Promote the globally standardized use of terminology, nomenclature and descriptions of AqGR.

Rationale

The SoW-AqGR identifies the lack of standardized nomenclature for describing AqGR below the level of species as a critical constraint to sharing and understanding information on farmed types. FAO has proposed a standardized nomenclature for farmed types of AqGR as a component of a prototype information system for AqGR.[28]

There are multiple genetic processes and technologies that change the genetic status of aquatic species under domestication including: domestication selection; inbreeding; genetic drift; selective breeding; hybridization and crossbreeding; ploidy manipulation; and development of monosex populations. These

[27] FAO does maintain a Database on Introductions of Aquatic Species (DIAS) but this is not regularly updated and records only first introductions of species (available at http://www.fao.org/fishery/topic/14786/en).
[28] The concept of farmed types and their definitions are provided in Mair, G.C. & Lucente, D. 2020. What are "Farmed Types" in Aquaculture and why do they Matter? *FAO Aquaculture Newsletter 61* (also available at http://www.fao.org/3/ca8302en/CA8302EN.pdf#page=40).

processes and technologies lead to multiple different farmed types in addition to the so-called wild-sourced farmed types that are represented by individuals that are directly collected from the wild for farming purposes. Inventory, characterization and monitoring of status and trends and associated risks will be greatly facilitated and strengthened by a common understanding of standardized descriptors of these farmed types.

Goal

Greater harmonization of terminology used to describe AqGR in the aquaculture community at all levels.

Actions

- Develop and disseminate among key stakeholders a web-based glossary or thesaurus of key terms for describing AqGR, including examples of usage, in multiple languages, to promote the globally standardized use of terminology.
- Disseminate standardized nomenclature among key stakeholders through implementation of a communication strategy including presentation at key aquaculture events (conferences and workshops), publication of a guide or article on terminology usage, and promotion of usage through social media and by key influencers in academia, industry and government.
- Establish or strengthen catalogues of standardized description of AqGR, including phenotypic and/or genetic characterization of AqGR at/or beneath the species level.

Strategic Priority 1.2:

Improve and harmonize monitoring and reporting procedures and expand existing species-based information systems to cover unreported or underreported AqGR.

Rationale

Existing national reporting systems on aquaculture production, with global reporting coordinated by FAO,[29] focus only at the level of species or collective species groups. Given the discrepancy between species lists communicated to FAO as part of production reporting, and species lists provided in the country reports submitted in the preparation of the SoW-AqGR, there is a lack of harmonization of reporting. The species for which production is reported to FAO are based on the Aquatic Sciences and Fisheries Information System (ASFIS) list of species, which includes a large number of species items (i.e. mainly groupings of species, but also includes a small number of hybrids) that do not enable identification of the genetic resource to the species level and thus cannot also be used to further classify farmed types of species.

The country reports contributing to the SoW-AqGR identified a number of species produced in aquaculture that are not indicated in the reporting of production data. Many of these species were non-food species such as ornamental species and micro-organisms. While priority should be given to food species, these non-food species should not be excluded from reporting systems as ornamental fish farming is an important livelihood option for rural communities, in particular rural women. Lastly, there are traditional culture systems for freshwater aquatic macrophytes in many countries, especially in Asia. Most of this production goes unrecorded.

Goal

Long-term resourcing and adoption of global metadata standards to facilitate exchange of AqGR records, at least at the species level, between information systems.

[29] Production data provided by countries are collected and made available by FAO through the FishstatJ information system, which is updated semi-annually (available at http://www.fao.org/fishery/statistics/software/fishstatj/en).

Actions

- Develop standardized reporting procedures and guidelines (including standard species and common names) for data collection and capture, including digital recording tools and reporting templates, and incentivize their use.
- Develop and conduct pilot studies on the development of national inventories of AqGR.
- Build the capacity of the national and regional institutions on standardized reporting procedures and systems.
- Secure long-term funding resources for information systems nationally, regionally and internationally.
- Produce and disseminate national, regional and global reports on the status of AqGR through established communication tools.

Strategic Priority 1.3:

Maintain and/or develop, promote and institutionalize national, regional and global standardized information systems for the collection, validation, monitoring and reporting on AqGR below the level of species (i.e. genetic diversity of farmed types and stocks).

Rationale

With the exception of very few national systems on aquatic biodiversity, existing information systems do not record information on AqGR below the level of species. The extreme paucity of data on these resources renders it extremely difficult to develop strategies and policies for effective conservation, sustainable use and development of these resources. It also means that producers often have no independent information on the farmed types available for culture, including information on their relative properties and the history of their genetic management.

This lack of information also means that it is impossible to fully evaluate and monitor the national, regional and global status of AqGR, especially below the level of species, for example in the context of SDG target 2.5 "…maintain genetic diversity of seeds, cultivated plants, farmed and domesticated animals and their related wild species…", with the result that AqGR are often ignored in actions taken to meet development goals or report against specific biodiversity indicators.

Goal

Long-term funding secured for the development and maintenance of an appropriate information system for AqGR.

Actions

- FAO to continue to develop and promote an information system for AqGR that is capable of recording and generating information globally, regionally and nationally and to train key stakeholders in its use.
- FAO to complete implementation of the global information system and seek long-term funding resources.
- Develop and implement a strategy to communicate and disseminate key messages on the value and benefits of the information system for farmed types of AqGR to relevant stakeholders, including governments, fishers and fish farmers and other relevant stakeholders.
- Strengthen monitoring systems at national and regional level for AqGR (e.g. through Technical Cooperation Programmes).
- Identify national information systems on AqGR and promote integration with FAO AqGR information system.

- Raise awareness among all stakeholders on the importance of the establishment of an information system on AqGR with a view to facilitating their participation.

PRIORITY AREA 2 – CONSERVATION AND SUSTAINABLE USE OF AQGR

Promote the conservation and sustainable use of cultured and wild relative AqGR

Introduction

36. Given the relatively recent domestication of most species used in aquaculture, most present-day cultured farmed types still retain most of the genetic diversity present in their wild relatives and thus have the potential to deliver significant gains in commercially important traits through selective breeding. This presents the opportunity to retain this genetic diversity for the future, ensuring the potential for long-term genetic gains, through effective management and development of genetic diversity in domesticated farmed types.

37. Wild relatives still exist for all aquaculture species, although some are threatened. Threats come from habitat change and loss, environmental change including climate change, overfishing, spread of diseases, parasites and invasive species and even sometimes from aquaculture including through the deliberate (e.g. for enhancement of commercial and recreational fisheries) or accidental release of genetically changed aquaculture farmed types into the wild. Climate change represents a growing challenge, particularly with extreme and increasingly frequent events such as storms and marine heatwaves, capable of wiping out entire populations, and also through modifying the relative distribution of species. Climate change can also present opportunities, for example by making culture of species possible in locations where it was not previously possible.

38. There is often a lack of information on the conservation status of wild relative stocks. As of April 2021, up to 5.4 percent of aquatic species used for food are listed in the appendices of the Convention on International Trade in Endangered Species (CITES) and 10.5 percent of cultured species referenced by the International Union for Conservation of Nature (IUCN) are classified as vulnerable or with a higher risk status. Wild relatives of farmed species are essential reservoirs of genetic diversity for the species in the wild and also for the future development of farmed types, and thus need to be conserved.

39. In the context of AqGR, conservation focuses on preserving the genetic diversity present in the national, regional and global gene pools of AqGR species. Given that there are relatively few developed farmed types (e.g. strains and varieties) that are under threat and must be conserved, current conservation efforts need to focus mainly on wild relative genetic resources. Thus, for AqGR, the current priority for conservation is to preserve the genetic resources of wild relatives as the main reservoirs of genetic diversity for the future development of farmed types of aquatic species, with a focus on those most under threat both locally and globally.

40. Sustainable use, in this context, relates more narrowly to farmed aquatic species under domestication and it is important to recognize the opportunity to effectively manage and thus sustainably utilize these resources and conserve this genetic diversity before it is lost. Lack of attention to management of genetic diversity in domesticated farmed types can lead to loss of genetic diversity and inbreeding and there are many documented cases of this occurring. Also uncontrolled hybridization in aquaculture can lead to species introgression, resulting in the loss of the discrete species. Such practices of poor genetic management amount to unsustainable utilization of the genetic resource.

41. Sustainable use, in the context of AqGR, applies to the effective genetic management of farmed types during and subsequent to the domestication process. However, the genetic status of most farmed types of species under domestication is unknown and is not monitored.

42. Use of non-native species is common in aquaculture and introductions and exchange of genetic resources (both native and non-native) between countries occur frequently. Introduction of non-native species or even of farmed types of native species carries potential risk of impacts on the ecosystem and genetic contamination of indigenous genetic diversity.

Long-term Goal

AqGR, including native and non-native species, their farmed types and wild relatives, are conserved and sustainably used for the benefit of aquaculture, culture-based fisheries, commercial and recreational fisheries, and sustainable ecosystems.

Strategic Priority 2.1

Identify wild relatives of AqGR most at risk and ensure that they are managed sustainably and appropriate conservation measures are implemented where necessary, nationally and regionally.

Rationale

Wild relative genetic resources represent the principal reservoir of genetic diversity for most aquaculture species and some are under threat and thus need to be conserved. Due to the relative lack of information on AqGR and particularly of the threat status of the majority of cultured species, it is important to put in place monitoring systems, for example by incorporating data on risk levels in an information system on AqGR.

Once identified as at-risk, appropriate conservation measures will need to be developed at a national, regional or even global level prioritizing *in situ* conservation where feasible. Measures of *in situ* conservation can include effective fisheries management (for fished stocks), aquatic protected areas, spatial management and zoning, and habitat protection/restoration.

There is a need to maintain the genetic resources of migratory species and to maintain the heterogeneity of the species through the preservation of their habitats.

In situ conservation may be supplemented or, in extreme cases, supplanted by *ex situ* conservation in the form of live gene banks or *in vitro* gene banks such as cryoconservation on gametes or embryos (in some species).

Goal

Wild relative genetic resources conserved as reservoirs of genetic diversity and local/global extinction of wild relative species prevented.

Actions

- Promote, develop and implement participatory processes to identify the risk status of stocks of wild relative species and develop lists of those at risk.
- Promote effective *in situ* conservation, to protect threatened wild relatives of AqGR, supplemented by *ex situ* conservation where needed.
- Put in place monitoring systems to assess abundance and genetic status of at-risk stocks of wild relatives.

Strategic Priority 2.2

Anticipate the current and future impacts of environmental change, including climate change, on AqGR and respond accordingly.

Rationale

The SoW-AqGR identifies climate change as an important driver of predominantly, but not exclusively, negative changes in both farmed AqGR and their wild relatives, especially where species may already be cultured at the limit of their thermal tolerance range. Fifty percent of responding countries indicated that climate change would have a negative or strongly negative impact on farmed type genetic resources and the report lists a series of such potential impacts. Some positive impacts were also noted.

There is a need to expand assessments of anthropogenic and environmental factors affecting aquatic ecosystems. Efforts to address the implications of climate change for fisheries and aquaculture should strongly emphasize the ecological and economic resilience of fisheries and aquaculture operations in the development of effective and adaptive management systems.

Many of the identified impacts concerned terrestrial and freshwater ecosystems and coastal environments, with correspondingly fewer concerning marine systems. The impacts were typically related to effects on wild relatives, but also included culture systems (farmed types) in some instances.

General ecosystem-level changes affect water availability, hydrological regimes and habitats, which have a variety of knock-on effects on AqGR, particularly on wild relatives.

It is important to be able to recognize these changes and the threats they pose to AqGR and develop appropriate responses including targeted conservation programmes.

Goal

Impacts of environmental change on AqGR and wild relatives effectively monitored and conservation and mitigation measures implemented.

Actions

- Monitor and anticipate the current and future impacts of environmental change, including climate change, on AqGR and respond accordingly.
- Develop climate change scenarios for key habitats (including acidification) and their impact on cultured species including wild relatives.
- Expand research and development into impacts of climate change and mitigation measures involving AqGR including the genetic basis for resilience and adaptation to changing environment.
- Implement appropriate conservation measures for AqGR most at risk from impacts of environmental change.
- Identify where genetic management and improvement can play a role in mitigating the impacts of environmental change (e.g. selection for greater environmental tolerance traits).

Strategic Priority 2.3

Actively incorporate in situ *conservation of AqGR in the development of fisheries management and ecosystem-based management plans, particularly for threatened species.*

Rationale

The SoW-AqGR identifies managed fisheries and aquatic protected areas as important components of the conservation of wild relative stocks of farmed fish species. Under certain conditions, well-managed fisheries can be considered as a form of *in situ* conservation when the objective of the fishery management plan is to maintain natural populations and the ecosystem that supports them.

The ecosystem approach to fisheries (EAF) encompasses a broad view of fishery management and fishery managers around the world are adopting the EAF and similar approaches. The objectives of a fishery management plan or an aquatic protected area should be clearly stated and should indicate whether they would be considered as *in situ* conservation. Furthermore the relevance of any conservation objective, including retention and management of unique genetic diversity, to aquaculture, should be acknowledged.

Restocking or stock enhancement, e.g. in support of commercial and recreational fisheries (both of which can provide economic benefit to coastal communities), should consider risks associated with these releases but also the opportunities they present to meet conservation goals.

Goal

Proportion of fisheries management plans (including stock enhancement programmes) and aquatic protected area management plans that acknowledge their role in managing and, where appropriate, conserving AqGR for wild relative species increased, including as a resource for aquaculture.

Actions

- Follow EAF and ecosystem-based management (EBM) to address fished species (used in aquaculture) and also relevant non-target species.

- Promote collaboration among fishery managers, aquaculture managers and conservationists.
- Incorporate conservation into fishery management and stock enhancement objectives where appropriate, considering genetic variability as well as real stock size.
- Promote use of genetic tools in fishery stock assessment and management.

Strategic Priority 2.4

Promote ex situ *conservation for AqGR, including wild relatives and threatened species.*

Rationale

While *in situ* conservation (including *in situ* on farm conservation) should be the preferred approach for conservation of species and genetic diversity of AqGR, *ex situ* conservation can be an important adjunct or alternative where wild relatives are not or cannot be effectively conserved *in situ*. *Ex situ* conservation should be integrated with any *in situ* management efforts and should consider the future genetic status of both wild relative and farmed resources.

In vivo ex situ conservation is generally practised in live gene banks and breeding centres but requires significant resources in the case of large and fecund species such as many finfish and crustaceans, although it can be more feasible and cost-effective for micro-organisms.

In vitro conservation can be effective for certain AqGR, particularly micro-organisms, male gametes (e.g. cryopreserved sperm banks) and some early life history stages of molluscs, but currently has limited application for many aquaculture species due to the difficulties of cryopreserving eggs and embryos.

The goal *of ex situ* conservation should be to maintain the genetic diversity and integrity of the conserved genetic resource allowing for minimum genetic change such as genetic drift or inbreeding, e.g. through control of effective population size and controlling and minimizing selection forces.

Goal

Threatened and important AqGR conserved in *ex situ* gene banks in support of aquaculture development and *in situ* conservation.

Actions

- Develop and promote guidelines and best practices for both *in vivo* and *in vitro ex situ* conservation that ensure effective maintenance of genetic diversity.
- Develop methodologies for *ex situ in vitro* conservation including cryoconservation of oocytes and embryos.
- Identify most at-risk AqGR that cannot be conserved effectively *in situ*.
- Establish *ex situ* conservation programmes, as required.
- Link *ex situ* and *in situ* conservation in regard to threatened and important species.
- Support networking of existing gene banks within regions and globally.
- Consider the role of aquaculture and specifically hatcheries for *ex situ* conservation of genetic resources.

Strategic Priority 2.5

Improve sustainable use of domesticated farmed types through improved management of genetic diversity.

Rationale

In aquaculture, sustainable use of AqGR is the management of the domesticated genetic resource in the aquaculture systems with the focus on retaining genetic diversity and genetic integrity of species and farmed types within seed supply systems. Many domesticated AqGR retain relatively high levels of

genetic diversity they inherited from their wild relatives but this can and is being lost without careful management of genetic diversity, for example through monitoring of effective population size and inbreeding.

Deliberate and accidental hybridization is relatively common in aquaculture given the ease of breeding between species and even between some genera, and hybrids are often fertile. While benefits can arise from hybridization through hybrid vigour of specific combinations of desirable traits, indiscriminate or unconscious application of hybridization can lead to species introgression and loss of genetic integrity of species in the aquaculture environment and even potentially in wild relative resources, in the case of release or escape of aquacultured farmed types.

Culture of species for release into the natural environment (e.g. in support of commercial and recreational fisheries or for conservation) should be considered as a special case and genetic diversity and the risk to the genetic integrity of wild stocks must be considered and mitigated in such programmes.

Goal

Productivity improved through retention of genetic diversity and genetic integrity of species and farmed types in seed supply systems.

Actions

- Promote application of basic principles of broodstock management within seed supply systems, including by applying minimum effective population sizes and preventing unplanned introgression between species/farmed types.
- Develop and promote use of effective tools for monitoring the genetic status of farmed types within seed supply systems.
- Develop recommendations and guidelines for genetic management of cultured resources for release into the natural environment.

Strategic Priority 2.6

Safely manage and control the use and exchange of AqGR taking into account national and international instruments, as applicable.

Rationale

Given the risks associated with introductions, especially of non-native species and genetically changed and modified farmed types, and the high frequencies of exchanges and transfers that occur in aquaculture, it is important that introductions and exchanges of AqGR for aquaculture (including for non-food purposes such as of ornamental species) are effectively managed and regulated and based on appropriate analysis of risks and benefits. Existing codes of practice do not address the products of many genetic improvement technologies and international guidelines do not exist for the responsible use and control of non-native species and genetically changed farmed types.

Goal

Farmed types safely exchanged and used.

Actions

- Promote more widely existing codes of practice and guidelines on the introduction and transfers of aquatic species and farmed types.

- Revise or develop and promote guidelines on risk-based best practices for use and exchange of different farmed types of AqGR incorporating key elements of existing codes of practice (e.g. ICES[30] and EIFAC[31]).
- Promote development and use of material transfer agreements to ensure responsible use of AqGR and prevent or mitigate the risks associated with introductions, especially of non-native species and genetically changed and modified farmed types.
- Promote evaluation and monitoring of the properties of farmed types of AqGR.
- Increase public and industry awareness and communication on risks and benefits of genetic improvement technologies.

[30] ICES (International Council for the Exploration of the Sea). 2005. *ICES Code of Practice on the Introductions and Transfers of Marine Organisms* 2005. 30 pp. (available at https://www.nobanis.org/globalassets/ices-code-of-practice.pdf).

[31] Turner, G.E. 1988. *Codes of practice and manual of procedures for consideration of introductions and transfers of marine and freshwater organisms*. EIFAC/CECPI Occasional Paper No. 23. 44 pp. (available at http://www.fao.org/3/ae989e/ae989e00.htm).

PRIORITY AREA 3 – DEVELOPMENT OF AQGR FOR AQUACULTURE

Accelerate the development and uptake of genetic improvement of aquaculture farmed types with a focus on the expansion of selective breeding programmes.

Introduction

43. There is great potential to further improve aquaculture production through the genetic improvement of AqGR. Though numerous genetic improvement technologies exist for improving production efficiency and profitability in aquaculture, their advantages and disadvantages are not always well understood and appropriate assessment of risks and benefits is often lacking. Misunderstanding and miscommunication of the roles and risk of different technologies are commonplace. Hence, risk-benefit assessment based on scientific facts of all technologies used in aquaculture should be considered a high priority.

44. Planned development and management of AqGR are lacking for most farmed aquatic species, and countries are not realizing the benefits of effective and appropriate application of genetic management and improvement. The slow adoption of genetic improvement programmes limits their impact on global aquaculture production, even for some major aquaculture species.

45. Adoption of conventional selective breeding is still limited even though it is considered the core approach that is needed to underpin progression in genetic improvement. Such programmes can be expensive to initiate and are often considered the remit of government agencies. There is, however, evidence that public–private partnerships, cooperatives and commercial breeding companies can be effective in building and sustaining long-term genetic improvement programmes. As in crops and livestock, selective breeding programmes have proven effective in a range of aquatic species across different taxa and have been shown to deliver strong returns on investment.

46. Other genetic improvement approaches such as hybridization, crossbreeding, ploidy manipulation, monosex production and transgenesis can be applied to enhance production and further improve targeted traits. While these can, in most cases, also be applied in standalone programmes, they are better integrated with selective breeding programmes to add value to cumulative improvements in quantitative traits while retaining effective management of genetic diversity. This combined approach more effectively delivers long-term sustained improvement focused on an expanding list of specific and important traits.

47. Genetic improvement of the majority of aquatic species lags far behind that in the majority of terrestrial agriculture for crop and livestock species, due primarily to their relatively recent domestication. However, given that much of the genetic diversity present in wild relative stocks is retained within these domesticated farmed types there is a huge opportunity, if managed well, to deliver impressive gains through selective breeding. Gains of 10 percent per generation are feasible for commercially important traits in a range of species across different taxa.

Long-term Goal

Increased adoption of demand-driven genetic improvement programmes enhancing the efficiency and sustainability of aquaculture production and delivering benefits to the consumers, broader society and the environment.

Strategic Priority 3.1

Improve understanding of the properties, benefits and potential risks (and effective risk mitigation mechanisms) of genetic improvement technologies and their application to AqGR.

Rationale

Lack of awareness of the potential benefits, risks and the requirements for breeding programmes constrain their adoption or can lead to inappropriate application of genetic improvement technologies. In the development of any aquaculture sector there comes a point where genetic improvement programmes are warranted based on a number of factors including the scale and value of production, the entities involved in production, the maturity of the sector and the extent of demand for improvement

in key traits of the farmed types produced. It is important to recognize when it is appropriate to initiate genetic improvement programmes and what genetic technology and breeding programme approach is likely to best address the demand. For example, hybridization can be relatively straightforward to apply and cost effective and can deliver improvements in commercial traits through heterosis (also known as hybrid vigour) or a specific combination of traits. However, it does not deliver cumulative gains over generations and carries the risk of unwanted and uncontrolled species introgression and loss of species purity.

Lack of awareness among decision-makers can lead to inappropriate policies governing the use of genetic improvement technologies. Improved awareness of the properties of different genetic improvement technologies, including methods and resource requirements, can provide confidence for government and private sector investors to plan and support appropriate applications of genetic improvement. For this, understanding of the associated risks generated by the genetic changes resulting from improvement and the costs vs benefits is also crucial.

While transgenesis currently plays a very minor role in aquaculture production, more recent developments, such as gene editing, may have significant potential to contribute to production gains and, in some cases, to reduce the risks of aquaculture. However, the relative risks and benefits of this nascent technology are not yet well understood. Hence, broad, independent and interdisciplinary investigations of responsible research and innovation processes are required to secure trust and support responsible applications of such new genetic improvement technologies.

Goal

Understanding among key stakeholders in AqGR of the relevant and important issues, needs and challenges inhibiting the greater uptake of appropriate and impactful development of genetic resources in aquaculture broadened.

Actions

- Develop and distribute guidelines on appropriate application of genetic improvement technologies including their risks and benefits, to be used as a decision support tool in the development of genetic improvement strategies at national and regional levels.
- Develop and disseminate genetic improvement risk assessment and mitigation tools and programmes.
- Develop and organize (online) courses and webinars on basic genetic improvement in aquaculture species for different target groups (e.g. farmers, breeders and governmental officers).
- Conduct national and/or regional stakeholder consultations on appropriate genetic improvement strategies for key species.
- Develop and implement media communication strategies on benefits and risks for producers and consumers (sensitization).
- Review and identify lessons learned from genetic improvement strategies and related communication within terrestrial agriculture and history of aquaculture breeding strategies and communication including the importance of accurate trait measurement.
- Develop or support the role of biosafety committees in the development of genetic resources for aquaculture.
- Encourage discussion among stakeholders and discipline experts in a range of fora to deepen understanding of genetic improvement technologies to optimize practical and sustainable solutions to a range of aquaculture issues.

Strategic Priority 3.2

Promote greater adoption of well-managed, long-term, selective breeding programmes as a core genetic improvement technology with a focus on major aquaculture species.

Rationale

Well-managed selective breeding programmes combine selection for commercially important quantitative traits with effective management of genetic diversity and are considered a core technology for genetic improvement in aquaculture. Nevertheless, adoption rates remain relatively low and growth is slow, especially for major aquaculture species in developing countries that are important to food security (e.g. Indian and Chinese major carps).

It is necessary to address the constraints to adoption of selective breeding and promote its wider uptake. The reasons for the relatively slow adoption of genetic improvement in aquaculture are complex and not well understood but are likely to include: lack of responsible research and innovation processes; lack of appreciation of the scale of benefits that can arise; lack of private investment and long-term public support; the perception that programmes must be large in scale and thus resource-intensive; limited focus on short-term public-sector programmes and consequent lack of engagement of the private sector (especially for lower-value species in the developing world); challenges in protecting the results of improvement programmes; concerns over the negative genetic impacts of selectively bred farmed escapees on their wild relatives; and lack of human resource and infrastructure capacity to implement breeding programmes.

Goal

Enabling environment created for accelerating the adoption of well-managed breeding programmes leading to a doubling of the contribution of improved farmed types to aquaculture production in the next ten years.

Actions

- Develop regionally applicable training packages for breeders/producers on the benefits and risks of genetic improvement for national and regional delivery.
- Promote development of value propositions (e.g. through workshops with national focal points) for genetic improvement in relation to food security, economic development and livelihoods.
- Identify and communicate to key stakeholders case studies of well-managed, successful and impactful local, national and/or regional breeding programmes identifying the roles of public and private agencies.
- Foster public/private collaboration, including with farmer associations, in the development of long-term breeding programmes including provision of tools to support knowledge-based management of broodstock (locally, nationally, regionally, and globally).
- Develop guidelines for national and/or regional benchmarking of performance characteristics (including genetic diversity indices) of available native and non-native farmed types and promote their application.
- Support scientific research to underpin the development of appropriate policies, on: (i) effective access to and integration of molecular technologies, such as genomic selection and genotyping services, in selective breeding programmes; (ii) risks to the environment posed by genetically improved farmed types; and (iii) genetics-based climate change mitigation and monitoring strategies.
- Promote international and regional cooperation and networking on genetic improvement of transboundary AqGR including exchange of data and information among institutions responsible for AqGR for fisheries and aquaculture, development agencies and relevant international organizations.

Strategic Priority 3.3

Establish national and/or regional development strategies and programmes for species and farmed types, responsive to market and societal needs, to unlock the full potential of AqGR.

Rationale

Relatively few countries have national strategies that prioritize species and traits for development of farmed types for aquaculture that provide a framework for research priorities, infrastructure development, risk management and mitigation, and investment. In part such strategies need baseline information on the genetic resources available, which could be generated by an AqGR information system (as proposed under priority area 1). Strategies would also need to be informed by future priorities such as changes in market demand and environmental changes such as might arise from climate change. Countries also need to have in place the minimum requirements for sustainable management of AqGR[32] and consider the appropriate respective role of public and private sector stakeholders and the management of intellectual property issues.

Strategies should create an enabling environment to support stakeholders in seed supply systems to sustainably manage their genetic resource and initiate genetic improvement when it is timely to do so and using the most appropriate technology to realize the optimum benefit to the specific sector.

Strategies and associated policies and legal frameworks should also respect relevant international instruments, as applicable, such as the CBD, the Cartagena Protocol on Biosafety and the Nagoya Protocol on Access and Benefit sharing and be consistent with national policy.

Strategies and policies should also consider the evaluation, monitoring and registration of new farmed types arising from genetic improvement programmes.

Goal

Countries and intergovernmental organizations develop and implement strategies for the development of key AqGR based on understanding of risks and benefits of different approaches.

Actions

- Conduct foresight and market analysis and involve different stakeholders (e.g. consumers, retailers, farmers, non-government organizations and scientists) to establish priority goals for genetic improvement and develop benefit–cost analysis models as decision support tools.
- Create enabling environments for genetic improvement within seed supply sectors by identifying and addressing the key concerns of stakeholders and through development and implementation of supporting strategies and policies.
- Develop and implement strategies and policies (supported by capacity building and technical input) to enable implementation of local, national and regional breeding programmes. These may include appropriate integration with conservation initiatives and should incorporate monitoring and evaluation of the impact of these strategies and policies.
- Promote development and implementation of local, national and regional breeding programmes for development of improved farmed types of native and non-native species suited to local conditions and markets including delivery of improved farmed types to the market.
- Encourage public and/or private entities and regional funding agencies to support genetic improvement of economically important aquaculture species.
- Review legal frameworks, underpinning species selection and farmed type development, in line with relevant international instruments such as the CBD, the Cartagena Protocol and the Nagoya Protocol on Access and Benefit sharing.
- Develop systems for evaluation and registration of improved farmed types.

[32] FAO. 2018. *Development of aquatic genetic resources: A framework of essential criteria*. Aquaculture Development 9. TG5 Suppl. 9. Rome. 88 pp (also available at http://www.fao.org/3/ca2296en/ca2296en.pdf).

- Ensure an appropriate balance between the development of aquaculture of new species (both native and non-native), and development of farmed types of existing cultured species.

Strategic Priority 3.4

Raise capacity of stakeholders in aquaculture to develop improved farmed types.

Rationale

Significant know-how and expertise are required to implement comprehensive and well-managed breeding programmes capable of delivering optimized genetic gains and to avoid inbreeding and negative impacts on organisms' health and welfare. Such expertise includes quantitative genetics and data management and analysis expertise and in some cases molecular biology expertise, in addition to an understanding of aquaculture, husbandry and breeding of the target species. This expertise is often lacking, especially in the area of quantitative genetics expertise.

Some cultured species can represent transboundary resources both in terms of the original source populations and also in the development of improved farmed types. In such cases opportunities can arise for cooperative approaches to genetic improvement through regional breeding programmes, and global programmes may even be possible. Such programmes can utilize a wider network of experts to assist with the design and operation of genetic improvement programmes.

Goal

Human resources are no longer a limitation to the appropriate implementation of genetic improvement and the adoption of improved farmed types in aquaculture. Capacity development programmes ensuring long-term availability of capacity, including succession planning.

Actions

- Establish national and/or regional stakeholder networks, platforms or partnerships (or integrate these into existing networks) including directories of experts in the region, to develop cooperative actions in genetic improvement and quantitative genetics. Call upon donors to support such platforms.
- Engage partners with expertise in genetic resource development and management and advanced scientific institutions to develop training materials and develop a roster of experts for training in genetic improvement technologies.
- Conduct national and/or regional workshops/conferences (independently or within sessions in aquaculture conferences) to discuss and provide updates on new technologies in the development of AqGR. Conduct regular training needs assessments at the national and regional levels to ensure capacity building is appropriate to the future needs of the sector.
- Encourage funding agencies to support capacity building in the identified areas (e.g. quantitative genetics) that lack the necessary human resource.
- Educate and train key stakeholders on genetic improvement and improved husbandry and biosecurity for selective breeding by providing training and technical support for the breeding activities within farming communities and the integration of improved husbandry practices in AqGR development programmes.

PRIORITY AREA 4 – POLICIES, INSTITUTIONS AND CAPACITY BUILDING

Promote the development of AqGR-related policies, support the development of stakeholder institutions and build capacity to support the management of AqGR.

Introduction

48. The SoW-AqGR indicates that policies and institutions addressing AqGR are many and must deal with multiple drivers and a diversity of stakeholders in the aquatic environment. Where policies and management plans exist for AqGR, be they at national or international levels, they are often ineffective due to a lack of awareness and lack of human and financial resources necessary for proper implementation, monitoring and enforcement.

49. In addressing AqGR, policy-makers and institutions face the challenge of having to cover a wide variety of habitats, economic situations and sociocultural environments and multiple stakeholders and users of AqGR. Aquaculture competes with many other economic sectors, such as fisheries, agriculture, tourism and other industries for the same habitats and resources.

50. Given the frequency of imports and exports of AqGR driven in part by the extensive use of non-native species in aquaculture, policies addressing AqGR need to consider the transboundary dimension of managing AqGR. Policies must also consider access and benefit-sharing (ABS), long-term development strategies for aquaculture, conservation, stock enhancement, climate change, the role of financial subsidies and non-food uses. Aquaculture is also indirectly impacted by policies and legislation outside those directly impacting agriculture and fisheries.

51. This complexity, inherent to regulating aquaculture, has resulted in inconsistencies and gaps in national policies. For example, conservation policies may be critical of or ban introductions of non-native aquatic species that are promoted by the aquaculture sector. There is often both, a lack of awareness of the value of AqGR and the needs of people that depend on them, and corresponding lack of awareness of the risks associated with introductions and how these may be mediated.

52. While the conservation, sustainable use and management of AqGR fall within the scope of various international instruments and are explicitly addressed by soft law instruments, such as the FAO Code of Conduct for Responsible Fisheries, and the ICES Code of Practice on the Introductions and Transfers of Marine Organisms, comprehensive national policies or strategies, let alone legal measures, addressing the conservation, sustainable use and development of AqGR at national level are often lacking.

53. Increasingly, legislative, administrative and policy measures addressing access to and the sharing of benefits arising from the utilization of genetic resources might play a role for research and development in AqGR. However, ABS measures accommodating the distinctive features of AqGR are rare. Intellectual property rights could play an increasingly important role in the development of AqGR.

54. Key stakeholders, including institutions, policy-makers, extension providers, resource managers, fishers and fish farmers, generally lack the capacity to fully address the complexities of conservation, sustainable use and development of AqGR within or across the fishery and aquaculture sectors. Also, capacity-building needs and priorities differ among regions and according to countries' status of aquaculture development and economic status. Overall there is a lack of awareness of the value of AqGR in fisheries and aquaculture and thus there is a need to build awareness and capacity in research, development, education and training in order to ensure the conservation, sustainable use and development of AqGR based on sound science and effective natural resources management.

55. According to the SoW-AqGR, countries have varying training and capacity-building priorities but overall identify basic knowledge of AqGR and capacity building in the characterization and genetic improvement of AqGR as priorities. Research priorities also vary based on the state of aquaculture research and development of countries.

56. Opportunities for cooperation and collaboration in managing AqGR exist, especially for transboundary resources. Regional and global networks have, in the past, facilitated capacity building

and communication/collaboration on management of AqGR but these mechanisms have generally not been sustained.

Long-term Goal

Capacity to support sustainable and efficient implementation of AqGR policy that takes into consideration environmental and economic dimensions enhanced through dedicated institutions.

Strategic Priority 4.1

Develop or revise, implement and monitor strategies and policies for the conservation, sustainable use and development of AqGR in cooperation with relevant stakeholders.

Rationale

The development of dedicated national policies or strategies is essential for the conservation, sustainable use and development of AqGR. Given the importance of AqGR and the value associated with their effective and sustainable management, it is important that relevant policies and strategies are reviewed or developed, as appropriate, in cooperation with relevant stakeholders. Inconsistencies between different policy instruments (for example those governing aquatic food species and ornamental species) need to be identified and addressed.

The implementation of national policies or strategies needs to be monitored to ensure they are delivering the targeted outcomes.

Goal

Dedicated policies or national strategies addressing the conservation, sustainable use and development of AqGR are implemented and implementation is monitored.

Actions

- Raise awareness and enhance capacity of policy-makers to support management of AqGR through training programmes and sharing of knowledge on AqGR.
- Promote the review or development, as appropriate, of national policies/strategies for the conservation, sustainable use and development of AqGR in consultation with relevant stakeholders.
- Support the implementation of national and regional strategies for the conservation and sustainable use and development of AqGR including transboundary resources.
- Develop and support networks of private/public gene banks (*in vivo* and *in vitro*) at national and regional level to support the conservation and sustainable use of AqGR.

Strategic Priority 4.2

Improve global, regional and national exchange of information and network activities on AqGR and raise awareness of the importance of AqGR among relevant stakeholders, including of the roles that indigenous peoples and local communities, youth and women, play in the conservation, sustainable use and development of AqGR.

Rationale

Aquaculture and fishing of wild relative species involve numerous sectoral stakeholders including women, youth, indigenous peoples and local communities. It is thus important to promote understanding among regulators and policy-makers of the roles and interests of all stakeholders, including indigenous peoples and local communities, women and youth, and develop means to effectively engage these stakeholders.

The effective management of AqGR has a vital role to play in securing the future of aquatic food supply and in enabling continuing and sustainable expansion of production from aquaculture delivering in turn

socio-economic benefits from the sector. However, this role of AqGR is not well understood nor effectively communicated to and among the stakeholders in aquaculture including the consumers of aquatic food.

This Global Plan of Action and its effective implementation has an important role to play in promoting awareness of the importance of the role of AqGR in food aquatic food supply.

Goal

Stakeholders and public better informed about aquaculture, the important role that the management of genetic resources plays in securing the future availability of sustainably produced aquatic food and the opportunities and risks associated with genetic improvement of AqGR.

Actions

- Establish campaigns and outreach models to raise awareness on the role of management of AqGR, including by women, indigenous peoples and local communities (IPLC) and youth.
- Develop and promote material, including in local languages, to be used at key aquaculture events to raise awareness on aquaculture and to increase the involvement of specific target groups in the conservation, sustainable use and development of AqGR.
- Hold regular meetings to share information on AqGR including the implementation of the Global Plan of Action.

Strategic Priority 4.3

Support the responsible introduction, exchange and use of AqGR, including through appropriate risk assessments, adequate policies and their effective implementation.

Rationale

Given the ongoing importance of non-native species in aquaculture and the economic benefits they can deliver, consideration of the risks that they can pose to native genetic resources, and the environment more generally, is very important. The introduction, exchange and use of non-native AqGR must be carried out responsibly and be regulated through legislation to incorporate appropriate assessment and management of risks to be considered alongside the potential benefits. Well-designed decision support tools may support this process.

As the genetic development of farmed types progresses, for example through the accelerated uptake of selective breeding, the properties of farmed types will change and thus the risks involved in their use may also change. It is thus important to carefully consider the risks associated with developed farmed types, including of native species, when developing national and regional legislation concerning their introduction, exchange and use for aquaculture.

Responsible introduction, exchange and use of non-native species and developed farmed types will require control systems to enable the international traceability of these AqGR.

Goal

Responsible use of AqGR incorporated into national legislation.

Actions

- Develop measures, including guidelines, to ensure responsible introduction and exchange of AqGR for aquaculture based on the ICES Code of Practice on the Introductions and Transfers of Marine Organisms and other relevant policy instruments.
- Develop and effectively implement national and regional legislation for the responsible use and exchange of AqGR, also in line with relevant international agreements.
- Incorporate AqGR issues into risk assessment processes to improve control systems in the international traceability to include farmed types as well as species.

- Consider the development or expansion of information systems on introductions and transfers of AqGR ensuring timely notification of imminent imports of AqGR that may pose risks to countries' native genetic resources and the environment more generally.

Strategic Priority 4.4

Implement existing international agreements and instruments relevant to the conservation, sustainable use and development of AqGR.

Rationale

There are a range of international agreements that relate to the conservation, sustainable use and development of AqGR such as the CBD and CITES. The SoW-AqGR demonstrates that awareness of the role of these agreements for the long-term management of AqGR is rather limited among relevant stakeholders. There is therefore a need to raise awareness of the specific provisions of and obligations under these instruments in relation to AqGR.

Goal

International and regional agreements fully implemented in relation to AqGR taking into account the specific needs of the sector.

Actions

- Raise awareness and implement existing international agreements relevant to the conservation, sustainable use and development of AqGR, while ensuring that national policies and regulatory frameworks meet international obligations and reflect the importance of AqGR for food security; the distinctive features of these resources; the importance of science and innovation; the need to balance the goals and objectives of the various agreements; and the interests of regions, countries and stakeholders (including fishers and farmers).

Strategic Priority 4.5

Establish or strengthen national institutions, including national focal points, for planning, implementing and monitoring AqGR measures, for aquaculture and fishery sector development.

Rationale

The number of national focal points (NFPs) for AqGR has increased significantly since the initial request for nominations was made by FAO. In April 2021, 67.5 percent of the Commission's Members had nominated NFPs for AqGR. However, a significant number of Members have not yet nominated NFPs. NFPs can be important catalysts for improvement of management of AqGR in their countries and regionally and efforts should be made to enhance engagement with and among them and to build their capacity. NFPs could develop platforms for relevant institutions, stakeholders, private and public sectors, to develop concerted action plans and share relevant information, for example through national AqGR status reports.

According to the SoW-AqGR, almost all countries have at least one institution specifically dedicated to AqGR. National and regional institutions dedicated to aquaculture and/or the management of genetic resources are important and may act as catalysts for change. They may play a key role in building capacity and raising awareness of the needs and challenges AqGR management faces, in mobilizing resources, in engaging more proactively the sector and in building linkages and enhancing cooperation and collaboration.

Goal

National institutions, including NFPs established or strengthened.

Actions

- Nominate NFPs for AqGR and build capacity of NFPs through regular training, information sharing, regional networking and participation in research calls.
- Mobilize national and international resources for institutional development programmes for AqGR and support NFPs and institutions to engage in development of national strategies on AqGR.
- Establish better linkages and mechanisms to enhance coordination and collaboration between institutions on technology policy implementation and information sharing.

Strategic Priority 4.6

Establish or strengthen national and regional institutions for characterization, inventory, and monitoring of trends and associated risks, as well as for education and research on AqGR, and establish intersectoral coordination of their management, including economic valuation, characterization and genetic improvement.

Rationale

According to the SoW-AqGR, almost all countries have one or more institutions that engage in research and/or education and training in relation to AqGR but many reported the need to build capacity in these institutions. The report further identifies as main capacity-building needs for research institutions basic knowledge on AqGR, characterization and monitoring, and genetic improvement of AqGR. Capacity-building needs are also identified for education and training institutions that included genetic resource management and conservation as well as characterization and monitoring.

There is a strong need to build the capacity of these institutions, especially in developing countries, and to enhance the national, regional and international networking of these institutions to enable sharing of experience and knowledge and promote cooperation and collaboration. There is a clear role to play for intergovernmental organizations to develop and share key resource materials.

Goal

Institutions for education and research established or strengthened and intersectoral coordination enhanced.

Actions

- Support the establishment and strengthening of existing national, regional and international networks that will share information, experiences and theoretical knowledge on AqGR and their management.
- Establish, strengthen and promote national and international courses, pilot projects and training programmes on specific topics on AqGR at higher education level, including online training and the use of international research networks, on AqGR, as well as provide certification to local farmers.
- Build capacity through the establishment of training programmes from schools to universities, field visits and expert exchange programmes for characterization, inventory and monitoring of trends and associated risks, for conservation, sustainable use and development of AqGR including economic valuation, characterization and genetic improvement.
- Improve data collection, including tools and methodologies through the creation of a registry of institutions.
- FAO and other intergovernmental organizations to make relevant resource material available to educators, trainers and researchers.

Strategic Priority 4.7

Facilitate access to and the fair and equitable sharing of benefits arising from the use of AqGR.

Rationale

There is a need to ensure adequate access to AqGR and associated traditional knowledge for research and development as well as the fair and equitable sharing of benefits arising from the utilization of AqGR and associated traditional knowledge for the conservation and sustainable use of AqGR. Countries that decide to adopt ABS measures need to be aware of the distinctive features of AqGR and the special role they play in food security.

Many countries have adopted or are in the process of adopting ABS measures relevant to AqGR and associated traditional knowledge but there is a wide variation in these measures, and there is a lack of knowledge on how ABS measures and intellectual property rights may affect AqGR research and development.

The awareness and understanding of stakeholders of ABS and intellectual property protection (e.g. patents) and their capacity to operate within this legal environment at national, regional and global levels needs to be improved. When adapting, developing or implementing ABS measures, the distinctive features of AqGR and associated traditional knowledge, and the special role of AqGR and associated traditional knowledge for food security, should be taken into account. It is important to maintain adequate access to AqGR and associated traditional knowledge since such access is essential for progress in research and development and for food security.

Goal

Adequate policies and measures developed or adapted and implemented, reflecting the distinctive features of AqGR and associated traditional knowledge and the special role of AqGR and traditional knowledge associated with them for food security.

Actions

- Consider developing, adapting or implementing access and benefit-sharing measures to take into account the importance of AqGR and associated traditional knowledge, their special role for food security, and their distinctive features, while complying, as applicable, with international instruments.
- Promote understanding, through capacity-building initiatives, among AqGR stakeholders, of ABS measures for AqGR and their relevance to the use and exchange of materials.
- Support governments, including policy-makers, in reflecting the distinctive features of AqGR and the special role of AqGR for food security, in developing, adapting or implementing ABS and other measures.
- Develop and share national and regional case studies of the lessons learned from aquaculture-specific benefit-sharing examples.
- Support ABS policy-makers to consider regional or special ABS arrangements that facilitate exchange of AqGR for research and development within a specific region or group of countries under pre-agreed terms of reference, including those concerning benefit-sharing.
- Consider the important role of academic research, international research organizations and regional and international collaboration on research and development on AqGR.
- Encourage regional networks to support responsible exchange of AqGR among members and support the development of instruments to regulate transfers and exchanges, including development of material transfer agreements, in line with international instruments, as applicable.

Strategic Priority 4.8

Mobilize resources, including financial resources, for the conservation, sustainable use and development of AqGR.

Rationale

Most countries report that the conservation, sustainable use and development of AqGR are under-resourced and identifying funding sources is challenging. In order for this GPA to be a catalyst for change and to support the significant improvement in its management of AqGR across its four priority areas, it is necessary to significantly enhance efforts at national, regional and international levels, to better resource and fund key initiatives most relevant to the needs of individual members and regions.

Goal

Increased resources mobilized.

Actions

- Develop a funding strategy for the implementation of the GPA or any of its key elements, considering:
    - support from national funding agencies;
    - support from regional bodies;
    - public contribution and donation to conservation programmes
    - developing detailed value proposition(s); and
    - collaboration with the private sector.
- Strengthen the countries' and regions' exchange of resources, including technology transfer, including through South–South cooperation and FAO's Hand-in-Hand initiative.

Summary table of the Strategic Priorities of the Global Plan of Action for the Conservation, Sustainable Use and Development of Aquatic Genetic Resources for Food and Agriculture

Inventory, characterization and monitoring	**Conservation and sustainable use and of AqGR**	**Development of AqGR for aquaculture**	**Policies, institutions, capacity building**
1.1 Promote the globally standardized use of terminology, nomenclature and descriptions of AqGR	2.1 Identify wild relatives of AqGR most at risk (e.g. through an AqGR information system) and ensure that they are managed sustainably and appropriate conservation measures are implemented where necessary, nationally and regionally.	3.1 Improve understanding of the properties, benefits and potential risks (and effective risk mitigation mechanisms) of genetic improvement technologies and their application to AqGR.	4.1 Develop or revise, implement and monitor strategies and policies for the conservation, sustainable use4 and development of AqGR in cooperation with relevant stakeholders.
1.2 Improve and harmonize monitoring and reporting procedures and expand existing species-based information systems to cover unreported or underreported AqGR.	2.2 Anticipate the current and future impacts of environmental change, including climate change, on AqGR and respond accordingly.	3.2 Promote greater adoption of well-managed, long-term, selective breeding programmes as a core genetic improvement technology with a focus on major aquaculture species.	4.2 Improve global, regional and national exchange of information and network activities on AqGR and raise awareness of the importance of AqGR among relevant stakeholders, including of the roles that indigenous peoples and local communities, youth and women, play in the conservation, sustainable use and development of AqGR.
1.3 Maintain and/or develop, promote and institutionalize national, regional and global standardized information systems for the collection, validation, monitoring and reporting on AqGR below the level of species (i.e. genetic diversity of farmed types and stocks).	2.3 Actively incorporate *in situ* conservation of AqGR in the development of fisheries management and ecosystem-based management plans, particularly for threatened species.	3.3 Establish national and/or regional development strategies and programmes for species and farmed types, responsive to market and societal needs, to unlock the full potential of AqGR.	4.3 Support the responsible introduction, exchange and use of AqGR, including through appropriate risk assessments, adequate policies and their effective implementation.
	2.4 *Promote* ex situ *conservation for AqGR, including wild relatives and threatened species.*	3.4 Raise capacity of stakeholders in aquaculture to develop improved farmed types.	4.4 Implement existing international agreements and instruments relevant to the conservation, sustainable use and development of AqGR.

	2.5 Improve sustainable use of domesticated farmed types through improved management of genetic diversity.		4.5 Establish or strengthen national institutions, including national focal points, for planning, implementing and monitoring AqGR measures, for aquaculture and fishery sector development.
	2.6 Safely manage and control the use and exchange of AqGR taking into account national and international instruments, as applicable.		4.6 Establish or strengthen national and regional institutions for characterization, inventory, and monitoring of trends and associated risks, as well as for education and research on AqGR, and establish intersectoral coordination of their management, including economic valuation, characterization and genetic improvement.
			4.7 Facilitate access to and the fair and equitable sharing of benefits arising from the use of AqGR.
			4.8 Mobilize resources, including financial resources, for the conservation, sustainable use and development of AqGR

APPENDIX D

MEMBERS AND ALTERNATES OF THE INTERGOVERNMENTAL TECHNICAL WORKING GROUP ON AQUATIC GENETIC RESOURCES FOR FOOD AND AGRICULTURE, ELECTED BY THE COMMISSION AT ITS SEVENTEENTH REGULAR SESSION

Composition (no. of countries per region)	*Country*
Africa (5)	Burkina Faso Chad Morocco South Africa Uganda *First Alternate:* Angola *Second Alternate:* Mauritania
Asia (5)	India Indonesia Japan Malaysia Philippines *First Alternate:* Thailand *Second Alternate:* Lao People's Democratic Republic
Europe (5)	Bosnia Herzegovina Czechia France Germany Norway
Latin America and the Caribbean (5)	Argentina Brazil Chile Panama Peru *First Alternate:* Jamaica *Second Alternate:* Paraguay
Near East (4)	Egypt Oman Saudi Arabia Syrian Arab Republic *First Alternate:* Kuwait *Second Alternate:* Iraq
North America (2)	Canada United States of America
Southwest Pacific (2)	Palau Solomon Islands *First Alternate:* Tonga *Second Alternate:* Marshall Islands