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RESEARCH

Ecosystem-based governance according to the Malawi principles: a test for the southern Lake Malawi

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Abstract

This paper examines what may happen when the internationally renowned Malawi principles for ecosystem-based fisheries management are implemented in real-life situations. To explore this, an ecosystem-based fisheries management plan for the southern part of the Lake Malawi is used as a case study. However, the lessons learned are relevant for the global implementation of these principles. Drawing on 'interactive governance theory', we argue that implementation involves all three 'governance-orders', (1) where the governance principles are formulated, (2) where the institutions are designed to operationalise and implement these principles, and (3) where implementation and enforcement actually take place and become routine operation. The Malawi principles must be institutionalised and, subsequently, find their concretisation in the way the southern Lake Malawi ecosystem is actually managed by, and according to, the Malawi Principles and the institutions of which management is a function. Our case study portrays the need to build capacity to address the implementation challenges as they appear at all three governance-orders. We suggest that ecosystem-based governance is a more appropriate term, for what the Malawi principles aim to achieve**,** than management, which we associate with the more technical elements of this approach.

Keywords Malawi principles · Ecosystem-based governance · Governance orders · Small-scale fisheries · Implementation · Lake Malawi

Introduction

Ecosystem-based governance presupposes 'holistic' and 'equitable approaches' (Waylen et al. 2014). It also requires inter- and transdisciplinary knowledge (Chuenpagdee and Jentoft 2018b). Both are achieved with broad, inclusive and interactive participation of relevant experts and stakeholders (Oates and Dodds 2017), including local resource users like small-scale fishers. The goal is to achieve sustainable use of resources and services derived from the ecosystems and to maintain their structure, functioning and productivity while satisfying the social and economic needs of stakeholders. According to Garcia (2000), such a goal can be realised only if its governing system is based on good governance principles.

The "Malawi Principles for the Ecosystem Approach" (MPs) align with current ideas of what constitute good governance in an aquatic context (Garcia et al. 2003, 2013). They include both natural and socio-economic concerns as well as participatory decision-making involving scientific and local knowledge. Together, they set out an ambitious agenda, which has proved difficult to implement (Waylen et al. 2013, 2014).

Katsanevakis et al. (2011, p. 808) define ecosystem-based management (EBM) as 'an environmental management system approach that recognises the full array of interactions within a marine ecosystem, including humans, rather than considering single issues, species, or ecosystem services in isolation'. This definition would also apply to freshwater systems. According to the MPs, ecosystem-based fisheries management requires an institutional framework that engages government, policymakers, scientists, user-groups and the public in a co-operative co-governance mode to facilitate a

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shared understanding and informed decision-making regarding the entire social-ecological system with its linkages and interactions.

Given the multiplicity of interacting actors and stakeholder groups that are involved, it makes better sense for us to talk about 'ecosystem-based governance' (EBG), rather than the commonly used 'ecosystem-based management'. EBG is an inclusive and interactive social process, rather than the more technical approach associated with the term 'management'. In addition to the technical and scientific elements, the governance concept encompasses the biological, socio-political and institutional elements, making it a transdisciplinary approach. Decision-making would then require rules and procedures like those specified in the Malawi principles (Chuenpagdee and Jentoft 2018a, b).

Researchers such as Oates and Dodd (2017) and Waylen et al. (2013, 2014) point out that the MPs have tended to be only partially implemented if not totally forgotten. These authors argue that EBG according to the MPs is a very ambitious undertaking, and that their realism can be questioned. While recognising the multiple challenges involved, especially related to the MPs holistic perspective, social engagements, and governance solutions, they argue that more should be done to implement them. They call for research into the governance arrangement as the MPs describe it, which is what we attempted to do with our case study, reported in this paper. Our aim is to identify the implementation challenges as they appear in a real-life situation, like in Lake Malawi, specifically the southern part.

To analyse the Lake Malawi experience of implementing the MPs, we shall use a part of Kooiman's (2003) conceptual governance framework where he distinguishes between what he calls the three 'governance orders': (1) The 'third (meta) order' is where the governance principles are formulated, (2) the 'second order' is where the institutions are established to operationalise and implement the meta-order principles and (3) 'the first order' where implementation and enforcement actually take place and become routine activity. We argue that to be successful, implementation of the MPs must involve all orders, and that there must be consistency between them. In other words, third (meta-) order principles must find their way to the second and first governance order. Our case study explores how they are implemented at all governance orders.

The case study location is in the southern part of Lake Malawi, which is highly productive for the commercially valuable *Oreochromis* species locally called 'Chambo' (Donda et al. 2014). Even if all twelve MPs might not be fully implemented in this part of the Lake, important lessons may still be drawn from a concrete situation like the one we are exploring. We analyse the extent to which the Malawi principles have been implemented in the southern part of Lake Malawi. What may appear to be the problem in the Lake Malawi case may also be a problem elsewhere where the MPs are sought implemented. A question is at which governance order does an implementation problem exits? Is it about the principles at the meta-order, within institutions/rules at second order, or is it the governing interactions at first order that might pose the challenge? Or could it be that problems are occurring at all three orders or how they link? We argue that the answer to these questions is pivotal for EBG goal achievement, for which the MPs are a global instrument.

The next section presents the Malawi principles (Table 1) as they were originally phrased. 'Methods' describes how the research was carried out. Thereafter ('Context: Lake Malawi as a system to-be-governed'), the focus is on what is in place for fisheries governance of Lake Malawi. We depict the situation in the South West and East Arms of the Lake where the case study is carried out. 'Results: the implementation of EAFA plan' details how the EAFA plan was developed and implemented, and how the MPs informed the process. Drawing on the case study findings about the experiences from implementing this ecosystem-based project, 'Discussion' discusses what it takes to effectively realise the MPs, particularly from the perspective of small-scale fisheries in the Lake Malawi and beyond. 'Conclusion' draws conclusions about the necessary condition for successfully implementing the MPs.

The Malawi principles

The 'Malawi principles' (MPs) (Table 1) gained their name from where they were originally developed that is at a workshop held in Lilongwe, Malawi, 26–28 January 1998. The workshop was held under the auspices of the Secretariat of the Convention on Biological Diversity (CBD). The aim was to identify principles that could operationalise the 'ecosystem approach' in order to enable conservation and sustainable use of resources in an equitable manner[1] (CBD SBSTTA 2000; Garcia et al. 2003; Chairman's Report 1999). Two years later, the 5th UNEP meeting formally adopted the MPs as the key principles for the implementation of the CBD. The MPs are meant to apply broadly (Enright and Boteler 2020; O'Hagan 2020).

The Malawian principles are at what Kooiman (2003) would term 'third-' or 'meta governance order'. Their application would vary according to the particular social and ecosystem that is being governed. There is no one way of implementing these principles because contextual differences. The complexity of the ecosystem and available institutional

[1] https://www.cbd.int/doc/meetings/cop/cop-04/information/cop-04-inf-09-en.pdf

Table 1 Description of the Malawi Principles of the ecosystem approach

The 12 Malawi principles	Explanations to the principles
1	Management objectives are a matter of societal choice
2	Management should be decentralised to the lowest appropriate level
3	Ecosystem managers should consider the effects of their activities on adjacent and other ecosystems
4	Recognising potential gains from management there is a need to understand the ecosystem in an economic context, considering, e.g. mitigating market distortions, aligning incentives to promote sustainable use and internalising costs and benefits
5	A key feature of the ecosystem approach includes conservation of ecosystem structure and functioning
6	Ecosystems must be managed within the limits to their functioning
7	The ecosystem approach should be undertaken at the appropriate scale
8	Recognising the varying temporal scales and lag effects which characterise ecosystem processes, objectives for ecosystem management should be set for the long-term
9	Management must recognise that change is inevitable
10	The ecosystem approach should seek the appropriate balance between conservation and use of biodiversity
11	The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices
12	The ecosystem approach should involve all relevant sectors of society and scientific disciplines

These are the Malawi principles as originally formulated

(legal and organisational) instruments and resources of the governing system would always matter.

Pitcher et al. (2009) hold that developing countries are lagging behind developed countries with regard to the implementation of EBG. According to these authors, this may have to do with insufficient research and administrative capacity. They argue that implementation of EBG is difficult unless the international community agree on clear and simply measured indicators. Such indicators must also be sufficiently fine-tuned to be applicable at national and local scales.

Methods

The first and second authors are native Malawians, with intimate research knowledge of the Lake Malawi situation. The first author has long-term research experience from both Africa and Europe. She initiated the idea of the study herein and has been actively involved in data collection, but more so, in the data analysis and writing of the article as a whole. The second author is currently employed by the Department of Fisheries and has been part of the implementation of ecosystem-based fisheries management including the Malawi principles in the Lake. His long experience and in-depth knowledge of the lakes and fisheries in Malawi in general and the field reports, observations and/or first-hand account of the herein case study of the Ecosystem Approach to Fisheries and Aquaculture plan (EAFA) for the Southwest and Southeast Arms, have proved valuable input for the writing of this article. The third author has profound experience in fisheries management and governance. He has contributed a lot in initiating and designing the study, and has been directly involved in writing this article.

We chose this particular case after consulting with the Department of Fisheries. Data was collected from purposively selected practitioners and fisheries staff using an instrument of semi-open questions, covering all governance orders and for each principle. Questions about stakeholder and institutional involvement were raised and followed up if a particular principle was not contained within the projects. Prior informed consent was obtained from all who participated in the interviews for data collection in this study. Interview questions and responses were all written in English, with no videos or recordings. English is Malawi's formal language of communication. When necessary, the questions were explained to the participants orally in the participant's local language.

Data collection process was practically administered by the Department of Fisheries in Malawi. We could here also draw on the second author's direct involvement in the projects and his first-hand account as a fisheries government employee. We also benefitted from his earlier published research (Njaya 2018), which involved several consultative meetings in Mangochi with beach village committees, local leaders and other sectors like agriculture, land resources and water resources, including tourism sectors.

Besides, reports and other written documents related to the case study were used for triangulation purposes. Data was extracted and analysed manually from the responses and available documented information. Excel programme was used to help in managing and quantifying both the qualitative and quantitative data extracted for the analysis process. The findings are summarised in column 2 and 3 of Table 2.

Context: Lake Malawi as a system to-be-governed

Twenty percent of Malawi's surface area of 118,484 km^2 is covered by water. The major water bodies of Malawi include Lakes Malawi, Chilwa, Malombe and Chiuta and the Upper and Lower Shire River System. The lakes provide a diversity of ecosystem services and livelihood benefits such as food, water for domestic and agriculture use, hydroelectricity, transportation, recreation and tourism. Fish supplies from the lakes, the Shire River and their tributaries and surrounding mashes provide over 70% of dietary animal protein intake of Malawians and account for 40% of the total protein supplies in the country (Njaya 2016). They thereby constitute a critical, life-sustaining input to the chronically food deficit and malnourished population (Bulirani 2003). More than 60% of total fish catch is from Lake Malawi (29,600 km^2), which is the third largest lake in Africa. The lake is approximately 560 km long with the greatest width of about 75 km and maximum depth of 785 m near the western shore — about 45 km north of Nkhata Bay in the northern part of the Lake (Msomphora 2005).

Nearly 25% of the Lake Malawi belongs to Mozambique (Fig. 1). Its catchment area covers around 130,000 km^2, and much of it (53%) lies in Malawi, then Tanzania and Mozambique. However, 28% of the lake's total drainage basin area is within Tanzanian borders, where the major rivers are Songwe (shared with Malawi), Kiwira, Lufirio, Ruhuru and Rumakal, and with annual mean runoff that exceeds 10 million l/km^2 in many areas (Msomphora 2005).

Lake Malawi has more endemic fish species than other lake in the world. It harbours 500–1000 endemic species of cichlid fishes (Kidd et al. 2006; Ono et al. 1993). Although the lake overall is still in a relatively good condition and supporting its remarkable biodiversity, valuable riverine fisheries and inshore fish communities (primarily in the shallower southern portion of the lake) are being impacted by current resource use trends. Among the factors causing these trends are agricultural activities, discharges from urban wastewater treatment plants, separate discharges from industries, deforestation, forest-burning and increasing human population (Msomphora 2000, 2005). Several rivers are substantially altered by the activities within their catchment area. Riverine fisheries in these catchments are reported to have declined through a combination of over-fishing and habitat degradation of spawning and nursery areas (Hara et al. 2015; Njaya 2018; GoM 2021[4]).

Bulirani (2003) and Turner et al. (2002) indicated that the rivers, especially in the southern part of Lake Malawi, are already changing the water quality and algal communities in areas of the lake in ways that could reduce the habitat availability of inshore, highly diverse benthic fishes. With rapidly increasing human populations, there is need to bring more marginal land into cultivation. Therefore, the potential for serious degradation may increase in the next few decades.

Agricultural production in Malawi, with 70% coming from smallholder farmers, accounts for more than 90% of export earnings, contributes 45% of GDP and supports more than 80% of the population. More so, 90% of Malawi's energy requirements are met through the liquidation of forest capital. Despite the central importance of agriculture and wood energy, their side effects with increasing human population are likely to degrade the lake's watersheds and pose a threat to the lake ecology. Although the northern shoreline is significantly less exposed to agricultural practices and development pressures than the south-western areas on the Malawi side of the lake, further land clearance in the more mountainous northern areas, in addition to the current pressure on demand for land, will have negative impact on the lake due to steeper slopes and higher rainfall (Bulirani 2003; Msomphora 2005). As such, EBG may be of help in improving the health of the resource in the watersheds and in Lake Malawi as a whole.

Lake Malawi's South West and East Arms

The southern part of Lake Malawi is the most productive area due to its shallowness. It is about 80 km long, 30 km wide and with a surface area of 302 km^2. It is composed of two areas, the South West Arm (SWA) and the South East Arm (SEA) (Fig. 1). The two sites hold interrelated economic sectors, such as capture and aquaculture fisheries, tourism, agriculture, irrigation, parks, mining and forestry. Aquaculture establishments include both ponds and cages. The cages are owned by one commercial operator, the MALDECO fisheries (Macuiane et al. 2015). The SWA and SEA have about 34% of the total number of fishers in Lake Malawi (Hara et al. 2015) and account for 60% of the annual fish landings, including chambo (*Oreochromis* sp.) among other cichlids. Since the late 1980s, the annual fish landings have been declining. For instance, *Oreochromis* sp. dropped from about 12,000 mt. in the 1980s to about 2000 mt. for the past decade (Hara et al. 2015; GoM 2021[2]), thereby representing a loss of around USD 30 million.[3]

The reduced fish landings are reported to be due to three main reasons (Donda et al. 2014; Njaya 2009): (1)

[2] Government of Malawi (GoM) 2021. Report on fish prices for 2020. Department of Fisheries, Ministry of Forestry and Natural Resources, Lilongwe.

[3] Using estimated 2020 Chambo fish price of MK2334 per kg at national level at 1 USD = MK 790 exchange rate as of 15 May 2021. However, in supermarkets the price of Chambo is above MK 4000 per kg as of 15 May 2021.

Table 2 Malawi principles included in the planning and implementation of the Lake Malawi's South West and South East Arm

Meta-order: Malawi principles	Second order: Lake Malawi plan (yes/no)?	First order: interaction and practices
Management objectives are a matter of societal choice	Yes	Community consultations including local leaders, fishers, fish traders, Beach Village Committees, district authorities and some farmers were held around southern Lake Malawi and Lake Malombe
Management should be decentralised to the lowest appropriate level	Yes — governance issues were prioritised	Community consultations including local leaders, Village Committees, and district authorities were done in the project area
Ecosystem managers should consider the effects of their activities on adjacent and other ecosystems	To a certain extent	Issues about aquaculture, capture fisheries, irrigation, wildlife and hotel development were considered but not fully
Recognising potential gains from management, there is a need to understand the ecosystem in an economic context, considering, e.g. mitigating market distortions, aligning incentives to promote sustainable use and internalising costs and benefits	No	This was planned to be a study during implementation, which did not happen
A key feature of the ecosystem approach includes conservation of ecosystem structure and functioning	To a certain extent	Information was limited and is now being done through the FAO-TCP Project but only in Lake Malombe
Ecosystems must be managed within the limits to their functioning	No	As above
The ecosystem approach should be undertaken at the appropriate scale	No	As above
Recognising the varying temporal scales and lag effects which characterise ecosystem processes, objectives for ecosystem management should be set for the long-term	To a certain extent	Some aspects were analysed during the preparation of the EAFA plan but still more are being done
Management must recognise that change is inevitable	Yes	This was done during consultative meetings when setting objectives with the resource users and other key stakeholders. The change was mainly about policy to address illegal fishing by introducing a vessel monitoring system for the commercial operators, consideration of rights-based fisheries, incentives for the community participation, impacts of other sectors on the fisheries and aquaculture, and putting in place water quality monitoring systems around cages and data collection on climate change related parameters
The ecosystem approach should seek the appropriate balance between conservation and use of biodiversity	Yes	This was done during consultative meetings when setting objectives with the resource users and other key stakeholders
The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices	Yes — this was considered during baseline studies	This was done during consultative meetings when setting objectives with the resource users and other key stakeholders and the biological analysis done to support formulation of the objectives
The ecosystem approach should involve all relevant sectors of society and scientific disciplines	Yes	This was done during consultative meetings when setting objectives with the resource users and other key stakeholders and the biological analysis done to support formulation of the objectives. However, the EAFA Plan is mainly focusing on capture fisheries and aquaculture

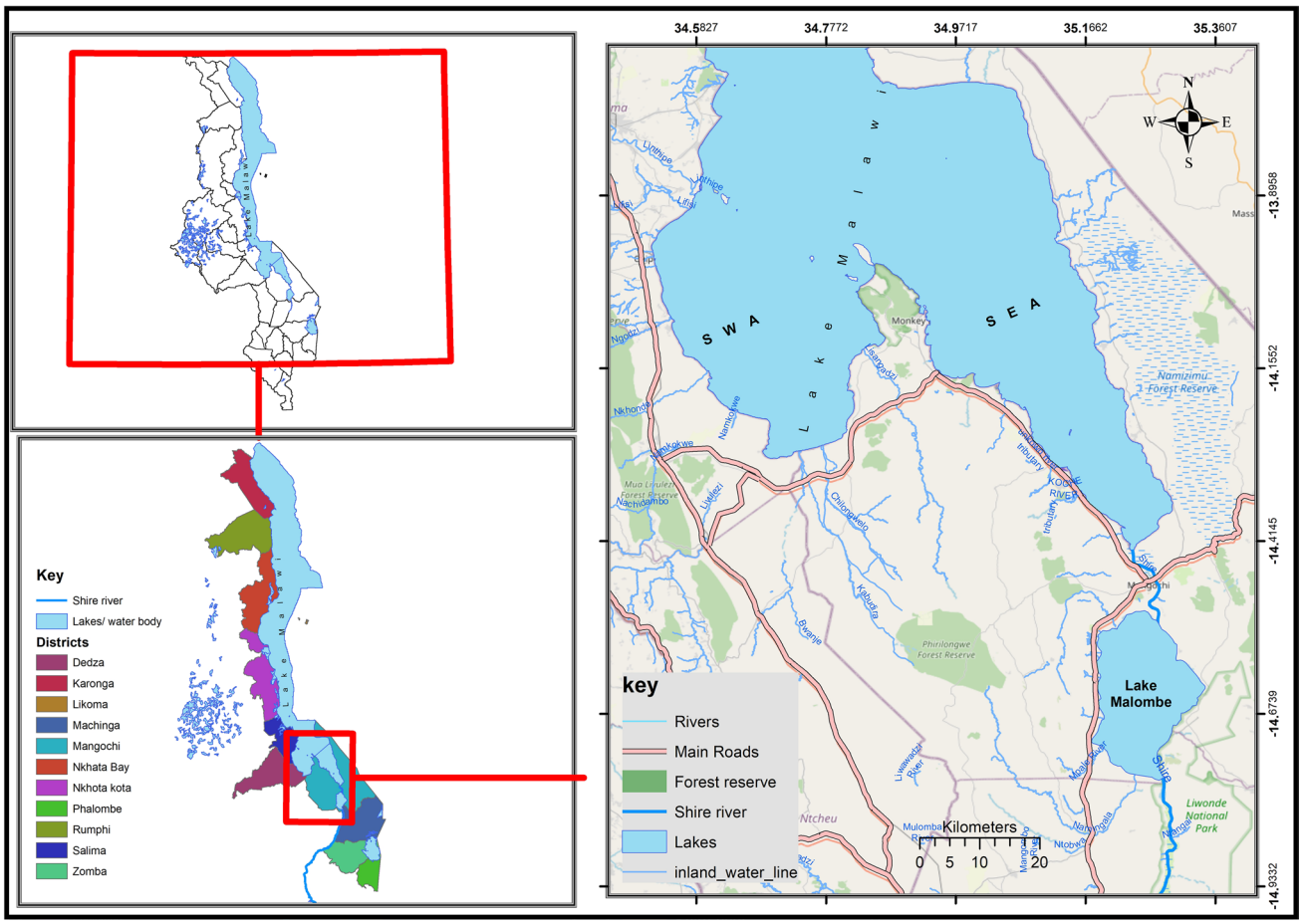

Fig. 1 Map of Malawi showing the position of Lake Malawi and Malombe including other main water bodies of Malawi and its bordering countries. Source: https://commons.wikimedia.org/w/index.php?title=File:MalawiOMC.png&oldid=467624780

Overfishing in shallow waters mainly caused by the use of under-meshed nets, seining operations, trawling in undesignated areas, open access, limited observance of closed seasons and low 'conservation awareness' (Song and Chuenpagdee 2011) leading to increased fishing effort (gears and fishers); (2) ineffective governance, limited capacity to enforce fishing laws and unclear boundaries. Moreover, co-management involving stakeholders such as the Department of Fisheries, traditional leaders and Beach Village Committees) is characterised by unclear roles and not embedded within a decentralised framework (Njaya 2009), which breeds power conflicts among stakeholders. There are also conflicts between industrial and small-scale fishers and between cage farming (aquaculture) investors and fishers; 3) Environmental degradation, i.e. deforestation, bush fires, improper farming methods upland, removal of aquatic vegetation through fishing or cottage development along lakeshore areas, and pollution from mining and chemical fertilisers (Donda et al. 2014).

Lake Malawi's catchment area is not well protected. The only area which currently protects the cichlid fishes is the 94.1 km^2 Lake Malawi National Park in the southern part of the lake. UNESCO declared the park as a 'World Heritage Site' in 1982. However, the continuous nature of the lake environment leaves the park to large scale changes in the lake and its basin. As such, as Chafota (2005) reports, the area is identified by WWF as a conservation priority.

As a follow-up, the Department of Fisheries has started implementing two projects developed from the formulated Ecosystem Approach to Fisheries and Aquaculture (EAFA) plan for the southern part of the Lake Malawi (Njaya 2016, 2018). The Malawi principles provided the basis for the development of the management plan, which is based on EAFA, i.e. an approach that FAO (the Food and Agriculture Organization of the United Nations) currently refers to as Ecosystems Approach to Fisheries and Aquaculture (Njaya 2016). Therefore, the southern part of Lake Malawi, covering SWA and SEA (Fig. 1), provides a good case for exploring further the

contextualisation of the Malawi principles, in order to get a deeper understanding of what may happen when EBG is implemented.

Results: the implementation of EAFA plan

The ecosystem approach to fisheries and aquaculture (EAFA) plan for Lake Malawi is developed mostly by the staff from the Department of Fisheries, in cooperation with Environmental Affairs Department, Mangochi District Council, Beach Village Committees (BVCs) (which organise fishers, fish traders and processors), universities, traditional leaders, private sector (cage fish-farming investors) and NGOs, with support from FAO as highlighted in Njaya (2016, 2018). The ongoing project implementation is sector based. Currently, it is mostly the fisheries and watershed sectors that are being targeted with support from the Government of Malawi and partners, including FAO and USAID (the United States Agency for International Development).

The first project was the USAID/Malawi Fisheries Integration of Society and Habitats Project (FISH) from 2014 to 2019 targeting Mangochi district only. The second one, *Restoring Fisheries for Sustainable Livelih*oods (REFRESH), is covering all districts, including Mangochi, Salima, Nkhotakota, Likoma, Nkhata Bay, Rumphi and Karonga along Lake Malawi. A third project, *Building resilience in the fisheries sector in Malawi* (FiRM), is coordinated by FAO with funding from the Global Environment Facility (GEF) and has been implemented since 2017. Thus, implementation of the EAFA plan is on-going. Our analysis depends mainly on the developed EAFA plan and its implementation so far, with regards to the MPs. The information in Table 2 is based on the data from our interviews with the practitioners and specialists in 'policy and planning' at Department of Fisheries, including observational and documented data.

As reported in Table 2, and mentioned above, the implementation of the EAFA plan in the southern Lake Malawi is conducted in partnership mainly with a number of stakeholders such as the Department of Fisheries and LUANAR (Lilongwe University of Agriculture and Natural Resources). The USAID and FAO/GEF support is directly linked to the formulation of the plan, and the funding and provision of technical expertise and capacity building at various levels. The implementation of resource management projects in resource poor countries like Malawi is therefore not a self-generated and -supported bottom-up process, where the input of local knowledge, according to what the Malawi Principles stress, is supposed to be important.

The key stakeholders actively involved in the consultation and development of the EAFA plan, and its subsequent implementation include BVCs representing fishers, fish traders and processors, cage fish-farming investors and traditional leaders, plus fisheries and environmental officers. Thus, as indicated in Table 2, the projects lack the full scale of sectoral stakeholder integration, which according to literature is one of the needs for effective ecosystem-based approach.

Since funding is provided only for specific sectors, there is still no coherent, holistic implementation of the plan. The implementation of the EAFA plan is currently on-going in fisheries and watershed management sectors through several projects, launched in different periods depending on funding-aid available. The projects are only specific for the fisheries sector, which was not supposed to be the case. Hence, the MPs are followed only to a limited extent.

The criteria and procedures to ensure a democratic process for the development and implementation of the projects are not specified in the EAFA plan. Based on the available information, there are no clear inclusion criteria, apart from generally selecting the relevant sectors supposed to having impact on the lake. The same selected stakeholders and institutions that were involved in developing the plan are also involved in the implementation of it. However, the involved stakeholders were recruited with governance issues at the centre of it, including gender considerations and sectoral engagement. Even though not all eligible stakeholders were involved, their sectors' involvement was at least recognised in the development of the EAFA plan, as the intention was to have an inclusive approach.

Besides, as noticed in Table 2 above, not all the MPs were considered in the plan. This has affected the application of ecosystem-based approach in the implementation of the projects as originally indicated in the EAFA plan. However, to implement the MPs to the full may not be easy due to lack of funding resources, research capacity and governance structures to needed to implement the EBG approach. Thus, the MPs must find their specific and pragmatic applications according to the circumstances that exist locally, conducive to their implementation. In the two projects presented herein, they could not overcome these obstacles.

Discussion

The MPs were initiated in 1998, whereas the EAFA projects in the southern part of the Lake Malawi (SWA and SEA) were launched in 2013, with support for FAO. Thus, from when the MPs were initiated, many years passed before the projects' launching. As such, there is a possibility that the MPs may then have been left behind, as initially pointed out

in the Introduction Section. There is no explicit reference to the MPs in the EAFA, although EBG thinking is still visible and indirectly applied through the FAO instructions. The EAFA therefore serves as an illustration for the conceptual governance framework and assessment methodology regarding the implementation of the MPs.

Sector-based management policies attempting to restore environmental quality have often failed due to lack of appropriate scale-management and insufficient inclusion of other sectoral interests — in particular lack of full engagement of the affected local people (Maltby 2000). Msomphora (2015, 2016) argues that the involvement of multiple stakeholders and multisector-based integration encourage interactive learning through collective decision-making and conflict resolution. However, with increasing number of stakeholders and sectors involved, the more the governance problem becomes 'wicked' due to cumbersome and potentially conflictive negotiations (Jentoft and Chuenpagdee 2009; O'Higgins et al. 2020). Hence, more exchange of knowledge is needed when stakeholders make their claims and argue for their interests. Thus, as pointed out by Kooiman and Jentoft (2009), experience-based interactive learning must play a key role in the governance processes (see also O'Higgins et al. 2020).

The implementation of the Malawi principles is a governance process comprising interactive learning about how these principles are brought from the third to the second and first governance orders (Table 1). We argue that to understand the governance challenges that are associated with the implementation of the MPs, one must assess how all three governing orders are mobilised and aligned. EBG is supposed to have a lasting effect. For that, the MPs must become common practice also after the project period.

From an interactive governance perspective, the evaluation of the Lake Malawi SWA and SEA projects according to the MPs examines all three governing orders and the learning that takes place within and between all of them. The meta-order is about the principles themselves and the values and norms underpinning them. At this order, the evaluator would check for their coherence, clarity and interpretation. Are the MPs also guiding the project design principles? At the second order, the evaluator would analyse how principles are converted into institutions and rules. Which are they? How inclusive? How were they negotiated? Moreover, the MPs advocate interactive decision-making at the first governance order. The evaluator would therefore also focus on how the MPs guide the interactions between stakeholders as they go about their daily business of extracting resources. An issue here is to what extent local stakeholder knowledge, rationalities, and ethics inform decision-making, as mentioned in MP number 11. Interactive EBG is also about creating opportunities for alternative or complementary livelihood activities within the existing ecosystem boundaries, as per MP number 6.

As can be seen from Table 2, there are gaps between the listed MPs and the summarised ecosystem-based management actions for Lake Malawi SWA and SEA projects. Beginning with third — or meta — governance order, all twelve MPs were not implemented, partly due to insufficient capacities and capabilities. The SWA and SEA project planning principles are predominantly biological and scarcely regarding economic and socio-cultural issues. As to the second governing order, the MPs require governable institutions, including laws and regulations for decision-making protocols that involve local stakeholders. Many of these institutions are in place for Lake Malawi, but they are sector-based and, hence, too narrowly focused for holistic EBG. This means that there are inadequate interactions between stakeholders from different sectors, hampering interactive learning as a condition for the full compliance with the MPs.

According to the MPs, it is essential that the wider regional consultation and participation should not be restricted to the academic or natural science community but to stakeholders of relevant sectors, including those who possess specific knowledge of local situations. In addition, it is essential to ensure that apart from ecological knowledge, also economic and social considerations are represented. The MPs include the subsidiarity principle listed as number 2 in Table 1, i.e. 'Management should be decentralised to the lowest appropriate level'. Not only has this principle organisational merit, but it also stresses the importance of making decisions in proximity to the location of the problem and the importance of involving those who experience it.

The EBG in the southern Lake Malawi involves interactive processes where public and private stakeholders of various sectors participate, if not directly so, at least indirectly through consultations. While ensuring the presence of stakeholder engagement at second governing order, practical implementation that enables governing operations at first governance order is essential for the implementation of MPs. It is at the first governance order that the final litmus test of the MPs must occur. For the practical implementation of the MPs, key stakeholders such as small-scale fisheries people in the case of Lake Malawi where they dominate (Song and Chuenpagdee 2010) must learn what the MPs are and how they can inform the process that they supposed to be part of. Such learning would be more effective if they are familiarised with the MPs through active and direct participation in projects like the SWA and SEA. Consultations only would most likely not be sufficient. You do not learn much when your only role is to provide answers to other people's questions. To what extent interactive learning has taken place would require more research than our research has permitted.

Lack of enabling capacities and capabilities in a particular region affects the performance of EBG according to the MPs (Njaya 2009). More so, an EBG approach requires to

be in line with regional or national interests, given the cross-national boundaries of the social and ecological system as in Lake Malawi. There is need for a country/regional specific EBG approach, which mobilises and integrates the existing institutional mechanisms that are different for each country. However, the MPs suggest the demand for innovative institutional structures or decision-making protocols. A close working relationship with local people, guidance and support measures based on demonstration of practical, simple techniques at the appropriate scale is also essential in each national and local context.

The EBG approach according to the MPs involves integration of evidence-based decision-making, involving both science and local knowledge of stakeholders linking ecosystem functions to socioeconomics and cross-sectoral institutional integration. Transdisciplinary knowledge (Chuenpagdee and Jentoft 2018b) is essential for a holistic understanding of structures, functions, and processes of natural and social systems. Encapsulated in the MPs, such an EBG approach is vital for meeting the socio-ecological challenges of Lake Malawi and beyond.

This would require learning about what EBG is supposed to be according to the MPs and how it may work in concrete settings, such as Lake Malawi. Such a learning process would benefit from interactive governance, as no one actor, not even a government agency, is likely to know all it needs in order to make a broad and inclusive governance approach as EBG function in practice (Kooiman 2003; Partelow et al. 2020). There may be limits to what one could possibly know about the social and ecological system, particularly at the planning stage. This brings in an element of uncertainty, risk and the relevance of the 'precautionary approach' (Kriebel et al. 2001). Therefore, interactive learning must be an adaptive EBG process, given that 'change is inevitable' (MP 9).

Nonetheless, it is not certain that lack of enabling resources is always the main reason for poor EBG implementation in developing countries (Bianchi and Montemaggiore 2008; Pitcher et al. 2009). The implementation of the MPs would be a challenging undertaking in any circumstance, also in more developed countries where resources are not that limited. Lake Malawi as a system-to-be-governed is used as for a case study to discern the 'governability' problems associated with the implementation of the MPs (Bavinck et al. 2013). There is much that is unique about Lake Malawi, but there are also things that are common to the implementation of the MPs elsewhere, such as the need to build knowledge about how to govern ecosystems in a manner that is inclusive, equitable and fair to stakeholders, especially to those among them who are most vulnerable, like small-scale fisheries people (MP number 12). This is also a lesson that must be learned in developed countries as many of the same implementation challenges are also found there.

The implementation of the MPs in real contexts like that of Lake Malawi would imply governability (Song and Chuenpagdee 2010) issues, as discussed by Kooiman (2003) in his interactive governance framework. Specifically, as we have sought to illustrate in this paper, implementation would need to involve all three governance orders to make the change that the MPs intend to create. The MPs must be contextualised at third governance order in ways that make them appropriate for the concrete situation that exist in the location where they are supposed to work. The general MPs as originally stated (see 'The Malawi principles' of this paper) would require a further precision to fit the local situation. In our case (Table 2), consultative meetings with stakeholders and biologists were arranged to clarify objectives for the projects.

Successful implementation of the MPs would also depend on what is happening at second and first governance orders. The MP number 2 and MP number 12 are about institutional design (functional responsibility and stakeholder representation) and would encompass decisions on organisational matters, including the establishment of relevant constitutive and operational rules. In the case herein, participating stakeholders were mostly from the fisheries sector. EBG is, however, a dynamic process. It is an operative routine that would steer the working practices of local stakeholders, including, but not exclusively, the small-scale fishers, in ways that help to sustain the ecosystem as a whole. The EAFA plan is still in the implementation phase. How they will leave a lasting work routine once fully implemented remains to be seen. It would be an interesting follow-up of the research that we have undertaken with our study. Thus, there is obviously more to learn from this particular case.

Conclusion

The southern Lake Malawi provides a pertinent site for the exploration of the challenges associated with the implementation of the MPs. We wanted to learn from the Lake Malawi efforts to introduce EBG, what opportunities and obstacles may occur when the MPs are being operationalised and implemented in a concrete empirical setting. There are things that are unique about Lake Malawi case, like its particular biodiversity described initially, but all situations and systems, be they salt- or freshwater, where the MPs are introduced, have unique features that must be considered. This is also why the MPs invoke the subsidiarity principle (MP number 2), i.e. the decentralisation of decision-making as integral to EBG and the need to integrate local knowledge. Solutions are to be found in proximity to where the problem is and knowing the problem in its concrete context is a major argument for local knowledge and the involvement

of local stakeholders, like small-scale fisheries people (MP number 11). The subsidiarity principle must be embraced at the third (meta-) governance order and implemented at lower governance orders, for institutional designs and management interactions.

More case studies like we have undertaken in Lake Malawi would deepen our understanding of MPs as a grouping of EBG implementation challenges. Regardless of the socio-ecological system under investigation, interactive governance theory as outlined by Kooiman (2003) and Kooiman et al. (2005) and applied by Song and Chuenpagdee (2010) in their research in Lake Malawi is a useful analytical tool for exploring what the MPs implementation challenges are and where they sit, i.e. at which of the three governance orders. In themselves, the Malawi principles are in this framework at the 'third'- or 'meta-governance' order meant to 'govern the governing' of social and ecological systems, in our case in the south-eastern part of Lake Malawi (Song and Chuenpagdee 2011). Their implementation must find their way into all orders in the EBG projects described in this paper.

The implementation of the MPs is not just a technical problem, but one that requires ethical and normative considerations at all governance orders. Empowering stakeholders by involving them in the institutional and cognitive building of EBG in accordance with the MPs is about values and norms about how social and ecological systems should be governed. Whether or not a particular institutional design at second governance order delivers good outcomes at first order is an empirical question. We argue, however, for the need to build capacity about the EBG implementation challenges in the concrete context where it is supposed to function. This would require interactive, transdisciplinary learning at all governing orders among stakeholders.

Stakeholders must know the MPs and the reasoning behind them, and why there is a need to consider the entire social and ecological system in a holistic fashion when decisions are made. They must also, at the second governing order, be part of the formation of the EBG institutions to allow experiential learning. They must learn to understand their own role in EBG as the MPs envisage. They must learn about how EBG works in practice, which they draw from taking part at first governance order. To facilitate learning, stakeholders' involvement must be more than symbolic, formal and reactive. Consultation is hardly sufficient because it does not align well with the subsidiary principle (MP number 2). The lesson learned from the southern Lake Malawi projects is that their involvement must be more pro-active and direct.

For effective implementation of the MPs into Lake Malawi's EBG, second order institutional reform would be needed to ensure both sectoral and cross-scale (from community to country to lake) integration. Science and scientists must inform the governance system along with stakeholders from various sectors, including communities and stakeholder organisations such as the Beach Village Committees. Other lessons about EBG learnt from the case study suggest that (1) the implementing body should be independent from the statutory and regulatory agencies of government, (2) the significant economic benefits to stakeholders, and the health of the ecosystem quality should be well communicated, (3) the wider regional consultation should not be restricted to the academic or natural science community and also to other stakeholders and resource institutions in a transdisciplinary manner. It is important that EBG is not sector-based as currently experienced in the Lake Malawi case study if we are to effectively manage the systems' ecosystem coherently, justly and holistically as per the MPs.

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Declarations

Conflict of interest The authors declare no competing interests.

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