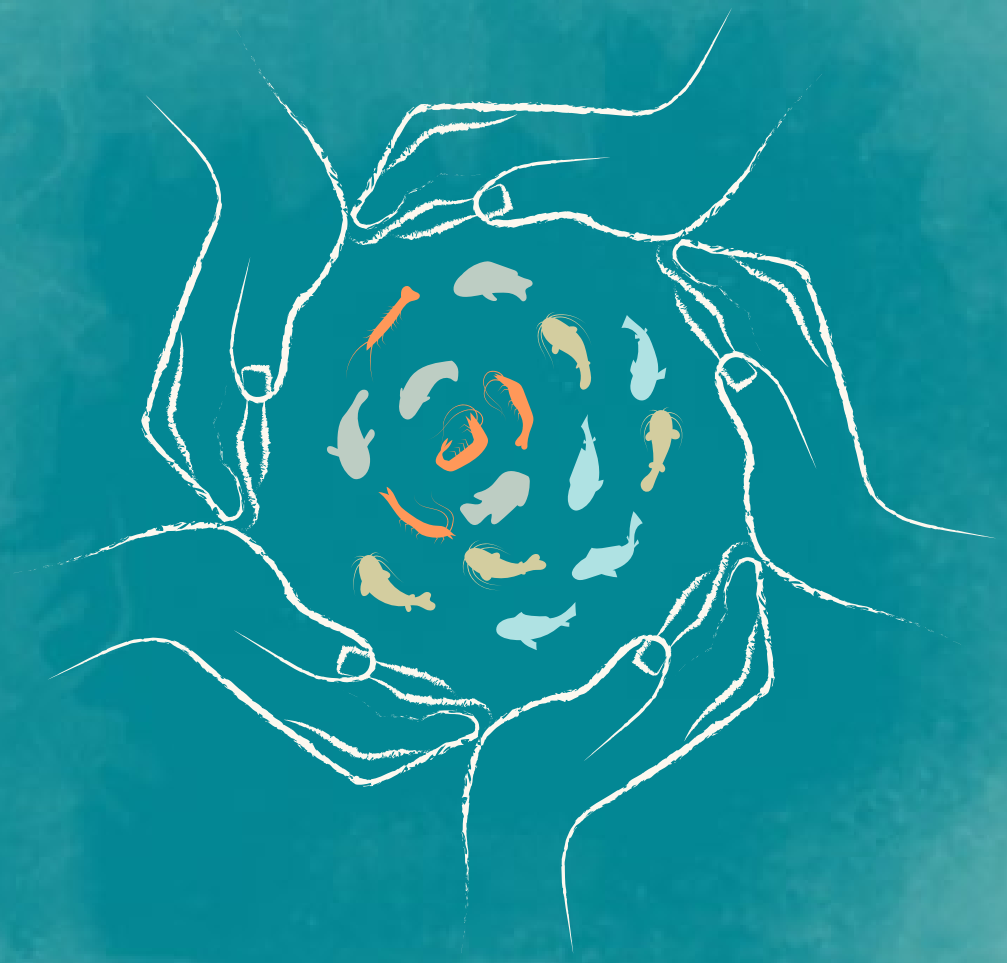
Food and Agriculture Organization of the United Nations

# Guidebook for developing aquaculture co-management systems



# Guidebook for developing aquaculture co-management systems

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# Abstract

Ensuring the continued contribution of aquaculture to the production of nutritious aquatic food requires the management of shared risks, such as disease, and shared access to key resources, such as water, land, feed and seed, necessary for sustainable production across a range of inland, coastal and marine ecosystems. How these shared risks and resources can be addressed by farmers who focus largely on practices within production units remains a management challenge that extends to the aquaculture sector as a whole.

The *Guidebook for developing aquaculture co-management systems* introduces the concept of "aquaculture co-management" that enables the shared but differentiated responsibility, rights and benefits from shared resources and risks. Aquaculture co-management can assist farmers and governments alike to implement the Food and Agriculture Organization of the United Nations' (FAO's) ecosystem-based approach to aquaculture and the FAO Guidelines for Sustainable Aquaculture, and achieve the ambitions set out in FAO's Blue Transformation: Roadmap 2022–2030.

The Guidebook provides guidance on possible types of aquaculture co-management, as well as strategic and operational goals and best practices for aquaculture co-management. Guidance is also provided for implementing, monitoring and evaluating aquaculture co-management, with the goal of developing adaptive approaches to inclusive, legitimate and innovative aquaculture that contributes to sustainable aquatic food systems.

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# Abbreviations

| | |
|---|---|
| ACM | aquaculture co-management |
| EAA | ecosystem approach to aquaculture |
| FAO | Food and Agriculture Organization of the United Nations |
| GSA | Guidelines for Sustainable Aquaculture |
| NAP | National Adaptation Plan |
| NDC | nationally determined contribution |
| NGO | non-governmental organization |

# 1

# INTRODUCTION

The sustainability of the global aquaculture industry depends to a large extent on national policy, legal and management frameworks that grant rights, impose responsibilities and require compliance with rules and standards. These frameworks also commonly translate international commitments, standards, principles and guidelines, typically ensuring both regulators and actors perform their roles and take appropriate action to promote and engage in sustainable aquaculture. A growing suite of global frameworks, instruments and guidelines is being used to steer the national development of aquaculture towards sustainable production at the ecosystem to farm level. These include the FAO ecosystem approach to aquaculture (EAA) technical guidelines (Bush and Oosterveer, 2019), the FAO Guidelines for Sustainable Aquaculture (GSA) (FAO, 2023a) and FAO's vision for Blue Transformation in aquatic food systems (FAO, 2022a). Together these emphasise that the sustainability of the aquaculture sector requires innovation, equitable benefit sharing and sustainable growth, underpinned by the stewardship of shared resources and management of shared social, production, market and environmental risks (Bush *et al.*, 2019; Naylor *et al.*, 2021a). Reconciling the individual performance of producers with the wider sustainability and performance of the sector therefore requires collaborative management, or co-management, that fosters multistakeholder participation and joint decision-making to bridge both farm and ecosystem scales.

Co-management, broadly defined as a collaborative approach for strategic and operational decision-making between government and diverse user groups over shared resources, has been advanced in natural resource settings (Sen and Nielsen, 1996; Berkes *et al.*, 2001). It 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; (iii) the degree to which rules and norms are set by states and/or resource users; and (iv) the specific types of risks that are co-managed (Plummer and Armitage, 2007). While co-management in fisheries and forestry 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 (Carlsson and Berkes, 2005; Adger, Brown and Tompkins, 2005). Common to most, if not all co-management, is the legitimation of decision-making processes over the use of shared resources and/or production risks based on the inclusion and empowerment of relevant stakeholders.

Co-management has been applied to a range of common property natural resource sectors, most notably fisheries, forestry and water (Armitage *et al.*, 2009), to overcome short-term operational challenges related to resource allocation and long-term strategic challenges such as climate change adaptation (Baird, Plummer and Bodin, 2016). Co-management has, as such, offered a means of enabling communities and networks for resource users to advocate for and gain greater recognition for customary and/or joint management of common property or public natural resources.

Aquaculture, in contrast to common property natural resource sectors, is commonly seen as a private enterprise with private tenure over the organisms grown and the land and water used to grow them. However, as recognized in the FAO EAA technical guidelines (FAO, 2010), all but a small number of recirculating aquaculture systems are dependent on surrounding socio-ecological systems for shared resources, including land, water, seed, and broodstock and ecosystem services such as nutrient recycling (Galappaththi and Berkes, 2015; Partelow *et al.*, 2018). In addition, production risks associated with disease and water quality are directly linked to shared land, water and biological resources (Boyd *et al.*, 2020). While aquaculture industries remain dependent on individual farm performance, it is increasingly recognized that individual farm performance is in turn dependent on collaborative management of shared risks and resources to maintain or improve economic efficiency (Galappaththi, Kodithuwakku and Galappaththi, 2016; Watson *et al.*, 2018). As such, Aquaculture co-management

(ACM) is fundamentally linked to sustainably increasing the production of aquatic food for nutrition and food security, in direct support of FAO's vision for aquatic food systems.

The *Guidebook for developing aquaculture co-management systems* provides a reference for government agencies, non-governmental agencies and private sector actors to develop ACM. It sets out an agenda for ACM by defining its key characteristics, goals and good practices. It also provides a generic process for implementing and evaluating an ACM system in order to improve its contribution to positive environmental, social and economic outcomes. A key premise of the Guidebook is that ACM is relevant to aquaculture systems that produce all species at all intensities of production – ranging from offshore marine cage culture to coastal, reservoir and riverine pond, cage and pen systems and terrestrial tank systems.

The Guidebook is divided into seven parts. The Section 2 presents an overview of the challenges and opportunities for collaborative beyond farm-scale management of aquaculture. This is followed by a definition of ACM in Section 3 and an explanation of the strategic and operational goals of ACM in Section 4. Section 5 provides an overview of potential types of ACM across a range of production systems, organizational forms and actors, and presents presents good practices for the establishment and continued organization of ACM. Sections 6 and 7 outline key steps for implementing aquaculture, as well as for monitoring, evaluation and learning. Based on a review of fisheries co-management, which may be applied to ACM, a broad framework for implementation, monitoring and evaluation is presented.

# 2

# CHALLENGES AND OPPORTUNITIES IN AQUACULTURE MANAGEMENT

## 2.1 Diversity of global aquaculture

The aquaculture sector has undergone sustained growth over the past two decades and contributed 87 million tonnes of fish and shellfish and 35 million tonnes of seaweeds in 2020 (FAO, 2022b). The growth in the global aquaculture sector is characterized by enormous diversity. Around 425 species of animals, plants and algae are farmed across the world, extending across a range of offshore and inshore marine, coastal and inland habitats (Figure 1) (Naylor *et al.*, 2021a). There is also a huge diversity of producers involved in the sector and a variety of value chains meeting demand for aquaculture products, with consumers in both low- and high-income nations benefiting from greater availability and access to aquatic foods rich in protein and micronutrients, on a year-round basis (Belton, Bush and Little, 2018; Naylor *et al.*, 2021b). With continued growth, the aquaculture sector is expected to produce 106 million tonnes of nutritious aquatic food by 2030 (FAO, 2022b) and play an increasingly important role in global food systems.

Figure 1
**Diversity of species, production systems and geographical scope of the aquaculture sector**

Expansion and innovation in the sector remain highly uneven, with low-income countries facing great challenges to achieve their aspirations for aquaculture development in support of national food production and employment (FAO, 2022b). Despite the projected potential of marine production (Gentry *et al.*, 2017), aquaculture production in the global south is expected to build on the fresh water systems that already deliver 75 percent of global edible aquaculture production into the foreseeable future (Naylor *et al.*, 2021a; Belton *et al.*, 2020). Overall, the sector exhibits fluctuating production patterns across regions. Asia continues to dominate, with relatively steady production in the major producing countries, although with decreasing growth rates as overall volumes increase (FAO, 2022b; Edwards *et al.*, 2019). Other regions contribute far lower volumes of production with fluctuating or negative growth.

## 2.2 Shared risks and resources

Realizing the remaining potential of the aquaculture sector to contribute nutritious food requires that production risks are addressed and access to the key resources necessary for production is assured. In some cases, production risks both emanate from and can be managed within the borders of a single farm – for instance, salinity levels of water in recirculation systems. However, any system that is open to the surrounding environment is subject to a range of shared systemic risks. Similarly, most production systems rely on access to production inputs, such as water and key feed ingredients, that constitute or rely on the shared or common pool resources (Table 1).

Systemic production risks that affect the quantity and quality of aquaculture products span the full spectrum of open and semi-closed pond, cage or tank systems. Summarizing the GSA, these production risks include: (i) waste discharge, including from inefficient feed use on water quality, habitats and biodiversity (Naylor *et al.*, 2021a; Ahmed, Thompson and Glaser, 2019); (ii) the effect of escaped organisms on the genetics of wild populations (Clavelle *et al.*, 2019); (iii) impacts on vulnerable coastal, marine and inland habitats (Boyd *et al.*, 2020); (iv) impacts on broodstock and seed (partially) dependent on wild sources (Boyd *et al.*, 2020); (v) disease, disease transmission and indiscriminate use of pro and antibiotics (Bondad-Reantaso *et al.*, 2023); and (vi) poor labour conditions for farm workers (Ngajilo and Jeebhay, 2019). The source and mitigation of these risks are nearly all related to practices that extend beyond an individual farm to include the practices of other aquaculture farmers and other spatially adjacent sectors. In the case of key inputs such as feed, these systemic risks extend to the practices of sometimes distant suppliers and traders.

Individual aquaculture farmers are also dependent on equitable access to and use of common pool or public resources for key production inputs (Partelow *et al.*, 2022). For instance, in all but closed or recirculation systems aquaculture is fundamentally dependent on access to public water resources across inland, coastal and marine environments (Lebel, Lebel and Chuah, 2019). Aquaculture is also dependent on the use of fishery-derived sources of protein (Naylor *et al.*, 2021a), despite considerable improvements in fish-in-fish-out ratios. Similarly, wild-caught and managed broodstock remain important in many freshwater and coastal aquaculture systems. Maintaining access to these common property resources, while ensuring that overall carrying capacities are not exceeded, is essential for the long-term viability of production. Furthermore, shared benefits can be enhanced at ecosystem scales where aquaculture provides valuable ecosystem services, such as in low trophic bivalve and algae systems (Gentry *et al.*, 2020; Mizuta, Froehlich and Wilson, 2023).

The individual performance of farms cannot be seen separately from the collective management of shared risks and resources. As outlined in Table 1, the collaborative forms of managing these shared risks can contribute to economic efficiency and improved nutrition security for farmers and/or dependent consumers, and improved labour conditions for farm workers. Figure 2 illustrates how co-management is fundamental to the commercial rationale of aquaculture as a business – collective action and coordination can reduce production risk which has a direct impact on the economic efficiency of producers. Furthermore, collaboration can improve the reputation of high quality and/or sustainable products which can lead to improved market access. It can also reduce the cost of production innovations that both reduce losses and help to anticipate future challenges – all of which again improve harvests and economic efficiency.

In summary, the shared nature of key production risks and resources in the aquaculture sector means farmers can only rarely, if ever, act in isolation. The continued viability of their production, in terms

of optimizing production volumes and consistently delivering key product qualities (e.g. nutritional value, taste and "sustainability") requires management that reduces risks and maintains access to inputs beyond individual farms.

Table 1
## Shared risks and resources relevant for aquaculture production

| Shared risk or resource | Type of good | Governance challenge | Importance for aquaculture | Benefits from collaborative management |
|---|---|---|---|---|
| **Water quantity and availability** | Common pool resource and shared risk | Who has access, withdrawal, management, exclusion and alienation rights? | Aquaculture is dependent on water for production and competition can be high if water resources are limited. | Water rights are negotiated and allocated, potentially with the recognition and support of government – contributing to the economic efficiency of individual farmers and improved food security. |
| **Water quality** | Common pool resource and shared risk | How to reduce pollution incentives? How to increase maintenance incentives. Who has access, withdrawal, management, exclusion and alienation rights? | Aquatic organisms depend on available nutrients in the water and this varies by species (e.g. oxygen, nitrogen, organic matter, temperature of water and salinity). | Coordinated water release or agreements on water treatment reduce risk of e.g. anoxia, eutrophication, which in turn reduce economic losses for individual farmers. |
| **Physical space** | Common pool resource | Who has access, withdrawal, management, exclusion and alienation rights? | Aquaculture requires space, either on offshore surface water or on land, and competition and costs can be high. | Rights over sites negotiated and allocated (including exclusive rights), with potential for individual or groups of farmers to secure investment and finance. |
| **Inputs: seed, juveniles, eggs or feed** | Shared risk and common pool resource | Who has access to key inputs, including good quality inputs? How are private goods distributed? | Inputs are needed for farming. Where they come from and how they are produced and distributed can vary substantially. | Collective management can lead to equitable distribution and/or collective bargaining – both of which improve harvests and/or economic performance for individual farmers. |
| **Genetic diversity** | Shared risk and public good | How to increase incentives and reduce costs for maintaining species and ecosystem diversity. | Maintaining genetic diversity helps ensure future options for adaptation and innovation in food security, breeding and environmental resilience. | Increased resilience of seed reduces mortality and increases harvests and/or economic performance for individual farmers. |
| **Mitigating infectious diseases** | Shared risk and public good | How to increase incentives and reduce the cost of safe aquaculture practices. | The spread of disease threatens farming livelihoods and food security. Mitigating the spread of disease and enhancing the resilience of species is a social dilemma because increasing stocking density, monoculture and antibiotic use may increase the economic efficiency of individual farms but increase disease and resistance risk for all. | Reduced incidence of disease, reduced mortality and increased harvests and/or economic performance for individual farmers. |

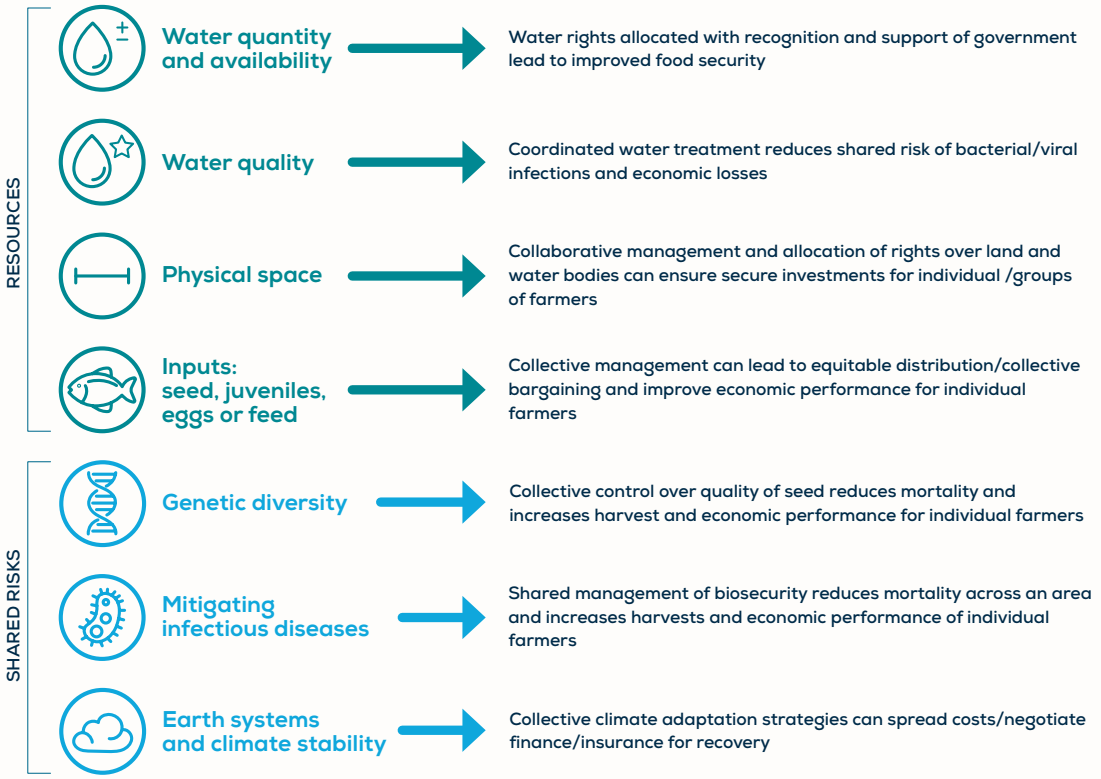
(cont.)

| Shared risk or resource | Type of good | Governance challenge | Importance for aquaculture | Benefits from collaborative management |
|---|---|---|---|---|
| **Earth system and climate stability** | Public goods | Who contributes, and how, to maintaining physical earth system stability (i.e. carbon, nitrogen, climate stability, sea level rise, rainfall patterns, storm frequency). | Predictable and adequate water availability and environmental conditions are essential. Coastal storms, sea level rise, ocean acidification and increasingly varied temperatures make this more difficult. | Collective climate adaptation strategies can spread costs and/or negotiate finance and/or insurance (mutual funds) for recovery. |

*Source*: Adapted from Partelow, S., Schlüter, A., Manlosa, A.O., Nagel, B. & Paramita, A.O. 2022. Governing aquaculture commons. *Reviews in Aquaculture*, 14(2): 729–750.

Figure 2

## Potential benefits of collaborative management to individual aquaculture producers



## 2.3 Collaboration in policy and practice

The term ACM is not yet widely used, but there are a range of collaborative forms of management that have been put in place across the sector to manage many of the shared risks and resources outlined above. For instance, in the salmon industry, bay area management plans and aquaculture neighbourhoods are in place to manage disease, lice and water quality risks (Murray and Gubbins, 2016). In the shrimp and tilapia industries, various area-based forms of management linked to improved management of disease and water quality have been observed, (Bottema, Bush and Oosterveer, 2018). And, some cooperatives of aquaculture producers, established with the goal of improving market access and economic performance, collaborate to manage shared risks and resources (Galappaththi, Kodithuwakku and Galappaththi, 2016; Watson *et al.*, 2018). As such, ACM already exists in instances where it reflects the individual and collective needs of farmers.

Collective action on managing shared resources and risks is already inherent to several FAO guidance documents (Box 1). For example, the EAA technical guidelines call for the integrated management of aquaculture beyond the farm scale through transparent and participatory planning, with all relevant stakeholders and in line with state policy objectives (Bush and Oosterveer, 2019). Similarly, the GSA calls for states to ensure effective, transparent consultation between aquaculture stakeholders, the establishment of respective rights and responsibilities, and the resolution of competing objectives of aquaculture development to ensure optimum utilization of resources (GSA 4.1.1). It also outlines the rights and responsibilities of producers to develop, with states, shared area management plans that enable "risks and risk management" and "access to land and water and conflict mitigation among resource users" (GSA 4.2.10), as well as collaborative "innovation partnerships" (GSA 5.2.3) for developing new technologies and farming practices (FAO, 2023a). The EAA technical guidelines and the GSA are supplemented by a growing shift in private or market-based forms of aquaculture governance (such as the Aquaculture Stewardship Council and the Better Aquaculture Practices of the Global Seafood Alliance), to move beyond farm level standards to forms of zonal, area-based and/or group certification standards aimed at managing shared risks and resources.

Collaborative forms of management that enable collective and coordinated mitigation of shared risks and resources have the potential to enhance the contribution of aquaculture to sustainable aquatic food systems, in line with FAO's vision for "Blue Transformation" (FAO, 2022a). In doing so, collaborative forms can support innovation to overcome resource constraints and mitigate systemic risks in support of aquaculture's contribution to nutrition, food safety/quality, environmental and livelihoods outcomes. These approaches redirect the focus of research and policy from a collective pre-occupation with the farm level (Mialhe *et al.*, 2018) to take better account of the social, economic, environmental and political contexts within which production takes place. They also have the potential to harness the diversity of producers and other value chain actors involved in resolving collective problems.

Box 1

## FAO guidance documents supporting collaborative forms of aquaculture management

***FAO Code of Conduct for Responsible Fisheries* (including aquaculture)**

Article 9.4.2 recommends that states promote the active participation of stakeholders concerned with the development of responsible aquaculture management practices. This provision should be read in conjunction with articles 10.1.2 and 10.2.2 which respectively recommend that states consult stakeholders ("those affected") in decision-making processes and activities related to coastal area management, and promote the assessment of the value of coastal resources, taking into account economic, social and cultural factors to assist decision-making on the allocation and use of these resources (FAO, 1995).

***FAO ecosystem approach to aquaculture***

Principles 1, 2 and 3 provide guidance on the contribution of aquaculture to ecosystem functions and services and human well-being through integrated planning and management systems that are within the capacity of the aquaculture sector to change or modify. The EAA guidelines explicitly state the need for coordinated decision-making between clusters of farms that "share a common waterbody and that need a coordinated management" (Bush and Oosterveer, 2019, p.10).

***FAO's Blue Transformation vision for aquatic food systems***

The guiding principles stress the need for effective aquaculture management and development and equitable access to resources to secure aquaculture-based livelihoods and resilient aquatic food systems through: (1) accountable and transparent policy and planning; (2) active, free, effective, meaningful and informed consultation and participation, and (3) the promotion of just and fair "treatment of all people and communities and … measures to accelerate the achievement of equitable outcomes, particularly for vulnerable and marginalized groups" (FAO, 2022a, p.5).

***FAO Guidelines for Sustainable Aquaculture***

Sets out conditions and actions for creating "inclusive networks and dialogue platforms" involving both state and non-state actors to "foster shared understanding and negotiated solutions and facilitate policy and decision-making processes relevant to sustainable aquaculture sector development" (GSA 4.1). Attention is also given to "clear, transparent, equitable and inclusive" processes for identifying suitable areas for aquaculture and developing "appropriate mechanisms and plans in order to monitor the impact of the operations on the environmental and social and economic sustainability" (GSA 4.2) (FAO, 2023a, p.48).

*Sources*: FAO. 1995. *Code of Conduct for Responsible Fisheries*. Rome.

Bush, S.R. & Oosterveer, P. 2019. *Governing sustainable seafood*. London, Routledge, Earthscan.

FAO. 2022. *Blue Transformation – Roadmap 2022–2030: A vision for FAO's work on aquatic food systems*. Rome. https://doi.org/10.4060/cc0459en.

FAO. 2023. *Report of the Twelfth Session of the Sub-Committee on Aquaculture, Hermosillo, Mexico, 16–19 May 2023. Committee on Fisheries*. FAO Fisheries and Aquaculture Report No. 1414. Rome. https://doi.org/10.4060/cc7093t

# 3

# WHAT IS AQUACULTURE CO-MANAGEMENT?

## 3.1 Defining aquaculture management and co-management

Aquaculture management can be defined as the iterative implementation of methods, techniques and actions to produce aquatic organisms using: (i) less than perfect information on the use and costs of inputs to production and their effect on the performance of production processes; and (ii) societally agreed rules and norms for the environmental and socially optimal production of safe and nutritious outputs. Management refers to both on-farm decisions and practices employing labour, knowledge and technologies that seek to mitigate production risks and optimize resource use – including reducing wider environmental impact, conflicts over access to resources and mitigation of social disruptions to securing the long-term sustainable contribution of aquaculture to human needs and ecosystem resilience (Phillips, Boyd and Edwards, 2001; Pullin, 1994).

Collaborative management is seen as a means of improving the legitimacy and effectiveness of integrated management systems involving at least government and resource users, but extending to adjacent sectors and disaffected communities (Armitage *et al.*, 2009). In fisheries, water and forestry, co-management has been shown to enhance trust and enable power sharing over resource access and use. It has also enabled collaborative opportunities for knowledge sharing and learning leading to improved collective decision-making and action (e.g. Cundill and Fabricius, 2009). The application of co-management in these different resource sectors is ultimately designed to enhance the production of marketable products – be it fish and other food products or timber for lumber or pulp and paper.

Co-management 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 other actors, 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 affected actors to jointly deliberate over their rights and responsibilities related to resource access and use (Berkes, 2009; Hasselman, 2017). Co-management also defines who qualifies as participants in these deliberations, as opposed to adjacent stakeholders who may be affected but do not actively participate in decision-making. It can also make explicit the participation of vulnerable groups including Indigenous Peoples, youth and women (Freitas *et al.*, 2020). Co-management can enable collaboration between actors in different sectors – for example, between aquaculture and other food production sectors dependent on the same resources, or between producers and actors downstream in value chains.

Based on the FAO definition of co-management for fisheries and other resource sectors, but reflecting the specific conditions and challenges of the aquaculture industry, ACM is defined as follows:

> Aquaculture co-management is a set of strategic and operational collaborative arrangements that enable equitable participation in shared yet differentiated 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 shared and equitable management of resources and risks are practiced (adapted from FAO, 2023b, p.3).

This definition of ACM extends beyond the application of co-management in other resource sectors. The form and function of ACM depend on:

i. **Variation in intensity and "openness" of aquaculture production system.** Aquaculture systems range from super-extensive non- or semi-fed systems (e.g. shrimp farms in Indonesia, pangasius Ghers in

Bangladesh and rice field systems across Asia), to open intensive systems (e.g. any form of cage culture) and closed recirculation systems. In line with the EAA, these levels of intensity and openness to the surrounding environment affect the degree to which resources and risks are shared between farms.

ii. **Private and communal forms of ownership over key inputs**. Aquaculture systems can be based on private, public or communally owned land and technical means of production (e.g. machinery and genetic material). However, many inputs to aquaculture systems are collective goods, including water (quality and quantity) and genetic resources.

iii. **Individual and collective decision-making between producers on shared risks beyond the farm scale**. The shared nature of many production risks (as outlined in Section 2 and both the EAA and GSA), means that farmers cannot act in isolation when trying to optimize farm productivity. The incentive to engage in ACM is, as such, an issue of collective action that depends on the benefits from collaboration that accrue to a farmer outweighing the cost of not collaborating to manage shared risks and resources in an equitable manner.

iv. **Sharing rights and responsibilities between producers and the state**. In line with the EAA and GSA, states maintain authority for the overall planning and regulation of the aquaculture sector. However, devolving responsibility to producers who make decisions on individual farms can improve compliance and problem solving for risks and resources that affect the overall performance of the sector in a given area.

v. **Sharing rights and responsibilities with value chain actors**. The extension of decision-making over risks and resources beyond the farm also encompasses suppliers and buyers who provide inputs or set market incentives for responsible or sustainable production.

## 3.2 Organization of aquaculture co-management

Variations within and across these dimensions mean it is unlikely there is a single approach to ACM. They also indicate that co-management should be seen as a networked relationship rather than limited to the role of producers and the state. A such, reflecting the early work of Sen and Nielsen (1996) and Armitage *et al.* (2009), multiple ACM approaches are possible based on different goals of collective action, the degree to which joint decision-making with states and other actors is required, and the type of production system located in different ecosystems.

The specific type of co-management depends in large part on the actors involved, their willingness to engage in power-sharing over resource-related decisions and in doing so integrate community, regulatory and/or economic rules and management systems. Adapting Sen and Nielsen's (1996) four broad types of co-management to accommodate this wider set of actors opens up the scope of collaboration:

i. *Instructive* forms of ACM are linked to government-led organization of producers through e.g. extension services that inform producers of new techniques or regulations and/or product requirements.

ii. *Consultative* forms of ACM extend from state actors consulting producers on decisions taken by government, or decisions related to water, land and/or those affected by effluent.

iii. *Cooperative* forms of ACM can include equal decision-making, not just between government and producers, but also input suppliers and buyers affected by variable supply over the management of production risks related to water management or disease.

iv. *Delegated* forms of ACM can involve the devolution of responsibility for the management of resources and risks by the industry, with government only being informed about the decisions taken.

The type of co-management that might be most relevant for aquaculture remains an open question. In closed recirculating systems, delegated co-management may be accepted by producers and governments, given their limited engagement with shared resources (e.g. Dong *et al.*, 2022). In open aquaculture systems with distributed risks, more cooperative forms of co-management may be needed to manage input use (e.g. water, land and feed) or output flow (e.g. effluent, escapees and land–water quality) in line with wider ambitions of the FAO EAA (Bush and Oosterveer, 2019; Brugère *et al.*, 2018). Where alignment between producers, input suppliers and buyers for meeting market requirements is strong, more delegated forms of co-management may be selected. In small-scale urban and rural aquaculture, more instructive co-management may be relevant for building the capabilities of producers to access knowledge on better farming practices, as well as gain access to key inputs and/or negotiate tenure over land and water (e.g. Galappaththi and Berkes, 2014). And, where conservation or regenerative forms of aquaculture are being developed (Mizuta, Froehlich and Wilson, 2023), cooperative forms of ACM may be employed to align cross-sectoral regulation, knowledge and incentives.

Many existing organizational forms used in the aquaculture sector have elements of collaborative management, even though they may not be labelled as co-management. For instance, farmer-led cooperatives used primarily for purchasing inputs and marketing may enable farmers to collaborate on shared water use and monitoring disease. In other instances, the government may organize farmers through area-based forms of licencing or managing environmental carrying capacity. Additionally, processing companies organize farmers to enable stable supply, which also allows for shared risks and resources to be managed. In summary, co-management can be overlayed on many existing forms of farmer organization and can be led by the farmers themselves, or the state, or buyers. Determining who takes the lead depends on what may be permitted by the regulatory framework, the management goals and the degree to which self-determination or state and private sector involvement is legal and deemed legitimate by those collaborating.

## 3.3 Typology of aquaculture co-management

Based on a review by Bush *et al.* (forthcoming) of existing forms of collaboration between farmers, states and the private sector, the following four models of ACM are presented (Figure 3):

i. **Communal approaches** to ACM relate to production systems that manage the production of collective water bodies to a level that is sustainable through natural processes and through stocking and recapture (Da Silva, 2003; FAO, 2015). Community-based aquaculture is defined by a collective (community or subset of households) who hold tenure over a (natural or human-constructed) water body and have jointly invested in stocking and post-harvest processing (Sarkar *et al.*, 2020). The role of government in these arrangements depends on the ownership of the water body and/or degree of support communities need for stocking and maintaining access over harvesting. Where public water bodies are stocked, including irrigation or hydroelectric reservoirs, government may become a primary stakeholder in negotiations over production levels and access (Galappaththi, Ford and Bennett, 2020). The operational goals are related

primarily to competition for and control over the water body, and technical management of stocking and harvesting to increase productivity in an integrated fashion. These co-management arrangements also have a series of strategic goals related to social license to operate, especially when water bodies cross jurisdictional boundaries. Overall, these co-management arrangements are aimed at increasing production of the water bodies in a sustainable way to deliver nutrition and/or income to the communities involved.

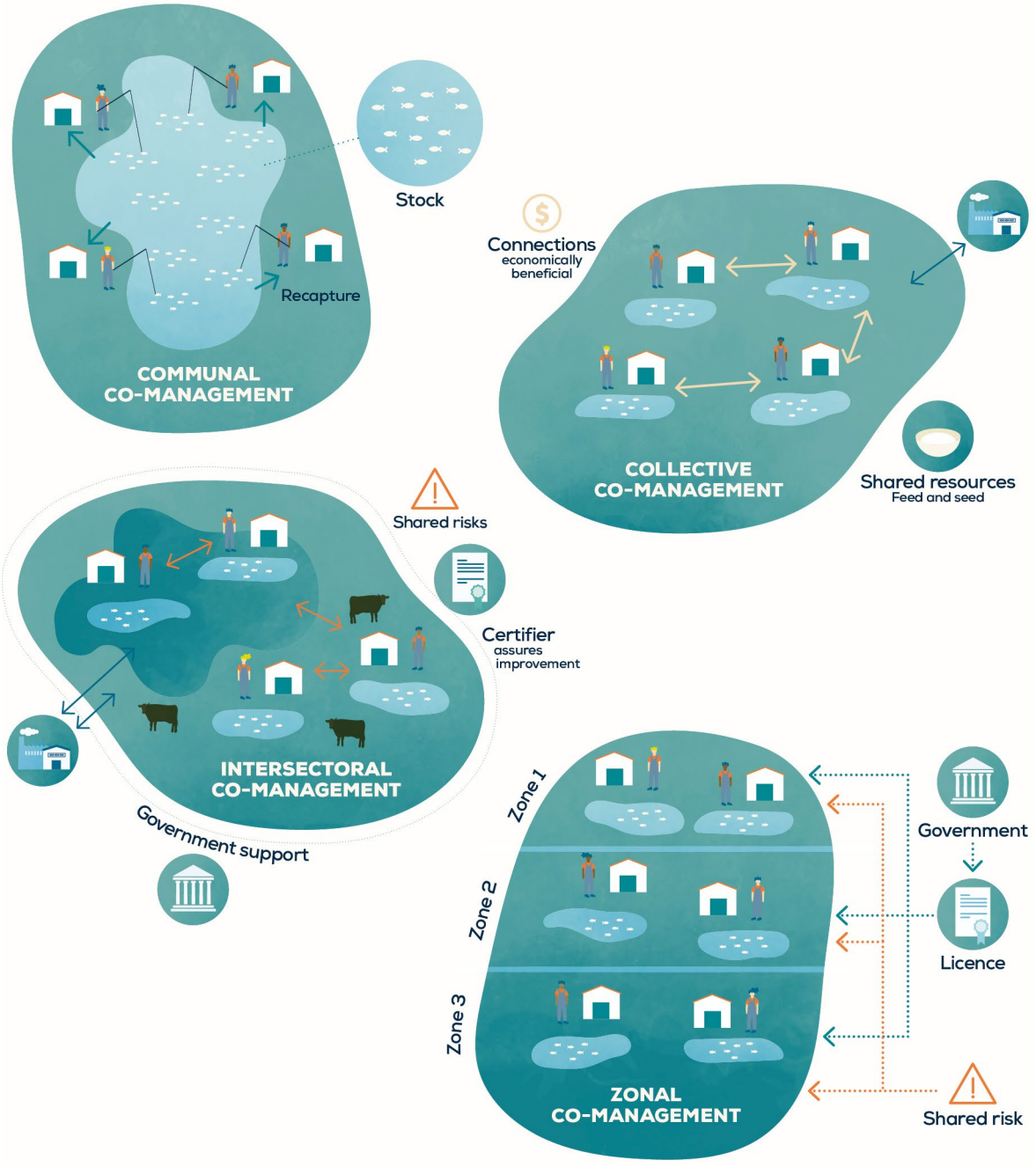
ii. **Collective approaches** to aquaculture include a range of cooperatives, clusters and associations in which aquaculture enterprises compete but also cooperate. Aquaculture cooperatives tend to focus on improving the economic performance of their members, while clusters are either farmer- or government-driven attempts to organize smallholders and associations into more formal organizations that often represent producers and other value chains actors at the national level (see Bottema, 2019). These collective approaches are designed to mitigate production and market risks, negotiate access to markets and enhance the adoption of new technologies and practices. In some instances, they also enable joint management of common water sources, joint compliance with state or market regulation, or innovation within countries or across regions as large as Europe or Southeast Asia (Ha, Bush and van Dijk, 2013; Kassam, Subasinghe and Phillips, 2011; Umesh *et al.*, 2010; Joffre, Poortvliet and Klerkx, 2018; Bush *et al.*, 2021). As such, collective approaches can be seen as a form of collective action aligned with economic and livelihood goals, including compliance with public and private standards and best management practices at the farm level (Kassam, Subasinghe and Phillips, 2011; Umesh *et al.*, 2010) and that also manage production risks (Bush *et al.*, 2019; Kassam, Subasinghe and Phillips, 2011; Joffre, Poortvliet and Klerkx, 2019).

iii. **Zonal approaches** to ACM are a spatial means of managing production risks related to carrying capacity. Zonal approaches are explicitly mentioned in 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.*, 2018). 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, Aguilar-Manjarrez and Brugére, 2008, p. 2). Zonal approaches also have been used by public institutions (in Scotland, Norway and Chile) for translating ambitions for integrative and cross-sectoral management into site selection and spatial planning and site selection (e.g. Aguilar-Manjarrez, Soto and Brummett, 2017). Non-governmental organizations (NGOs), such as China Blue Sustainable Fisheries Partnership and The Nature Conservancy (e.g. Bottema, 2019), have also advocated for this approach to tilapia and shrimp production in Asia.

iv. **Inter-sectoral** approaches include collaborative arrangements aimed at reconciling competing social, economic and environmental objectives through the improved participation of state, civil society and/or private sector actors in and across sectors through formalized collaboration around the practices and policies that affect all within a given spatial unit or jurisdiction (von Essen and Lambin, 2021; Buchanan *et al.*, 2019; Kittinger *et al.*, 2021). In doing so they "align government-led, multistakeholder processes within provinces and districts with prospective external incentives" for collaboration across an area or region (Seymour, Aurora and Arif, 2020, p. 1). They align with co-management in terms of including multiple stakeholders with diverging interests and can also increase the legitimacy of policy and regulation. They also align 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 achieving outcomes at a

large scale that can contribute to "system-wide transformation" (von Essen and Lambin, 2021). Inter-sectoral approaches open up the scope of co-management in terms of enabling both locally and market-defined incentives and support to achieve ecosystem-based management. They also foster multistakeholder partnerships that agree on an ACM plan or covenant stipulating the goals, responsibilities and benefits of collaboration.

Figure 3
**Typology of potential aquaculture co-management models**



# 4

# GOALS OF AQUACULTURE CO-MANAGEMENT

ACM can have multiple (often simultaneous) aims that are defined by the actors within or affected by the sector to different degrees. Within the ambitions laid out by the EAA and GSA, and most recently FAO's vision for Blue Transformation, more specific goals for ACM can be set that align to states, producers and other non-state actors. For example, for co-management arrangements in which the state plays a major role, the aims of co-management may be influenced or even prescribed by longer-term government planning. 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), goals may be more self-defined and iteratively defined.

Whether prescribed or self-determined, the social, environmental and economic goals of co-management should ideally contribute to the sustainable development of aquatic food systems, as outlined in the Programme Priority Areas of FAO's Strategic Framework (FAO, 2021), the Blue Transformation: Roadmap 2022–2030 and the United Nation's 2030 Agenda for Sustainable Development. This can happen on two interrelated levels. First, ACM can aid in fulfilling strategic goals related to the governance of systemic (and less measurable) risks related to the environmental and social transformation of aquatic food systems. In doing so ACM can enable legitimacy and participation, thereby enhancing the role of aquaculture in providing nutritious, equitably valuable and sustainable aquatic food. Second, ACM can assist in achieving operational goals related to improving the conduct and performance of the day-to-day management of aquaculture, e.g. disease, feed and water management in sustainable farm management. As such, ACM is also a means of linking strategic goals to operational goals through their implementation by participating state and non-state stakeholders.

## 4.1 Strategic goals

ACM can contribute to broad strategic goals by creating links between national, regional and local decision-making and practices. This strategic role may be less related to daily decision-making and less measurable in terms of direct impact on aquaculture production. 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. If institutionalized as a means of sector planning and management, ACM can also play a central role in creating an enabling environment to realize FAO's vision for Blue Transformation and the implementation of the EAA and GSA.

Based on the ambitions of the EAA, GSA and FAO's vision for Blue Transformation, six strategic goals for ACM are identified (see also Figure 4):

i. **Healthy and sustainable aquatic food systems**. By providing a framework for participatory decision-making, ACM can enable the improved design of an institutional framework that includes aquaculture in wider aquatic food system policies and decision-making. As such, ACM can support the priority actions of FAO's vision for Blue Transformation (FAO, 2022a) including: effective global and regional cooperation, planning and governance to enhance aquaculture development and management (Target A1); equitable access to resources and services to deliver new and secure existing aquaculture-based livelihoods (Target A3); and regular monitoring and reporting of the state and the ecological, social and economic impacts of aquaculture development (Target A5). It can also, in support of GSA 4.2.1 promote ambitions for an "holistic food system perspective" that enables socially inclusive aquaculture value chains and manages conflicts with other food-related sectors "using land, water, aquatic resources and maritime space" (FAO, 2023a).

ii. **Climate change adaptation**. ACM may foster decision-making at farm and regional scales that enables more timely adaptation to changing environmental conditions caused by climate change, such as acidification, salinization and temperature and precipitation changes (as stipulated in GSA 5.6). Faced with these longer-term environmental risks, participants in ACM may be encouraged to develop mitigation and adaptation strategies based on their shared knowledge of the land or seascape in which they operate. They may also be enabled to make decisions on diversifying production and/or adapted farming practices to create "climate-smart aqua-business" (Target A2 of FAO's vision for Blue Transformation). ACM may enable producers to contribute more directly to the formulation of National Adaptation Plans so that they include and support aquaculture adaptation needs, such as the inclusion of nature-based opportunities and solutions in the nationally determined contributions (GSA 5.6.1). Other benefits may include the implementation of contingency planning for droughts, floods, diseases, harmful algal blooms, the adoption of more diversified and resilient production systems, integration of climate-proofing innovations such as wind turbines, and locally embedded environmental monitoring systems to strengthen aquaculture resilience and improve early warning (GSA 5.6).

iii. **Ecosystem carrying capacity**. In line with the EAA (Bush and Oosterveer, 2019) this requires greater embedding of environmental objectives within wider economic and social goals "linked to and dependent on many other sectors that use the coastal and aquatic environment". 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" (FAO, 2010, p.7). ACM can promote the shared management of water resources and the carrying capacity of shared water bodies – both between aquaculture producers and between aquaculture producers and other water users. It can also facilitate the management of genetic resources by enhancing the monitoring of aquatic organisms at risk of extinction and enable the adoption of measures to mitigate the risks (FAO's vision for Blue Transformation Target A5 and GSA 10). This may include the adoption of new practices that avoid habitat degradation or enabling forms of conservation aquaculture that enhance habitats and biodiversity (GSA 5).

iv. **Market credibility**. ACM can promote market confidence in the sustainability and/or food safety of aquaculture products. Co-management contributes to the resilience of the aquatic food system through the development of strategic partnerships between the private and public sector; better resource, economic and environmental management; strengthening of networks, and the encouragement of innovation (FAO Blue Transformation Target A2). ACM can also enable farmers to make collective market claims in domestic and international markets that may in turn generate employment, greater income and technological improvements (FAO Blue Transformations Target A3 and GSA 5 and 8).

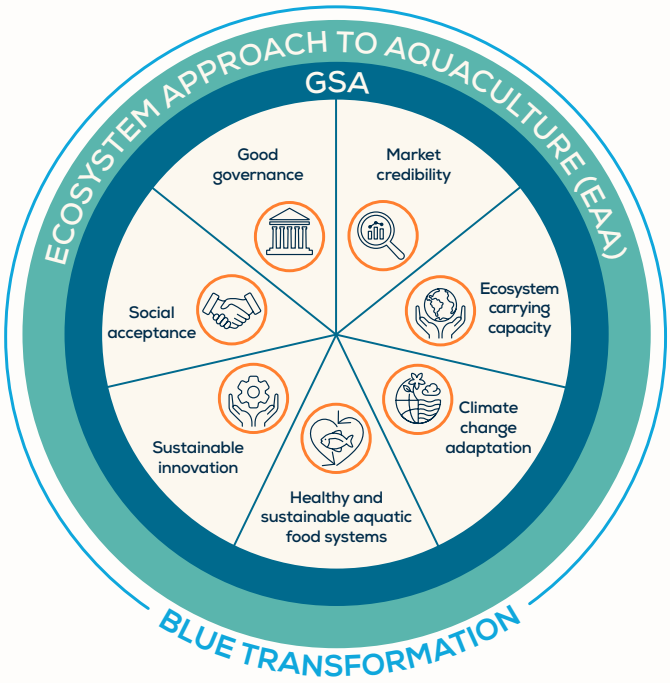
v. **Good governance**. ACM can enable more open and transparent decision-making around access and tenure of key resources such as land and water. ACM can also promote consistency and transparency, consultation and participation by public actors and non-state actors (see the Guiding Principles of GSA), which can in turn enable consistency and predictability of tenure rights for producers in aquaculture planning (Hishamunda, Ridler and Martone, 2014; Lester *et al.*, 2022). Furthermore, overall good governance through co-management can improve investment confidence in the sector.

vi. **Social acceptance**. Co-management can enable participants to create legitimacy for aquaculture production, either at the level of production units or for the sector as a whole. Co-management can legitimize decisions over resource use and planning by facilitating some type of stakeholder arrangement, either in terms of enrolling resource users in established management systems, or through co-production via multistakeholder engagement, or through joint management and planning

of aquaculture when expanding to new production areas (in line with the ambitions of the EAA for area-based management) (see for example, Corner *et al.*, 2020). In other cases, co-management may be used as a means of establishing: (i) a social license to operate, i.e. increasing cross-sector involvement in management in order to enhance societal recognition for activities that is additional to legal compliance (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 (Sepúlveda *et al.*, 2019).

vii. **Sustainable innovation**. ACM can, in line with FAO's vision for Blue Transformation (Bush and Oosterveer, 2019), enhance "more efficient, inclusive, resilient and sustainable blue food systems through integrated science-based management, technological innovation and private-sector engagement" (Bush and Oosterveer, 2019, p.1). Technological innovation through multistakeholder innovation platforms enable learning and enhance capacity for anticipating and responding to change but do so at a system or sector level (Schut *et al.*, 2016). Examples of technological innovation come from both Europe and Asia (Bush et al., 2021; Bostok, et al., 2016). Such learning and anticipation may be linked to innovations aimed at resolving production risks and/or enabling a transition to sustainable intensification (Edwards, 2015). This includes, as outlined by Naylor et al. (2021a), 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.

Figure 4
**Strategic goals for aquaculture co-management**



## 4.2 Operational goals

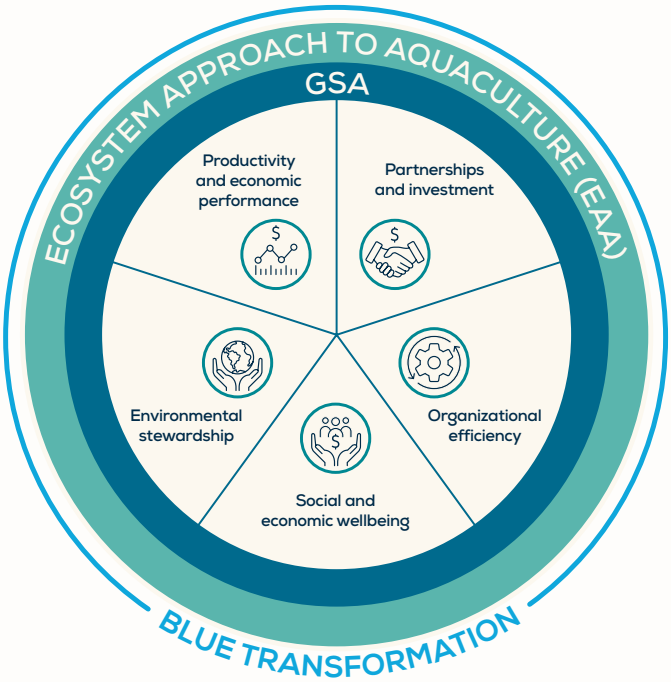
At the operational level, ACM can enable the improved management of shared resources, production risks and improved compliance with state policy and legislation, and enhance the sector's legitimacy or social licence to operate when being extended to new regions or environments – including areas identified and organized in state-led spatial planning processes (as outlined under the EAA and GSA 4 on governance and planning). It can also provide a means of meeting wider ambitions, as set out in FAO's vision for Blue Transformation, such as equitable participation of stakeholders, with due attention given to vulnerable groups in decision-making and benefit sharing associated with the sector, knowledge exchange for innovation and upgrading production performance and/or regulatory compliance (GSA guidelines 4, 7 and 8). The five categories of operational goals for ACM, in line with the GSA, are also illustrated in Figure 5 and listed here:

i. **Productivity and economic performance**. A primary operational goal of producers participating in any ACM arrangement is to increase the economic performance of their production unit by reducing the cost of inputs, increasing production efficiency and/or negotiating fair farm gate prices. In line with the aims of economic cooperatives, ACM can enable producers to reduce the cost of feed, seed and pharmaceuticals by collectively bargaining with suppliers, and enable producers to cross-insure losses (Watson et al., 2018). Such bargaining can also encourage a better quality of feed (in terms of protein content and feed conversion rates) and seed (e.g. leading to lower mortality rates) (Bjørndal, Child and Lem, 2015). It can also enable collaboration and learning between producers to improve feeding practices and gain additional efficiencies in feeding (e.g. Salazar *et al.*, 2018). ACM can create opportunities for coordinated water management in terms of timing discharges to avoid the spread of disease (Ahmad *et al.*, 2021) or staggering harvesting to maximize shared labour. It can also ensure a balanced supply to markets, leading to greater stability in prices.
ii. **Partnerships and investment**. ACM can enable participants to form new, strategic partnerships that encourage public and private investments, while allowing a platform for farmer organizations, cooperatives, small- and medium-sized enterprises and export-oriented enterprises to tap into the potential of the private sector (in support of GSA 7.1 on sustainable value chain development). Partnerships along the value chain also enable operational goals related to improving income and reduced risks through improved market access (Watson *et al.*, 2018). They can facilitate training for business capacity and engagement with financial institutions, open up opportunities for negotiating investment opportunities, whether these are public incentives and resources or private investments inside and outside value chains. Notably, these partnerships are different to public-private partnerships which are focused primarily on public service provision.
iii. **Organizational efficiency**. ACM can contribute to enhancing the procedural goals of states and/or the organization of aquaculture producers in line with wider goals of participation, transparency and accountability. Collaboration in these instances is seen as a means of enabling more equitable and efficient decision-making related to the management of key (shared) inputs such as water, 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 (GSA 4.1.2). Formalized decision-making can furthermore enhance policy dialogue with the goal of mobilizing key stakeholders, creating decision opportunities and consultations for public investment (GSA 4.1.1). It can also help producers to meet timelines set out in state legislation and timelines for meeting the conditions of private standards and certification set by conformity assessment bodies (FAO, 2011; GSA 5 and 7).

iv. **Social and economic well-being**. Co-management can enable participants to facilitate knowledge exchange between producers about practices and technologies, renegotiate their terms of inclusion and labour in the industry and/or value chains, and in doing so enhance nutritional or livelihoods outcomes (FAO, 2023a; Armitage *et al.*, 2009). These goals are broadly aligned with the GSA, which focuses in part on just and fair treatment, social equality and economic and labour rights and opportunities (GSA 3.1.e). ACM may also help enable the voice and representation of producer organizations (GSA 6), and in doing so help small producers access an array of services, including improved market information, extension and collective bargaining power (GSA 7 and 8; ILO, 2021). Co-management may, as such, contribute to a fairer distribution of the benefits derived from aquaculture (Gurney *et al.*, 2021). Benefits may relate to the achievement of food security and improved nutrition, either directly or indirectly from aquatic food production (GSA 1), and/or the promotion of inclusive livelihoods and economies throughout aquaculture-related value chains (GSA 6 and 7).

v. **Environmental stewardship**. Co-management can enable improved resource use and reduce the environmental impacts of production. Environmental stewardship relates to the protection, restoration and promotion of sustainable ecosystems; and the efficient use of resources to enable "more efficient, inclusive, resilient and sustainable" food systems (FAO, 2021). It includes both the impacts of aquaculture on the environment, and the impacts of the terrestrial, freshwater and marine environments in which aquaculture is practiced. ACM can assist farmers to facilitate the measurement of these types of impacts beyond individual farms and implement and monitor both individual and shared sustainable aquaculture practices – including those defined by the GSA, EAA and various private standards (e.g. Aquaculture Stewardship Council and Global Aquaculture Alliance) (Bush and Oosterveer, 2019). Across these guidelines and standards is a growing recognition that "beyond-farm" environmental risks, both to and from aquaculture, require collaborative forms of management.

Figure 5
**Operational goals for aquaculture co-management**



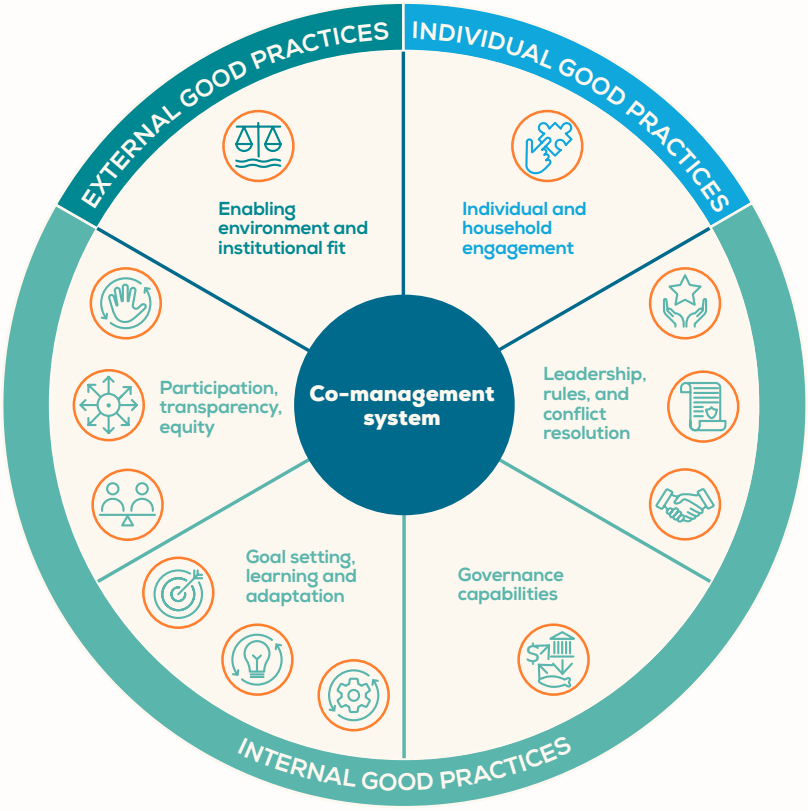
# 5

# "GOOD" AQUACULTURE CO-MANAGEMENT PRACTICES

Co-management is the outcome of deliberative processes between collaborating actors. This means there is no "one-size-fits-all" single model for co-management. Instead, there is a range of possible forms of collaboration within which different goals, in line with the strategic and operational goals outlined above, can be set and worked towards. The actors involved in ACM may extend beyond government and producers to include other value chain actors. The specific goals may also extend to dealing with production risks and innovation, which again are not the core remit of co-management in natural resource-based sectors. Nevertheless, the practices of developing ACM are likely to align with those of other sectors (Pomeroy and Rivera Guieb, 2005; Pomeroy *et al.*, 2022).

Building on the Guidebook for evaluating fisheries co-management effectiveness (Pomeroy *et al.*, 2022), the "good" practices of ACM across three levels or dimensions are outlined here and illustrated in Figure 6. First, external good practices associated with the enabling environment are related to those that affect how co-management is defined and initially implemented. Second, internal good practices related to the co-management system refer to the implementation and maintenance of the co-management arrangement. Finally, individual good practices refer to the practices of actors who individually or collectively (e.g. in households or communities) engage in co-management. All three sets of "good" practices can be used as a starting point for the implementation of ACM, as well as monitoring and evaluating the ongoing performance of ACM in accordance with the EAA and GSA.

Figure 6
**Three levels of good aquaculture co-management practice**



## 5.1 Enabling environment and institutional fit

Enabling the definition and implementation of co-management requires the rights and responsibilities of participants, including the state, to be clearly mandated. Creating this mandate provides government actors the authority to proactively empower participants to engage in co-management, in line with the objectives of the GSA. Such a mandate also enables ACM to align with existing state and private institutions according 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 reflects the recognition by resource users, the state and/or non-state actors that the spatial "jurisdictions" of rules do not align with the spatial extent of environmental risks or impacts (Bottema, Bush and Oosterveer, 2018). Creating greater institutional fit is already inherent to the EAA which explicitly aims to extend management to "ecosystems" (Brugère et al., 2018). 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.

Eight best practices for enabling environmental and institutional fit can be identified:

i. **Set "appropriate" scale**. The scale of the co-management system should be determined, taking into consideration the resources upon which aquaculture depends (e.g. a water body) and/or the scale at which key production risks (e.g. poor water quality) are observed and collectively managed. The definition of the scale of management can be established anew or aligned with existing forms of producer organization (such as cooperatives or clusters, as outlined in Section 3.2).
ii. **Support the alignment of spatial boundaries of co-management**. Assess the degree to which (potential) participants are enabled to define the boundaries of the co-management system based on the type, number and location of actors involved; the spatial extent of the shared resources and risks being managed; and the jurisdictions of relevant levels (e.g. province or district) or of executive branches (e.g. ministries, departments or agencies) of government.
iii. **Identify level of support for ACM in policies and legislation**. Identify and where necessary introduce or amend public laws and regulation and private codes and standards that enable the implementation of ACM and participation in it. For example, it must be established whether legislation grants authority to participants to collaborate and make management decisions on shared resources and risks to aquaculture.
iv. **Establish mandates and responsibilities of (potential) participants**. Assess and where necessary introduce new legislation or amend existing laws and regulations to delineate the mandate and responsibilities of government, farmers and other private sector actors seeking to participate in ACM. Additionally, it will be important to raise awareness of those mandates and responsibilities amongst (potential) participants.
v. **Delineate tenure rights of aquaculture producers**. Assess and where necessary introduce or amend legislation that enables government to grant or recognize tenure rights over key resources such as water, land and/or genetic material needed for aquaculture production. This includes the rules and procedures for allocating use rights to aquaculture producers and ensuring that the tenure rights of adjacent sectors (e.g. agriculture) are not encroached upon.
vi. **Engage support of government and private sector providers to enable improvement**. Assess existing state and private services that can support collaborative management of shared resources and risks. In doing so, determine the mandate and responsibility of government extension

services, aquaculture improvement project providers and other private actors for providing support to ACM.

vii. **Enforce management rules**. Determine the mandate given to ACM participants in legislation, and with reference to private codes and standards, to establish a system of self-enforced rules and penalties. This mandate should enable producers and other participants to take responsibility for establishing and imposing operational rules designed to enable the management of shared resources and production risks.

viii. **Establish and enforce graduated sanctions**. Assess and where necessary introduce or amend legislation to empower participants in ACM (including the government, producers and other private actors) to differentiate the severity of penalties and sanctions for non-compliance with agreed rules and requirements for the shared management of resources and production risks.

## 5.2 The co-management system

Good practices associated with the establishment of a co-management system focus on the arrangements that enable participants (including producers, buyers and government) to interact and make collective decisions. These practices enable decisions to be made about who participates in decision-making, under what conditions and with what expectations on how resources and risks should be accessed or mitigated. These practices are expressed through collective conduct involved in defining an ACM plan, the design of specific management activities and the implementation of these activities on and between farms. The following section outlines four different categories of good ACM practices: participation, transparency and equity; leadership, rules and conflict resolution; goal setting, learning and adaptation; and governance capabilities.

### 5.2.1 Participation, transparency and equity

Co-management can enable more inclusive and fair participation in decisions around the aquaculture sector. ACM arrangements can enable collective management arrangements that foster the exchange of information on key inputs and outputs of production, or marketing information. By enabling participation, transparency and accountability and more equal opportunity and fair access to key inputs, production technologies and markets can be enhanced.

Seven practices associated with participation, transparency and equity in ACM arrangements, are as follows:

i. **Enable participation by affected stakeholders**. Empower affected ACM participants, including producers and other users of shared resources (such as water or land), as well as value chain actors affected by, for example, supply risks such as disease, with the right to participate in the ACM arrangement, taking due account of the equitable participation of Indigenous Peoples, women and youth, where applicable.

ii. **Foster social cohesion**. Enable participants in a given area, or producing the same species, with similar production systems, to engage in collaborative management by creating a common understanding of shared resource use and production risks.

iii. **Enable participant capacity development**. Empower those participating in ACM to engage in the development of their own capacity for farm level and collaborative management of

aquaculture (with support from the private sector, NGOs and/or government), including the requisite skills and knowledge for managing shared resources and mitigating shared risks.

iv. **Establish transparency of information**. Coordinate the organization of transparent rules (including predefined timelines) for participants to access information necessary for enabling joint decision-making between government, producers and other relevant stakeholders (value chain or affected adjacent).

v. **Establish transparent decision-making**. Coordinate the organization of transparent decision-making, including rules and timelines for participants to access decisions made on the management of shared resources and risks by participants.

vi. **Ensure legitimate representation of ACM arrangement**. Organize the legitimate representation (as recognized by actors from within the aquaculture sector) of the interests of producers in decision-making towards achieving shared goals (with consideration of gender inclusivity and the equal representation of vulnerable groups).

vii. **Ensure equitable costs and benefits**. Co-management arrangements should enable fair access to shared land and water resources, as well as equitable distribution of responsibility, costs and benefits for managing shared risks and benefits between producers and/or between producers and adjacent/affected groups (with consideration of gender, Indigenous Peoples and vulnerable groups).

### 5.2.2 Leadership, rule setting and conflict resolution

Co-management can mitigate conflict between actors in a single sector (Murunga, Partelow and Breckwoldt, 2021) or between sectors (Alipour and Arefipour, 202). Conflicts may (pre)exist between competing actors or sectors, or emerge in the process of implementing either co-management or in the process of expanding the aquaculture sector (Galparsoro *et al.*, 2020). Co-management may also offer a means of enabling deliberation and resolution over long-standing conflicts related to ambiguous tenure arrangements and social and environmental impacts derived from production.

There are six good practices associated with leadership, rule setting and conflict resolution for ACM:

i. **Establish an ACM Agreement**. Where it is deemed desirable by participants, coordinate the formulation of the ACM agreement that includes a rationale, set of goals and a set of rules for participants to engage in ACM, including rules about leadership, membership, compliance and conflict resolution, incorporating the conditions for holding participants and non-participants accountable for non-compliance.

ii. **Ensure legitimate leadership**. In the ACM agreement, establish the requirements for the leadership of the group. The leader should have the mandate to steer participants towards the achievement of shared goals. Leadership should be granted to individuals or a group of representatives deemed legitimate by participants. A mechanism for the appointment and dissolving of leadership positions must be made transparent.

iii. **Define membership and rights and responsibilities**. Establish rules for participants, as defined in the ACM agreement, to actively contribute to collaborative management. Additionally, explicitly define the rights and responsibilities for decision-making around access to and/or use of shared resources and inputs, participation in bargaining and/or negotiation over public and private regulation.

iv. **Enable and assess rule compliance**. Set requirements for enforcing rules, and conditions for the violation of those rules, in the co-management agreement. The leadership of the ACM

arrangement can align rules with both public legislation and/or private codes and standards. Compliance assessment can be limited to internal procedures or draw on state and/or private codes and standards.

v. **Establish conflict management mechanisms**. Mandate authority for addressing conflict between participants in the ACM arrangement, including rules for internal resolution or, when necessary, external adjudication. Authority for managing conflicts between participants and non-participants drawing on shared resources (e.g. water quantity) or affected by shared risks (e.g. water quality) is mandated to relevant public authorities.

vi. **Foster accountability**. Establish a mandate within the conflict mechanism for ACM leadership to hold those in violation of shared rules to account in an open and transparent manner. Similarly, a mandate is set for relevant public authorities to hold non-participants to account for rule violation.

### 5.2.3 Goal setting, learning and adaptation

Co-management enables adaptive decision-making by plural sets of cross-scale actors through structured learning and reflection (Carlsson and Berkes, 2005; Finkbeiner and Basurto, 2015). This learning and adaptation 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. Co-management is, as such, seen as a stage of development that may dissipate and be resurrected in the future when the need arises (Butler *et al.*, 2015; Cox *et al.*, 2020). The principles of adaptive 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.

There are seven good practices for goal setting, learning and adaptation for ACM:

i. **Establish a co-management plan**. Mandate the creation of a shared co-management plan between participants. The plan identifies issues, goals and objectives at an appropriate scale of shared management through an equitable and transparent process that promotes informed contributions to its design. Public legislation and private sector-led improvement projects should refer to the ACM plan when governing shared resources and risks associated with aquaculture production.

ii. **Set clear goals and objectives based on collectively recognized issues**. Enable the joint definition of goals and objectives (where appropriate with the guidance of the categories outlined in Sections 4.1 and 4.2). Communicate these clearly and simply to participants to steer the direction of farm- and beyond farm-scale management activities.

iii. **Enable regular interaction and coordination**. Participants engage in regular, active and participatory meetings with all ACM stakeholders, including those from producers, government and the private sector, to discuss ongoing challenges related to power-sharing, trust building and progress towards achieving shared goals.

iv. **Enhance technical knowledge**. Empower participants to gain a greater understanding of strategies to improve engagement in shared management knowledge and techniques, including, where relevant, those associated with the GSA, national better/best management practices or private sustainability standards.

v. **Establish a durable monitoring and evaluation system**. A system for monitoring and evaluating both the co-management plan or agreement (against the best practices outlined here) and the

wider goals of the co-management system (related to for example, the goals in Sections 4.1 and 4.2) is put in place (see further details in Section 7 of this Guidebook).

vi. **Enable adaptive management**. The information collected through the monitoring and evaluation system is fed directly into decision-making by those participating in the co-management arrangement. This allows adjustments to be made to goals and forms of collaboration and innovation, with the objective of ensuring the strategic and operational goals (Sections 4.1 and 4.2) are achieved.

vii. **Establish mutually beneficial alliances and networks**. On the basis of new information and learning, the co-management unit seeks out new alliances and networks that can enable them to make changes, innovate and achieve strategic and operational goals.

### 5.2.4 Enhancing governance capabilities

The development of "governance" capabilities for policymakers, decision-makers and other actors is vital to ensure acceptance and implementation of co-management and for identifying, defining and dealing with problems in ways they see fit and which suit them best in context of their background, ambitions or specific position. Developing governance capabilities also requires collaboration with state, market and financial actors (Termeer *et al.*, 2015). For aquaculture, co-management should enable those participating in co-management to come up with technical innovations for managing shared resources and risks, identify strategies for advocacy or political action, and/or respond to changing agendas or public demands, such as reducing impacts on coastal habitats.

There are four practices identified for enhancing governance capabilities:

i. **Develop and enhance organizational capacity**. Enhance the capacity of participants to organize and engage policymakers, NGOs and buyers to advocate for change and support when faced with major and structural changes affecting the aquaculture industry. Such changes include changes in government, changing market demand and conditions for access, disease outbreaks or major climactic events.

ii. **Develop and enhance innovation drive**. Enable participants in ACM to recognize the need for new knowledge, practices and products that improve their ability to engage in the management of shared resources and risks and seek out new partnerships to realize them. Innovation can involve the development of technical instruments and production systems, as well as new ways of organizing and enabling compliance with government regulation and private codes and standards.

iii. **Develop and enhance capacity for rescaling**. Enhance the ability of ACM participants to strategically recognize the need for establishing new boundaries that align with the scale of management, the spatial extent of the industry and/or ecosystems in which production takes place. Rescaling can enable ACM participants to better seek support or collaboration with actors that can assist them in addressing key challenges – e.g. moving from local to national authorities, from local to global markets, or partnerships with NGOs working across species or production systems.

iv. **Develop and enhance capacity for reflexivity**. Enable ACM participants to access, understand and act upon information relevant to the management of shared resources and mitigation of shared risks. Enhanced reflexive capacity also enables participants to identify the need for changing production practices, the need to establish ACM in the first place, or the need to adapt ACM to newly emerging issues.

## 5.3 Individual engagement in co-management

Individual good practices refer to the practices of actors who individually (or in small social groups, e.g. in households) engage in co-management. In the context of ACM, individuals remain important because of the importance of farms based on household ownership in smallholder aquaculture. Individual co-management practices are also important for understanding the level of engagement with the goals and implementation of the co-management system. Engagement includes sensitization to the goals of co-management, clarity of incentives for engagement with co-management, equitability in the distribution of the benefits derived from collaborative decision-making, reflexivity leading to changes in farming practices and shared resource management, enhanced capacity for engagement in collective action, and/or the development of leadership and innovation.

There are five practices associated with enhanced individual engagement:

i. **Sensitization**. Individual ACM participants understand, identify with and actively engage with the goals underpinning the ACM system (e.g. Nowell *et al.*, 2022). For farmers this could be by extending their decision-making over shared resources and the risks associated with the aquaculture sector.
ii. **Incentives**. Individual ACM participants recognize and positively respond to incentives (economic, social and political) for participating in co-management, and voluntarily comply with co-management rules and decisions while providing for innovative problem solving (based on the EAA [FAO, 2005]). Additionally, these incentives push them to reason towards collaboration over conflict (De Pourcq *et al.*, 2015).
iii. **Accountability**. Individual ACM participants recognize and act upon their own responsibilities and subject themselves to accountability under the conditions set out by the ACM agreement and plan. Individual participants similarly hold others accountable for their actions related to the shared management of resources and risks.
iv. **Equity**. Individual ACM participants engage with equitable benefit distribution in a co-management plan – whether based on the right, merit or needs of those involved in the co-management arrangement (Gurney *et al.*, 2021).
v. **Reflexivity**: Individuals seek out access to and understanding of information surrounding risks and resources and benefits through the ACM plan (Butler *et al.*, 2015); they in turn act on that information by demonstrably changing their practices so as to contribute to the goals of the ACM plan, or seek to change the plan given their own contrasting knowledge or experiences for achieving those goals.

# 6

# IMPLEMENTING AQUACULTURE CO-MANAGEMENT

The implementation steps required for ACM depend on the design of the co-management system and the implementation of the co-management plan or agreement, taking into consideration national and local contexts. Despite the potential differences, it is possible to identify three generic steps: (i) pre-implementation, (ii) implementation, and (iii) post-implementation. These steps are based on those set out for fisheries co-management (Pomeroy and Rivera-Guieb, 2005; Butler *et al.*, 2016; Olsson, Folke and Berkes, 2004) and can be translated to ACM.

Within each of the three steps are several specific activities. For example, during pre-implementation, meetings between those engaging in collaboration can be held. During implementation the practical changes required to access resources and develop capacities for management are put in place. Nevertheless, these steps remain generic in nature because there is no "blueprint" or model for co-management. Instead, the design of "collaborative" management requires a collaborative process of design, development and implementation. As outlined above, in some cases this will mean that only producers and the government may be involved. But in other cases a wider set of value chain actors may be involved, extending to "input" and service-related actors, in addition to cross-sector actors affected by aquaculture activities.

## 6.1 Pre-implementation phase

Pre-implementation requires joint recognition, and therefore legitimacy, of co-management (Chuenpagdee and Jentoft, 2007). A rationale might be built around a shared recognition of the value of 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 ACM, including the credible intent of government to consolidate or develop supportive legislation and/or policy. In this step past (perceived) injustices may be identified, acknowledged and addressed to avoid an impasse at later stages of development. Furthermore, opportunities might be identified for ACM to assist participants to anticipate future challenges related to the economic, social and environmental performance of the industry into the future.

In the pre-implementation phase input should be sought from all potential participants. If this input indicates there is no support for the collaborative management of shared resources and risks, then no further action should be taken. If there is recognition and support for ACM and provided that there is established supportive policy and legislation, then the pre-implementation phase should culminate in the formulation of an ACM plan. This plan outlines the goals, objectives and activities for joint decision-making, as well as the strategies that address the specific needs of those participating.
In line with Pomeroy and Rivera Guieb (2005), the pre-implementation phase involves the following steps for deciding on the implementation of ACM:

1 

**Identify local organization that can assess potential for ACM**. As outlined above, this organization may be an existing cooperative, industry association, or a newly formed organization specifically designated to conduct the assessment.

2 

**Identify resource and/or input constraints** that potential participants in ACM face in maintaining the productivity and profitability of individual production units. These constraints relate primarily to resources required for achieving tactical goals related to access to suitable production sites – water, seed, feed and/or (clean) energy

supplies. Attention should be given to both access and ownership rights over these resources and inputs.

3 

**Identify collective social and/or environmental risks** through consultation with potential co-management participants. Social risks include labour, weak benefit sharing in value chains or associations, poor access to finance and/or impacts on customary institutions of Indigenous Peoples. Environmental risks may relate to poor water quality, weak biosecurity and/or sources of adverse chemical use.

4 

**Identify market opportunities and constraints** that potential participants in ACM can collectively address to maintain the productivity and profitability of individual production units. Opportunities may emerge in response to collective bargaining around input and farm gate contracts, or access to new product categories in domestic and/or export markets. Constraints include increased market requirements from buyers or regulators, and/or increased competition.

5 

**Provide a motivation for (or against) the establishment of co-management**, with attention to points i, ii and iii above: Why is co-management needed? What issues relating to the management of shared resources and risks does it need to address? Here attention should be given to why co-management is considered the most effective arrangement for resolving issues related to the management of shared resources and risks.

6 

**Describe the area used for aquaculture production**, including geography, demography, important resources for aquaculture production and their condition at the time of writing the description. Other social dimensions of production should also be included, such as the socioeconomic status of farmers, institutions and laws, and other relevant information for management. Maps of the area in which aquaculture production is practiced could also be included. As a minimum, include detailed locations of resources and use patterns and existing management interventions.

7 

**Identify key stakeholders** willing to participate in the ACM arrangement, taking account of the interests and needs of vulnerable groups, including Indigenous Peoples, youth and women, where applicable. This also involves the identification of their rights and responsibilities related to the implementation of ACM, as well as the benefits and opportunities they anticipate receiving from their ongoing involvement. Identify the motivations for joining an ACM arrangement, e.g. responding to a (perceived) resource management crisis such as disease or water quality or an opportunity for enhancing production performance through innovation. Attention can also be given to the stakeholders along the value chain or 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).

8 

**Assess the innovation capacity of potential participants** to identify and resolve risks, resource constraints and market once ACM is established. Attention should be given to expanding the group of participants to address shortfalls in

capacity, and/or identify sources of technical and knowledge support for participants. Involvement in ACM should enable producers to improve their ability to access inputs, for example new knowledge, technologies and capital required to upgrade production practices for sustainable aquaculture (such as FAO, 2023a).

9 

**Identify constraints and assess the support provided by the government** to producer representative organizations for the implementation of ACM. Questions should focus on whether prevailing legislation allows and/or provides legal tenure and decision over, for example, shared resources. An assessment should be conducted of how bylaws established by the ACM unit would be supported by regulators. Attention should also be given to the political will of government authorities to implement and/or enforce rights and responsibilities.

10 

**Identify the scale of management needed**. The level at which the scheme is organized must "fit" the ecology, management system and the people that inhabit it. The definition of sociospatial boundaries should be based on principles of subsidiarity (Pomeroy, 1995), spatial planning aligned to the EAA (FAO, 2010) and/or defining the spatial extent of shared risks (see Lien, 2020). Where relevant, transboundary management can be assessed to determine opportunities for "regional" (landscape and/or seascape) approaches for harmonizing laws and creating binding legal mechanisms across boundaries.

11 

**Identify a lead actor or organization** with the capacity and resources to lead the establishment of the co-management arrangement – or motivate why a new organization should be formed. The type of actor is key for determining the type of ACM arrangement that is finally adopted – i.e. more or less involvement and leadership from the state or producer associations or buyers. The identification of the lead actor can be driven by their own self-interest or strategic policy goals. They may also be identified through a structured negotiation if past conflicts or future benefit sharing remain contentious or are unclear to all parties involved.

12 

**Identify a willing investor or financier** for the establishment of the ACM arrangement. An investor may be self-evident based on those actors taking a lead in the development of the co-management initiative. However, where lead actors do not have the resources to finance the implementation of ACM, third party funders need to be found. An assessment should be made of short-term benefits versus long-term gains to identify which (types) of investors (e.g. public, institutional or private) are most likely to engage.

13 

**Collect baseline data** at the start of implementation to enable post-implementation evaluation. ACM first implies the establishment of suitable and relevant indicators that are comprehensive (i.e. span ecological, institutional/governance and economic factors), but not too detailed that they go beyond the comprehension and capacity of actors (indicators for fisheries are well-established [see for example, Pomeroy *et al.*, 2022; Evans, Cherrett and Pemsl, 2011] and some may be interchangeable with aquaculture).

14 **Write a preliminary ACM plan** (see Box 2) reporting on the above assessments and outlining a set of goals to overcome constraints and risks and/or enhance the benefits to participants. This should include both operational and strategic level goals and a strategy with clear activities and responsibilities for achieving those goals. The plan should also stipulate the methodology, responsibility and technologies for monitoring and evaluation, including a timeline for implementation, interactive reflection and adaptation of the ACM plan. Conflict resolution mechanisms should be established between producers, as well as producers and the state, other (adjacent) sectors and stakeholders that choose not to participate in ACM.

15 **Decision is made on the implementation of ACM**. When ACM is not deemed to be an appropriate approach for addressing the issues or challenges faced by the aquaculture sector, an alternative approach to management may be motivated.

Box 2
**Aquaculture co-management plan and agreement**

The **ACM plan** is a technical document that outlines the priorities of participants collaborating for the shared management of key resources necessary for aquaculture production (e.g. water, seed or feed) and/or the mitigation of shared risks (including poor water discharge from production systems that increases the incidence of disease). The ACM plan should specify functions, roles, benefits and responsibilities amongst participants. The plan defines the issues to be managed and the policies that support collaborative management of these issues. The co-management plan should be relevant for addressing contemporary issues, as well as provide a collective vision for the future of the aquaculture industry in question.

Based on the ACM plan, participants may opt to adopt the **ACM agreement**, which is a legal document that binds those signing the agreement, and formalizes the mandates, responsibilities, rights, and other applicable minimum requirements for the ACM. The agreement should be signed by each participant – potentially ranging from producers to buyers to the government. The signatories should be those stakeholders who are directly assigned a role and responsibility in the agreement. All agreements should specify the scope and applicability (including the activities to be undertaken, the area in which activities are undertaken, and by whom). The principles that guide the ways in which the activities are undertaken, and outline provisions on the minimum requirements to be observed in the undertaking of activities, their monitoring, control, surveillance and enforcement, should also be specified.

*Source*: Adapted from Pomeroy & Rivera-Guieb, 2005. *Fishery co-management: a practical handbook*. Wallingford, UK, CAB International and Otawa, Canada, the International Development Research Centre.

## 6.2 Implementation phase

The ACM plan may be implemented by participants on a voluntary basis, i.e. without the need for an additional instrument that formalizes the ACM plan. Alternatively, the implementation of the ACM plan may be strengthened by the adoption of a legal document such as an ACM agreement. Accordingly, once an ACM plan has been agreed upon, interested participants may decide to formalize the plan through an ACM agreement (Box 2).

The process of implementing the ACM plan does not depend on the ACM agreement and the ACM plan provides flexibility to the participants to modify the plan, subject to consultation, learning and adaptation. The following considerations can be taken up in the process of implementing the ACM plan:

1 

**Establish and/or formalize an ACM organization** that can lead the process of seeking approval for the ACM plan and, where agreed upon, interested participants take the necessary steps to adopt the ACM agreement. This organization takes the lead in ensuring the participants implement the various steps set out in the ACM plan and, where the ACM agreement has been adopted, monitoring compliance by parties to the ACM agreement with the terms of the ACM agreement.

2 

**Jointly draft and approve an ACM agreement** that provides a clear division of roles, responsibilities and rights between stakeholders. In this voluntary agreement, key norms and rules for participation should be stipulated, including the rights and responsibilities for participation and benefit sharing (including costs) and procedures for conflict management. Attention should be given to effective collaboration between agencies or departments issuing the leases and permits necessary for operation. Producers, government and relevant private sector actors should have the opportunity to negotiate in a fair and free manner, meaning in the absence of threat, violence and/or intimidation from others. The agreement should also outline arrangements on benefit sharing. Where market assurance is required, partnership agreements (or "covenants") should be put in place that define roles and responsibilities, the level of self-determination (authority) and conflict resolution mechanisms (in the case of disputes).

3 

**Establish a mandate for joint decision-making** on the management of shared resources and risks. Decision-making mechanisms that set conditions for allocating access to shared resources (e.g. water, land, feed and/or seed) and responsibilities for the management of shared risks (e.g. water quality, quantity and disease) should be put in place. Producers should be supported to develop self-enforcement mechanisms and monitoring of agreed norms, rules and/or standards related to, for instance, production inputs (feed, seed and water), effluent flows and relevant environmental and social issues outlined in the co-management plan (see FAO, 2023a).

4 

**Share costs and benefits.** ACM should enable inclusive forms of collaboration in which fair benefit sharing, including the costs and benefits of managing shared resources and risks in time and space, can be openly negotiated by participants.

5 

**Include local, indigenous and scientific knowledge** in the development of activities designed to innovate and manage shared risks, resource constraints and/or market access. Co-management can be used to enable the transfer of material- and management-related technologies pertaining to farm installation and construction, culture techniques, pond maintenance practices, disease diagnosis and reporting. The synthesis of scientific and other (non-scientific) knowledge is important, though important co-management decisions must primarily be evidence-based.

6 

**Negotiate market conditions**. Participants can use the ACM agreement to strengthen cooperative and/or collective action for (re)negotiating contracts for production inputs and/or farm gate prices. This can include engaging in decision-making processes related to the allocation of resources (e.g. land, water and space), co-definition or revision of better production practices, and/or compliance with (domestic and global) market-related standards and requirements.

7 

**Develop a sustainable financing strategy** that identifies either an internal membership or subsidy-based model of funding, or external source of funding based on a long-term business model. ACM can 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. In the case of smallholders, ACM may enable innovations to be shared among producers or connections to be made with service providers (e.g. information communication 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).

8 

**Develop the capabilities** of those involved in the ACM arrangement to undertake activities in the co-management plan and agreement. These capabilities may relate to knowledge and skills for technology innovation, better production practices and/or new management arrangements for accessing shared resources and managing shared risks. Ongoing evaluation of the need for state and market actors to support these capabilities is needed – including the identification of constraints these actors may pose to realizing the agreed goals of co-management. Collaborative management, including sustainability partnerships with NGOs or government-led aquaculture improvement projects (see Sarkar *et al.*, 2020) can enable compliance with better management practices or market-based requirements in either domestic or international markets.

9 

**Agree on a timeline for the re-evaluation of the ACM agreement and strategy**. Depending on the goals of those involved in the co-management arrangement and/or demands from funders, an agreed timeline for re-evaluating the ACM agreement and strategy should be transparently established and communicated.

## 6.3 Post implementation phase

After implementation, co-management needs to be self-sustaining. In line with the potential of ACM 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:

1 

**Implement post factum evaluation** to enable adaptive adjustment of the co-management plan, agreement and wider enabling environment. The evaluation should include all stakeholders to determine the extent to which the programme has reached its goals and objectives. Results can be used as a reference for future planning, and to measure progress through time.

2 

**(Re)evaluate the membership and role of participants** as the ACM plan and strategy are evaluated and updated. This may lead to the exit of some participants and the enrolment of others as new opportunities for innovation and/or the risks and impacts of aquaculture are better understood.

3 

**Reflect on the capabilities of participants** to engage in ACM activities, including lessons learned, improvement of production and trade practices, and engagement with wider public policy, regulation and private standards. Where necessary, existing structures should be adapted to better enable state, market and civil society support for improved participant capabilities so that the objectives set out in the ACM plan and processes set out in the ACM agreement may be achieved.

4 

**Reflect on the need to scale up or scale down** the co-management initiative by changing the boundaries of collaboration through the ACM agreement, and/or institutionalizing the ACM agreement at a higher level of either private sector representation or government. The choice to scale ACM up or down should be made in relation to the operational and strategic goals set out in the plan and agreement.

# 7

# MONITORING, EVALUATION, AND LEARNING

Monitoring and evaluation systems need to be developed to determine the impact of any of the ACM models outlined above. Based on a wider set of generic monitoring and evaluation methodologies, these systems require the systematized collection and evaluation of relevant data to enable the assessment of: (i) the conduct and performance of co-managers and the co-management system; and (ii) the achievement of co-management plan goals and objectives. In line with wider goals of adaptive forms of co-management, these assessments should also enable co-managers to reflect and learn from past actions and adapt goals, rationales, rules and arrangements. An evaluation may also enable donors and government policymakers to revise funding and priorities for enhancing the performance of the aquaculture industry more broadly.

Monitoring and evaluation of co-management is far more advanced in other resource sectors such as fisheries (see for example, Pomeroy *et al.*, 2022). Generic indicators related to the evaluation of co-management plans from these other sectors are likely to be highly instructive for ACM. However, broader system-level ecological, social and economic impact indicators require specific elaboration – and potentially link to other impact assessment frameworks developed through third party certification. In preparation for developing these more elaborate monitoring and evaluation indicators, the following section outlines key considerations in the development of a generic approach for evaluating ACM.

## 7.1 Design considerations

The overall goal of monitoring and evaluation is to assess both the performance of ACM against pre-defined goals and objectives (with an applicable and relevant set of indicators) set out a priori in a co-management plan, and the wider impact of ACM on social, environmental and economic outcomes. Central to both levels of evaluation is the opportunity for those engaged in co-management to learn what is working and what can be enhanced so that the co-management arrangement can be adapted and improved.

Who sets the goals and objectives of monitoring and evaluation, and who evaluates them, may differ depending on the needs of either internal (e.g. resource users, collaborating state or non-state actors) or external actors (e.g. donors, buyers and auditors). 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 the capabilities of those involved and the goals of ACM arrangements, monitoring systems can also be internal, defined and run by producers, or externally run based on intermittent sampling or auditing.

Monitoring and evaluation systems for co-management are also fundamentally oriented towards enhanced learning and adaptive change. Generally, evaluation within co-management improves individual and organizational learning, fosters the acquisition of skills by 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 ACM design, implementation, operation and outcomes. However, reflecting the findings of co-management to other sectors, the learning potential of monitoring and evaluation is not a given (Armitage *et al.*, 2009). Instead, learning requires that specific attention is paid to developing the capacity to design, monitor, understand and respond to evaluation, and establish incentives for encouraging learning (Armitage, Marschke and Plummer, 2008). To ensure that those engaged in learning are representative of the aquaculture sector (i.e. men and women, youth and Indigenous Peoples), particular effort is required to overcome the potential marginalization of actors and/or groups from participating in learning processes.

Finally, consideration should be given to balancing internal and external demands for evaluation in the form of market verification and/or assurance (Bottema, Bush and Oosterveer, 2021). If the internal process of monitoring and evaluating either the co-management system or its impact is deemed legitimate by market or state actors, then the co-management system may be afforded high levels of self-determination. Conversely, if external evaluation needs are not met, the ACM may be deemed less credible with the consequence of higher levels of external evaluation and assurance. This spectrum of outcomes not only reflects the range of co-management arrangements, as outlined by Sen and Nielsen (1996), but also indicates the legitimacy and accountability of these arrangements for and to different audiences.

## 7.2 What to evaluate

Monitoring and evaluation of ACM can be done in relation to the practice of implementing co-management and the goals of the co-management plan established by the participants, as well as the wider strategic outcomes of the ACM system. These two distinct levels of evaluation require different approaches and methodologies for monitoring and evaluation. They can be evaluated separately but, following Pomeroy *et al.* (2022), evaluating both levels can provide a deeper understanding of the effectiveness of the co-management system as a whole.

### 7.2.1 Evaluating the co-management system

The evaluation of implementation focuses on the process of putting co-management in place and how well it performs against the good practices outlined in Section 5.

### 7.2.2 Evaluating the co-management plan

Evaluation of the achievement of goals and objectives as stated in the ACM plan is to assess its performance and effectiveness against a set of criteria and standards expressed as indicators (see Annex 2 for an example of an assessment sheet adapted from the *Guidebook for evaluating fisheries co-management effectiveness* [Pomeroy *et al.*, 2022]).

These goals may be operational in nature, meaning they are focused on the shared goals of improving the social and environmental performance of aquaculture production (as outlined in Section 4.2). Strategic goals (Section 4.1) may also be assessed. Indicators for these operational and strategic goals may span the spatial extent of aquaculture production (a delta or coastal area) or extend to wider coastal landscapes, seascapes or social groups, including Indigenous Peoples. Government goals and policy may define these goals and, as such, the evaluation strategy when they extend beyond those immediately involved in the aquaculture sector.

Following the *Guidebook for evaluating fisheries co-management effectiveness* (Pomeroy *et al.*, 2022), it is recommended that the effectiveness of the co-management system should only be assessed if it has been in place for at least two years and there is a written ACM plan, including clearly stated goals and objectives. If the goals and objectives have not been written down, it is still possible to conduct an evaluation but no meaningful post factum evaluation can be undertaken.

## 7.3 Steps of monitoring and evaluation

Depending on the level of evaluation, and again in line with the *Guidebook for evaluating fisheries co-management effectiveness* (Pomeroy *et al.*, 2022), it is recommended that any of the above evaluations is undertaken in four steps:

1. **plan the content, goals and design of an evaluation**, including the identification of key criteria (related to the principles outlined above) and the goals and objectives as set out in the co-management plan or covenant;
2. **compile information**, including a detailed description of the context, system and design of the ACM arrangement using the selected indicators associated with the principles outlined above;
3. **measure and analysing indicators** related to the ACM system and co-management plan; and
4. **validate and communicate the results** with key stakeholders involved in the ACM arrangement.

### 7.3.1 Planning the content, goals and design of an evaluation

To ensure a comprehensive and effective evaluation, it is essential to carefully plan its content, goals and design. Here are the recommended steps for this planning process:

i. Establish a timeline for the evaluation. This timing would include the frequency for conducting an effectiveness evaluation, which in turn is defined by the period in which measurable change may be observed. In line with the *Guidebook for evaluating fisheries co-management effectiveness* (Pomeroy *et al.*, 2022), it is recommended that an evaluation be conducted every three to five years, or that it is linked to revisions of the co-management plan. This will allow time for adjustments in co-management design and processes, and time for the ACM activities to be implemented. Overall, the evaluation of ACM should be embedded within routine internal operational monitoring by those involved in the arrangement to enable adaptive management. The results of the evaluation are used by the co-managers to better understand why goals and objectives and expected impacts have or have not been achieved, and to adapt co-management design, processes and actions. Evaluation will also improve knowledge of ACM more generally.

ii. Define the co-management system. The unit of assessment needs to be determined before the evaluation begins. This may be an aquaculture community, cluster or cooperative, a geographic area defined by the government as an aquaculture management "zone"' or "area" (in line with the EAA and GSA) or a partnership between producers, government and communities and private sector partners (e.g. akin to the jurisdictional approach). The evaluation should be agreed upon by those participating in the co-management arrangement – or stipulated in the co-management plan. This process enables the evaluators to determine whose practices should be included in the evaluation and determines the scale at which performance indicators should be evaluated.

iii. Identify indicators for assessment. Both the evaluation of the co-management system and co-management plan require indicators to be identified. Indicators for evaluation should be agreed upon in the ACM plan or negotiated by all stakeholders prior to the evaluation. This evaluation is an essential part of learning and adaptation by those engaged in the co-management arrangement because it improves understanding of the ways in which the goals, rules, partnerships and management systems in place affect the achievement of operational goals. Notably, if no goals have been set *a priori*, and set out in a co-management plan, then the evaluation can perform a participatory assessment to establish the values and practices adopted by the co-management system and these are agreed upon, albeit post factum, by the participants.

iv. Establish an evaluation team. The evaluation team is charged with planning, collecting and evaluating information and communicating results. The expertise of the team is determined by the goals and indicators selected and the agreed outcomes and audience of the evaluation. If the evaluation is conducted for internal evaluation, either participants or external experts can be engaged. If the evaluation is for an external audience, independent experts should be engaged. In either case, the team should be legitimized by aquaculture producers, industry and/or government.

v. Set and secure a budget. The time and cost of the evaluation should be calculated before the evaluation. Calculating these costs should consider the scale of the co-management area, and whether the evaluation is of the co-management system (practices) or the performance of the co-management plan (outcomes). Similarly, it depends on the indicators selected to assess these wider goals – including the type of methodology used, access to data and the frequency data should be collected to observe effects or outcomes. If the budget is not available internally, a plan for acquiring funds should be set out before the evaluation begins.

vi. Determine the audiences for the evaluation. The audience(s) to whom the results should be reported should be identified and a communication plan developed before the evaluation begins. There may be several different audiences who will each require different methods of communication. Determining which data can be shared depends on the goals in the ACM plan which guide the parameters through which an internal management system for the participants is designed. Secondary audiences can include buyers who seek improved insight into their own supply risk, or who are coordinating certification for a group of producers, for instance assisting with auditing requirements. Government may also seek access to data to assess the capacity development of producers or gain insight into the social and environmental performance of the producers. Alternatively, private actors supporting market-oriented aquaculture improvement projects may use the evaluation for planning and compliance purposes. Again, access and use of data by these actors needs to be described in the ACM plan.

### 7.3.2 Compiling information

Monitoring and evaluation methodologies are increasingly linked to new digital technologies that enable both near field and remote sensing. These technologies include sensors used on-farm to monitor operational parameters of performance related to water quality (e.g. temperature, turbidity, dissolved oxygen, pH, solid, salinity, alkalinity, ammonia, nitrite and nitrate), providing real-time or near real-time feedback to producers and other value chain actors. These technologies are introduced by producers themselves, by governments or service providers (including feed manufacturers) to monitor and advise on production (Yue and Shen, 2021). Remote sensing technologies are used to monitor larger

scale environmental impacts, including coastal water quality, land use change and temperature, to both regulate and provide early warning to farmers on conditions leading to, for example, mass mortality events Yadav *et al.*, 2022. Other technologies provide enhanced value chain traceability (Hardt, Flette and Howell, 2017), with information in some cases returned to producers (Yadav *et al.*, 2022).

These technologies provide automated and even predictive information on operational and strategic performance that is relevant for ACM. In some instances, the information flows generated by these technologies are programmed by producers and other value chain actors seeking greater insights into production and market performance (Yue and Shen, 2021). However, the majority of these digital technologies are programmed by digital service providers who are increasingly being considered as co-governors of the aquaculture industry (Kruk *et al.*, 2021). This implies that they should also be involved in ACM arrangements, and with this involvement, enrolled in the design of co-management plans and programming of monitoring and evaluation methodologies.

### 7.3.3 Measuring and analysing indicators

A distinction can be made between the evaluation of: (i) the ACM system and (ii) the co-management plan.

For the wider co-management system, the good practices outlined in Section 5 can be used to assess the enabling support provided to the development of co-management. For this the (preliminary) key indicators are outlined in Annex 1 and can be measured by a range of data collection methods such as qualitative interview techniques (interviews, focus groups and document analysis) to quantitative surveys.

The evaluation of the co-management plan should be based on indicators that are aligned with the goals and processes agreed to by those who design the co-management plan and are subject to it. Notably, data may already be available from baseline surveys conducted in support of monitoring and evaluation, routine monitoring of the co-management process and from secondary data sources (such as data collected during Step 2 on the co-management context and process).

Data collected are used to answer the specific questions relevant to the evaluation, as expressed through the selected indicators. The indicators provided in Annex 1 provide examples of how such an evaluation could take place. Notably, such an evaluation should be closely aligned with the ongoing monitoring of the co-management plan.

The analysis of indicators involves the careful consideration of information with the goal of clarifying uncertainties, identifying problems and coming to a structured set of recommendations for the next phase of ACM planning and development. To enable a comparison of the results over time, a common structure that will allow for data to be analysed in a systematic way and enable generalizations and comparisons to be made, should be chosen. As explained in the *Guidebook for evaluating fisheries co-management effectiveness* (Pomeroy *et al.*, 2022), such analysis involves the interpretation of indicators to understand the links and relationships between the context and process of the wider co-management system and the co-management plan under assessment. This means not looking at the results of a given evaluation in isolation, but rather at the trends and implications of changes to both the co-management system and plan over time. Core to this analysis is to understand "why" the result has occurred of all the elements in the co-management system and to consider how the results can best be explained (Pomeroy *et al.*, 2022).

### 7.3.4 Validating and communicating the results

Once analysed, findings should be validated with key stakeholders involved in the ACM arrangement. Doing so enables these stakeholders to review and provide critical feedback on the accuracy, interpretation, conclusions and/or consequences of these findings before they are disseminated. This feedback should be transparently included or excluded when drafting the external evaluation report. It may also require the evaluation team reconsider certain results or findings and/or go back and re-plan and remeasure certain indicators.

In line with the *Guidebook for evaluating fisheries co-management effectiveness* (Pomeroy *et al.*, 2022), the (revised) external evaluation report should also be reviewed by respected technical experts (scientific and policy research) and the target audience (participants, funders and/or policy makers). Comments received should then be incorporated into the report as deemed appropriate by the evaluation team. This external review will typically improve the legitimacy, transparency and credibility of the evaluation process to key target audiences. If conflicting interpretations and remain, an arbitration process can be established by an independent body to consider grievances and whether further changes or actions are needed before changes are made to the ACM plan.

## 7.4 Post-evaluation and adaptive management

Once an evaluation is complete, the results can be used to assess and where necessary adapt the design and/or performance of ACM. This process of adaptive management is based on a systematic process of revisiting assumptions and learning from the evaluation to improve management practices (Armitage, Berkes and Doubleday, 2010). In line with the Guidebook for evaluating fisheries co-management effectiveness (Pomeroy *et al.*, 2022), adaptive management and learning post evaluation enables the improvement of ACM so that it meets the goals set out in the management plan, as well as the wider goals in the EAA, GSA and FAO's vision for Blue Transformation.

Lessons can be drawn, for instance, on why an ACM arrangement did not have the intended impact, or the reasons why strategic or operational goals were not achieved. Such findings might reflect on whether those involved in the arrangement have fulfilled the roles and activities allocated to them in the ACM plan, or it might indicate that some intended participants were excluded. It might also show that the quality of data generated in the monitoring and evaluation phase was of too poor a quality to derive any clear conclusions. Alternatively, the evaluation may find that there is no need for changes to be made. Knowledge, strategies and actions for correcting underperformance and improving implementation can be identified. In all instances, lessons should be recorded in an accessible format to enable future reflection and decision-making on ACM.

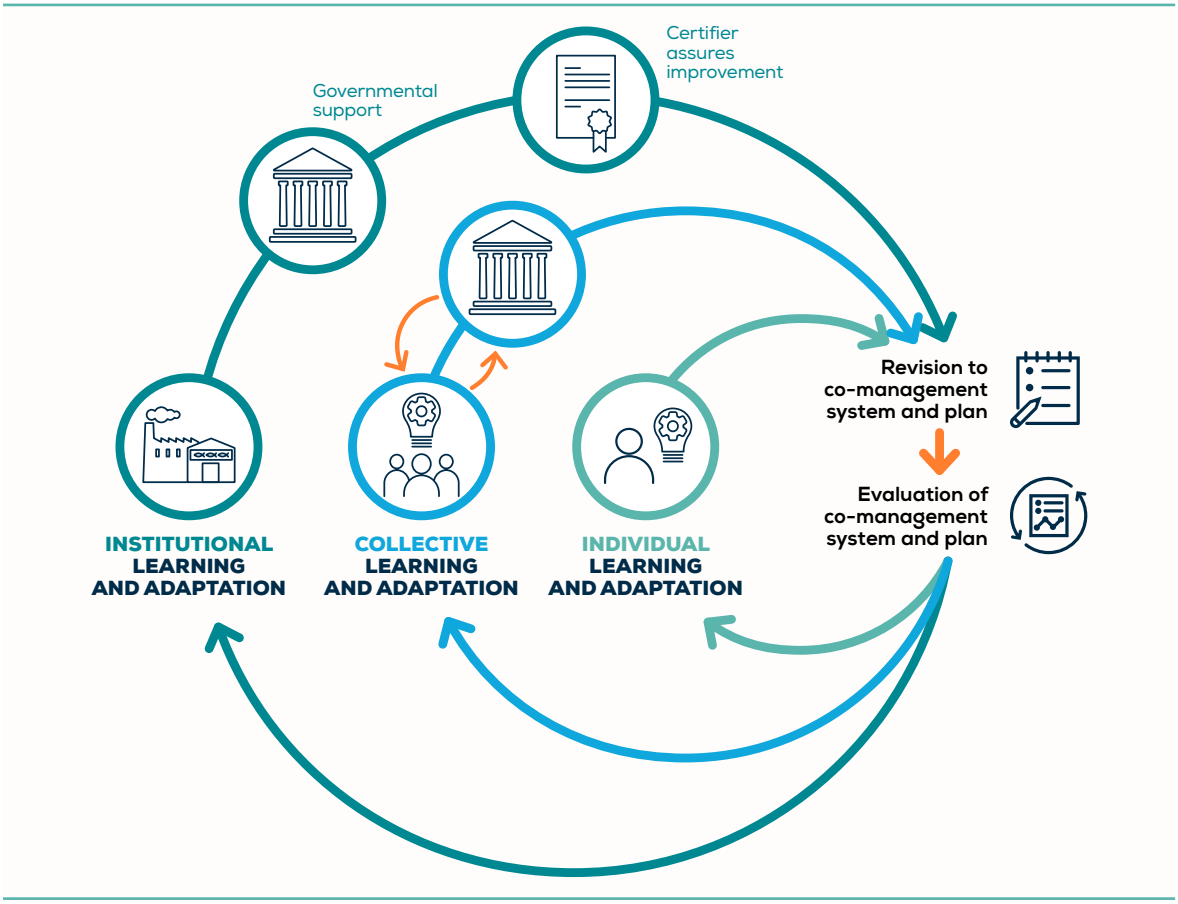
Any of the above findings can be used in the post evaluation phase to revisit and adapt (where necessary) the design and implementation of (i) the enabling environment (institutional learning); (ii) the design of the co-management system (collective learning); or (iii) the inclusion and incentives offered to individuals or households engaged in the ACM system (individual learning) (Figure 7).

Changes to goals, activities and practices should, in line with GSA guidelines, include all those involved in the ACM system. The system should also engage a participatory approach of reviewing and revising the ACM plan, as well as the design of the system itself (including the enabling environment). Changes may include modifications to the ACM plan directly, including "who will lead the changes, what will need to be changed, how to make the changes, what resources are needed, and a timeline

for making the changes" (Pomeroy *et al.*, 2022, p.41). Any changes should be made on a priority basis, including the degree of importance to meet strategic and/or operational goals, and the resources available to make the changes. Responsibility for making changes to the ACM plan, system or enabling environment should also be agreed upon and specified – e.g. resource users, value chain actors, other user groups and/or the government.

Figure 7

**Adaptive management and learning across three levels of aquaculture co-management**



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# Annex 1. Example assessment sheet for the evaluation of the design and performance of the aquaculture co-management system

Assessment sheet for the evaluation of the design and performance of the aquaculture co-management system based on the *Guidebook for evaluating fisheries co-management effectiveness* (Pomeroy *et al.*, 2022).

**Name of aquaculture co-management system:**

| No. | Good practice and indicator | Examples of approaches for measuring indicators | Scoring (existence of good practice) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| I.1 | **Enabling environmental and institutional fit – external good practices** | | | | | | | |
| I.1.1 | **Good practice**: Set appropriate scale: The scale of the co-management system may vary but should be appropriate to the environmental issues related to aquaculture, actors in the industry and relate to existing levels of management. | | | | | | | |
| I.1.1.1 | **Indicator**: The scale and the area of the co-managed aquaculture system have been agreed through a participatory process with concerned stakeholders | Review of co-management documentation; and Questionnaire survey (perception) | | | | | | |
| I.1.2 | **Good practice**: Define boundaries: The boundaries of the co-management system are defined in relation to the actors involved, the biophysical extent of the issues being managed and the jurisdiction of different levels or executive branches of government. | | | | | | | |
| I.1.2.1 | **Indicator**: Boundaries of the aquaculture system to be co-managed have been demarcated, if a spatially defined area, or otherwise clearly described in a co-management agreement | Review of co-management documentation; Observation or photos of markers; Review of documentation relating to demarcation procedure; Existence of (GIS-based) maps officially endorsed by the co-management body and incorporated in the co-management agreement; and Consistency of the demarcated co-managed areas for fishing with the zones of exclusion, such as conservation areas, navigation routes, nursery grounds, etc. | | | | | | |

(cont.)

| No. | Good practice and indicator | Examples of approaches for measuring indicators | Scoring (existence of good practice) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| I.1.3 | **Good practice**:<br>Identify level of support for ACM: Identify and where necessary amend public laws, regulations and private codes and standards that affect participation in ACM. | | | | | | | |
| I.1.3.1 | **Indicator**: There are legal provisions for resource users to organize and register formal organizations. | Review of legislation and procedures for registering an organization. | | | | | | |
| I.1.3.2 | **Indicator**: Co-management responsibilities have been formally delegated to the co-management committee. | Review of co-management agreement;<br>Review of the charters of professional fishers' organizations; and<br>Review of terms of reference (TOR) of co-management committee partners, co-management bodies, professional organizations and executive boards. | | | | | | |
| I.1.4 | **Good practice**:<br>Establish mandates and responsibilities of (potential) participants. | | | | | | | |
| I.1.4.1 | **Indicator**: existing laws and regulations to delineate the mandate and responsibilities of government, farmers and other private sector actors seeking to participate in ACM. | Review of legislation and procedures for registering an organization; and<br>Review of TORs of co-management committee partners, co-management bodies, professional organizations and executive boards. | | | | | | |
| I.1.4.2 | **Indicator**: Awareness of mandates and responsibilities is raised amongst (potential) participants. | Review existence and content of communication materials. | | | | | | |
| I.1.5 | **Good practice**:<br>Delineate tenure rights of aquaculture producers: Formal and recognized rights to, for example, water, land and/or genetic material are granted to those collaborating, and the structures required for allocating use rights among participants are agreed to. | | | | | | | |
| I.1.5.1 | **Indicator**: Tenure and access rights are deemed and equitably allocated in a transparent and accountable manner. | Review of government agreement and tenure arrangements;<br>Questionnaire survey (perception) among different resource users along the value chain;<br>Focus group discussion among resource user groups; and<br>Consultations with organizations/ associations of resource users. | | | | | | |

(cont.)

| No. | Good practice and indicator | Examples of approaches for measuring indicators | Scoring (existence of good practice) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| I.1.5.2 | **Indicator**: Tenure and access rights have been adequately integrated/reflected in the ACM agreement. | Review of government agreement and tenure arrangements;<br>Questionnaire survey (perception) among different resource users along the value chain;<br>Focus group discussion among resource user groups; and<br>Consultations with organizations/ associations of resource users. | | | | | | |
| I.1.5.3 | **Indicator**: All stakeholders have access to information on the tenure rights and resource allocation criteria and processes. | Review of existing (legal) documentation and how it can be accessed;<br>Stakeholder consultations; and<br>Standardized semi-structured questionnaire as part of key informant survey, supported through focus group discussions. | | | | | | |
| I.1.6 | **Good practice**:<br>Engage support of government and political/economic elites: Active cooperation and power sharing between producers and government actors and/or producers and other value chain actors (suppliers or buyers) and/or where relevant, adjacent land and resource users. | | | | | | | |
| I.1.6.1 | **Indicator**: The government supports and participates in co-management according to agreement with resource users on cooperation. | Review of co-management agreement;<br>Discussions with key informants;<br>Interviews with local authorities (district, communal) delegated to implement co-management;<br>Focus group discussion with co-management partners; and<br>Interviews with key informants and stakeholders. | | | | | | |
| I.1.6.2 | **Indicator**:<br>Decision-making is shared across scales and between diverse stakeholders with an interest in the resource being co-managed. | Review of co-management membership and protocols for member participation and representation on the co-management committee; and<br>Interviews with key informants and stakeholders. | | | | | | |
| I.1.7 | **Good practice**:<br>Enforce management rules: A system of self-enforced penalties is established and imposed by strong operational rules designed, enforced and controlled by those collaborating. | | | | | | | |
| I.1.7.1 | **Indicator**:<br>Self-enforcement system of penalties is designed by resource users/co-management participants. | Review of documentation on enforcement system;<br>Focal group discussions; and<br>Review of the mechanism of sanctioning of violations and active participation of the authorities in the process. | | | | | | |

(cont.)

| No. | Good practice and indicator | Examples of approaches for measuring indicators | Scoring (existence of good practice) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| I.1.7.2 | **Indicator**: There is an active enforcement mechanism in place and operational. | Review of documentation on enforcement system; Focal group discussions; and Review of the effectiveness/ regularity of enforcement. | | | | | | |
| I.1.8 | **Good practice**: Establish and enforce graduated sanctions: Sanctions increase with the number or the severity of offences. | | | | | | | |
| I.1.8.1 | **Indicator**: Sanctions are proportional to the number or severity of offences. | Review of documentation of sanctions; Questionnaire survey (perception). | | | | | | |
| I.2 | **Co-management system – internal good practices** | | | | | | | |
| I.2.A | **Participation, transparency and equity** | | | | | | | |
| I.2.A.1 | **Good practice**: Enable participation by affected parties: The co-management arrangement includes producers, adjacent resource users and/or value chain actors involved in or affected by aquaculture production, granting them the right to participate in achieving agreed goals or resolving sector related decisions. | | | | | | | |
| I.2.A.1.1 | **Indicator**: Stakeholders affected by co-management arrangements and decisions are included in the co-management committee. | Review of co-management committee membership in comparison with stakeholder analysis; Focus group discussion with outsiders/ excluded stakeholders' groups; and Review of mechanisms envisioned to broaden the membership into co-management organization. | | | | | | |
| I.2.A.1.2 | **Indicator**: Co-management participants and committee members receive advance information before decision-making. | Focus group discussions; and Review of communication mechanisms and meeting minutes. | | | | | | |
| I.2.A.2 | **Good practice**: Foster social cohesion: Participants are defined by their use of the same or similar production systems, the species grown, the feeds sourced, their use of shared water resources or their exposure to shared risks related to disease. | | | | | | | |
| I.2.A.2.1 | **Indicator**: Co-management participants trust each other. | Questionnaire survey (perception); and Interviews with key informants. | | | | | | |
| I.2.A.2.2 | **Indicator**: The co-management committee members are representative of the ethnicity, religion, etc. of the resource users/co-management participants. | Review of co-management committee members; Review of the election/ selection mechanisms; and Review of the co-management agreement concerning social inclusion and equitable share of representation. | | | | | | |

(cont.)

| No. | Good practice and indicator | Examples of approaches for measuring indicators | Scoring (existence of good practice) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| 1.2.A.2.3 | **Indicator**: Members of the co-management system work well and make decisions together. | Review of co-management meeting minutes. | | | | | | |
| 1.2.A.3 | **Good practice**: Enable participant capacity development: Those engaging in the co-management arrangement are supported by other participants or external parties (private sector, NGOs and government) to develop the requisite skills and knowledge for contributing to the achievement of joint goals. | | | | | | | |
| 1.2.A.3.1 | **Indicator**: There are active skills development programmes for enhancing capacity building for aquaculture farmers to participate in co-management activities at community level. | Review of activity programme; Review of training/ skills development programmes; and Review of training needs assessment (if any). | | | | | | |
| 1.2.A.3.2 | **Indicator**: There is a basic understanding among participants about the purpose and operation of the co-management system. | Questionnaire survey. | | | | | | |
| 1.2.A.4 | **Good practice**: Establish transparent information: Information is transparently shared, enabling access to information necessary for joint decision-making between government, producers and other relevant actors. | | | | | | | |
| 1.2.A.4.1 | **Indicator**: Information is available on the coordination and cooperation of government and resource users. | Review of institutional structures and meeting minutes; and Review of the mechanisms of horizontal and vertical coordination in place. | | | | | | |
| 1.2.A.4.2 | **Indicator**: There are regular meetings between government and resource users. | Review of meeting minutes; and Review of the mechanisms of horizontal and vertical coordination in place. | | | | | | |
| 1.2.A.5 | **Good practice**: Establish transparent decision-making: A transparent set of rules for decision-making is established and used at predefined intervals. | | | | | | | |
| 1.2.A.5.1 | **Indicator**: The organization of decision-making, including rules and timelines for participants, is made available to all participants so that they are able to access decisions made on the management of shared resources and risks. | Review of institutional structures and meeting minutes; and Review of the mechanisms of horizontal and vertical coordination in place. | | | | | | |
| 1.2.A.5.2 | **Indicator**: There are regular meetings between government and resource users. | Review of meeting minutes; and Review of the mechanisms of horizontal and vertical coordination in place. | | | | | | |

(cont.)

| No. | Good practice and indicator | Examples of approaches for measuring indicators | Scoring (existence of good practice) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| 1.2.A.6 | **Good practice**: Ensure legitimate representation of ACM arrangement: Legitimate organization of representation (as recognized by actors from within the aquaculture sector) is in place so that the interests of producers and other key stakeholders are represented in decision-making towards achieving shared goals. | | | | | | | |
| 1.2.A.6.1 | **Indicator**: A legitimate organization (as recognized by the local people) representing resource users and other stakeholders in decision-making is in place. | Review of institutional structures and meeting minutes; Questionnaire survey (perception); and Review of formal documents/ endorsement papers relating to the establishment of the organization. | | | | | | |
| 1.2.A.7 | **Good practice**: Ensure equitable costs and benefits: The co-management arrangements should enable fair access to shared land and water resources or distribution of responsibility for managing shared risks between producers and/or between producers and adjacent/affected groups (e.g. farmers in other food sectors). | | | | | | | |
| 1.2.A.7.1 | **Indicator**: Different resource user groups have equal opportunities to participate in and benefit from the co-management system. | Questionnaire survey; Focal group discussions (perceptions); and Focal group discussions with excluded/ non-participating resource users/groups. | | | | | | |
| 1.2.A.7.2 | **Indicator**: Different legitimate resource user groups, including youth, women and Indigenous Peoples, are recognized as stakeholders in co-management and have equal opportunities to participate in the co-management arrangement. | Questionnaire survey; Focal group discussions; Questionnaire survey (perception); and Focus group discussion with excluded/ non-participating resource users/ groups). | | | | | | |
| 1.2.B | **Leadership, rules and conflict resolution** | | | | | | | |
| 1.2.B.1 | **Good practice**: Establish a co-management agreement: Documentation for actively contributing to the co-management arrangement is defined and rights associated with decision-making over access to and/or use of shared resources and inputs, as well as participation in bargaining inputs and/or negotiation over public and private regulation, is made explicit. | | | | | | | |
| 1.2.B.1.1 | **Indicator**: Agreement that formulates a rationale, set of goals and set of joint rules for participants to engage in ACM, including leadership, membership, rule compliance and conflict resolution – and conditions for holding participants and non-participants accountable for non-compliance. | Review of co-management documentation; Interviews with key informants; and Consultations with representatives of the community or farming association on compliance with the rules and regulations by all co-management participants. | | | | | | |
| 1.2.B.2 | **Good practice**: Ensure legitimate leadership: The requirements for leadership of the group are set out in a co-management plan (see **Section 6.1**). Leadership may be granted to an individual or to a group (board) of representatives deemed legitimate by participants. A mechanism for appointing and dissolving leadership positions is made transparent. | | | | | | | |
| 1.2.B.2.1 | **Indicator**: A qualified local leader with entrepreneurial skills elected by local people to lead overall co-management activities. | Review of protocols of the elections of co-management committee members. | | | | | | |

(cont.)

| No. | Good practice and indicator | Examples of approaches for measuring indicators | Scoring (existence of good practice) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| 1.2.B.2.2 | **Indicator**: A qualified local leader is properly working with resource users/user groups for sustainable aquaculture and community livelihoods. | Questionnaire survey (perception); Focus group discussions; and Observation. | | | | | | |
| 1.2.B.3 | **Good practice**: Define membership and rights and responsibilities: Rules for participants to actively contribute to collaborative management are defined in the ACM agreement. | | | | | | | |
| 1.2.B.3.1 | **Indicator**: Rules for participants are defined in the ACM agreement. | Review of co-management documentation; Interviews with key informants; and Consultations with representatives of the community or farming association on compliance with the rules and regulations by all co-management participants. | | | | | | |
| 1.2.B.3.2 | **Indicator**: Rights and responsibilities for decision-making over access and/or use of shared resources and inputs, participation in bargaining inputs and/or negotiation over public and private regulation are made explicit. | Review of co-management documentation; Interviews with key informants; and Consultations with representatives of the community or farming association on compliance with the rules and regulations by all co-management participants. | | | | | | |
| 1.2.B.4 | **Good practice**: Enable and assess rule compliance: Set requirements for enforcing rules, and conditions for the violations of those rules, in the ACM agreement. | | | | | | | |
| 1.2.B.4.1 | **Indicator**: The leadership of the ACM arrangement can align rule compliance with both public legislation and/or private codes and standards. | Review of co-management documentation; and Interviews with key informants. | | | | | | |
| 1.2.B.4.2 | **Indicator**: Compliance assessment is in place, either drawing on internal procedures or state and/or private codes and standards. | Review of co-management documentation; and Interviews with key informants. | | | | | | |
| 1.2.B.5 | **GOOD PRACTICE**: Establish conflict management mechanisms: A mechanism for addressing conflict between members of the ACM arrangement is established, including rules for internal resolution or, when necessary, external adjudication. | | | | | | | |
| 1.2.B.5.1 | **INDICATOR**: Conflict management mechanism is in place, functional and documented. | Review of co-management documentation; Interviews with key informants; and Consultations with representatives of the community or farming association. | | | | | | |

(cont.)

| No. | Good practice and indicator | Examples of approaches for measuring indicators | Scoring (existence of good practice) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| 1.2.B.5.2 | **Indicator**: Conflicts between different resource user groups/stakeholders are resolved in a sustainable manner. | Review of incident reports and complaints to police, community leaders or other instances addressing conflicts; and Interviews with conflicting parties (if any). | | | | | | |
| 1.2.B.6 | **Good practice**: Foster accountability: The conflict mechanism in place sets out conditions for holding those in violation of shared rules to account in an open and transparent manner. | | | | | | | |
| 1.2.B.6.1 | **Indicator**: Decision-making by and leadership of the co-management system is transparent and documented in committee meeting minutes available to all co-management participants. | Review of co-management committee meeting minutes; and Questionnaire survey (perception). | | | | | | |
| 1.2.B.6.2 | **Indicator**: There is a democratically elected management committee representing resource users/user groups. | Review of protocols of the election of co-management committee members. | | | | | | |
| 1.2.C | **Goal setting, learning and adaptation** | | | | | | | |
| 1.2.C.1 | **Good practice**: Establish a co-management plan: A co-management plan at the community level or a co-management agreement at the provincial level is developed and agreed by participants through an open and transparent process that enables informed input for its design. | | | | | | | |
| 1.2.C.1.1 | **Indicator**: There is a co-management plan and it contains key provisions and clear goals and objectives. | Review of co-management plan. | | | | | | |
| 1.2.C.1.2 | **Indicator**: The co-management plan has been developed with the adequate participation of different stakeholders. | Documentation of co-management plan development process; Perception survey; Interviews with key informants; and Stakeholders' focus group discussion. | | | | | | |
| 1.2.C.1.3 | **Indicator**: The co-management plan has been translated into the stakeholders' native languages. | Review of co-management plan. | | | | | | |
| 1.2.C.1.4 | **Indicator**: The co-management plan adequately addresses gender equity needs and reflects the diversity of perspectives in community/society. | Review of co-management plan; and Interviews with key informants. | | | | | | |

(cont.)

| No. | Good practice and indicator | Examples of approaches for measuring indicators | Scoring (existence of good practice) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| 1.2.C.2 | **Good practice:** Set clear goals and objectives based on collectively recognized issues: Goals and objectives are collectively determined (with or without guidance from the information in **Sections 4.1** and **4.2**) and communicated with clarity and simplicity to steer the direction of farm- and beyond farm-scale management activities. | | | | | | | |
| 1.2.C.2.1 | **Indicator**: Clear and simple goals/objectives and indicators are defined in the co-management plan. | Review of co-management plan; and Analysis of the extent to which objectives are SMART (specific, measurable, achievable, realistic and timely). | | | | | | |
| 1.2.C.3 | **Good practice**: Enable regular interaction and coordination: Participants engage in regular, active and participatory meetings with others involved in the co-management arrangement to discuss ongoing challenges related to power-sharing, trust building and progress to achieving shared goals. | | | | | | | |
| 1.2.C.3.1 | **Indicator**: Regular, active and participatory meetings of co-management participants are held. | Review of co-management meeting minutes; Questionnaire survey (perception); and Observation of meetings. | | | | | | |
| 1.2.C.3.2 | **Indicator**: There is representation of men and women at meetings and active participation by both men and women. | Review of co-management meeting minutes; Questionnaire survey (perception); and Observation of meetings. | | | | | | |
| 1.2.C.4 | **Good practice**: Enhance technical knowledge: The co-management arrangement should enable participants to gain a greater understanding of "better" farming techniques (in line with, for example, the GSA, national better/best management practice standards or private sustainability standards), as well as on the cause and solutions for dealing with wider social and environmental issues related to aquaculture production. | | | | | | | |
| 1.2.C.4.1 | **Indicator**: Stakeholders have a good knowledge of farming techniques. | Questionnaire survey; and Focus group discussions. | | | | | | |
| 1.2.C.5 | **Good practice**: Establish durable monitoring and evaluation system: A system for monitoring and evaluating both the co-management plan or agreement (against the best practices outlined here) and the wider goals of the co-management system (related to, for example, the goals in **Sections 4.1** and **4.2**) is put in place. See further details in **Section 7** of this Guidebook. | | | | | | | |
| 1.2.C.5.1 | **Indicator**: Continued monitoring and evaluation are conducted in a participatory way. | Questionnaire survey (perception); Reviews of monitoring and evaluation reports and minutes; and Interviews with key informants. | | | | | | |
| 1.2.C.5.2 | **Indicator**: Indicators, targets and baselines are defined in a monitoring and evaluation plan in the co-management plan. | Review of co-management plan. | | | | | | |
| 1.2.C.5.3 | **Indicator**: Number of changes/ adaptations made by co-management committee based on analysis and decision-making of available monitoring and evaluation results. | Review of minutes of co-management committee; and Interviews with key informants. | | | | | | |

(cont.)

| No. | Good practice and indicator | Examples of approaches for measuring indicators | Scoring (existence of good practice) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| 1.2.C.6 | **Good practice**: Enable adaptive management: The information collected through the monitoring and evaluation system is fed directly into decision-making by those participating in the co-management arrangement to adjust goals, forms of collaboration and innovation, with the goal of ensuring strategic and operational goals (**Sections 4.1** and **4.2**) are achieved. | | | | | | | |
| 1.2.C.6.1 | **Indicator**: Adjustments to the co-management arrangement have taken place based on monitoring and evaluation results. | Review of co-management plan and committee meeting minutes; and Review of the monitoring and evaluation reports. | | | | | | |
| 1.2.C.7 | **Good practice**: Establish mutually beneficial alliances and networks: On the basis of new information and learning the co-management unit seeks out new alliances and networks that can enable them to make changes, innovate and achieve strategic and operational goals. | | | | | | | |
| 1.2.C.7.1 | **Indicator**: Networks and alliances among various user groups/ stakeholders are in place and functional. | Review of registered organizations and their membership; Questionnaire survey among stakeholders on their organizational membership; and Focus group discussions among co-management participants/ user groups and stakeholders. | | | | | | |
| 1.2.C.7.2 | **Indicator**: Experiences and lessons learned are shared among stakeholder groups. | Focus group discussions; and Questionnaire survey (perception). | | | | | | |
| 1.2.D | **Enhancing governance capabilities** | | | | | | | |
| 1.2.D.1 | **Good practice**: Develop and enhance organizational capacity: Address the needs of participants to organize and engage with major and structural changes affecting the aquaculture industry. | | | | | | | |
| 1.2.D.1.1 | **Indicator**: Co-management allows for extra measures to be taken in support of participants in the event of major and structural changes affecting the aquaculture industry. | Review of co-management plan and committee meeting minutes; and Interviews with key informants. | | | | | | |
| 1.2.D.2.2 | **Indicator**: The co-management plan/ process/arrangement is adaptable to support members in the event of major and structural changes affecting the aquaculture industry. | Review of co-management plan and committee meeting minutes; and Interviews with key informants. | | | | | | |
| 1.2.D.2 | **Good practice**: Develop and enhance innovation drive: The participants in the co-management arrangement can recognize the need for new products and practices and seek out new partnerships to realize them. | | | | | | | |
| 1.2.D.2.1 | **Indicator**: The co-management plan encourages and actively aims to address barriers to the uptake of new technologies. | Review of co-management plan and committee meeting minutes; and Interviews with key informants. | | | | | | |

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| No. | Good practice and indicator | Examples of approaches for measuring indicators | Scoring (existence of good practice) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| 1.2.D.2.2 | **Indicator**: Participants establish new practices, develop new products or seek out new partnerships in line with goals set out in the co-management plan | Review of co-management plan and committee meeting minutes; and Interviews with key informants. | | | | | | |
| 1.2.D.3 | **Good practice**: Develop and enhance capacity for rescaling: Participants strategically recognize the need to advocate for and/or seek support or collaboration with actors that can assist them in addressing key challenges. | | | | | | | |
| 1.2.D.3.1 | **Indicator**: Increases in the level of outreach to actors – both public and private – are observable. | Review of co-management plan and committee meeting minutes; and Interviews with key informants. | | | | | | |
| 1.2.D.3.2 | **Indicator**: There is clear evidence of advocacy by participants on key issues that constrain aquaculture activities. | Review of co-management plan and committee meeting minutes; and Interviews with key informants. | | | | | | |
| 1.2.D.4 | **Good practice**: Develop and enhance capacity for reflexivity: Participants are able to understand and act upon information relevant to the management of shared resources and mitigation of shared risks. | | | | | | | |
| 1.2.D.4.1 | **Indicator**: Moments of monitoring and assessment result in action points that are taken up by participants. | Review of co-management plan and committee meeting minutes; Review of the monitoring and evaluation reports; and Interviews with key informants. | | | | | | |
| I.3 | **Co-management participants – individual good practices** | | | | | | | |
| I.3.1 | **Good practice**: Sensitization: Individuals understand, identify with and actively engage with the goals underpinning the ACM system. | | | | | | | |
| I.3.1.1 | **Indicator**: Farmers extend their decision-making and farming practices to consider shared risks and resources beyond their own farm. | Questionnaire survey (perception); Focal group discussions; Interviews with key informants; and Focus group discussion with excluded/ non-participating user groups. | | | | | | |
| I.3.2 | **Good practice**: Incentives: Individuals recognize and positively respond to incentives (economic, social and political) to participate in co-management and voluntarily comply with co-management rules and decisions, while also leaving room for innovative problem solving. | | | | | | | |
| I.3.2.1 | **Indicator**: Individuals have incentives (economic, social and political) to participate in co-management and voluntarily comply with co-management rules and decisions. | Questionnaire survey (perception); Focal group discussions; Interviews with key informants; and Focus group discussion with excluded/ non-participating user groups. | | | | | | |

(cont.)

| No. | Good practice and indicator | Examples of approaches for measuring indicators | Scoring (existence of good practice) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| I.3.2.2 | **Indicator**: Incentives from government are available for individuals and stakeholder groups to positively participate in co-management. | Review of government programmes; Questionnaire survey; and Interviews with government key informants. | | | | | | |
| I.3.3 | **Good practice**: Accountability: Individual ACM participants recognize and act upon their own responsibilities and subject themselves to accountability under the conditions set out in the ACM agreement and plan. | | | | | | | |
| I.3.3.1 | **INDICATOR**: Individuals act upon their own responsibilities. | Questionnaire survey (perception); Focal group discussions; Interviews with key informants; and Focus group discussion with excluded/ non-participating user groups. | | | | | | |
| I.3.3.2 | Indicator: Individuals subject themselves to accountability under the conditions set out by the ACM agreement and plan. | Review of government programmes; Questionnaire survey; and Interviews with government key informants. | | | | | | |
| I.3.4 | **Good practice**: Equitability: Individual ACM participants engage with benefit distribution in co-management plan – whether based on the right, merit or needs of those involved in the co-management arrangement. | | | | | | | |
| I.3.4.1 | **Indicator**: Individuals demonstrate equitable decision-making in the management of shared risks and resources. | Questionnaire survey (perception); Focal group discussions; and Interviews with key informants. | | | | | | |
| I.3.4.2 | **Indicator**: Participants understand and agree with the role of their peers and support the distribution of the benefits according to the co-management plan. | Questionnaire survey (perception); Focal group discussions; and Interviews with key informants. | | | | | | |
| I.3.5 | **Good practice**: Reflexivity: Individuals seek access to and understanding of information surrounding risks and resources through the ACM plan (Alipour and Arefipour, 2020); they in turn act on that information by demonstrably changing their practices to contribute to the goals of ACM plan, or seek to change the plan given their own contrasting knowledge or experiences for achieving those goals. | | | | | | | |
| I.3.5.1 | **Indicator**: Individuals actively engage with the co-management plan and there is observable change in their practices. | Questionnaire survey (perception); Focal group discussions; and Interviews with key informants. | | | | | | |

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# Annex 2. Example assessment sheet for the evaluation of the achievement of the goals and objectives of the aquaculture co-management plan

Minimally adapted from the *Guidebook for evaluating fisheries co-management effectiveness* (Pomeroy *et al.*, 2022).

**Name of aquaculture co-management system:**

| No. | Type of goals and objectives and indicators | Examples of approaches for measuring indicators | Scoring (achievement) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| II.1 | **Social goals and objectives** (examples include benefits from aquaculture equitably distributed; compatibility between management and local culture maximized; environmental awareness and knowledge enhanced) | | | | | | | |
| II.1.1 | **Indicator**: The co-management approach and measures represent the range of interests of different stakeholders and accommodate the full diversity of those interests. | Review of management plan document; Questionnaire survey (perception); and Focus group discussions with stakeholder groups. | | | | | | |
| II.1.2 | **Indicator**: Equitable management that represents the range of interests of stakeholders and accommodates the full diversity of those interests. | Questionnaire survey (perceptions); and Focus group discussions with stakeholder groups. | | | | | | |
| II.1.3 | **Indicator**: There is support for co-management among different stakeholder groups. | Questionnaire survey (perceptions) among stakeholder groups; and Focus group discussions with stakeholder groups. | | | | | | |

(cont.)

| No. | Type of goals and objectives and indicators | Examples of approaches for measuring indicators | Scoring (achievement) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| II.1.4 | **Indicator**: Diversity of gender, youth and ethnicity has been incorporated into the co-management committee. | Review of co-management committee composition and the roles/powers of different members; Review of the selection/ election mechanism; and Interviews with key informants from different user groups. | | | | | | |
| II.1.5 | **Indicator**: Tenure and access rights are fairly allocated. | Review of government agreement and tenure arrangements; and Questionnaire survey (perception) among different resource users along the value chain. | | | | | | |
| II.1.6 | **Indicator**: Social learning (collective knowledge, shared values) is enhanced. | Questionnaire survey; and Focal group discussions (requires a baseline to compare with, either from earlier evaluation/survey or asking respondents to compare with how they remember the situation was previously). | | | | | | |
| II.1.7 | **Indicator**: ACM provides social benefits to stakeholders. | Questionnaire survey (perception) covering different stakeholder groups (including, women, youth and vulnerable groups). | | | | | | |
| II.2 | **Economic goals and objectives** (examples include livelihoods enhanced or maintained; food security and nutrition enhanced or maintained; increased incomes) | | | | | | | |
| II.2.1 | **Indicator**: Aquatic food availability and access have increased at household/community/ market levels. | Observation; and Focal group discussions (requires a baseline to compare with, either from earlier evaluation/survey or asking respondents to compare with how they remember the situation was previously). | | | | | | |
| II.2.2 | **Indicator**: Benefits of operating and maintaining co-management arrangements exceed the costs. | Financial analysis based on co-management accounts. | | | | | | |
| II.2.3 | **Indicator**: There are incentives for stakeholders to support co-management. | Questionnaire survey (perception); and Focal group discussions. | | | | | | |
| II.2.4 | **Indicator**: Co-management has benefited stakeholders economically. | Questionnaire survey; and Focus group discussions with stakeholders to aggregate data per group. | | | | | | |

(cont.)

| No. | Type of goals and objectives and indicators | Examples of approaches for measuring indicators | Scoring (achievement) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| II.2.5 | **Indicator**: Aquaculture outputs have improved in the co-managed area. | Aquaculture production data; and Focal group discussions (requires a baseline to compare with, either from earlier evaluation/survey or asking respondents to compare with how they remember the situation was previously). | | | | | | |
| II.2.6 | **Indicator**: Co-management participants have a higher level of material lifestyle (housing, household goods, etc.). | Focal group discussion; and Questionnaire survey (requires a baseline to compare with, either from earlier evaluation/survey or asking respondents to compare with how they remember the situation was previously). | | | | | | |
| II.2.7 | **Indicator**: Number of sick days among co-management participants. | Focal group discussion; and Questionnaire survey (requires a baseline to compare with, either from earlier evaluation/survey or asking respondents to compare with how they remember the situation was previously). | | | | | | |
| II.2.8 | **Indicator**: Incomes/ benefits are fairly distributed between men and women. | Focal group discussion; and Questionnaire survey (requires a baseline to compare with, either from earlier evaluation/survey or asking respondents to compare with how they remember the situation was previously). | | | | | | |
| II.3 | **Ecological goals and objectives** (examples include aquaculture resources exploited at sustainable levels, and resilient ecosystems secure multiple services to local communities) | | | | | | | |
| II.3.1 | **Indicator**: There is an abundance of key focal species affected by aquaculture production. | Observations (requires a baseline to compare with, either from earlier evaluation/survey or asking respondents to compare with how they remember the situation was previously). | | | | | | |
| II.3.2 | **Indicator**: Previously destroyed habitats show signs of recovery. | Observations (requires a baseline to compare with, either from earlier evaluation/survey or asking respondents to compare with how they remember the situation was previously). | | | | | | |

(cont.)

| No. | Type of goals and objectives and indicators | Examples of approaches for measuring indicators | Scoring (achievement) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| II.3.3 | **Indicator**: Management measures for aquaculture management are appropriate and operational. | Review of ACM plan; Focal group discussions; and Review co-management operational procedures though interviews with government/ management and executive/ management board key informants. | | | | | | |
| II.3.4 | **Indicator**: The EAA is an integral part of the aquaculture management plan. | Review of ACM plan. | | | | | | |
| II.3.5 | **Indicator**: Resource users/co-management participants take an active role in monitoring compliance with agreed regulations. | Review of compliance/ enforcement arrangements (documentation in co-management plan, existing institutional structures); and Review of co-management operational procedures though interviews with government/ management and executive/ management board key informants. | | | | | | |
| II.4 | **Governance goals and objectives** (examples include effective co-management structures and strategies maintained; effective stakeholder participation and representation ensured; resource use conflicts managed and reduced) | | | | | | | |
| II.4.1 | **Indicator**: Effective co-management institutions (committee, administrative team) and related important structures (professional organizations) are in place and functional. | Review of co-management documentation (meeting minutes, etc.); Focal group discussions; and Questionnaire survey (perception). | | | | | | |
| II.4.2 | **Indicator**: There is a co-management plan and it contains key provisions and clear goals and objectives. | Review of co-management plan. | | | | | | |
| II.4.3 | **Indicator**: The degree of legitimacy of the management system with stakeholders increased. | Focal group discussions; and Questionnaire survey (perception). | | | | | | |
| II.4.4 | **Indicator**: Decision-making is transparent to all stakeholders and decision-makers are accountable. | Focal group discussions; and Questionnaire survey (perception). | | | | | | |
| II.4.5 | **Indicator**: All main stakeholders are empowered and capable to actively participate in decision-making. | Focal group discussions; and Questionnaire survey (perception). | | | | | | |

(cont.)

| No. | Type of goals and objectives and indicators | Examples of approaches for measuring indicators | Scoring (achievement) | | | | Comments/ explanations | Data collection method and source |
|---|---|---|---|---|---|---|---|---|
| | | | Yes | Partly | No | Not applicable | | |
| II.4.6 | **Indicator**: Conflict management mechanism is in place and documented. | Review of co-management documentation; and Analysis of formal versus informal mechanisms, traditional versus legal/ modern mechanisms. | | | | | | |
| II.4.7 | **Indicator**: Conflict management mechanism is contributing to reducing the number of conflicts between different resource user groups/stakeholders. | Review of incident reports and complaints to police, community leaders or other instances addressing conflicts; and Analysis of frequency (number) and type of conflicts. | | | | | | |
| II.4.8 | **Indicator**: Self-enforcement system of penalties is designed by resource users/co-management participants. | Review of documentation on enforcement system; and Focal group discussions. | | | | | | |
| II.4.9 | **Indicator**: Networks and alliances among various user groups/ stakeholders are in place and functional. | Review of registered organizations and their membership; and Questionnaire survey among stakeholders on their organizational membership. | | | | | | |
| II.4.10 | **Indicator**: Different legitimate resource user groups, including youth, women and Indigenous Peoples, are recognized as stakeholders in the co-management arrangement and have equal opportunities to participate in the co-management arrangement. | Questionnaire survey; Focal group discussions; and Questionnaire survey (perception). | | | | | | |
| II.4.11 | **Indicator**: There is a formal legal framework regulating ACM. | Review of legislation; and Questionnaire survey (perception). | | | | | | |

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# Guidebook for developing aquaculture co-management systems

*The Guidebook for developing aquaculture co-management systems* introduces the concept of "aquaculture co-management" that enables shared but differentiated responsibility, rights and benefits from shared resources and risks. The Guidebook provides advice on potential types of aquaculture co-management, as well as strategic and operational goals and best practices for aquaculture co-management. Guidance is also provided on the implementation, monitoring and evaluation of aquaculture co-management, with the goal of developing adaptive approaches to inclusive, legitimate and innovative aquaculture that contributes to sustainable aquatic food systems.

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