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EXPERT WORKSHOP ON AQUACULTURE CO-MANAGEMENT

**Hybrid meeting
Kigali, Rwanda, 8–10 June 2022**

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PREPARATION OF THIS DOCUMENT

This document provides a summary of the presentations, discussions, conclusions and recommendations of the FAO Expert Workshop on Aquaculture Co-management held in Kigali, Rwanda from 8 to 10 June 2022 in hybrid mode. The workshop was prepared and coordinated by the FAO Fisheries and Aquaculture Division with the support of FAO representation in Rwanda.

ABSTRACT

The FAO Expert Workshop on Aquaculture Co-management was held in hybrid mode from 8 to 10 June 2022 in Kigali, Rwanda. Eighteen experts attended the workshop, including 11 who attended in person and seven who participated online.

The main objectives of the workshop were to: (i) elucidate the concept of aquaculture co-management in terms of definition, rationale, scope, objective and underlying principles; (ii) discuss the effective implementation of aquaculture co-management; (iii) draft a methodology and the main steps to guide a successful implementation of co-management systems in aquaculture; and (iv) reflect on future sector developments and the role of co-management in aquaculture.

During the workshop, participants were presented with a draft rationale, a definition, principles and models of aquaculture co-management as outlined in a background document which was shared ahead of the event. They were then invited to provide advice on these elements of aquaculture co-management to establish a shared understanding of the concept and define a pathway for its further development. The expert input will be used to develop a methodology and to produce a guidebook to establish aquaculture co-management systems, write case studies and conduct outreach activities.

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ABBREVIATIONS

2030 Agenda	2030 Agenda for Sustainable Development
EAA	ecosystem approach to aquaculture
FAO	Food and Agriculture Organization of the United Nations
NGO	non-governmental organization
SDG	Sustainable Development Goal
GSA	Guidelines for Sustainable Aquaculture

BACKGROUND

1. Co-management is a broad concept that has been advanced in a number of sectors that require collaboration between resource users and government. To date, the aquaculture sector has not explicitly applied co-management, but there are many examples of aquaculture systems on land and at sea that manage shared risks and use common resources (e.g. water, land and feed) or outputs (e.g. effluent, escapees and water quality on land) in line with the ecosystem approach to aquaculture (EAA) of the Food and Agriculture Organization of the United Nations (FAO)).

2. FAO also recognizes that better implementation of EAA requires management models that provide guidance to governments and the private sector alike. Furthermore, collaborative management models are needed for the implementation of the upcoming FAO Guidelines for Sustainable Aquaculture (GSA). Aquaculture co-management is also proposed as a means to bridge the growing range of private sector attempts to provide guidance beyond farm sustainability, including private standards, and integrated jurisdictional approaches that bring together producers, buyers, financiers and governments to promote regional-scale improvements in sustainability.

3. The FAO Expert Workshop on Aquaculture Co-Management was held from 8 to 10 June 2022 in Kigali, Rwanda. The workshop was conducted in hybrid mode to elicit global experience and knowledge relevant to the definition and characterization of aquaculture co-management. The workshop was attended by 18 experts from Cameroon, Canada, China, Kenya, Malawi, Netherlands, Nigeria, Republic of Korea, Rwanda, Thailand, United Kingdom of Great Britain and Northern Ireland, United States of America and Viet Nam, including 11 experts who attended in person and a further seven who participated online (Appendix 1).

4. The specific goals of the workshop were to: (i) elucidate the concept of aquaculture co-management in terms of definition, rationale, scope, objective and underlying principles; (ii) discuss the effective implementation of aquaculture co-management; (iii) draft a methodology and the main steps to guide a successful implementation of co-management systems in aquaculture; and, (iv) reflect on the future role of aquaculture co-management in the global development of the aquaculture sector.

OPENING

5. Mr Orlando Sosa, Officer in Charge of the FAO Representation in Rwanda, welcomed participants and highlighted the objective of the meeting, reiterating FAO's commitment to developing the aquaculture sector. He remarked that the United Nations General Assembly had declared 2022 the International Year of Artisanal Fisheries and Aquaculture. The workshop was opened by Ms Chantal Ingabire, the Director General of Planning in the Rwandan Ministry of Agriculture and Animal Resources, who highlighted the potential for aquaculture co-management in Rwanda by providing incentives for value chain investments aimed at increasing employment and incomes (Appendix 2).

AGENDA

6. After the opening ceremony, Mr KwangSuk Oh, Senior Fishery Officer, FAO, presented the workshop's framework, background, objectives and expected results. Ms Elisabetta Martone, Fishery Officer, FAO, then presented the workshop agenda (Appendix 3).

SESSION 1: DEFINING AQUACULTURE CO-MANAGEMENT

Presentation

7. Mr Simon Bush, FAO Expert, FAO, introduced the background document on aquaculture co-management that was prepared to guide the workshop participants and contribute to the definition and characterization of aquaculture co-management. He then presented and led a discussion on the four sections of the report, namely: (i) defining aquaculture co-management, including its scope of application, requirements and characteristics; (ii) potential models and practices that can guide the successful implementation of aquaculture co-management; (iii) approaches for the monitoring and evaluation of aquaculture co-management; and, (iv) future sector developments and the role of co-management.

8. Mr Bush introduced the objectives of the background document. He emphasised the main points for discussion and the input required from the experts for a revised version of the document. He started by challenging the participants to explore the reasons why co-management is relevant for aquaculture. He then presented an overview of the concept of co-management from other resource sectors, including fisheries, water and forestry, stressing the various ways in which collaborative forms of management are applied, from ecosystem management to value chains. After that, he presented ideas for ways in which co-management could be applied to the aquaculture sector, given the diversity of species and production systems, as well as ways in which the concept could assist in the operationalization of EAA and GSA goals and practices for sustainable aquaculture. In doing so, he emphasised on the potential role of aquaculture co-management in counterbalancing some of the limitations of EAA.

9. Mr Bush then presented a draft rationale, aims, definition and principles for aquaculture co-management. A starting definition of co-management, based on fisheries and other resources sectors, was presented. This definition was based on Berkes *et al.* (2001) and Armitage *et al.* (2009): a set of approaches that cover the full range of collaborations through which resource users and states, with the support of “external agents”, share responsibility and authority for decisions over how, where and when management is practised (Appendix 4). This definition formed the basis for discussing and further defining co-management for aquaculture.

10. Mr Bush asked the participants to reflect on the potential definition, aims and principles for aquaculture presented in the background document. The following key questions were specified for discussion:

- (i) What should the definition of aquaculture co-management include?
- (ii) How distinct should this definition be from co-management in other sectors?
- (iii) Are the key goals and rationales listed for aquaculture co-management complete and realistic?
- (iv) Are the principles listed for aquaculture co-management complete and realistic?

Plenary discussion

11. Many workshop participants emphasised the need to provide a clear rationale for aquaculture co-management given the diversity of production systems and countries engaging in aquaculture globally. They also emphasised the potential role of aquaculture co-management in contributing to the participatory transformation of the aquatic food system towards more sustainable outcomes. Some experts stressed that the link between the problems that aquaculture co-management might address, and its goals and outcomes, need to be clearly articulated.

12. Workshop participants argued there is a need to emphasise the role of aquaculture co-management in fostering collaborative actions between the public and private sectors, and those providing services to the industry along the value-chain. As such, aquaculture co-management can be seen as a means of creating shared value in a sustainable way. They argued that the definition of aquaculture co-management should move beyond a focus on producers alone. Conflict resolution, for example, should not necessarily be farm-based, but include those actors that are negatively affected. In line with a more networked approach to co-management in other sectors, they argued that collaboration needs to include many other stakeholders within and beyond aquaculture value chains.

13. Recognizing the challenges of implementing the EAA, some of the experts argued that aquaculture co-management is a promising way of enabling the three components of the EAA: ecological integrity, human well-being and good governance. They added that aquaculture co-management could provide a means addressing system level challenges to the aquaculture industry, e.g. by enhancing resilience to climate change, biodiversity loss and natural disasters.

14. Most of the experts noted the need to make a clear distinction between the strategic and operational goals of co-management. Strategic goals, they said, should be framed in terms of legitimacy and participation to enable or enhance the role of aquaculture in providing nutritious, equitably valuable and sustainable aquatic food. Operational goals relate to the everyday management of aquaculture, e.g. disease control, feed and water management.

15. Finally, some of the experts noted the need to order the principles to better align with the different stages of the “policy cycle”, or the implementation process of aquaculture co-management, so that they are operational and able to be assessed.

Session conclusions

16. On the basis of the input received, it was agreed that changes should be made to the rationale, aims, principles and definition of aquaculture co-management as presented in the background document. A discussion around a new definition was scheduled for the second day of the workshop, following the presentation of the models and practices to guide the successful implementation of aquaculture co-management.

17. The session on the second day led to a working rationale, goals and outcomes, and a definition for aquaculture co-management. The working definition for aquaculture co-management agreed by the participants was the following:

Aquaculture co-management is a set of strategic and operational collaborative approaches that enable decision-making between public agencies and producers, as well as civil society, supporting services, and other stakeholders along the value chain. These actors share responsibility, rights and benefits over how, where and when the management of shared resources and risks are practised.

18. The workshop participants agreed on this definition because it emphasises new institutions or frameworks for institutional collaboration, and joint decision-making for producers and other value chain actors, to overcome resource constraints, systemic risks and equity issues through collective action and innovation. The definition also explicitly links resource and environmental risk, such as those related to key inputs such as water, feed and seed, to social risks related to benefit sharing, and economic risks related to market access. Together these risks coalesce around their effect on the sustainability of production. It also emphasises the need to improve rights, responsibilities and benefits to enable efficient and inclusive, resilient and sustainable advancement of the aquaculture industry and thereby contribute to aquatic food systems.

19. The workshop participants agreed to reduce the number of aims in the forthcoming guidebook for aquaculture co-management to the following six “building blocks”:

- (i) pluralism
- (ii) participation, transparency and compliance
- (iii) conflict resolution
- (iv) learning and adaptation
- (v) enhancing capabilities
- (vi) institutional fit.

20. It emerged that the principles for aquaculture co-management require a new round of discussion. In preparation for this discussion, two sets of goals were agreed to. The operational goals include:

- (i) productivity and economic performance
- (ii) partnerships and investment opportunities
- (iii) procedural efficiency
- (iv) social well-being
- (v) environmental stewardship.

The strategic goals include:

- (i) integration in food systems
- (ii) enabling circular food systems
- (iii) climate change adaptation
- (iv) ecosystem carrying capacity
- (v) market credibility
- (vi) social licence to operate
- (vii) innovation.

SESSION 2: POTENTIAL MODELS OF AQUACULTURE CO-MANAGEMENT

Presentation

21. Mr Bush presented five potential models or “ideal types” of aquaculture co-management that could be used to further guide thinking on the diversity of ways in which co-management might be implemented in the sector. Each of the models was defined, with support from cases in the academic literature that might be considered a form of aquaculture co-management. Using these examples, and by reflecting on key dimensions, each model was refined. The key dimensions included:

- (i) the intensity and “openness” of aquaculture systems;
- (ii) the varying degree of capacity of producers in different parts of the world (and/or countries, and/or species);
- (iii) ownership (tenure) arrangements;
- (iv) the potential spread of production systems across and links between marine, coastal and terrestrial ecosystems; and
- (v) the range of risks to and from the surrounding environment on production.

22. Each of the five models were then presented: (i) culture-based fisheries; (ii) farm-based; (iii) clusters and clubs; (iv) zonal approaches; and (v) jurisdictional approaches. The participants were then asked to discuss these models using three questions as a guide: do the five types of aquaculture co-management cover the possible range of approaches relevant for aquaculture? Do the various aquaculture co-management approaches listed consistently relate to the aims, rationales and principles?

To what extent might the different aquaculture co-management approaches enable the goals of the EAA and the GSA?

23. The session was split over the second and third days of the workshop. On the second day, the experts were introduced to the models and asked to discuss their design. On the third day, they were divided into working groups and asked to illustrate key dimensions of each model using the input from the various sessions: rationale, goals and outcomes; monitoring and evaluation; and implementation.

Plenary discussion

24. Some of the experts questioned the inclusion of “culture-based fisheries” as a model of co-management. This resulted in a discussion of what falls under the FAO (1990) definition of aquaculture, emphasising “ownership” and “an intervention in the rearing process to enhance production” of organisms. The participants agreed, with evidence from countries such as Sri Lanka, that collectively stocked water bodies with defined tenure rights over harvesting the organisms stocked can constitute one type of aquaculture co-management. It was also agreed that this model is distinct from all other forms of aquaculture co-management because it is based on private ownership of the production unit.

25. Some of the experts called for clarity on “farm-based” forms of co-management. They questioned whether production-based aquaculture co-management would be more appropriate, given that the unit of production cannot always be defined as a “farm” (e.g. cage culture and multi-site production). It was agreed that farm-based needed to be defined not as a spatially defined production site, but instead as a unit of decision-making. Multiple units of decision-making are then the basis of collaboration for any model of aquaculture co-management.

26. Some of the experts noted that both “vertical” and “horizontal” dimensions of collaboration need to be given attention in the description of the models. In this instance, vertical refers to relations between industry and the state and horizontal refers to collaboration between industry and non-state actors.

27. Many of the experts also argued that the five aquaculture models presented in the original background document should be divided into two broad categories, based on collective (culture-based fisheries) and single management units (clustering, zonal and jurisdictional approaches).

28. Most of the experts agreed that the five models should be grouped into two types, based on ownership and unit of decision-making. This led to the separation of the collective form of aquaculture-based fisheries from farm-based forms of co-management. The latter was then further divided into three types: clustering, zonal and jurisdictional approaches to aquaculture co-management. This separation could be made on the basis of the collective use of a water body (culture fisheries) and the “farm-based” model, looking at what collective action can occur in that model, linking a group of individual producers with individual farms (e.g. marketing, environmental). Both are then defined on the basis of how collective action arises in each of those models.

Session conclusions

29. The models provide a basis for discussion around the types of aquaculture co-management that may be possible for the sector. The comments called for clearer goals and outcomes for each of the models. It was concluded that the models should be reduced to four types, divided into two broad categories (community- and enterprise-based). The community-based aquaculture is composed of culture-based fisheries, while the enterprise-based aquaculture includes clusters and associations, zonal management and the jurisdictional approach.

30. To enable the adoption of the two broad categories, it was agreed that the content of the background document should be revised in the development of the upcoming guidebook for aquaculture co-management to better reflect these key differences. The further elaboration of the typology of aquaculture co-management should include:

- (i) outcomes
- (ii) resources/risks addressed
- (iii) relevant stakeholders
- (iv) level of decision-making (strategic/operational)
- (v) audiences/goals of monitoring and evaluation
- (vi) key implementation steps
- (vii) examples.

SESSION 3: MONITORING AND EVALUATION OF AQUACULTURE CO-MANAGEMENT

Presentation

31. Mr Bush presented key dimensions that should be considered in the design of any future monitoring and evaluation system for aquaculture co-management. Using the *Guidebook for evaluating fisheries co-management effectiveness* (Pomeroy *et al.*, 2022) as a reference, he outlined the objectives of any assessment of aquaculture co-management at both strategic and operational levels. He also described how these objectives differ according to who requests the internal assessment (e.g. resource users, collaborating state or non-state actors) or external actors (e.g. donors, buyers and auditors). He also outlined how the methodology of assessment differs depending on the mix of capabilities and goals, and demand for verification and/or assurance for aquaculture co-management.

32. Mr Bush adapted the *Guidebook for evaluating fisheries co-management effectiveness* (Pomeroy *et al.*, 2022) to aquaculture by defining input evaluation (i.e. assessing the antecedents for aquaculture co-management prior to design and implementation; throughput evaluation (assessing the implementation and ongoing operation of the aquaculture co-management system); and output and outcome evaluation (assessing the achievement of the goals and objectives that are stated in the aquaculture co-management plan).

33. Finally, Mr Bush presented three key steps that should be considered in the eventual design of any future monitoring and evaluation system for aquaculture co-management: (i) planning the content, goals and design of an evaluation, which includes the identification of key criteria (related to the principles outlined above), and of the goals and objectives as set out in the co-management plan or covenant; (ii) compilation of information, which includes the detailed description of the context, system and design of the aquaculture co-management arrangement using the selected indicators associated with the five principles outlined above; and (iii) conduct the evaluation, which involves analysing data and validating and communicating results to those involved in the aquaculture co-management arrangement.

34. The participants were then invited to discuss these models using the following questions as a guide:

- (i) Identify key principles for aquaculture co-management evaluation based on objectives and verification – do these differ from fisheries co-management evaluation?
- (ii) Discuss which steps of evaluation should be included in an evaluation framework by asking: how might evaluation and monitoring differ for each of the aquaculture co-management approaches identified in the previous discussion?

Plenary discussion

35. Most of the participants emphasized learning as a core component of any monitoring and evaluation system. This comment was discussed in the context of learning being one of the key outcomes of any form of co-management.

36. Some of the participants highlighted that indicators should be negotiated amongst those collaborating in the co-management system and outlined in a co-management plan. Guidelines for the kinds of social and environmental indicators that are relevant for aquaculture co-management are already outlined in the *Guidebook for evaluating fisheries co-management effectiveness* (Pomeroy *et al.*, 2022). These indicators are generic enough to provide guidance for aquaculture monitoring and evaluation frameworks. However, the group noted that further elaboration of aquaculture-specific indicators, at both strategic and operational levels, should be defined at a separate workshop.

37. Some experts argued that assessment indicators should be developed in a future workshop to draft a guidebook on aquaculture co-management. They also argued that in this document, indicators should include a mix of internal performance indicators and outcome performance indicators (aligned to the kinds of strategic and operational goals set out in the background document). This, they argued, should be step-wise – with a first step focused on assessing the attributes of implementing a given aquaculture co-management plan against its own goals, and a second step assessing its impact on wider social and environmental outcomes. Some of the participants suggested the indicators should also reflect the scales outlined in the *Guidebook for evaluating fisheries co-management effectiveness* (Pomeroy *et al.*, 2022) – from regions to farm scale and households.

38. All of the experts agreed that any monitoring and evaluation system should be aligned with the principles of aquaculture co-management. A first draft of these principles is included in the background document, and they should be further developed with input from the industry. The experts also noted that the design of these systems may differ from the models presented in the background document, which they argued requires monitoring and evaluation to be tailored to each model.

39. Some experts noted the need to explore the opportunities for digital forms of data collection that are currently being employed in the aquaculture sector for assurance and finance purposes. The implementation of digital technologies should, they argued, be taken up in the development of a forthcoming guidebook for aquaculture co-management.

40. The development of indicators for aquaculture co-management should be conducted in line with other evaluation frameworks, including private and public certification standards.

Session conclusions

41. It was agreed that in the development of a guidebook for aquaculture co-management, the learning function of monitoring and evaluation should be emphasised. It was also concluded that attention should be given to the role of novel digital technologies.

42. A future guidebook for aquaculture co-management should also elaborate the potential difference in monitoring and evaluation needs between the aquaculture co-management models outlined in the background document.

43. An expert workshop with the goal of developing a guidebook for aquaculture co-management should be conducted at a later date, with participation from both industry and public and private certifications. It should focus on specifying key indicators for evaluating aquaculture co-management.

SESSION 4: IMPLEMENTATION OF AQUACULTURE CO-MANAGEMENT

Presentation

44. Mr Bush presented the key steps for the implementation of aquaculture co-management. Based on a synthesis of the *Guidebook for evaluating fisheries co-management effectiveness* (Pomeroy *et al.*, 2022), he outlined key elements for implementation across three stages: (i) pre-implementation, (ii) implementation, and (iii) post-implementation.

45. For the pre-implementation stage he emphasised the need to establish joint recognition for co-management in order to build legitimacy and elicit a stated willingness to engage in aquaculture co-management and address past or perceived injustices. For the implementation stage, he emphasized the need for stakeholders to follow agreements established in the pre-implementation phase, but remain open to ongoing consultation and adaptation, and the development of conflict resolution instruments which steer the interaction and activities of those involved. For the post-implementation stage, he outlined the need for the iterative evaluation and adjustment of key objectives and opportunities, the turnover and phase-out of the external agents that introduced the scheme to the community, the *ex-ante* evaluation of the co-management system, and reflection on the capabilities of actors to shift from undesirable to desirable.

46. To guide the plenary discussion the experts were asked to consider the following questions:

- (i) Are the phases of implementation relevant for the full spectrum of aquaculture co-management goals, principles and models?
- (ii) What are the key differences between fisheries and aquaculture co-management?
- (iii) What are the differences (if any) between the implementation of aquaculture co-management and the ecosystem-based approach?

Plenary discussion

47. Most of the experts suggested that more attention needs to be given to the policy environment and potential for investment when implementing aquaculture co-management. This was closely accompanied by a call to more clearly identify the key stakeholders who enrol in the co-management process, including the kinds of actors that can initiate aquaculture co-management.

48. A number of experts contributed elements of each of the three steps that were missing from the background document. These included (i) the inclusion of a step “identification of relevant local and Indigenous knowledge” in the pre-implementation stage; (ii) inserting a step “identifying constraints and mapping stakeholders” prior to pre-implementation; (iii) not only identifying risks in the pre-implementation stage, but also exploring the identification of benefits and opportunities; and (iv) food control systems and biosecurity.

49. Prompted by the leading questions for this session, some of the participants also discussed the key differences between aquaculture co-management and co-management in fisheries and other sectors, including agriculture. Further efforts were requested to determine what these differences are, especially in terms of implementation. It was acknowledged that co-management in agriculture is not yet clearly elaborated, but the co-management of water resources used for agriculture might be instructive. It was also noted that one key difference with fisheries co-management may be the kinds of actors, because there are “input” and service-related actors, in addition to resource-related actors.

50. Some participants noted that aquaculture co-management is not different to ecosystem-based management and suggested the EAA should be highlighted as part of the implementation strategy of aquaculture co-management. It was stressed that aquaculture co-management is placed within the

political boundary, while the EAA is beyond political dialogue and is more about pursuing ecological objectives.

Session conclusions

51. It was agreed that in a future guidebook for aquaculture co-management, attention should be given to the feedback provided by the experts in this workshop. It was also concluded that key differences in the implementation of aquaculture co-management should be included in the description of the different models presented.

SESSION 5: FUTURE SECTOR DEVELOPMENTS AND THE ROLE OF CO-MANAGEMENT

Presentation

52. Mr Bush presented the different roles that aquaculture co-management might play in helping to resolve the food and environmental challenges outlined in the United Nation's 2030 Agenda for Sustainable Development (2030 Agenda). He presented a summary of the proximate (operational) and tertiary (strategic) roles aquaculture co-management might play in the future.

53. Strategic contributions relate to governance of systemic (and less measurable) issues related to the environmental and social transformation of aquatic food systems. Key elements may include: (i) integration in food systems; ii) enabling circular food systems; iii) enabling adaptation to new environmental risks; (iv) integration of biodiversity goals; (v) enhanced market incentives in domestic settings; and (vi) enhancing the social responsibility of the sector.

54. The debate among participants was guided through these discussion points:

- (i) Based on the presentation of proximate (operational) and tertiary (strategic) roles in aquaculture co-management, what roles are missing from the background document?
- (ii) Based on the FAO preliminary supporting document *Action-oriented guidance for transforming aquaculture for greater contribution to achieve the Sustainable Development Goals: Key interconnected actions to guide decision makers and practitioners*,¹ are there additional roles that aquaculture co-management might play in the future?

Plenary discussion

55. The participants reflected on the future role of aquaculture co-management in relation to the goals presented in Session 1. Many of the experts argued that the scope of aquaculture co-management risks becoming all encompassing. Instead, the focus should return to enabling sustainable and resilient expansion of aquaculture to contribute to the efficient, sustainable and inclusive aquatic food system.

56. Most of the participants noted a range of additional points for consideration including: (i) the potential role of aquaculture co-management in enabling collaboration at the national level when faced with regional competition – especially where countries share a water body; (ii) promoting the blue economy; and (iii) incorporating a life cycle approach in the implementation of sustainable aquaculture with a focus on resource efficiency.

¹ This preliminary supporting document was encompassed in the current draft Guidelines for Sustainable Aquaculture (GSA).

57. Special attention was given to the socially inclusive role of aquaculture co-management, especially in relation to value chains. In this context, one expert argued that aquaculture co-management can enable small-scale farmers to overcome the capital constraints that prevent them from investing in more sustainable production systems by enabling buyers and others to invest in facilities and/or product development. This linked to another discussion about the FAO Blue Transformation roadmap (FAO, 2022). Aquaculture co-management could be a means of supporting the implementation of value chain partnerships that can increase profitability, reduce food loss, increase access to markets, and offer more inclusive and gender balanced production.

Session conclusions

58. It was agreed that in the preparation of a future guidebook for aquaculture co-management, attention should be given to the future roles of aquaculture co-management. These roles can be used to better define the rationale, goals and potential outcomes of aquaculture co-management, with a view to ensuring coherence with wider policy ambitions in member countries.

CONCLUSIONS AND WAY FORWARD

59. On the final day, closing remarks were made by Mr Nathanael Hishamunda, Senior Fishery Officer, FAO; and Ms Cecille Uwizeyimana, Aquaculture and Fisheries Program Coordinator, Rwanda Agriculture and Animal Resources Development Board.

60. The comments of the experts were documented and will be included in a further revision of the background document presented in Appendix 4, and in the process of developing a guidebook for aquaculture co-management. In pursuit of the development of a guidebook, further deliberation will be held with the expert group with the aim of elaborating steps for implementing and evaluating aquaculture co-management. Once these implementation and evaluation steps have been defined, a new round of pilot cases will be developed.

61. FAO will implement a three-year project entitled “Development of the Aquaculture Co-management System for Sustainable Aquaculture” funded by the Korea Maritime Institute of the Republic of Korea. The long-term goal of this project is to implement aquaculture co-management systems to contribute to the eradication of poverty and enhance food security and nutrition. The objective of the project is to enhance the knowledge of co-management for sustainable aquaculture development among government officers, aquaculture farmers and related stakeholders.

62. The details of aquaculture co-management, as defined by this expert workshop, will guide the implementation of the project. The background document presented in this workshop provides a starting point for producing a guidebook for aquaculture co-management. As aquaculture co-management is piloted, assessments can be done to determine the extent to which it affects livelihoods, food security and nutrition.

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APPENDIX 1 – LIST OF PARTICIPANTS

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APPENDIX 2 – OPENING STATEMENTS

WELCOME REMARKS BY MR ORLANDO SOSA, FAO REPRESENTATIVE IN RWANDA

Dear Ms. Chantal Ingabire, Acting Permanent Secretary of the Ministry of Agriculture and Animal Resources,

Dear esteemed development partners,
Fellow FAO colleagues from Rome and Kigali,
Dear experts, guests,
All protocols observed.

Mwaramutse, good morning!

I am pleased to be with you today in this Expert Workshop on Aquaculture Co-management, taking place in this beautiful country of a thousand hills. Let me express my gratitude to the Rwandan Government for not only being a great host of this workshop but also for the constant unwavering collaboration with the Food and Agriculture Organization of the United Nations (FAO) to accelerate the development of the agricultural sector and aquaculture in particular in this country.

I greatly thank all of you for having kindly accepted FAO's invitation during this busy season of the year and for your commitment to availing your technical expertise to this workshop.

In Rwanda, aquaculture started in the 1940s as small-scale extensive pond farming.² More than 80 years later so much has been done to improve this sector. Fish production now stands at 41 664 million tonnes.³ However there is still a long way to go. Rwanda's fishery sector is not a significant contributor to the country's gross domestic product – at just 0.5 percent in 2016.⁴ One of the challenges fish producers have include poor post-harvest handling practices and inadequate knowledge of fish post processing and value addition. Will this workshop on aquaculture co-management draw recommendations that will help a farmer in Karongi District, Western Rwanda? I believe so.

Ladies and gentlemen,

I would like to take you to 2050, 28 years from now. According to Rwanda Environment Management Authority (REMA),⁵ Rwanda's population could be 25.8 million, from around 13 million people now, if the population growth stays at 2.3 percent. And this is likely to happen because the country's population has grown more than five times in the past 60 years. This simply means a rapidly growing food demand. It is not just because we are in Rwanda, but the worldwide population growth is considerably increasing the demand for aquatic foods. Just imagine how scarce aquatic foods would be in 2050, if we sat and did nothing to improve the management of aquaculture resources.

Therefore, the strategic discussions you are going to have in this workshop, and the blueprint documents you will write, ladies and gentlemen, are going to add a step to the ladder of ensuring food security for all, not only for us here but for the future generations. This workshop is timely and vital because aquaculture is the fastest growing animal food production sector.⁶ It now provides over 50 percent of fish for human consumption and is expected to continue to increase in the long term. Aquaculture is one of the most important priorities of not only FAO, but also the entire United Nations.

For example, the UN General Assembly declared 2022⁷ the International Year of Artisanal Fisheries and Aquaculture. This is because small-scale fishers, fish farmers and fish workers play a paramount

² www.tandfonline.com/doi/full/10.1080/10454438.2021.2024315

³ www.minagri.gov.rw/index.php?eID=dumpFile&t=f&f=33188&token=e2f186e6140740180d0d6a6e8980bfe40e881884

⁴ National Institute of Statistics of Rwanda, 2016

⁵ www.rema.gov.rw/fileadmin/user_upload/Rwanda_SOER_-_Summary_for_Policy_Makers_Final-HR.pdf

⁶ www.fao.org/3/cb4850en/cb4850en.pdf

⁷ www.fao.org/artisanal-fisheries-aquaculture-2022/home/en

role in food security and nutrition, poverty eradication, and the achievement of Sustainable Development Goals.

Dear experts and leaders,

We are living in a time when science and expertise are increasingly demonstrating the ability to solve the world's most difficult challenges. Your attendance in this workshop gives me hope that aquaculture co-management is going to be advanced and embraced so the responsibility of managing aquaculture resources is shared between user groups and governments, where both individuals, the community, civil society organizations and the government institutions are involved during the decision-making, implementation and enforcement processes. Your deliberations will undoubtedly contribute to making aquaculture a thriving business and will help FAO and governments mitigate the risk of aquatic resource depletion.

In simple terms, the aquaculture co-management model, in my humble view, will help us enhance the ownership and participation of the fishery actors at five levels. The first is the instructive level. This top-down approach entails that governments instruct aquaculture actors on laws, policies and innovations that they should be aware of. Second, the consultative approach, where decision-makers consult with the community and the farmers to collect their insights on aquaculture policies that need to be established. Third, the cooperative approach. This brings in a degree of sharing the responsibility of aquaculture resource management between policymakers, decision-makers and farmers. Each party really contributes. Fourth, the advisory approach. This co-management approach brings together groups of farmers and value chain actors to outline decisions, initiatives and strategies that need to be made by the decision-makers. This is very crucial because it helps government officials design policies that are well tailored to real needs. Then, finally, the informative approach. Knowledge and information are power. Aquaculture co-management (ACM) will help every actor be informed of everything they need to know in the aquaculture sector. To effectively implement the ACM is to translate Confucius's thoughts into actions. He said, quote: "Tell people and they may forget, show them, they may remember, but involve them and they will understand." End of quote.

This workshop will explain further the global significance of sustainable aquaculture development and its importance for food security and nutrition.

Ladies and gentlemen,

Your work to promote aquaculture co-management is very important to increase farmers' adherence to the regulations set by the governments for better production, better nutrition full of fish proteins, a better environment, and a better life for all, leaving no one behind.

I wish you a very successful and fruitful workshop.

Thank you for your kind attention. *Merci beaucoup* and *Murakoze cyane*.

OPENING REMARKS BY MS CHANTAL INGABIRE, DIRECTOR GENERAL OF PLANNING, THE MINISTRY OF AGRICULTURE AND ANIMAL RESOURCES, THE REPUBLIC OF RWANDA

Mr Orlando Sosa, FAO Agricultural Officer at the Subregional Office for Eastern Africa and the Officer in Charge of the FAO Representation in Rwanda,
Fellow government officials,
Development partners,
FAO staff from Rome and Kigali,
Dear experts,
All protocols observed.

Good morning,

It is a great pleasure to be here with you this morning as you commence this three-day FAO Expert Workshop on Aquaculture Co-Management.

I am very grateful for your choice to convene this meeting here in the country of a thousand hills and coincidentally at the Hotels des Mille Collines (thousand hills)!

On behalf of the Ministry of Agriculture and Animal Resources, I would like to commend the fruitful, result-based and strong collaboration we have built and sustained since 1985,⁸ when the Food and Agriculture Organization of the United Nations (FAO) first got a fully-fledged office in our country. Thirty-seven years later, a shared vision to end hunger in Rwanda has drawn nearer and become more achievable. I ask the FAO staff from Rome present at this meeting to kindly extend our appreciation to the Director-General, Mr Qu Dongyu.

Ladies and gentlemen,

Aquaculture and co-management are two important words that appear in both our leadership and our Livestock Master Plan.

Let me start by explaining how the notion of co-management precisely reflects the spirit of our leadership at all levels across this country. Twenty-eight years ago, Rwanda experienced the well-known genocide that set the country back in terms of development. When His Excellency the President of the Republic, Mr Paul Kagame, took leadership of our country and started to build it up from the ashes, he put co-management at the centre of his leadership. By co-management, I am stressing the tangible citizen participation throughout the process of designing and implementing what is best for us as a country in renewal. I am referring to the mutual, frank and open participation of various actors. I am talking about Rwanda's decision to consider constructive ideas of experts like you, academia, non-governmental organizations, faith-based organizations and other members of the civil society. Actually, co-management for us means putting all hands on deck to develop this green and prosperous country you are seeing today. This is a result of our leaders' decision to involve every actor.

I believe, ladies and gentlemen, this is what this workshop is about – to promote practical and fruitful participation of all actors towards the development of the aquaculture sector and making available new business opportunities to enhance our economy.

As you know, Rwanda is a small, landlocked country with an area of 26 338 km, of which 1 390 km² is water.⁹ Our country has 24 lakes, including three that are shared with our neighbouring countries. Lake Kivu is shared with the Democratic Republic of the Congo and lakes Cyohoha and Rweru are shared

⁸ www.fao.org/rwanda/news/detail-events/ru/c/1506812

⁹ <https://rab.gov.rw/index.php?id=202>

with Burundi.¹⁰ Many Rwandans are involved in subsistence fish farming and in small-scale and artisanal aquaculture. The sector provides 200 000 jobs along the fishery value chain. Globally, small-scale artisanal fishers, fish farmers and fish workers produce at least 40 percent¹¹ of the global fisheries catch. They help provide healthy, safe, affordable and nutritious aquatic foods and products. As FAO says, they are “small in scale but big in value”.

However, this looks like low-hanging fruit to me. If farmers are supported and aquaculture is well commercialized, our youthful population can sustainably utilize Rwanda’s resources to meet protein demand and attract many investments. This will create more jobs, end hunger, ensure good nutrition and contribute to the overall GDP. Aquaculture co-management could contribute to unleashing the potential of Rwandan farmers by providing the incentive for larger and more comprehensive investments along the value chain, meaning more gainful employment, better income and thereby increased purchasing power for our population.

Rwanda is positioning itself as a leader amongst African countries, a conference hub and a top-notch tourism destination. Our hospitality industry can be enhanced by homegrown aquatic foods through our local aquaculture production enterprises, thereby substituting them for imported products. Co-management experts, let’s join hands and brainstorm ways to effectively manage the aquaculture sector so we feed our people and our visitors as we transform and promote aquaculture as a business. There is so much investment potential in this sector and in Rwanda generally.

Co-management has been advanced in natural resource settings where shared public resources require collaboration between resource users and the state. To be specific, fisheries co-management has emerged as a viable solution and it is defined as a partnership arrangement in which the community of local resource users and government, with support and assistance as needed from other stakeholders and external agents, share the responsibility and authority for the management of the fishery.

During this workshop, dear experts, chart the way forward to leveraging already existing aquaculture management approaches and partnerships to address some of the challenges farmers still face.

Allow me to put these questions to you, I suggest you consider them during your strategic discussion: how can fish farmers best be organized for better production without creating unfair or detrimental competition conditions? How can they be capacitated and build their rich local knowledge and experience? What are the policies that can be established to ensure that they can build viable and profitable businesses?

My esteemed colleagues, in this sector, feed is a major input in aquaculture production, accounting for up to 60 percent of production costs. What can be done to help farmers increase production while keeping costs low and maximizing profits? What incentives can be created to attract investments, make finance accessible and affordable and manage risks?

I would like to task you to employ a co-management approach and develop recommendations that will help not only Rwanda but also other countries tackle those problems. I believe that if we effectively tap into all opportunities embedded in aquaculture co-management we will undoubtedly transform the aquaculture sector from a subsistence level to viable and sustainable, lucrative commercial systems.

Ladies and gentlemen,

I would like to finish by thanking you for your time, bringing your expertise and experience as well as your commitment and dedication to aquaculture development for the benefit of all. Please enjoy your time in Rwanda and in this regard, I am sure the Rwandans in the room will be more than happy to extend our warm hospitality to you all. To those participants that are connecting virtually, I invite you to come and visit the land of a thousand hills the minute you get a chance!

¹⁰ www.environment.gov.rw

¹¹ www.fao.org/artisnal-fisheries-aquaculture-2022/home/en

With that said and without further delay, I officially declare this FAO Expert Workshop on Aquaculture Co-management open.

I thank you for your kind attention.

Merci Beacoup, Murakoze cyane!

APPENDIX 3 – AGENDA

Wednesday 8 June 2022, 09.00–17.10 (Rwanda time)

08.30–09.00 Registration

09.00–10.00 Opening

- Opening session facilitated by Otto Muhinda, FAORW
- Welcome remarks by Orlando Sosa, Officer in Charge, FAO Representation in Rwanda
- Opening remarks by the Government Representative in Rwanda: Dr Chantal Ingabire, Acting Permanent Secretary, Ministry of Agriculture and Animal Resources
- Introduction of the meeting objectives and expected results by KwangSuk Oh, FAO
- Group photo (facilitated by Eugene Uwimana, FAORW)

10.00–10.30 Context-setting

- Self-introduction of participants (facilitated by Otto Muhinda, FAORW)
- Adoption of the agenda (facilitated by Elisabetta Martone, FAO)

10.30–10.45 Break

10.45–12.30 Plenary session

- Overview of the background document *Aquaculture Co-management* by Simon Bush, FAO
- Presentation of the **concept** (Objective 1 of the workshop) and **application scope, requirements and characteristics** of aquaculture co-management (Objectives 2a–2c of the workshop) by Simon Bush, FAO
- Discussions

12.30–14.00 Lunch break

14.00–17.00 Plenary session

- Presentation of the **models and practices** to guide a successful implementation of co-management system in aquaculture (Objective 2d of the workshop) by Simon Bush, FAO

15.30–15.45 Break

15.45–17.00 Plenary session

- Presentation of the **models and practices** to guide a successful implementation of co-management system in aquaculture (Objective 2d of the workshop) by Simon Bush, FAO (cont.)
- Discussions

17.00–17.10 Closure

- Closure of day one by KwangSuk Oh, FAO

Thursday 9 June 2022, 09.00–17.15 (Rwanda time)

09.00–10.30 Plenary session

- Presentation on **future sector developments and the role of co-management** (Objectives 5a–5b of the workshop) by Simon Bush, FAO

10.30–10.45 Break

10.45–12.30 Plenary session

- Presentation on **future sector developments and the role of co-management** (Objectives 5a–5b of the workshop) by Simon Bush, FAO (cont.)
- Discussions

12.30–14.00 Lunch break

14.00–15.30 Plenary session

- Presentation of the **monitoring and evaluation** of aquaculture co-management (objectives 4a–4c of the workshop) by Simon Bush, FAO
- Discussions

15.30–15.45 Break

15.45–17.00 Plenary session

- Presentation of the **main steps** to guide a successful implementation of aquaculture co-management (objective 3 of the workshop) by Simon Bush, FAO
- Discussions

17.00–17.15 Closure

- Closure of day two by KwangSuk Oh, FAO

Friday 10 June 2022, 09.00–12.00 (Rwanda time)

09.00–10.30 Plenary session ▪ Presentation of the updated background document (recap the workshop results) by Simon Bush, FAO

10.30–10.45 Break

10.45–11.15 Group session ▪ Group discussion on key dimensions of each model using the input from the various sessions: rationale, goals and outcomes; monitoring and evaluation; and implementation by Simon Bush, FAO

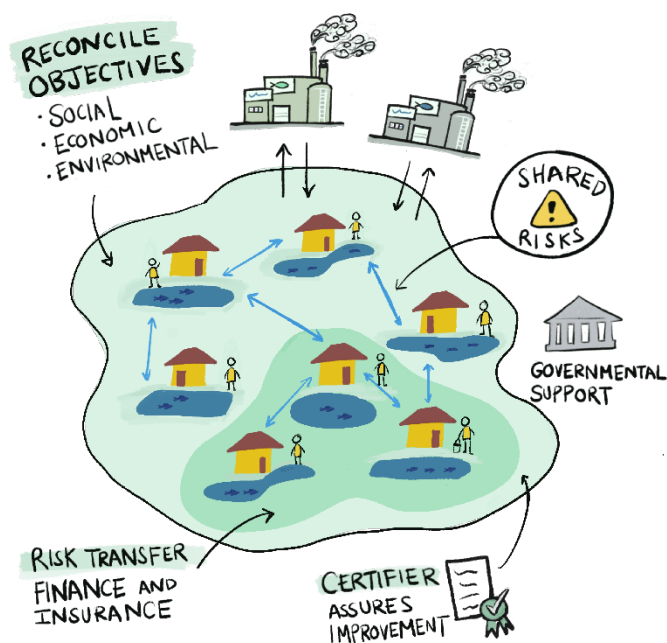
11.15–11.30 Plenary session ▪ Next steps by KwangSuk Oh, FAO

11.30–12.00 Closure ▪ Closing comments by Nathanael Hishamunda, FAO
 ▪ Closing remarks by the Government Representative in Rwanda: Cecille Uwizeyimana, Aquaculture and Fisheries Program Coordinator, Rwanda Agriculture and Animal Resources Development Board

12.30–13.30 Lunch

APPENDIX 4 – BACKGROUND DOCUMENT

Aquaculture co-management



Background document to FAO Expert Workshop on Aquaculture Co-management
 Hôtel des Mille Collines, Kigali, Rwanda
 8 to 10 June 2022

Prepared by Simon Bush and Arian van Huis
 Wageningen University, The Netherlands

Acknowledgements

Cover art and figures by Emily Liang. Thanks in advance to the workshop participants.

Acronyms and abbreviations

EAA	ecosystem approach to aquaculture
GSA	Guidelines for Sustainable Aquaculture
NGO	non-governmental organization
AqCM	Aquaculture co-management

INTRODUCTION

1. Governance, defined as a set of decision-making processes and practices that solve societal problems and create societal opportunities (Kooiman *et al.*, 2008, p. 17), plays a fundamental role in shaping the development of the global aquaculture sector. Aquaculture governance covers a range of scales – from the farm to international value chains (Bush and Oosterveer, 2019). However, it is commonly translated into a range of farm-based management processes and instruments that target farmers as key decision-makers over key inputs and outputs of production. For example, national and intergovernmental bodies have developed guidelines for improved farm management, either in line with or in addition to, market-based social and environmental standards (see for example, Vince and Haward, 2017). However, as aquaculture has expanded around the world, there is growing recognition that farm-level decisions that underpin growth and profit are directly affected by social, production, market and environmental risks that extend far beyond the farm scale (Bush *et al.*, 2019; Naylor *et al.*, 2021). Addressing risks that extend beyond individual farms requires collaborative forms of management – or co-management.

2. Co-management has been advanced in natural resource settings where shared public resources require collaboration between resource users and the state (Sen and Raakjaer Nielsen, 1996; Berkes *et al.*, 2001). Co-management takes many different forms based on (i) the scale at which resources are managed, (ii) the range of actors that claim a stake in those resources, and (iii) the degree to which rules and norms are set by states and/or resource users (Plummer and Armitage, 2007). While co-management in fisheries and forestry, for instance, has been traditionally seen in terms of the relationship between states and resource users, it has also been extended to networks of resource users across river basins and landscapes dealing with connected, but non-spatially contiguous risks (Adger, Brown and Tompkins, 2005; Carlsson and Berkes, 2005). Common to most, if not all co-management, is to generate legitimate goal identification and decision-making related to the use of resources and/or wider environmental risks based on pluralism, negotiation, learning and shared action (Plummer and Fitzgibbon, 2004).

3. The models of co-management that might be most relevant for aquaculture are currently unknown. In closed recirculating systems, co-management may extend less to resource use and more to shared infrastructure for achieving circularity and/or improved animal health (e.g. Dong *et al.*, 2022). In open aquaculture systems on land and at sea, which continue to dominate global aquaculture, co-management may be more focused on mitigating input use (e.g. water, land and feed) or output flow (e.g. effluent, escapees and water quality on land) in line with the Food and Agriculture Organization of the United Nations' (FAO's) ecosystem approach to aquaculture (EAA) (Brugère *et al.*, 2019). In small-scale urban and rural aquaculture, co-management may be relevant for building the capabilities of producers to access knowledge on better farming practices, and gain access to key inputs and/or negotiate tenure over land and water (e.g. Galappaththi and Berkes, 2014). Co-management may be relevant for enabling producers, governments and the private sector to upgrade production to meet international public guidelines (e.g. FAO's *Guidelines for Sustainable Aquaculture* [GSA] and the ecosystem approach to aquaculture [EAA]) and private standards (e.g. Aquaculture Stewardship Council). Finally, co-management may be relevant for implementing conservation or regenerative low trophic aquaculture in support of habitat restoration that achieves both improved ecological status improved livelihoods for (poor) resource users.

4. Aquaculture co-management (AqCM) does not yet exist in name. But if clearly defined, AqCM can offer a means of bringing together a range of existing approaches that are either already in practise or being developed. Here we think of the broad public policy ambitions of the EAA as well as more applied policy instruments such as zonal or area-based aquaculture management. However, AqCM may also offer a bridge to the growing range of private sector attempts to guide beyond farm sustainability, including jurisdictional approaches that bring together producers, buyers, financiers and states to promote regional sustainability innovation (Bush *et al.*, 2019; Bush *et al.*, 2021). By defining goals, models and practices of implementation, and monitoring and evaluation for AqCM, FAO can provide guidance on the ways collaborative aquaculture management can support future production, conservation and social equity ambitions in the aquaculture sector.

The remainder of this document provides background for participants who attended the FAO Workshop on Aquaculture Co-management with the goals of:

- (i) Defining the aim and principles of AqCM;
- (ii) Characterizing potential models of AqCM relevant to the breadth of aquaculture globally;
- (iii) Outlining indicators and tools to assess AqCM where it is developed;
- (iv) Defining the role of AqCM in addressing future challenges facing the sector; and
- (v) Defining the main steps for future implementation of AqCM.

5. Each section concludes with a set of questions that are designed to guide the discussion at the AqCM workshop. The responses from workshop participants to these questions will be used in the workshop report and help define future actions by FAO in the development of AqCM.

DEFINING AQUACULTURE CO-MANAGEMENT

6. Co-management has no single definition but it is broadly understood as: *a set of approaches that cover the full range of collaborations through which resource users and states, with the support of “external agents”, share responsibility and authority for decisions over how, where and when management is practiced* (Berkes *et al.*, 2001; Armitage *et al.*, 2009).

Co-management is, as such, distinct from other forms of cooperative environmental governance such as multistakeholder arrangements, policy networks and consultation processes, because it enables primary resource users (including food producers) to deliberate over their rights and responsibilities related to resource access and use (Berkes, 2009; Hasselman, 2017).

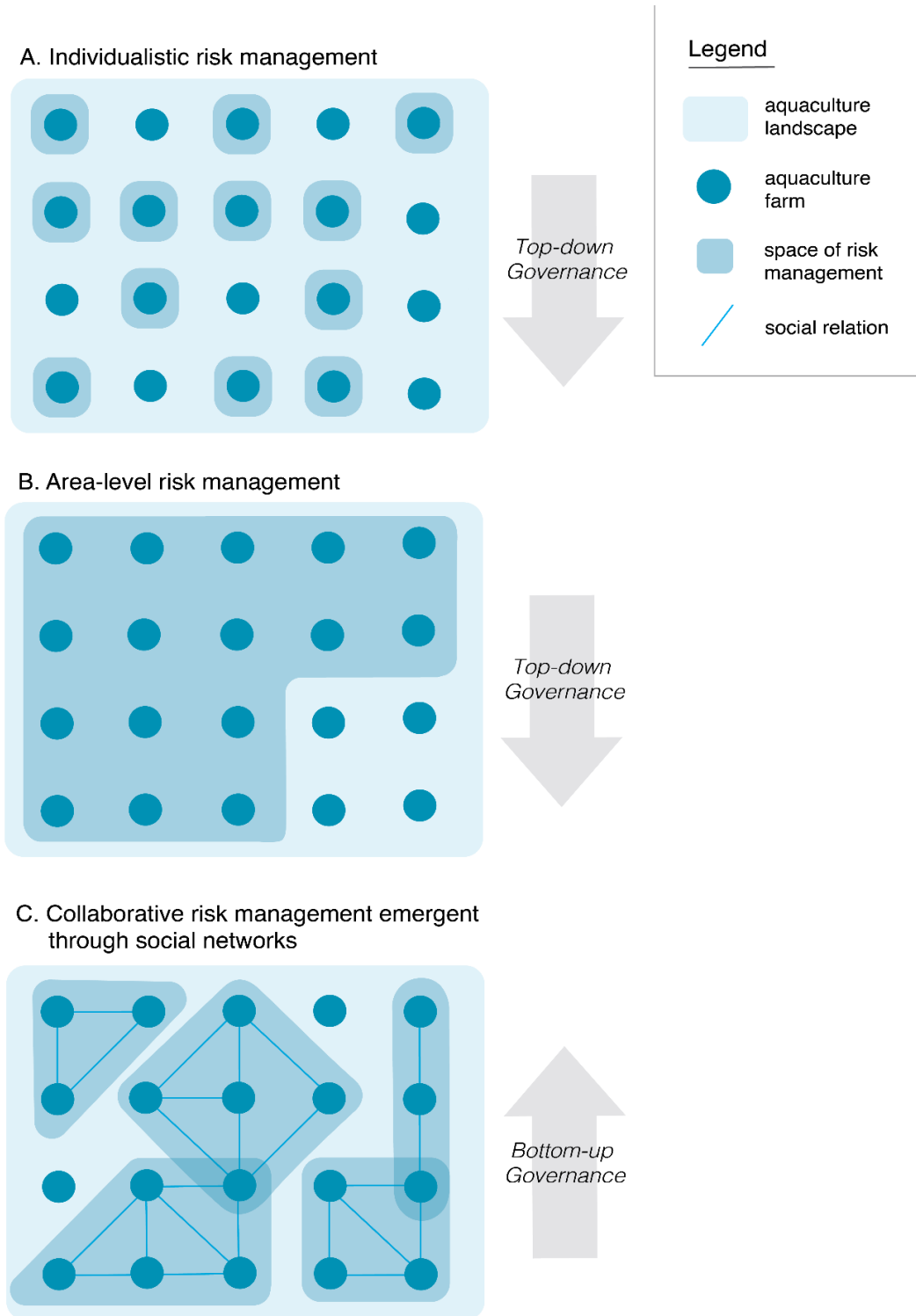
7. Co-management holds considerable potential for aquaculture given the expanding role of the sector in food systems and, concurrently, the growth and diversity of those involved or affected by its expansion. Co-management can also provide a means of simultaneously operationalizing the social and environmental objectives of the EAA and GSA by enabling the uptake of best practices for sustainable aquaculture. As outlined in the GSA and the EAA, collaboration is prescribed not only between producers, but a growing range of public and private actors, including: “local authorities, regional and international organizations, trade unions, research institutions, and other relevant stakeholders involved in the aquaculture value chain” (FAO, 2022). Co-management also responds to the EAA’s call for “new institutions or frameworks for institutional collaboration and joint decision-making” (FAO, 2022), in particular by offering a shared or even bottom-up counterbalance to the EAA as a top-down strategy for zoning and policy implementation.

8. AqCM may differ from co-management in other sectors because of the shared nature of production risks. Identifying risk as a key driver of collaboration links directly to the EAA in terms of recognizing aquaculture’s impact on the surrounding environment, as well as the influence of the surrounding environment on the conduct and performance of production. These risks can be defined in multiple ways – from environmental risks related to water quality, to social risks related to benefit sharing, and economic risks linked to market access. All of these risks, however, coalesce around their effect on the sustainability of production (Meuwissen *et al.*, 2019; Lien *et al.*, 2021). Following Bottema (2021), it is the shared nature of these risks that determine collaboration among producers (and other actors) and the spatial extent of that collaboration. From this socio-spatial understanding of risk, multiple AqCM approaches may be relevant – ranging from collaboration between individual farmers across a landscape, to the definition of zonal approaches (in line with the EAA), to the elaboration of socially defined collaborative management based on multiple shared risks (Figure 1).

9. The following provides (i) an outline of the key aims of co-management and their potential relationship to aquaculture; (ii) an overview of the rationales used to justify the use of co-management

in resource management, including food production; and (iii) a set of underlying principles pertinent to the broad field of co-management and their potential application to aquaculture.

Figure 1. Socio-spatial design of collaborative aquaculture management



Source: Bottema, M.J.M., Bush, S.R. & Oosterveer, P. 2021. Assuring aquaculture sustainability beyond the farm. *Marine Policy*, 132. <https://doi.org/10.1016/j.marpol.2021.104658>

Questions for discussion

During the workshop you will be invited to discuss the following questions. You will report back as a group on the key points raised for each.

1. Based on Section 2.1, identify the key aims of AqCM. In doing so, discuss whether AqCM should be:
 - a. Limited to implementation of government objectives, or enable legitimacy and empowerment of producers and other (dis)affected actors;
 - b. Extended to include both social and environmental goals – at farm and landscape levels; and
 - c. Expanded to include technological innovation?

2. Reflecting on Section 2.2, outline the main rationales for developing AqCM? In doing so you may consider whether AqCM is a solution for:
 - a. Resolving issues of distributive justice and legitimacy of the sector;
 - b. Extending opportunities to producers and other value chain actors to improve performance; and
 - c. Extend beyond resource users to include (pre-competitive) private sector sustainability partnerships.

3. Based on section 2.3, discuss which of the principles listed should be included in AqCM.

Aims

10. Co-management can have multiple (often simultaneous) aims that are defined by the actors involved to different degrees. In more instructive and consultative co-management arrangements (based on Sen and Raakjaer Nielsen, 1996), the aims of co-management may be defined by the government. However, in co-management arrangements where resource users are empowered to experiment, monitor, deliberate and respond to challenges, with support from state or non-state actors (see for example Armitage *et al.*, 2009; Hasselman, 2017), aims may iteratively defined. Whether prescribed or self-determined, the aims of co-management can be grouped into the following five categories – each of which hold relevance for AqCM.

11. **Procedural efficiency.** Co-management can contribute to enhancing procedural goals of states and/or the organization of aquaculture producers in line with wider goals of participation, transparency and accountability. In these instances, collaboration is seen as a means of enabling more equitable and efficient decision-making, related to the management of key (shared) inputs such water, as well as land use and effluent flows. By formalizing decision-making those participating in co-management can reduce the amount of time required for consultation and negotiation, either between producers or between producers and adjacent sectors (e.g. Cullen-Knox *et al.*, 2019). Co-management may also enhance information collection around aquaculture, overcoming a recognized constraint to managing both farm–ecosystem level interactions, as outlined in the GSA (FAO, 2022). It may also increase the coherence of fragmented laws and regulation related to aquaculture (see for example Lester *et al.*, 2022). In line with the GSA, co-management may also enable greater openness and accountability of government, especially when aligned to performance-based standards (Hishamunda, Ridler and Martone, 2014; FAO, 2022). It may also facilitate consistency and predictability in aquaculture planning (to foster investment) with the aim of securing tenure rights for producers.

12. **Legitimacy (and conflict resolution).** Co-management is also commonly aimed at generating legitimacy for management rules and processes that are relevant for aquaculture. Co-management is used, for instance, as a means of legitimizing decisions over resource use and planning, either in terms of enrolling resource users in established management systems, or through co-production via multi-stakeholder engagement. Such arrangements reflect initiatives that are already in place to foster joint management and planning of aquaculture when expanding to new production areas (see for example, Corner *et al.*, 2020). In other cases, co-management is used by communities and sectors as a means of establishing: (i) a social license to operate — in addition to legal compliance, increasing cross-sector involvement in management in order to enhance societal recognition for activities (Mather and Fanning, 2019); and/or (ii) a means of avoiding or mitigating conflict over access to resources and/or space, — under the assumption that *a priori* inclusion reduces the need for ongoing consultation. As variously observed (see for example, Sepúlveda *et al.*, 2019); both social license to operate and conflict resolution are key themes relevant to aquaculture in multi-use land and seascapes.

13. **Environmental stewardship.** A central aim of co-management is the improved stewardship of the environment through improved production. As outlined in the preliminary supporting document “*Action-oriented guidance for transforming aquaculture for greater contribution to achieve the SDGs: Key interconnected actions to guide decision makers and practitioners*”, environmental stewardship relates to (i) the protection, restoration and promotion of sustainable ecosystems; and (ii) the efficient use of resources to enable “more efficient, inclusive, resilient and sustainable” food systems. These entail both impacts of aquaculture on the environment, but also impacts of the environment on aquaculture (Naylor *et al.*, 2021). Central to this goal are both the implementation of sustainable aquaculture practices – including those defined by the GSA (FAO, 2022), EAA (FAO, 2010) and various private standards (e.g. Aquaculture Stewardship Council and Global Aquaculture Alliance).

14. Across these guidelines and standards is a growing recognition that “beyond-farm” environmental risks, both to and from aquaculture, require collaborative forms of management. In line with the EAA, this requires greater embedding of environmental objectives with wider economic and social goals “linked to and dependent on many other sectors that use the coastal and aquatic environment” (FAO, 2010). However, the EAA remains a relatively top-down planning “strategy” for, as explicitly stated, achieving “national, regional and international development goals and agreements” through “consultation” (p. 7). Building on Brugère *et al.* (2019), AqCM may enable co-definition of these goals where relevant, as well as over limitations faced by the EAA related to: (i) weak interaction with other resource users and realizing cross-sectoral integration; (ii) the mismatch between legal and administrative frameworks to ecosystem scales; (iii) a lack of clear benefits for producers; and (iv) weak linkages to other sites of knowledge and governance, such as value chains.

15. **Social inclusion.** Another central aim of co-management is to engage plural stakeholder groups and improve the terms of inclusion (including equality and/or fairness) for enhanced nutritional or livelihoods outcomes (Armitage *et al.*, 2009; FAO, 2022). These goals are broadly aligned with the *FAO Guidelines for sustainable aquaculture*, which focus in part on just and fair treatment in terms of equality of rights and opportunities (FAO, 2022). Co-management may, as such, enable negotiation around a fairer distribution of the benefits of aquaculture, and ensuring that these benefits are proportional to any potential burden that stakeholders may bear (Gurney *et al.*, 2021). In this instance, benefits may relate to the achievement of food security and improved nutrition, either directly or indirectly from aquatic food production), and/or the promotion of inclusive livelihoods and economies in aquaculture-related value chains (see for example, Hernandez *et al.*, 2018).

16. **Innovation.** A less common aim associated with co-management is innovation. While claims are made around the role of adaptive co-management as a means of institutional innovation – through learning and iterative adjustment – less attention has been given to technological innovation. Instead, technological innovation, a key theme in aquaculture, has been framed in terms of multistakeholder innovation platforms, with examples in both Europe and Asia (Bostock *et al.*, 2016; Bush *et al.*, 2021). In line with co-management, these platforms foster a learning process to enhance the capacity of different actors to anticipate and respond to change, but to do so at a system or sector level (Schut *et al.*,

2016; Pigford, Hickey and Klerkx, 2018). In the context of aquaculture, this learning and anticipation may be linked to innovations aimed at resolving production risks and/or enabling a transition to sustainable intensification (Edwards, 2015; Joffre, Klerkx and Khoa, 2018). This includes, as outlined by Naylor *et al.* (2021), the further domestication of species, improved seed production, species selection and selective breeding, improved biosecurity and health control and the development of new feed ingredients to replace fishmeal and fish oil.

Rationale

17. Co-management has emerged in resource sectors, most notably the fisheries, water and forestry sectors, in response to demands for greater recognition and/or giving legitimacy to (i) existing forms of community, local or Indigenous rule systems, and/or (ii) the formation of co-produced rule systems between resource sectors and the state. A common theme of co-management is the perceived importance of ensuring distributional fairness (Freitas *et al.*, 2020). Such fairness can again be in terms of recognizing historical rights and the achievement of wider social goals through the introduction of new sectors such as aquaculture. This may be achieved by creating legitimate rule systems that “harness self-interest for the common good” (Pinkerton, 2019, p. 336) – both defined by resources users, and wider ambitions as set out through the sustainable development goals (see Cowx and Ogutu-Owhayo, 2019; Nath, Jashimuddin and Inoue, 2020).

18. While shared rules systems, fairness and legitimacy are overarching rationales for co-management, other more specific rationales are pertinent. We reflect on seven of these and their relevance for AqCM.

19. ***Co-management as a means of participation, transparency and compliance.*** Co-management may afford aquaculture producers more inclusive and fair participation in decisions surrounding public resource issues (related to water and land use) or the management of common risks such as disease. However, the degree to which co-management allows fairness and collaboration for food producers, like aquaculture farmers, remains in large part determined by government (e.g. Nunan, 2020). In some instances, government may play an enabling role to allow aquaculture farmers to develop independent management of key inputs such as water or disease management. However, in keeping with other sectors, co-management may also be used as an instrument by governments to instruct or consult resource users (Sen and Raakjaer Nielsen, 1996) with the goal of improving compliance with state regulation and reducing transaction costs related to data collection, monitoring and enforcement (Peacock *et al.*, 2020).

20. ***Co-management as a means of pluralism.*** Co-management has advocated the recognition and empowerment of diverse (Indigenous and local knowledge and rule systems) into resource management (Berkes, 1993; Maxwell *et al.*, 2020). The focus on marginalized groups has reduced co-management to a dyadic relationship between states and resource users. More recently, co-management has adopted more networked models that include a range of state and non-state actors that either enable or constrain resource users to pursue activities related to production and/or resource stewardship (Adger, Brown and Tompkins, 2005; Kamiyama *et al.*, 2018). The role of the state has been central to co-management arrangements that seek greater recognition, decision-making and power sharing of plural legal regimes over common resources – from local to international actors and rule systems (Plummer, Armitage and De Loë, 2013). Given the multiscale nature of aquaculture, in terms of inputs and market regulation, co-management would benefit from a more plural, networked incorporation of non-state and international actors. In this instance, AqCM could for example incorporate private sector (sustainability) partnerships, including companies and international standards.

21. ***Co-management as conflict resolution.*** A common rationale for co-management is conflict mitigation or avoidance – between actors in a single sector (e.g. fisheries, see for example Murunga, Partelow and Breckwoldt, 2021) and/or between marginalized resources and new and adjacent sectors (e.g. between fisheries and tourism, see for example Alipour and Arefipour, 2020). Conflicts may also be primary, i.e. pre-existing between competing actors or sectors, or secondary – when they emerge

either from the process of implementing co-management or in the process of expanding the aquaculture sector (e.g. Galparsoro *et al.*, 2020). Conflict resolution is relevant to aquaculture in both ways. Co-management may offer a means of enabling deliberation and resolution of long-standing conflicts related to ambiguous tenure arrangements, and social and environmental impacts derived from production. Co-management may also enable the aquaculture sector to either establish a social license to operate that extends beyond legal compliance (Mather and Fanning, 2019), or establish grounds for non-expansion where other interests and values prevail.

22. ***Co-management as a means of learning and adaptation.*** Co-management is also promoted as a means of promoting adaptive decision-making through learning and reflection. Central to adaptive co-management is the inclusion of plural sets of cross-scale actors continuously interacting to adjust their positions and roles in solving problems around resources (Carlsson and Berkes, 2005; Finkbeiner and Basurto, 2015). Rather than an implementable model, adaptive co-management is seen as a stage of development that may dissipate and be resurrected in the face of a new (perceived) crisis, rather than a “plug and play” model (Butler *et al.*, 2015; Cox *et al.*, 2020). Adaptive co-management could be applied to any number of dimensions of aquaculture that require continued evaluation and adjusted actions – from water management to managing the quality of seed. The principles of networked learning may also be extended to the formation of aquaculture innovation and technology platforms (Bush *et al.*, 2021), thereby giving a wider role to non-local private sector actors.

23. ***Co-management as a means of enabling capabilities.*** Empowerment is another key rationale for co-management, especially where resource users or producers are adversely constrained by state regulation, conflict and market competition. Co-management can be seen as a means of enabling resource users to develop the capabilities (skills, rights and relations) to not only take on greater responsibility to comply and compete, but to transform how production is organized and performed (Finkbeiner and Basurto, 2015). Affording producers the opportunity to develop their capabilities, as well as how transformative these capabilities can be, requires collaboration with state, market and financial actors (e.g. Samerwong *et al.*, 2020). For aquaculture, such arrangements may include government support to secure tenure arrangements, market-led improvement programmes (such as aquaculture improvement projects), and risk transfer (finance and insurance) models based on achieving environmental and social goals.

24. ***Co-management as institutional fit.*** Co-management can be a means of improving the fit of existing state and private institutions to the spatial scale of environmental and/or social issues. Improved institutional fit through co-management can be an outcome of adaptive processes of decision-making (Armitage *et al.*, 2009) that reflect recognition by resource users, the state and/or non-state actors that spatial “jurisdictions” of rules do not align with the spatial extent of environmental risks or impacts (Bottema, Bush and Oosterveer, 2018). Creating improved institutional fit is already inherent to the EAA which explicitly aims to extend management to ecosystems (Brugère *et al.*, 2019). It is also taken up in models related to aquaculture management areas and approaches (Henriques *et al.*, 2017). Consistent across all these approaches is a recognition of the need to move beyond the farm scale towards collaborative forms of management that extend to higher social and ecological (landscape) scales.

Principles of “good” aquaculture co-management practice

25. The following six principles for good AqCM practice align with wider principles for good governance and best practice for collaborative resource management (e.g. Pomeroy, Katon and Harkes, 2001; Armitage, Berkes and Doubleday, 2010; FAO, 2022). The following section outlines these broad principles with an emphasis on their relevance for aquaculture. Attention is given to the “collaboration” in dimensions that extend beyond community-state relations to include market actors and non-governmental organizations (NGOs) – in line with the aspirations of the EAA and GSA.

26. Principle 1. Aquaculture co-management should only be established when key “antecedents” that justify and enable collaboration are in place

There are several antecedents for co-management, without which the scheme would not be sustained (based on Pomeroy, Katon and Harkes, 2001; Plummer and Fitzgibbon, 2004; Chuenpagdee and Jentoft, 2007). These are:

- i. AqCM should respond to a (perceived) resource management crisis (e.g. disease or water quality), for which there must exist an adequate recognition of the problems from actors involved.
- ii. Producers, government and relevant private sector actors should be willing to participate through a clear incentive scheme, to accept that some short-term benefits must be relinquished for longer term gain.
- iii. Producers, government and relevant private sector actors should have the opportunity to negotiate in a fair and free manner, i.e. in the absence of threat, violence, and/or intimidation from others.
- iv. The design of AqCM should be supported by the legislative and policy environment and sanctioned by government authorities with the political will to back it up.
- v. Past injustices between collaborating actors should be acknowledged (at a minimum) and addressed to avoid an impasse at later stages of development.

27. Principle 2. Aquaculture co-management should enable institutional fit to the socio-spatial extent of aquaculture impacts and risks

- i. AqCM must be organized at the appropriate scale. The level at which the scheme is organized must fit the ecology, management system and the people that inhabit it.
- ii. The definition of socio-spatial boundaries should be based on principles of subsidiarity (Jentoft 2003), spatial planning aligned to the EAA (FAO, 2010) and/or defining the spatial extent of shared risks (see Lien *et al.*, 2021).
- iii. Transboundary management should be enabled by authorities through the promotion of regional (landscape and/or seascape) approaches for harmonizing laws and creating binding legal mechanisms across boundaries.
- iv. Support should be given to those engaged in AqCM to respond private norms and standards (national, regional or global) for responsible aquaculture
- v. Because of the leases and permits required for operation, aquaculture needs effective interagency collaboration between departments.
- vi. The legitimacy of property rights and decision-making must be clearly defined to enable fair access to key inputs to production, including space and water resources.
- vii. Mechanisms for allocating use rights should be clearly established and corrected where actors feel it necessary.

28. Principle 3. Aquaculture co-management should enhance the institutional, production and livelihood-related capabilities of producers

- i. AqCM should enhance aquaculture producer capability by strengthening possibilities for cooperative and or collective action for setting rules around key inputs to production and/or enhancing bargaining power for inputs and/or farm gate prices.
- ii. Involvement in AqCM should enable producers to improve their ability to access new knowledge, technologies and finance required for upgrading production practices for sustainable aquaculture (e.g. FAO, 2022).
- iii. AqCM may enable producers to engage in decision-making processes related to the allocation of resources (e.g. land, water and space) and the co-definition or revision of production and market-related standards and requirements (domestic and global).
- iv. A clear division of responsibilities and rights over the conduct of socially equitable and environmentally responsible aquaculture must be open to negotiation by producers, government and the private sector.
- v. Conflict resolution mechanisms should be established between producers, the state and other (adjacent) sectors, to enable open access to negotiations, which in turn affect legitimacy, accountability and transparency.

- vi. Producers should be supported to develop self-enforcement and monitoring of agreed upon norms, rules and/or standards related to production inputs (feed, seed and water), effluent flows and other environmental and social issues (see FAO, 2022).
- vii. Co-management should enable the transfer of material and management-related technologies pertinent to farm installation and construction, culture techniques, pond maintenance practices, disease diagnosis and reporting.

29. Principle 4. Aquaculture co-management should enable inclusive social learning and adaptive change

- i. AqCM should be inclusive of actors that benefit from or are negatively affected by aquaculture production (including those working in aquaculture or an adjacent sector).
- ii. AqCM should be defined by fair and free negotiation that is inclusive, with a clear division of roles and responsibilities, and with benefit-sharing legitimized by participants.
- iii. A representative variety of stakeholders must take part in fair and free negotiation – meaning without threats, violence or intimidation.
- iv. Adaptive learning through participatory evaluation should be core to the design of co-management rules and procedures to enable inclusion.
- v. Communication should be respectful, and under the guidance of a governing body or other authoritative agency (e.g. scientists), that can guide the process in an efficient manner.
- vi. There should be a clear division of roles, responsibilities and rights between stakeholders. The synthesis of scientific and other (non-scientific) knowledge is important, but important co-management decisions must primarily be evidence-based.
- vii. Adaptive AqCM first implies the establishment of suitable and relevant indicators that are comprehensive (i.e. span ecological, institutional/governance and economic factors), but not so detailed that they go beyond the comprehension and capacity of actors (indicators for fisheries are well-established [see for example, Evans, Cherrett and Pems, 2011; Pomeroy *et al.*, 2022] and some may be interchangeable with aquaculture).
- viii. Measuring success is essential for adaptive AqCM, providing fiscal accountability for continued funding by demonstrating tangible benefits.

30. Principle 5. Aquaculture co-management should enable cross-sectoral collaboration to strengthen capacity, legitimacy and effectiveness

- i. Coordination between government and the private sector is a prerequisite for effective AqCM that not only requires the involvement of producers, but also market actors and spatially adjacent sectors (e.g. agriculture, processing industries and fisheries) competing for resources such as land and water (in line with the EAA [FAO, 2010]).
- ii. AqCM should develop networks of producer organizations to enable coordination, communication and bargaining power with adjacent sectors.
- iii. Government departments involved in AqCM and/or the management/regulation of cross sectoral public resources should develop partnerships with and between aquaculture and relevant non-aquaculture private sector actors and NGOs.
- iv. Where market assurance is required, partnership agreements (or covenants) should be put in place that define roles and responsibilities, level of self-determination (authority) and conflict resolution mechanisms in the case of disputes.
- v. AqCM should enable inclusive forms of collaboration where fair benefit sharing mechanisms, including costs, risks and benefits, can be openly negotiated by participants.

31. Principle 6. Aquaculture co-management should enable innovative and inclusive business

- i. AqCM should enable the design of internal risk transfer mechanisms, through collective forms of insurance and cooperative lending, or access to external risk transfer through state and/or private insurance, finance and/or supply contracts.
- ii. In the case of small-holders, AqCM may enable innovations to be shared among producers or enable connections to be made with service providers (e.g. information technology and extension services) that address day-to-day business challenges such as production

smoothing, savings and business planning (see for example, Pouw, Bush and Mangnus, 2019).

- iii. Collaborative management, including sustainability partnerships with NGOs or government-led leading aquaculture improvement projects (see Bottema, 2019) can enable compliance with better management practices or market-based requirements in either domestic or international markets.

MODELS OF AQUACULTURE CO-MANAGEMENT

32. Applying co-management to aquaculture brings with it challenges that extend beyond other resource sectors such as fisheries, water and forestry. In contrast to these sectors, aquaculture is arguably more diverse in terms the intensity and “openness” of systems, capacity of producers, ownership arrangements, spread across and links between marine, coastal and terrestrial ecosystems, and the range of risks for production to and from the surrounding environment. This diversity indicates that it is unlikely there is a single approach to AqCM. Instead, multiple AqCM approaches are likely to be needed that can enable any number of the aims, rationales and principles listed above to be addressed. The following describes five possible types of AqCM, with a short reflection on their advantages and disadvantages (see also Figure 2).

Questions for discussion

During the workshop you will be invited to discuss the following questions. You will report back as a group on the key points raised for each.

1. Review the five types of AqCM listed below and discuss whether they cover the possible range of co-management approaches relevant for aquaculture.
 - a. Are the types of AqCM relevant and appropriate?
 - b. Are there any AqCM approaches that you think are missing?
2. How do the various AqCM approaches listed below relate to the aims, rationales and principles listed above?
3. To what extent might the different AqCM approaches enable the goals of the EEA and the GSA?

3.1. Culture-based fisheries

33. Culture-based fisheries are a category of extensive aquaculture practice that supplement, sustain, or raise total production beyond a level which is sustainable through natural processes of stocking and recapture (De Silva, 2003; FAO, 2015). Culture-based fisheries are diverse in terms of the water bodies in which they are practised, the species stocked and the harvesting techniques employed (De Silva, 2016). They are also diverse in terms of ownership and benefit sharing and management strategies. Culture-based fisheries tend to be communally managed by a defined community which either holds tenure over a water body (natural or human-built) or has jointly invested in stocking (Sarkar *et al.*, 2020). In some cases, culture-based fisheries relate to secondary harvesting or gleaning of stocked and non-stocked activities in private aquaculture ponds (Mialhe *et al.*, 2018). Apart from these gleaning activities, most culture-based fisheries remain a communal activity in water bodies that have multiple uses – including irrigation for crop production and/or energy generation (De Silva, 2016). They may also feature different degrees of government involvement, either in terms of water management, or state supported stocking.

34. Co-management is seen as an inherent part of culture-based fisheries. The strong focus on community involvement in culture-based fisheries means that equitable distribution of benefits is a key objective, coupled with the establishment of community rights and responsibilities for stocking and harvesting (FAO, 2015; De Silva, 2016; Galappaththi, Ford and Bennett, 2020). The multi-use nature of many water bodies used for culture-based fisheries also means that coordination is needed between state and community institutions to ensure that water management goals related to irrigation and/or energy production, as well as environmental goals in wetland ecosystems, are maintained (FAO, 2015). Agreements are needed on the legitimate stocking arrangements by governments, including the assignation of rights and responsibilities. Co-management of culture-based fisheries can also enable adaptive decision-making when confronted with rapidly changing environmental conditions in perennial water bodies, or where changing socioeconomic conditions lead to reliance on fish production (Galappaththi, Ford and Bennett, 2020). Finally, arrangements need to be established for conflict resolution arising from the exclusion of other water resource users and fishers (often seasonal and migratory). These agreements may also extend to co-harvesting arrangements of target species, requiring engagement with fishery management practices (e.g. Sarkar *et al.*, 2020).

Figure 2. Typology of potential aquaculture co-management approach

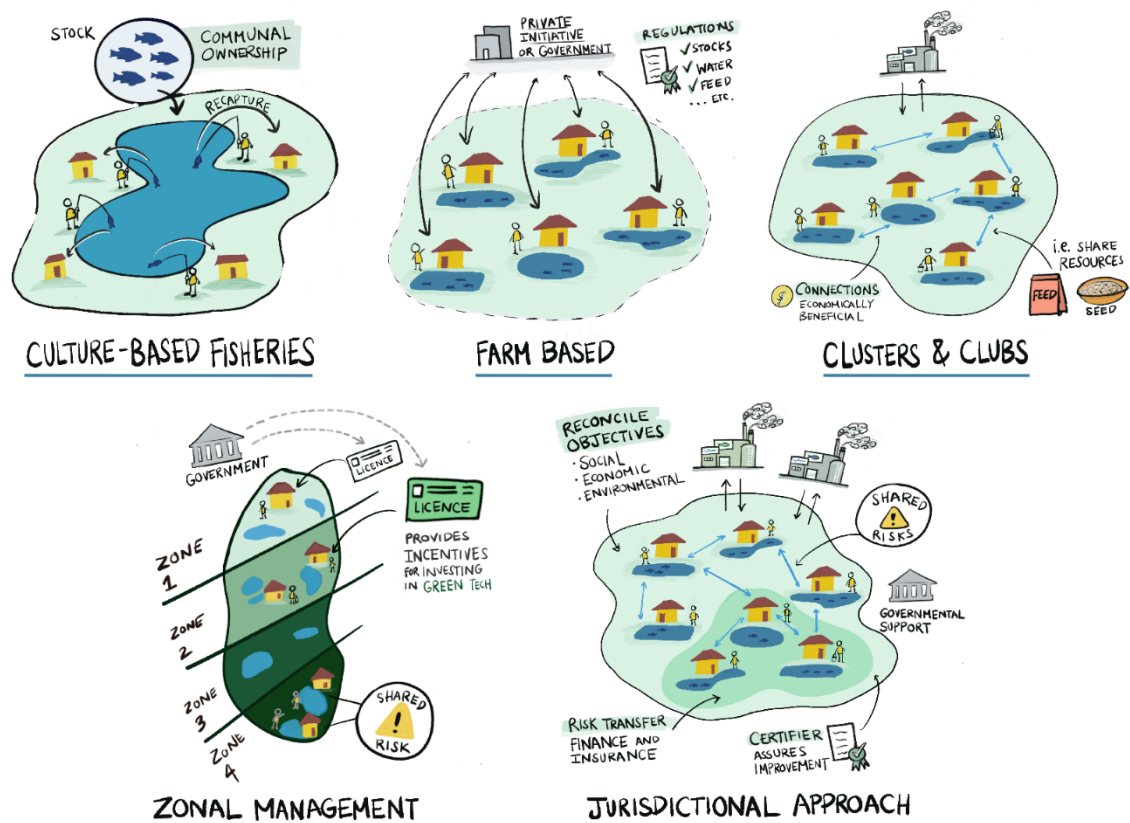


Image: © Emily Liang

Farm-based

35. Individual farmers are not, when operating on their own farms, commonly seen to engage in co-management. However, if the farm is taken as a primary scale of management it is apparent that both government and private actors provide varying degrees of guidance that shape production decisions and practices. Collaboration at the farm scale can be linked to government extension services, non-state-run

aquaculture improvement projects and the range of advice provided to producers by input suppliers. In some instances, external advice to farmers is instructive, specifying requirements, while in other instances it may be informative and even cooperative through contract arrangements with input companies, aquaculture improvement providers and/or government extension services (Bottema, 2019). In all instances, management is rarely the sole remit of producers, but instead depends on learning and adaptation that enhance compliance and (potentially) transparency as prerequisites for access to inputs and/or markets.

36. The consequences of individual farm-based management decisions, enabled by any of the external actors outlined above, can hold broader consequences for the livelihoods of actors as well as the surrounding environment. For instance, these various levels of collaboration with private and public actors can shape their risk perception related to disease risks, market risks and climate risks (Joffre, Poortvliet and Klerkx, 2019; Lien *et al.*, 2021). This can lead to farm level management decisions that, while shaped by wider collaborations, remain at the farm scale. Consequently, collaboration at the farm scale may not necessarily require collaboration between farmers, but it can have broader benefits as the sum of individual collaborations with farmers.

Clusters and clubs

37. Clusters are geographic concentrations of collective action by farmers that compete but also cooperate in each area. They can, as such, be seen as a form of co-management that is predominantly aligned to economic and livelihood goals and can also be used to manage production risk (Bush *et al.*, 2019). Clusters have been organized by informal, unregistered farmer organizations, associations and cooperatives to increase bargaining power for inputs or marketing purposes and extend the implementation of public and private standards and best management practices at the farm level (Umesh *et al.*, 2010; Kassam, Subasinghe and Phillips, 2011). They have also been, in a more top-down fashion, developed as production “clubs” linked to processing companies seeking to mitigate their supply risk (Bush and Oosterveer, 2007; Ha, Bush and van Dijk, 2013). As variously shown, clustering facilitates the adoption of farm level production risk management strategies, such as water quality management, and facilitates horizontal coordination between farmers to reduce market and financial risks (Umesh *et al.*, 2010; Kassam, Subasinghe and Phillips, 2011; Ha, Bush and van Dijk, 2013; Joffre, Poortvliet and Klerkx, 2018). It has also been shown that clusters can increase trust between producers, leading to improved information exchange and technology adoption (Joffre, Poortvliet and Klerkx, 2019).

38. Evidence demonstrates that cluster formation can attract more or less involvement from external actors, such as the state (Joffre, Poortvliet and Klerkx, 2019). There is, however, growing recognition that the ability of clusters to adaptively address common on-farm production risks is greatest when organized around homogenized environmental risk perception (e.g. climate and water quality) (Bottema, Bush and Oosterveer, 2018). Shared risks can, as such, be used as a key identifier in the co-management of clusters (in line with the GSA and EAA). Identifying these shared risks should, however, be based on social linkages as a starting point for the spatial extent of collaboration – with the explicit goal of ensuring the needs and requirements of its members are aligned (Bottema, Bush and Oosterveer, 2018). Given that the risks of producers are linked directly to the supply risk of traders and processors, clusters can be a means of creating stronger partnerships within value chains.

Zonal management

39. Zonal approaches to aquaculture management are a spatially explicit means of managing production risks related to carrying capacity. Zonal approaches are, as such, aligned to the EAA as a means of incorporating an integrative and cross-sectoral approach to sustainable development, which in principle align to the goals of co-management (Brugère *et al.*, 2019). To illustrate, the EAA emphasizes the need to integrate farming practices into a given ecosystem and to develop aquaculture in the context of other sectors, “such that it promotes sustainable development, equity, and resilience of interlinked

social-ecological systems” (Soto *et al.*, 2008). It also has been highly influential in translating holistic, integrative and cross-sectoral approaches to sustainable development into site selection and spatial planning and designation of aquaculture management areas or “zones” by public institutions (e.g. Aguilar-Manjarrez, Soto and Brummett, 2017) and NGOs such as the Sustainable Fisheries Partnership and The Nature Conservancy.

40. Zonal management has been applied to both macro and meso-level management of aquaculture. However, in keeping with the EAA, macro zonal approaches tend to focus on state-defined regional management areas for disease control in salmon farms (Chang, Coombs and Page, 2014; Gustafson *et al.*, 2016; Murray and Gubbins, 2016) and government-led spatial planning processes (Sanchez-Jerez, 2016). These have been translated into bay management plans for salmon (e.g. Chang, Coombs and Page, 2014; Brigolin *et al.*, 2015), “allocated zones for aquaculture” (e.g. Brigolin *et al.*, 2015), and “appropriate areas for aquaculture” (Vila *et al.*, 2016). The goal of these zones is – in contrast to cluster and farm-based approaches – to coordinate farmers across broad ecological units within which off-farm risks are unequally distributed. However, in practise, zonal approaches tend to be associated with improving short-term production efficiency based on single indicator measures such as reducing sea lice densities in salmon (see Olaussen, 2018), and wider goals such as incentivizing sustainability innovation through licencing requirements for accessing “green” production areas, as seen in Norway (Murray and Gubbins, 2016; Aguilar-Manjarrez, Soto and Brummett, 2017). Questions remain about the degree to which zonal approaches aligned with the EAA interact with non-aquaculture resource users, enable producers to achieve wider social benefits, and provide a basis for innovation, learning, legitimacy and improved market access (see Brugère *et al.*, 2019; Bush *et al.*, 2019).

Jurisdictional approach

41. Jurisdictional approaches have emerged in terrestrial production systems, including forestry, livestock and agriculture, with the goal of aligning social and environmental management to a spatial scale concordant with institutions and socio-ecological systems. Common to all definitions of jurisdictional approaches are the reconciliation of competing social, economic and environmental objectives through the improved participation of the state, civil society and/or private sector actors in and across sectors through formalized collaboration in a way that affects the practices and policies within a given spatial unit or jurisdiction (Buchanan *et al.*, 2019; Kittinger *et al.*, 2021; von Essen and Lambin, 2021). Jurisdictional approaches align with co-management in terms of including multiple stakeholders to reconcile divergent interests and increase the legitimacy of policy and regulation. They also resemble co-management by aligning institutional boundaries in an attempt to enable improved monitoring and enforcement – with the wider goal of enabling joint decisions that can both adapt to local contexts and actors while also achieving outcomes on a large scale that can contribute to “system-wide transformation” (von Essen and Lambin, 2021).

42. A key difference with the other approaches to co-management listed above is the broad inclusion of both the private sector, and market-based sustainability instruments (such as certification, finance and insurance), across multiple sectors (Bush *et al.*, 2019). In this way, jurisdictional approaches open up the scope of co-management in terms of enabling both locally- and market-defined incentives to achieve ecosystem-based management (Kittinger *et al.*, 2021). More specifically, they enable the inclusion of multiple supply chains and resources and set incentives for producers by reducing input prices. This is achieved through shared suppliers, shared investments in infrastructure, the promotion of shared knowledge across sectors and producers and enabling producers to access new markets based on the improved reputation of the jurisdiction, with or without certified assurance (von Essen and Lambin, 2021). Finally, they can enable a more direct and potentially pre-competitive role for buyer, financiers and certifiers to support the development of capabilities necessary for improved production. In doing so, these approaches can link food production with biodiversity conservation, climate change adaptation and poverty alleviation (FAO, 2010; Milder *et al.*, 2015; Sayer *et al.*, 2017).

MONITORING AND EVALUATION

43. Monitoring and evaluation systems need to be developed to determine the impact of any of the aquaculture co-management models outlined above. These systems, in short, require the development of information systems that can collect and evaluate relevant data on the conduct and performance of co-managers and co-management arrangements in achieving collaboratively defined goals. In line with the wider goals of adaptive forms of co-management, these assessments should also enable co-managers to reflect on past actions and adapt goals, rationales, rules and arrangements as deemed necessary. The following outline key design components for an AqCM monitoring and evaluation system.

Questions for discussion

During the workshop you will be invited to discuss the following questions. You will report back as a group on the key points raised for each.

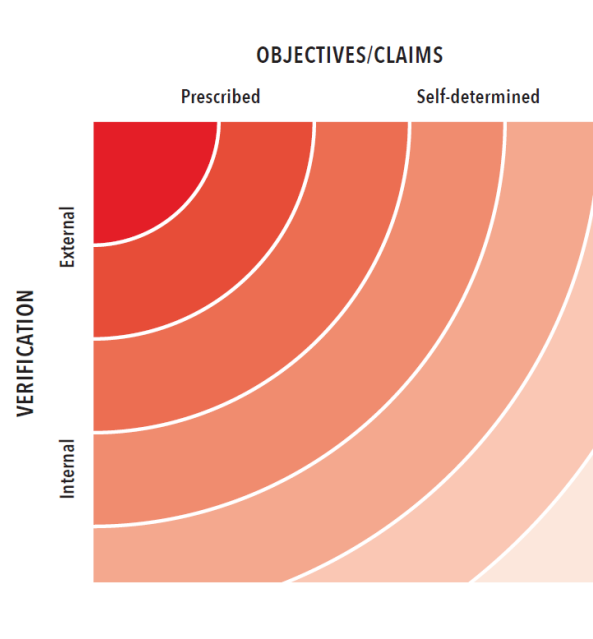
1. Identify key principles for AqCM evaluation based on objectives and verification – do these differ to an evaluation of fisheries co-management?
2. Based on the summary presented below, identify which of the steps of evaluation should be included in an evaluation framework.
3. How might evaluation and monitoring differ for each of the AqCM approaches identified in the previous discussion?

Rationale and approach

44. In line with other frameworks, the overall goal of monitoring and evaluation is to assess how well AqCM is achieving its goals and objectives. The needs of internal actors (e.g. resource users and collaborating state or non-state actors) or external actors (e.g. donors, buyers and auditors) will determine who sets these goals and objectives and who wishes to evaluate them. Following Pomeroy *et al.* (2022), monitoring systems and evaluation processes should be participatory and involve resource users and primary stakeholders in design, data collection and analysis. Depending on (i) the capabilities of those involved; and (ii) the goals of AqCM arrangements, monitoring systems can also be internal, defined and run by producers, or externally run based on intermittent sampling or auditing. Evaluation should, in contrast, only be conducted with the participation of those involved in the AqCM arrangement to enable reflection and changes as required. In line with the GSA, it is important that representation is inclusive of both men and women, as well as youth and Indigenous people.

45. An important consideration for the design of monitoring and evaluation is the degree to which internal or external actors demand verification and/or assurance on the effectiveness of AqCM (Bottema, Bush and Oosterveer, 2021). For instance, whether a co-management arrangement based on a high degree of self-determination is assessed internally or externally depends on the involvement and/or trust of those needing assurance verification (Figure 3). If greater self-determination is coupled with a high level of perceived legitimacy over the design and implementation of an AqCM arrangement, then limited external evaluation is needed. Conversely, if there is high degree of trust and legitimacy, greater attention may be given to self-determination and evaluation. This spectrum of outcomes not only reflects the range of co-management arrangements, such as those outlined by Sen and Nielsen (1996), but also indicates the spectrum of legitimacy and accountability for these arrangements for different audiences.

Figure 3. Spectrum of verification applied to “beyond farm” aquaculture co-management



Source: Bottema, M.J.M., Bush, S.R. & Oosterveer, P. 2021. Assuring aquaculture sustainability beyond the farm. *Marine Policy*, 132. <https://doi.org/10.1016/j.marpol.2021.104658>

46. Another important consideration in the design of monitoring and evaluation is the degree to which “social learning” and adaptive change is enabled. Generally, evaluation within co-management improves individual and organizational learning, fosters the knowledge acquisition of those involved, improves communication and increases their cohesion and self-confidence (Trimble and Plummer, 2019). These goals can be achieved by evaluating different processes of AqCM design, implementation, operation and outcomes.

Types of evaluation

47. Multiple dimensions of AqCM can be monitored and evaluated, including the different stages of implementation and the social, institutional and environmental impact of AqCM. To capture these different dimensions, five different types of evaluation may be considered (building on Pomeroy *et al.* [2022]):

- (i) **Input evaluation** – aligned with “principle zero” above, an input evaluation assesses whether the key antecedents for AqCM were in place prior to design and implementation. This evaluation assesses whether co-management was suitable for the aquaculture industry, region or country in the first place, in terms of responding to Principle 1.
- (ii) **Throughput evaluation** – this evaluation focuses on the implementation and ongoing operation of the fisheries co-management system. Questions may focus on how well it functions relative to principles 2 to 6 for AqCM, outlined above.
- (iii) **Output and outcome evaluation** – this level of evaluation focuses on the achievements of the goals and objectives that are stated in the AqCM plan. The evaluation assesses performance and effectiveness against a set of criteria and standards, expressed as indicators. These indicators can include social and environmental outcomes across different scales – from regions to farm scale and households. Social indicators would evaluate income, equity and inclusiveness; environmental parameters could focus on any number of measurable factors, either on- or off-farm. For instance, water quality, escapees and pharmaceutical use, etc.

Decisions over which indicators to use would be determined by those participating in the co-management arrangement in line with producer, government and market needs and demands.

48. The timeline for each of the evaluations above needs to be determined in the AqCM implementation plan or covenant. The timeline would include the frequency for conducting an effectiveness evaluation, which in turn is defined by the point in time when measurable change can be observed. In line with the *Guidelines for evaluating fisheries co-management* (Pomeroy *et al.*, 2022), it is recommended that an effectiveness evaluation be conducted every three to five years or linked to revisions of the co-management plan. This will allow time for adjustments in the design and processes of co-management, and for the AqCM activities to be implemented.

Steps of evaluation

49. Again, in line with the *Guidelines for evaluating fisheries co-management* (Pomeroy *et al.*, 2022), it is recommended that any of the above evaluations is undertaken in three steps:

Step 1 – Planning the content, goals and design of an evaluation. In this step the main tasks for the evaluation need to be prepared. This includes the identification of (i) key criteria (related to the principles outlined above), and (ii) the goals and objectives as set out in the co-management plan or covenant.

Step 2 – Compilation of information. This step involves a detailed description of the context, system and design of the AqCM arrangement using the selected indicators associated with the five principles outlined above.

Step 3 – Conduct the evaluation. This step involves conducting the evaluation and analysing data, as well as validating and communicating the results with those involved in the AqCM arrangement.

50. Overall, the evaluation of AqCM should be embedded within routine internal operational monitoring by those involved in the arrangement and, as such, enable adaptive management. The results of the evaluation are used by the co-managers to better understand why goals and objectives and expected impact have or have not been achieved, and to adapt co-management design, processes and actions. Evaluation will also improve knowledge of AqCM more generally.

ROLE OF AQUACULTURE CO-MANAGEMENT IN THE FUTURE

51. AqCM has the potential to play multiple roles and contribute to resolving food and environmental challenges as outlined in the United Nation’s 2030 Agenda for Sustainable Development. These roles can be divided into two categories: first, proximate roles that relate to improving the conduct and performance of aquaculture production, as outlined in the aims and goals in Section 2.1 and second, AqCM has the potential to play several tertiary roles by contributing to the wider governance of the environmental and social transformation of aquatic food systems. When combined, these roles indicate the short- and long-term impact of enabling the aquaculture sector to adapt to changing environmental conditions through more inclusive and adaptive decision-making, while at the same time enabling wider social goals to be met. The following text discusses whether and how co-management could play both proximate and tertiary roles and contribute to social and environmental goals.

Key questions for discussion

During the workshop you will be invited to discuss the following questions. You will report back as a group on the key points raised for each.

1. Based on the summary presented below, which of the proximate and tertiary roles are realistic ambitions for AqCM into the future?
2. Is the short review, based on FAO's *Action-oriented guidance for transforming aquaculture for greater contribution to achieve the SDGs: Key interconnected actions to guide decision-makers and practitioners* complete? Are there additional roles that AqCM might play into the future?

Proximate role of aquaculture co-management

52. AqCM has the potential to enable more inclusive and adaptive forms of decision-making at scales that are concordant with a range of social and environmental risks. In line with the goals outlined above, AqCM can enable the improved management of shared production risks, enable improved compliance with state policy and legislation, and enhance aquaculture's legitimacy or social licence to operate when it is extended to new regions or environments. It can provide a means of enabling greater social inclusion in decision-making and benefit sharing associated with the sector. It can also facilitate knowledge exchange that enables producers to comply with public and private rules and standards.

53. If institutionalized as a means of sector planning and management, AqCM can also play a central role in creating an enabling environment to achieve the 2030 Agenda for Sustainable Development, as outlined in the preliminary supporting document *Action-oriented guidance for transforming aquaculture for greater contribution to achieve the SDGs: Key interconnected actions to guide decision-makers and practitioners*. A sample of the actions that could benefit from AqCM include the following:

- (i) Contribute to the development of strategic partnerships "that work within established governance frameworks ... to strengthen the capacity to coordinate state and non-state actors in order to mobilize resources and capacity";
- (ii) Enhance policy dialogue with the goal of mobilizing "key stakeholders, create decision opportunities and consultations for public investment";
- (iii) Create "space to engage with entrepreneurs and tap into the potential of the private sector, including farmer organizations, cooperatives, small and medium-sized enterprises, in addition to large, export-oriented enterprises";
- (iv) Enable voice and representation of producer organizations and in doing so "help small producers access an array of services, including improved market information, extension and collective bargaining power";
- (v) Enable improved access to and facilitate adoption of best aquaculture practices;
- (vi) Enable partnerships that facilitate public and private investment and encourage "innovation that benefits smallholders and address issues like improving sustainability and resilience, raising incomes and reducing risks, including creating new market opportunities and encouraging diversification, and reducing natural resource depletion and degradation";
- and (vii) Strengthen "networks, partnerships and alliances to increase aquaculture production that generates equitable benefits to stakeholders while preserving the environment and contributing to social stability".

Tertiary roles of aquaculture co-management

54. AqCM can also have an impact on more systemic governance challenges by enabling a conduit between national, regional and local decision-making and practices. This tertiary role may be less related to daily decision-making, and less measurable in terms of direct impact. Nevertheless, co-management can be a means of facilitating changes that require longer time horizons and extend beyond the

immediate remit of production and consumption. Here we outline four potential tertiary roles for AqCM into the future, based on the preliminary supporting document *Action-oriented guidance for transforming aquaculture for greater contribution to achieve the SDGs: Key interconnected actions to guide decision-makers and practitioners*”.

55. **Integration in food systems.** By providing a framework for participatory decision-making, AqCM can enable the improved design of institutional frameworks that include aquaculture in wider food system policies and decision-making. These policies may in turn enable investment and/or the expansion of aquaculture into public policies for agrifood systems development and better access to and the use of public funds for investment in basic infrastructure.

56. **Enabling circular food systems.** AqCM’s role in enabling cross-sector deliberation may extend to intersecting sectors that face their own sustainability challenges – such as water and energy. By linking to these sectors, AqCM may create a role for these sectors to enhance their contribution to aquaculture. AqCM may also enable linkages to market actors, investment finance and credit that can enable risk transfer models and investment in fundamentally new forms of integrated and/or circular production systems. These circular systems can in turn enable water use efficiency, nutrient recovery and re-use and/or feed management with reduced carbon intensity.

57. **Enabling adaptation to new environmental risks.** AqCM may foster decision-making at farm and regional scales that enables more timely adaptation to environmental conditions caused by climate change, such as acidification, salinization and temperature and precipitation changes. Faced with these longer-term environmental risks, participants in AqCM may decide on diversification strategies for production and/or adapted farming practices. AqCM may also enable producers to contribute more directly to the formulation of National Adaptation Plans, ensuring they include and support aquaculture adaptation needs, such as the inclusion of nature-based opportunities and solutions in the nationally determined contributions. Other benefits may include the implementation of contingency planning for droughts, floods and diseases; harmful algal blooms; the adoption of more diversified and resilient production systems; and locally embedded environmental monitoring systems to strengthen aquaculture resilience and improve early warning. AqCM may also enable the integration of climate proofing innovations that increase adaptation and resilience of the sector, e.g. the co-location of aquaculture and renewable energy systems such as wind turbines.

58. **Integration of biodiversity goals.** AqCM may enable the management of genetic resources by enhancing the monitoring of the biodiversity of aquatic organisms at risk of extinction, and enable the adoption of measures to mitigate the risks. This may include new practices that avoid habitat degradation or enabling forms of conservation aquaculture that enhance habitats and biodiversity.

59. **Enhance market incentives in domestic settings.** AqCM can enable market confidence in the sustainability and/or food safety of aquaculture production. As confidence grows, farmers may be able to make claims in domestic and international markets that may in turn generate employment, greater income and technological improvements. If focused on domestic markets, where such claims remain underdeveloped in many parts of the world, producers may improve returns relative to explored markets.

60. **Social responsibility.** AqCM may enable smallholders to provide fair and transparent prices that adequately remunerate their work and investments. To do so, AqCM may empower producers to implement corporate social responsibility initiatives that address decent employment and working conditions in aquaculture, including eliminating child labour.

IMPLEMENTING AQUACULTURE CO-MANAGEMENT

61. Defining the steps that are required to implement AqCM depends on the design of the co-management system. A culture-based AqCM system would, for instance, be more aligned to fisheries co-management where community-level rules need to be developed in line with government

management regimes over stock management. In contrast, farm-based AqCM would require attention and performance at the farm level. A jurisdictional approach would require additional steps to enable cross-sectoral consultation. Despite these differences, the following outlines a set of three implementation steps based on those set out for fisheries co-management, with the key differences for the aquaculture sector identified (Olsson, Folke and Berkes, 2004; Pomeroy and Rivera-Guieb, 2005; Butler *et al.*, 2016).

Key questions for discussion

In your designated group, discuss the following questions. You will report back as a group on the key points raised for each.

1. Review the phases of implementation outlined below and assess whether they are relevant for the full spectrum of AqCM approaches identified in Section 3 of the report (and your discussion on day one of the workshop).
2. Discuss what the key differences might be between aquaculture and other resource sectors (e.g. fisheries) in terms of the implementation of co-management.
3. Discuss key differences between the implementation of AqCM and the ecosystem-based approach.

62. **Phase 1. Pre-implementation.** In line with Principle 1 above, this “step zero” requires joint recognition, and therefore legitimacy, of co-management. A rationale might be built around a shared recognition of the need for collaborative management based on a shared resource crisis (e.g. disease or water quality) or changing policy or market access requirements. This step also requires relevant actors to clearly state their willingness to engage in AqCM, including the credible intent of government to consolidate or develop supportive legislation and/or policy. Finally, past (perceived) injustices need to be identified, acknowledged and addressed to avoid an impasse at later stages of development.

63. In this pre-implementation phase, input should be sought from all potential participants. In line with Pomeroy and Rivera Guieb (2005), this implementation phase involves the following practical steps:(i) Identification of collective risks through consultation with potential co-management participants, with questions focused on defining shared production risks and enabling or constraining the nature of extant policy and market requirements.(ii) Assess the scale at which shared production risks manifest themselves as a function of the socio-spatial connectivity of producers in managing these risks (see for example, Lien *et al.*, 2021). Socio-spatial connectivity can be used to define an “aquaculture community” in terms of shared resources and risks rather than adjacent habitation.(iii) Identify the capabilities of those planning to engage in co-management and the degree to which key institutions (state and market) enable or constrain them.(iv) Investigate the need and feasibility for co-management as a response to the shared production risks identified through consultation. (v) Assess which type of AqCM model (see Section 3) would provide a suitable starting point for further development of collaborative management. (vi) Draft a preliminary AqCM plan. (vii) Assess and acquire funding for implementation.

64. **Phase 2 Implementation.** Once a plan has been agreed and funds acquired, the AqCM arrangement can be implemented. As such, implementation follows agreements that have been established in the pre-implementation phase but remain open to ongoing consultation and adaptation. Important activities in this phase include the development of key norms, rules, planning and conflict resolution instruments which steer the interaction and activities of those involved. These may include:

- (i) Joint drafting of the ongoing AqCM agreement and strategy – including management of key inputs to production (feed, seed and water) – into an AqCM covenant.

- (ii) Establishment of conflict management procedures within legislation and/or bylaws of the AqCM covenant.
- (iii) (Re)evaluation of participants as new information comes to light – including interests and activities of producers, labourers and a wider set of adjacent sectors.
- (iv) (Re)evaluation of state, finance and market institutions that actively support and develop actors' capabilities (e.g. resources, rights, responsibilities, skills, knowledge, relations, etc.) to shift from undesirable to desirable production and trade practices.
- (v) The introduction of a timeline for re-evaluation and rules for AqCM agreement and strategy.

65. **Phase 3. Post-implementation.** After implementation, co-management needs to be self-sustaining. In line with the potential of AqCM to enable learning and adaptation, the post-implementation phase enables iterative evaluation of key objectives, and opportunities for adjusting these goals (and their associated activities). This may include the following activities:

- (i) Turnover and phase-out of the external agents that initiated the scheme to the community (if applicable). External agents ought to have a temporary relationship with the programme but should not leave entirely. During this phase-out process, the roles and responsibilities of stakeholders will need to be renegotiated.
- (ii) An *ex-ante* evaluation of the co-management system between all stakeholders to determine the extent to which the programme has reached its goals and objectives (see Section 4). Results can be used as a reference for future planning, and evaluations to measure progress through time.
- (iii) Reflection on the capabilities of actors to shift from undesirable to desirable production and trade practices, and a re-evaluation and re-design of norms and rules across state, market and civil society institutions to support and enhance these capabilities.
- (iv) Scaling up the co-management initiative by including new stakeholders to increase the impact on systemic goals related to food system transformation.

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