Outcomes of participatory fisheries management: An example from co-management in Zambia's Mweru-Luapula fishery

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ABSTRACT

The study examined the outcomes of participatory fisheries management in Mweru-Luapula fishery in northern Zambia. The main objectives were to: evaluate the performance of Village Fisheries Management Committees (VFMCs), analyze participation of fishers in management activities and to assess fishers' compliance to fisheries regulations. Data were collected through structured interviews with 64 respondents, five focus group discussions and two key semi-structured interviews. Ostrom's eight design principles and White's typology of Interests was employed to analyze VFMCs performance and fisher participation respectively. Descriptive statistics and content analysis were employed to analyze the quantitative and qualitative data respectively. Results show that inadequate financial support to the Department of Fisheries has culminated in the capture of benefits by VFMC positions by local elites, and ultimately weakened enforcement of fisheries regulation. A nominal form of participation characterizes the co-management as resource users are not engaged in decision making and power still resides with the Department of Fisheries. Low compliance to the seasonal fish ban by fishers due to inconsistent patrols by VFMCs and Department of Fisheries has resulted in persistence of illegal fishing practices that threaten conservation of fish in the fishery. The minor positive outcomes of co-management suggest its ineffectiveness in curbing illegal fishing activities. A common property regime where smaller groups of fishers exploit a portion of the fishery with locally designed operational rules is therefore recommended to replace the ‘consultative’ type of co-management prevailing in Mweru-Luapula fishery.

1. Introduction

1.1. Background

The introduction of participatory fisheries management in Zambia through the revised fisheries Act No. 22 of 2011 was a long awaited legal reform in fisheries governance in Zambia (Annear, 2006; Van Zwieten and Aarnink, 1996; Malasha, 2007; Chabwela and Haller, 2010). Among the various stakeholders in anticipation of these reforms were Zambia's Department of Fisheries, policy makers and reviewers, researchers and fishing communities. Prior to this revision, the state had been solely responsible for the management of fisheries, as was stipulated in Section 2(I) of the Fisheries Act No. 21 of 1974 (Government of Zambia, 1974). The state in Zambia and other regions across the world, along with policy makers and researchers considered riparian communities as ‘threats’ or hindrances rather than agents of conservation during the period of top-down centralized management regimes, prior to the 1990s (Agarwal and Gibson, 1995; Hara, 1996; Chirwa, 1997; Hachongela et al. 1998; Normann et al. 1998; Sowman, 2006; Lwenya and Abila 2003; Thomas, 1996 in Haller and Merten 2008; Nielsen et al. 2004; Pomeroy, 1995).

During this era, the state and private commercial fishing companies were viewed as more reliable stewards and exploiters of major fisheries while fishing communities were excluded from all important fisheries management processes (Haambiya et al. 2015b; Chabwela and Haller, 2010). Artisanal fishing activities were under the custody of Fisheries Departments and were regulated by new conservation and management tools as opposed to traditional fishing rules, norms and practices (Annear, 2006).

The pre-colonial era, which was before 1924, was characterized with communal ownership of fisheries resources by various ethnic groups and managed under common property regime. This meant that by virtue of being a member of a particular tribe, one had rights to fisheries resources under the control or ownership of that tribe. In Mweru-Luapula fishery, fisheries products were used as valuable commodities for barter, trade and tribute to local chiefs (Musambachime, 1995). They also opened up the region to migration activities which later culminated into...
intermarriages between local indigenous fishers and immigrating Luba people from the Congo side of the fishery (Annear, 2006). ‘Native medicines’ prepared from special plants and grasses were incorporated in daily fishing activities to ensure a good catch and protect against crocodile and hippo attacks and tearing of nets. These medicines were either tied to the fishing gear or worn as ornaments by the fisherman. Furthermore, fisher’s wives were prohibited from interacting with other males in the village during their husband’s fishing expeditions (Moore, 1937).

The Ila and Plateau Tonga (the Balundwe) of the Kafue Flats relied on the flood plains for food, shelter (using reeds) and pasture for cattle and wild animals. Fishing activities were conducted using locally crafted gear such as spears, hooks, traps, baskets (popular among women and youth) and dugout canoes (Chabwela and Haller, 2010).

Fish poisoning was common among fishers on Lake Bangweulu in Samfya District. By scattering ground Tephrosia (Tephrosia elongata) locally known as ububa, intoxicated fish would be caught by the men using spears and scooped by the women using baskets. Such methods were common after flooding had receded (Brelsford, 1946 in Chilonge, 2011).

The relatively lower rural populations and undeveloped commercial fish trade networks enabled riparian communities to uphold their traditional customs and conduct fishing for subsistence. Thereby a steady demand for fish was supplied (Chabwela and Haller, 2010). In the Kafue flats, spiritual leaders known as the mwami or ‘big men’ guided collective fishing (Luwando) activities on behalf of the entire community. They also developed and enforced traditional institutions in form of taboos and norms to regulate the timing of fishing activities, the territory, the type of gear to use and who to participate, all based on spiritual ancestral beliefs. Traditional practices such as rituals, initiation and other ceremonies were also performed on water bodies. Their belief that ancestral spirits were embodied in wild animals such as crocodiles led them to perform rituals and coordinate communal harvest of resources (Haller, 2014). However, several local customs changed during the colonial era.

The new conservation and management tools included closed seasons, gear limitations, and licensing. The displacement of traditional management systems by the new politically imposed regulations contributed to conflicts among local and immigrant fishers and increased fishing pressure, among other issues (Haller and Merten, 2008; Annear 2006; Haambyia et al. 2015a).

In Zambia, the popularity of the colonially-inclined Fisheries Act of 1974 lost ground in the late 1980s and early 1990s when ‘winds of change’ in the political sector across sub-Saharan Africa conflated with other factors to bring about a paradigm shift in schools of thought about community participation in natural resources governance (Annear, 2009). The other factors that contributed to this change were inconsistent fisheries management by the Department of Fisheries resulting from low budget allocations (Haller and Merten, 2008; Malasha 2007), pressures from the international community to engage resource users in management and the need to explore community-based natural resources management programs (Malasha, 2007; Béné, 2009; Viswanathan et al. 2003).

In response to the above factors, the Fisheries Act No. 22 of 2011, an Act that promotes co-management and focuses on involvement of riparian communities in fisheries resource management and representation of fishers at village level (Government of Zambia, 2011) was enacted. The Act also provides for the establishment of a fisheries development fund to enable fisheries committees to raise revenue through avenues such as licensing (Government of Zambia, 2011). Other major areas of focus include: development of aquaculture as a means to offset dependence on capture fisheries, enforcement of the closed fishing season, closed breeding areas and a licensing system for all fishers (Government of Zambia, 2011). Once the 2011 Fisheries Act was promulgated, it is expected that local fishing communities started to participate in fisheries governance across all major fisheries in Zambia, with positive outcomes. However, research results on outcomes of participatory fisheries management are mixed.

In East Africa for example, co-management institutions on Lake Victoria (on the Tanzanian jurisdiction) have yielded notable successes such as improved boat registration, licensing of fishers and increased information sharing and collaborations of fisheries stakeholders (e.g. boat owners, women, youth, elders etc.) with government officials (Onyango, 2014; Nunan et al., 2018). However, high usage of illegal mesh size nets, limited enforcement capacity by regulatory agencies and high incidence of corruption in public service remain rampant in the region (Etiegni et al., 2016; Nunan et al., 2018). In the Southern region, co-management studies in Mozambique’s Kwirikwidge province showed reduced conflicts between small-scale and industrial fishing fleets, reduced use of destructive (mosquito) nets, increased awareness of conservation measures and financial support to fishers (Lopes and Gervasio, 1999; Benkenstein, 2013) while Malawi’s co-management system on Lake Chiuta successfully banned destructive seine net fishing activities through local Beach Village Committees and enforced formal and locally developed rules. Benefits accruing to local fishers include stabilized catches, increased household incomes and reduced monitoring and surveillance costs on the part of the state (Njaya 2005; Donda, 2017).

Meanwhile, South Africa’s KwaZulu-Natal province witnessed sustainable harvesting of fisheries resources (Sowman et al., 2003), granting of access rights to subsistence and small-scale fisheries (Sowman et al., 2003; Napier et al., 2005), greater protection of resources (Berkes, 1994; Napier, 2005) and increased trust and communication between stakeholders (Pinkerton, 1989; Napier et al., 2005) while co-management systems at the Olifants Estuary collapsed by 1999 due to illegitimacy of regulations, dissatisfaction with Fishing Committee leadership, lack of financial and technical resources to support small-scale fisheries and uncertainty due to new legal reforms among others (Sowman et al., 2003; Hauck and Sowman, 2001).

A study conducted on Lake Tanganyika portrays a limping co-management system characterized by rampant use of illegal and unsustainable gear; low penalty system for offenders; prevalence of conflicts among fishers operating in different parts of the fishery and low compliance to regulations attributed to low financing of enforcement teams (Banda et al. 2015; Haambiya et al. 2015a, 2015b). This study, therefore, aimed to assess participatory fisheries management in Mwerulu-Luapula fishery. Its three objectives were to: evaluate the performance of Village Fisheries Management Committees (VFMCs), analyze participation of fishers in fisheries management activities and assess fishers’ compliance to fisheries regulations. The rest of the article is organized as follows; the next section is a review of literature on the concepts of co-management and participation. This is followed by the methods section, after which results are presented and discussed. The study then concludes.

2. Literature review and theory

2.1. Co-management - definitions and types

Co-management has been defined broadly by many scholars. As a result, no universal definition exists. Berkes et al. (1991, p. 6) defined co-management as “the sharing of power and responsibility between the government and local resource users” while Singleton (1998, p. 7) defined it as “the term given to governance systems that combine state control with local, decentralized decision-making and accountability and which, ideally, combine the strengths and mitigate the weaknesses of each”. Jentoft et al. (1998, p. 423) referred to co-management as “a collaborative and participatory process or regulatory decision-making between representatives of user-groups, government agencies, research institutions and other stakeholders”. Jentoft et al. (1998) emphasized that power sharing and partnerships were an essential part of the definition. And according to Pathmanandakumar (2017, p. 2), co-management is “a relationship between a resource-user group and...
another organization or government agency for management purposes in which some degree of responsibility and/or authority is conferred to both parties”.

Besides failing to adopt a universal definition due to differences in its conceptualization, scholars have also debated whether or not co-management is community-based natural resources management. Consequently various concepts have been used interchangeably with co-management such as ‘collaborative management’, ‘adaptive management’, ‘ecosystem management’, ‘community-based conservation’ and ‘community-based management’ (CBM) (Jentoft et al., 1998; Hutton et al., 2005; Berkes, 2009). Sen and Nielsen (1996) contended that the presence of government in the decision-making process distinguishes co-management from CBNRM. Similarly Ballet et al. (2009) stated that CBNRM involves sole management of natural resources by local communities whereas co-management includes a variety of players namely; central government, local authorities and local communities. According to Sen and Nielsen (1996), co-management arrangements can be classified into five broad types (Table 1) based on the role of the state and resource users. These are instructive, consultative, cooperative, advisory and informative co-management.

Co-management has been adopted in small-scale fisheries management in developing countries, especially in the tropics (Purcell and Pomeroy 2015). Small-scale fisheries’ role as a source of livelihood, food security and cash incomes has potential to reduce poverty among developing and low-income countries (Vlachopoulou, 2014). Therefore in the African region, countries such as Côte d’Ivoire, Senegal, Nigeria, Benin, South Africa, Mozambique, Zimbabwe, Malawi and Zambia have adopted co-management to manage fisheries (Sverdrup-Jensen and Nielsen, 1998; Kosamu, 2015). Its adoption is attributed to the desire to improve fisher compliance to fisheries regulations by involving fishers in decision-making (Kosamu, 2015; Nunan et al., 2018); the need to resolve conflicts among artisanal fishers; reverse the depletion of fish stock; lack of monetary resources to finance centralized command and control regimes; inadequate government personnel, and pressure from international organizations and international treaties (Haambiya et al., 2015a; d’Armengol et al., 2018; Vlachopoulou, 2014).

### 2.2. Benefits of co-management

Co-management has been viewed as an alternative to centralized management systems which fail to offer resource users the opportunity to co-manage natural resources with state agencies and make decisions that eventually affect the wellbeing of those resources (Sverdrup-Jensen and Nielsen, 1998; Donda, 2017; Webster et al., 2017). User-groups derive material and immaterial benefits such as financial support, technology, scientific information, sustained resource pool, increased cash income and sustained livelihoods (Singleton, 2000; Sandstrom and Rova, 2010).

Proponents of co-management further claim that it results in legitimacy of the regime system (Jentoft et al., 1998). Allowing resource users to influence the decision-making process through information sharing enables them to acquire scientific information on ecological conditions of their ecosystem and encourages their input in the design of regulations (Donda, 2017). Resource users’ participation reduces government biasness towards meeting government needs and improves the quality of regulations that are ultimately designed. As a result, resource users are encouraged to comply with resource regulations (Jentoft et al., 1998; Ho et al., 2016). Gutiérrez et al. (2011) highlighted enhanced sense of ownership, collective ownership of regulations and better monitoring, control and surveillance by resource users as benefits for implementing co-management.

State agencies on the other hand benefit from co-management by achieving their conservation goals through sustainable practices, incurring reduced management costs by delegating or sharing monitoring activities with resource users, improving management by incorporating local ecological knowledge with scientific knowledge and acquiring better understanding of the local socio-economic conditions of the resource community (Pathmanandakumar, 2017). Additionally, resource users’ also provide social capital to state agencies which encourages partnerships and networks to be formed among the various actors (Vlachopoulou, 2014).

Co-management also offers conflict resolution platform where local disputes can be managed locally and cheaply through the various established local-level institutions (Ho et al., 2016; Donda, 2017). In addition, the process of information sharing and interaction creates trust and changes the behaviour and attitudes of resource users towards state agencies and fellow resource users, thereby reducing conflicts with the higher authorities (Jentoft et al., 1998; Ballet et al., 2009).

### 2.3. Challenges of co-management implementation

Several challenges associated with co-management approaches have been documented. For one, the lack of appropriate policies and legal frameworks to support local-based institutions such as Fishing Associations to strengthen their legitimacy and finance their activities undermines their role in the co-management system (Chabwela and Haller, 2010). Local-based organizations which often operate on voluntary basis are incentivized to receive bribes from fishers at the expense of imposing sanctions, thereby sustaining illegal and destructive fishing activities (Banda et al., 2015; Nunan et al., 2018). Weakly supported local organizations are unable to represent the views of resource-users and also prevent the state from delegating authority and responsibilities to resource users (Haambiya et al., 2015a). The absence of resource users’ role in management tasks such as design of fisheries regulations, installation of local leadership and conducting monitoring activities hinders co-management success (Chabwela and Haller, 2010). Eventually the management system is deemed illegitimate and regulations are regarded as alien thus they receive less compliance by resource communities (Plateau et al., 2014). This form of co-management, where little or no

| Table 1. Typology of co-management. |
|-------------------------------------|
| Type of co-management | Description of co-management type |
| Type A. Instructive | There is only minimal exchange of information between government and users. It differs from centralized management in that the mechanisms for dialogue with users exist, but the process tends to be government informing users on the decisions it plans to make. |
| Type B. Consultative | Mechanisms exist for governments to consult with users but all decisions are taken by government. |
| Type C. Cooperative | This type of co-management is where government and users cooperate together as equal partners in decision-making. |
| Type D. Advisory | Users advise government of decisions to be taken and government endorses these decisions. |
| Type E. Informative | Government has delegated authority to make decisions to user groups who are responsible for informing government of these decisions. |

Source: Sen and Nielsen (1996): p.406.
authority is delegated to local-level actors is consultative co-management (Table 1) (Sen and Nielsen, 1996).

The complexity of defining communities is another challenge to co-management (Berkes et al., 1998). Carlson and Berkes (2005) describe communities as complex; non-coherent and non-homogenous entities with ‘unpredictable behaviour’. Their dynamic nature results in group interests that are constantly changing therefore incorporating the various actors into decision-making units and meeting their unique interests can be challenging (Carlson and Berkes, 2005).

Elite capture is one other problem that can cripple the co-management process. Elite capture occurs when local elites such as local individuals or groups with higher access to social, political and economic power dominate or capture participatory projects and benefits (Schmidt and Theesfeld, 2013; Muyengwa, 2015). Conditions such as existence of strong local leadership may work against the co-management ideology of involving resource users in decision-making and end up benefitting the few local elites. Schmidt and Theesfeld (2013) argue that the co-management tenet of devolving power to local institutions can instead fuel elite capture and disadvantage the minority and marginalized individuals in a community. This is because local elites often have high literacy abilities which enable them to communicate with outsiders and can thereby influence the decision-making process to their favour (Plateau et al., 2014). As a result, co-management regulations, tasks or decisions end up being considered ‘alien’ as the local minorities are not fully involved in the management process and do not accrue the same benefits as the local elites. Plateau et al. (2014) also highlight high poverty levels and gender disparities as factors that enhance the problem of elite capture in resource communities.

Corruption is another challenge to co-management. Corruption occurs when payments of bribes are made to avoid sanctions, penalties or imprisonments and enable illegal practices to continue (Nunan et al., 2018). In the management of small-scale fisheries, ‘petty corruption’ is prevalent where fishers are forewarned by enforcement officers or agents of upcoming patrols in exchange for bribes. This form of weak and inconsistent enforcement of rules is dominant among enforcement officers at state as well as local level whose aim is to supplement inadequate salaries (Nunan et al., 2018). Other factors such as high market prices for scarce resource units, insufficient resources for implementing regulations and power imbalances between state agencies and poor artisanal fishers encourage illegalities to persist (Medard et al., 2016 in Nunan et al., 2018).

Sundström (2013) notes that when corrupt practices thrive, trust among resource users and enforcement agents is reduced. Consequently, the legitimacy of the management system and its regulations become compromised. As a result, resource users are not compelled to adhere to them. The natural resource pool is further degraded as unsustainable practices such as use of prohibited gear continually go unchecked (Jentoft, 2000). Nunan et al. (2018) revealed that corrupt practices and illegalities in small-scale fisheries co-management on Lake Victoria are perpetuated by fishers, Beach Management Unit (BMU) Committee members, the police, the judiciary and local politicians.

2.4. Conditions for successful co-management

Studies that have examined co-management in fisheries around the world have shown mixed results. Reviews of case studies have revealed some patterns or commonalities among successful cases, as well as conditions for successful co-management. These are presented in this section. Kindly note that we do not claim that our review is exhaustive.

Gutiérrez et al. (2011) identified the presence of community leaders as one condition that facilitates success of co-management. For example, traditional authorities or independent local leaders who are skilled, committed and highly motivated act as an entry point through which the state can transfer rights and authority to the entire community. Strong local leaders with intentions of promoting collective gain at the expense of self-interests promote strong social cohesion among the resource users and reinforce success in co-management.

Imposing ‘direct regulation’ mechanisms such as Total Allowable Catch (TAC) in form of individual and community fish quotas and Territorial Use Rights of Fisheries (TURFs) helps to prevent overfishing of resources and encourages ecological stewardship. Additionally, enforcing ‘indirect regulations’ such as community-based protected areas, closed seasons and limiting the number of resource users, the type, size and number of gear allowable helps control total harvesting effort. It also helps avert the open access scenario and enables restoration of degraded areas (Jentoft, 1989; Gutiérrez et al., 2011).

Increasing the legitimacy of regulations is another condition that re-enforces resource users’ desire to concentrate on group interests voluntarily and forgo personal ambitions thereby strengthening co-management schemes. According to Jentoft (1989), increasing legitimacy involves the following: designing resource regulations that provide solutions to actual resource problems; imposing restrictions on

| Table 2. Design principles illustrated by long-enduring CPR institutions. |
|---------------------------------------------------------------|
| **1. Clearly defined boundaries**                              |
| Individuals or households that have rights to withdraw resource units from the CPR must be clearly defined, as must the boundaries of the CPR itself. |
| **2. Congruence between appropriation and provision rules and local conditions** |
| Appropriation rules restricting time, place, technology, and/or quantity of resource units are related to local conditions and to provision rules requiring labor, material, and/or money. |
| **3. Collective-choice arrangements**                           |
| Most individuals affected by the operational rules can participate in modifying the operational rules. |
| **4. Monitoring**                                              |
| Monitors, who actively audit CPR conditions and appropriator behavior, are accountable to the appropriators or are the appropriators. |
| **5. Graduated sanctions**                                     |
| Appropriators who violate operational rules are likely to receive graduated sanctions (depending on the seriousness and context of the offense) imposed by other appropriators, by officials accountable to these appropriators or both. |
| **6. Conflict-resolution mechanism**                           |
| Appropriators and their officials have rapid access to low-cost local arenas to resolve conflicts among appropriators or between appropriators and officials. |
| **7. Minimum recognition of rights to organize**               |
| The rights of appropriators to devise their own institutions are not challenged by external governmental authorities. |
| **8. Nested enterprises**                                      |
| Appropriation, provision, monitoring, enforcement, conflict resolution, and governance activities are organized in multiple layers of nested enterprises. |

Source: Ostrom (1990), p. 69.
resource users equitably; involving resource users in the decision-making process; and directly involving users in implementation and enforcement processes. Evans et al. (2011) espouse strong state agencies that provide a bottom-up management system by decentralizing authority and responsibilities to user-groups, promoting the creation of strong social networks among stakeholders and strongly enforcing institutions against intruders. Pomeroy et al., (2001) cite the delivery of effective community training and empowerment as factors that facilitate co-management.

Ostrom (1990) extensively reviewed literature and came up with a summary of ‘success factors’ which she then formulated into eight principles which she contends are good indicators of successful management of common pool resources (Table 2). In summary, when resource user-groups are able to exclude non-members and modify resource rules, it builds their sense of ownership toward the resource and enhances their compliance to locally crafted rules (Rosam, 2015).

The existence of these conditions in a particular resource community however, is not a panacea to the complex common pool resources management problems encountered when implementing co-management (Carlsson and Berkes, 2005; Jenotf, 1989). This is due to the interplay of various factors which have the potential to undermine co-management efforts.

2.5. Participation in co-management

Participation means different things to different people (Bass et al., 1995). It can be used to mean individuals passively listening to a higher authority figure or individuals identifying their own needs, designing solutions and enforcing them. A lack of clarity on what the user of the term actually means has potential to mask an agenda for manipulation (Pretty, 1995). Pretty (1995) argues that participation can be used as a disguise to entice people-more often, resource users- into participating in activities or projects they have little interest in. Therefore to avoid misinterpretation and misunderstanding, it is necessary to explicitly define the actual actions that one is required to perform when called to ‘participate’. For instance, what does it mean to participate in fisheries co-management? The concept of participation has been expressed variously by several scholars such as Arnstein (1969)’s A ladder of citizen participation, White (1996)’s The forms and functions of participation and Pretty (1995)’s The typology of participation. White (1996) described participation as a framework to show the different forms, functions and interests of the individuals involved (Table 3).

White’s participation model reveals the ‘hidden agenda’ of actors in a participatory process as well as the extent of decentralization between the parties involved (IDS, 2014). However, the model assumes that participants are a homogenous unit with a single intention for participating e.g. ‘to retain access to benefits’. It also does not indicate at what stage of the participatory project (identification, implementation or evaluation stage) each form occurs (Cornwall, 2008).

3. Methods

3.1. Description of the study area

Lake Mweru lies on the border between Zambia and the Democratic Republic of Congo. Its surface area is 5,120 km². The Luapula and Kalungwishi Rivers feed into the Lake in the southern and eastern regions respectively while the Luvua River in the north provides an outflow into the Lualaba River (Bos et al., 2006). Mweru- Luapula fishery constitutes Lake Mweru, Luapula River, and their associated swamps and floodplains (van Zwieten and Aarnink, 1996). Its shoreline on the Zambian side covers 4 districts namely Mwensen, Kawambwa, Nchelenge and Chiengi (Figure 1).

Lake Mweru is situated in Zambia’s third agro-ecological region (AER III); it receives the highest annual rainfall in the country, ranging between 1100 mm and 1500 mm. Rainfall occurs in the warm-wet season from November to April. The long-term mean temperature for the region is 21.4 °C. The fishery exists in the Katanga Super Group region and comprises shale, sandstone, dolomites, quartzite, limestone and conglomerate (WARMA, 2019). The Lake forms part of the Central African Plateau (Tveines, 1983) and lies at an altitude of between 1000m and 1700m.

Lake Mweru is located in a predominantly rural area (72% rural, 28% urban) which has poverty levels of 81.1% (CSO, 2013). Major economic activities are crop production and fishing. Commonly grown crops are maize (Zea mays), cassava (Manihot esculenta), sorghum (Sorghum bicolor), beans (Phaseolus vulgaris), sweet potatoes (Ipomea batatas) and millet (Panicum milaeceum). The province is also favourable for growing sugarcane, palm oil, bananas and citrus fruits (WARMA, 2019). Small ruminants such as goats are reared on a small-scale for local trade while cattle herding is not a common practice.

Common species include Tiger fish (Hydrocynus Vittatus), Silver fish (Alestes macropthalmus), Purple bream (Serranochromis macrocephalus) and the Mweru Sprat (Microthrissa moeruensis) known locally as Chisense (GRZ, 2019).

This study was restricted to Kabuta, one of the fishing camps situated in Nchelenge district. The district’s projected population for 2020 was 209, 824 persons (CSO, 2013), with an average household size of 5 persons per household (ZSA, 2020). Three types of fisheries exist within the camp; these are; (i) Chisense fishery, (ii) Gill net and (iii) Long line fishery. Fishing gear used includes; plank boats, tilley lamps, mesh-less nets and floaters and nets of various sizes. Mechanized engines are also used. Fishing is practiced for subsistence as well as for local trade (GRZ, 2019). Chisense (Microthrissa moeruensis) is a small lake sardine that reproduces within nine months and adult sizes range from 5 to 7 cm (Van Zwieten and Aarnink, 1996 cited by Annear and Waylen, 2019). Kabuta camp experiences seasonal migrations of fishermen from one fishing camp to another. These seasonal migrations facilitate trade of commodities such as fish, cassava, caterpillars (edible Mopane worms), sweet potatoes, groundnuts and sorghum. Local smallholder farmers similarly migrate from their homesteads to camp in their agricultural fields until the cultivation activities are completed.

| Form of Participation | What ‘participation’ means to the implementing agency | What ‘participation’ means to those on the receiving end | Function of Participation |
|-----------------------|---------------------------------------------------|-------------------------------------------------------|--------------------------|
| Nominal participation | Legitimation- to show they are doing something     | Inclusion- to retain some access to potential benefits | Display                  |
| Instrumental participation | Efficiency- to limit funder’s input, draw on community contributions and make projects more cost-effective | Cost- of time spent on project-related labour and other activities | As a means to achieving cost-effectiveness and local facilities |
| Representative participation | Sustainability- to avoid creating dependence | Leverage- to influence the shape the project takes and its management | To give people ‘voice’ in determining their own development |
| Transformative participation | Empowerment- to enable people to make their own decisions, work out what to do and take action | Empowerment- to be able to decide and act for themselves | Both as a means and an end, a continuing dynamic |

Table 3. The forms and functions of participation.

Source: Cornwall (2008), p. 273 Adapted from: White (1996), p. 7-9.
Charcoal and firewood are the major sources of energy used for cooking and other domestic activities. Few houses and shops however, are connected to the national power grid thus solar energy is used for domestic use such as lighting, recharging radios and other electronic gadgets (GRZ, 2014). In addition, solar energy provides an energy source for fish preservation through the sun drying technique.

The community is characterized by poor sanitation and use of latrines. However, hand pumps and communal taps provide water for domestic use whereas water from the Lake and nearby rivers is used to irrigate vegetable gardens and service other domestic duties. The lack of adequate health care services, clean water, good sanitation and schools present high risks of transmission of communicable diseases such as cholera, HIV/STIs and results in high illiteracy especially among the young children (GRZ, 2014).

A dual system of government exists in form of traditional and state governance. Chiefs are aided in day to day local governance by village headpersons while the state is locally manifested in form of the local authority. Three chiefdoms are situated along Mweru- Luapula fishery namely: Chief Mununga who is located in the northern region, Chief Puta and the Paramount Chief of the Lunda people, Mwata Kazembe, situated in the southern region. This dual leadership system reinforces adherence of community members to regulations that promote good environmental stewardship (Aarnink et al., 1993). Conversely it acts as a source of power struggles between the traditional leaders and state representatives (Annear, 2009).

3.2. Data collection methods

Data were collected in July 2019. Before proceeding into the field for data collection, the study was approved by the University of Zambia’s Directorate of Research and Graduate Studies Ethics Board. Once in the study site, permission to conduct research was sought from the traditional leaders before any data was collected. Once permission was granted by the community gatekeepers, several data collection methods were used as detailed below.

3.2.1. Focus group discussions

A total of five focus group discussions (FGDs) were conducted; two with Fishing Association (FA) executive members, two with ordinary fishers and one with Village Fisheries Management Committee (VFMC) executive members. FA executive members were purposively selected due to their positions as local leaders at the village level. The ten fishers who participated in the FGDs were purposively selected from among the 64 respondents that had participated in the questionnaire survey based on the knowledge and unique opinions they expressed during the survey. Discussants from the VFMC executive were selected through convenient sampling. A total of four members, each representing their respective villages (from the total number of two members per village) participated in the FGDs. After obtaining informed consent, the FGDs were recorded using a digital recorder. Notes were also taken during the discussions to consolidate the recordings. The discussions lasted not more than an hour. Major themes in the FGDs were committee performance, participation and compliance to fishery rules. The FGDS were facilitated by the first author in IchiBemba, the language most widely spoken in the area. Informed consent and permission to record using a digital recorder was obtained at the beginning of the discussion.

3.2.2. Key interviews

Key interviewees were sampled purposively and comprised one government official from the Department of Fisheries and one traditional authority representative. Interviews were conducted with the key interviewee from the Department of Fisheries in order to gain an understanding of the operations of the co-management regime from the state’s perspective. Questions to the traditional authority focused on the role of the chiefaincy in fisheries management prior to and during co-management.
3.2.3. Structured interviews and observations

A questionnaire was developed and used to interview fishers in the study site. The instrument was divided into four parts; Part A captured the respondent's biographical-data such as age, marital status among others. Part B queried the respondent over the performance of Fisheries Committees, the respondent's awareness of community duties and what penalties they impose when a fisher errors. Part C was aimed at capturing fishers’ views the effect of community by-laws. The interviews were conducted in the common dialect of Ichisembwa which both the researcher and assistant were conversant with. Respondents for the structured interviews were conveniently selected through a door to door survey in the respective villages with the aid of members of the Fishing Association. This method was necessitated by the lack of up-to-date information on the population size and unavailability of village fisher registers. A total of 64 interviews were conducted. The number of interviews conducted was based on theoretical saturation, that is, interviews were conducted until an additional interview did not result in the acquisition of any new information (Glaser and Strauss, 1967 cited by Saunders et al. 2018). Informed consent was sought from and verbally granted by all the respondents.

Observations were made at various landing sites along the shoreline in Kabuta fishing camp to determine the types of fishing gear, fishing methods used as well as the type of fish landed and its size. Observations were also made of the homesteads to determine fish drying techniques and trading system for Chiense.

3.3. Data analysis

Software packages such as Microsoft Excel (Microsoft Corporation, 2010) and Minitab 18 (Minitab Inc, 2018) were used to enter and analyze survey data. Frequencies and measures of central tendency such as means were used to analyze survey data. The recordings of the FDGs were transcribed, that is they were listened to several times and the discussants’ views written down. The transcriptions were then analyzed based on the pre-selected themes. During the thematic analysis, attention was paid to views from the different sub-groups in the fishing community. Themes express meaningful patterns, stances of the participants, or concerns (Saumure, 2018). These results were consolidated with the notes taken during the discussions. Thematic analysis was also employed to analyze answers to open ended-questions of the structured interviews. The themes were created based on the responses, but guided by the study objectives. Ostrom’s Eight Design Principles were reworded and used to analyze the performance of the Village Fisheries Management Committee as an institution. The design principles were preferred over the institutional Analysis Development Framework as they are better for assessments of institutions around common pool resource management.

White’s (1996) typology for assessing participation was employed to evaluate fishers’ participation. The Fisheries Act No. 22 of 2011 and the Fisheries Regulations of 2012 provided the basis for analyzing fishers' compliance to fisheries laws and regulations.

4. Results and discussion

4.1. Socio-economic characteristics

Most of the respondents (92%) were men while only 8% were women. Field observations revealed that all the women respondents and women engaged in the fishing industry in the area more generally, are engaged in fish trading and processing. Women that own fishing gear hire the men folk to fish on the Lake on their behalf. The absence of the women folk in the actual fishing activity is a result of old local taboos against women fishing on the lake and norms about gender roles and fishing (Mathews, 1993; Vunisea, 1997; Williams et al., 2001). This implies a lack of equity in access to fish resources and level of authority between men and women in the co-management regime. Women's decision-making role is undermined and their access to fish mediated through their relationships with men e.g. having spouses or adult male children as fishers. Otherwise they have to hire men to fish for them, which is an added cost that their male counterparts do not incur. Thus, poorer women without the resources to hire male fishers are particularly limited in their participation.

The age range was between 23 and 65 (see Table 4), with a mean age of 40 years. Low levels of formal education were exhibited among the respondents with the majority (55%) having only attained primary level education while no respondents indicated to have acquired tertiary level schooling. This suggests low levels of formal employment opportunities and high dependence on natural resources for sustaining their livelihoods. Efforts to maximize profits compel some fishers to increase their fishing effort while others resort to using destructive fishing methods, thus leading to low compliance to co-management regulations.

In addition, the lack of stable incomes promotes rent-seeking behaviour and other corrupt activities among those in leadership positions thereby affecting the enforcement of fisheries regulations. A total of 96% of the respondents engaged in fishing for business and household consumption, 2% fished strictly for household consumption while the rest (2%) claimed to fish strictly for business. This indicates that fishing does not only help generate cash income but also provides nutritional benefits for the local residents. The estimated monthly cash income from fishing activities ranged between ZMW 100 and ZMW 7,000 with a mean of ZMW 1,500 minus the two outliers; ZMW 50 and ZMW 40,000. At the time of this study, the fisher with ZMW 50 monthly cash income had recently started trading part of his catch as a livelihood strategy and owned few nets while the fisher with the monthly cash income of ZMW 40,000 was a gear owner whose numerous fishing nets and motorized boats as well as large fishing crew brought in high returns. Among the respondents, alternative sources of income outside the fisheries sector were petty trade, bricklaying, transportation services and crop farming. About 30% of fishers also engaged in crop production activities. Despite diversifying their livelihood strategies, fishing and other related activities contribute significantly to the economic wellbeing of most fishers. This motivates their interest in co-management to ensure their interests are articulated.

Table 4. Survey respondents’ age ranges and education levels, Mweru- Luapula fishery.

| Age range (Years) | Level of education | Junior Secondary Grades (8–9) | Senior Secondary Grades (10–12) |
|-------------------|--------------------|-------------------------------|-------------------------------|
| Age               | No formal education| Primary (Grades 1–7)          |                               |
| 23–33             | 1                  | 8                             | 2                             |
| 34–44             | -                  | 18                            | 6                             |
| 45–55             | -                  | 7                             | 2                             |
| Above 56         | -                  | 2                             | 1                             |
| Total            | 35                 | 11                            | 16                            |

Source: Field Data (2019).
### 4.2. Performance of village fisheries management committees

The performance of the Village Fisheries Management Committee (VFMC) was assessed using Ostrom's eight design principles (Table 5).

#### 4.2.1. Membership criteria of VFMCs

The system of installing VFMC members is well defined by most stakeholders in the fishery. Potential committee members are nominated by fishers through consultative meetings held with several stakeholders namely; traditional leaders, officials from the Department of Fisheries and fishers in all villages along the fishery. The nominated fishers are interviewed, trained and eventually confirmed by the Department of Fisheries as Village Fisheries Management Committees members. However, a key interviewee from the Department of Fisheries revealed that low financial support to the Department of Fisheries had hindered the department from holding elections to install new VFMC members. Because of this, the committee members had over-stayed their tenure. Instead of the three years prescribed in Section 29 (4) Part IV (Government of Zambia, 2011), the VFMC committee had been in place for seven years at the time of the study.

Becoming a member of the VFMC requires skills such as writing, reading and large social connections. This invariably precludes some villagers from aspiring for membership to the VFMC and opens the committee to elite capture through having an esoteric group of the better connected and more educated villagers-the local elites-as the only ones that can perform functions of the VFMC.

Scholars have observed that local elites capture local benefits when majority of resource users are unable to engage in dialogue with government or other stakeholders due to low literacy levels. Failure to read, write and communicate with state agencies or project organizers makes them dependent on those with such abilities, who, in some instances may take advantage and work for personal interests (Plateau et al. 2014). Low education levels among respondents in Mweru- Luapula fishery (Table 4) support the likelihood of elite capture by the VFMC. The nature of the roles of the committee members such as writing minutes during meetings and keeping financial records require those who can read and write, and those capable of articulating themselves in formal settings such as workshops. We therefore argue that some villagers have disproportionately lower opportunities to offer themselves or to be nominated as VFMC members, and thus find the criteria of membership to VFMC to be unfair.

VFMC members claimed they had authority to function as an extension of the Department of Fisheries throughout fishing villages along the fishery. They explained that their mandate included conservation of fish resources for current and future generations as well as provision of extension services to fishers on fish conservation and utilization. They reportedly achieved this mandate by ensuring that fishers adhere to fisheries regulations, among them, observing the seasonal fish ban period from December 1st to February 28th the following year. Monitoring was effected through patrols. However, a review of the Fisheries Act No. 22 did not reveal any prescriptions on the mandate, duties and powers of VFMC. A key interviewee from the Department of Fisheries explained that the department uses subsidiary legislation (Statutory Instrument No. 24 of 2012) to delegate management tasks to VFMCs.

Despite having a clearly defined international boundary marked by the Luapula River (see Figure 1), fishers from Zambia and DRC still cross the boundary to conduct fishing activities from the neighbouring country. This often results in violent confrontations. The majority (81%) of respondents acknowledged the pervasive trans-boundary disputes while 19% did not report any disputes. Those that mentioned trans-boundary disputes explained that the disputes were brought on by Congolese authorities’ confiscation of fishing gear and fish catch and abduction of fishers. Institutions responsible for resolving such disputes were identified as follows; the Fishing Association (40%), VFMC (28%), Department of Fisheries (24%) and Marine soldiers (14%).

One VFMC member lamented how “wildlife guards have been equipped with guns and receive remunerations while the fisheries sector remains neglected”. He therefore suggested the reintroduction of ‘fish guards’ to take up the role of the VFMC in the fishery.

Mweru-Luapula fishery lacks a Joint Fisheries Management Committee or conflict resolution institution to oversee policy formulation and decision-making activities on behalf of the two riparian countries. Therefore conflicts are resolved unilaterally; regulations are passed by one country without any consultations with the neighbouring country.

#### 4.2.2. Balance between incentives and functions

Village Fisheries Management Committees on Mweru-Luapula fishery work on a ‘voluntary basis’ with no salaries. Conversely, during donor-funded projects they receive allowances. An executive member of the committee lamented the lack of tangible benefits as follows; “...some of us here are married. You go to the Lake at 3:00 AM [to patrol] only to come back with soaked cloths. How will a wife understand?” Without tangible benefits, local leaders are consequently enticed to engage in illegalities such as soliciting or accepting bribes or using prohibited fishing gear in an effort to meet their livelihood needs. One focus group discussant alleged that “VFMC members work for their pockets”. The mismatch between the benefits that they derive and the duties they are required to perform provides a justification for the local leadership to be involved in such illegalities. The lack of tangible benefits also compels the local leadership to engage in alternative livelihood activities such as crop production or fish trade at the expense of monitoring fishing activities. A FGD with the VFMC revealed that instead of conducting patrols on the lake concurrently during the three-month fish ban period, they end up patrolling only four times. As a result, the fishery is left under de facto open access regime and subject to illegal and unsustainable fishing practices. KC et al. (2020) noted that identifying incentives for participants to invest time and effort in co-management and understanding individual’s

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**Table 5. Assessment of village fisheries management committee, Mweru- Luapula fishery.**

| Ostrom’s Eight Design Principles | Result |
|---------------------------------|--------|
| (a) Membership criteria of VFMCs: Criteria of becoming VFMC member is fair and well known by most resource users. | Yes |
| (b) Fishery boundaries are clearly defined and known to fishers. | Yes |
| (c) VFMC duties are clearly stipulated and known to all committee members and fishery resource users. | Yes |
| 2 Benefits received by VFMC members match their duties. | VFMCs lack monetary incentives for members |
| 3 VFMC can engage in collective action on behalf of community | Yes |
| 4 (a) VFMCs monitor rule compliance through frequent patrols. | Few patrols conducted |
| (b) VFMC operations are upward and downwardly accountable. | No downward accountability |
| 5 (a) Sanctions imposed by VFMCs on erring members and ordinary resource users are legitimate | lack of standardized penalty system |
| (b) Penalties are known to all resource users | No |
| 6. VFMC conflict resolution mechanisms are swift, inexpensive, known to resource users. | No conflict resolution strategies |
| 7. VFMCs craft rules that are respected by state and non-state actors. e.g. traditional authorities. | No |
| 8. VFMC operations, rules feed into state district and provincial activities. | partially well-organized |
self-governance to obtain collective benefits in situations where the temptations to free-ride and to break commitments are substantial was challenging.

These findings reflect a common trend among local institutions in small-scale fisheries co-management on Lake Tanganyika (Banda et al., 2015) and Lake Victoria (Nunan et al., 2018), where Village Conservation and Development Committees (VCDGs) and Beach Management Units (BMUs) respectively are not paid wages. Rather they operate as volunteers. A Study by Etiegni et al. (2016) on Lake Victoria (on the Kenyan jurisdiction) agrees with these findings where the BMU activities are not funded by the government. Instead BMU are required to generate revenue for conducting patrols and for allowances through membership fees, penalties for by-law violations and fish landing fees.

4.2.3. Collective action

The VFMCs on Mweru-Lupula fishery can adapt some state regulations in order to suit the local conditions of the resource users and meet their livelihood needs. According to VFMC members, aberrant fishermen can get back their confiscated gear by paying a fine to avoid being prosecuted through the court system. This enables the VFMCs to generate revenue which is channeled towards patrols e.g. the purchase of fuel for patrol boats while some of the fines are shared as allowances by VFMC members. It was observed during FGDs that this practice is inimical to co-operative efforts among VFMC members. According to committee members, most matters are reported to the District of Fisheries but the response is very slow. This was attributed to the absence of Fisheries of Fisheries laws and/or regulations. More than a third of the respondents who are apprehended by the Department of Fisheries or marine soldiers during their patrols are handed over to the police and prosecuted accordingly.

4.2.4. Accountability of VFMCs

VFMCs are upwardly accountable to the district and provincial fisheries office. At the provincial level, the Department of Fisheries not only facilitates committee elections but also trains the newly elected leadership on enforcement of the Fisheries Act, and provision of extension services to fishers on fish conservation. However, the lack of regular trainings to the VFMCs by the Department inhibits the transfer of new knowledge and technology to fishers. Therefore fishers are unable to access new knowledge on sustainable fisheries management or adopt new technologies but continue to use the same gear and practice unsustainable fishing methods. The Department of Fisheries is also unable to directly monitor VFMC operations due to absence of Fisheries officers in the fishing camps. Consequently, the Department is constrained from ensuring that committee operations are in line with legally stipulated guidelines of the Fisheries Act. Fishers and VFMC leadership equally bemoaned the lack of prompt response to complaints by fisheries officials.

The VFMCs are downwardly accountable to the Traditional Authorities, that is, village head persons at the village level and indirectly to the chief at chiefdom level. Traditional Authorities organize fishers and receive nominations of fishers during VFMC elections. However, according to a village headperson, their role ceases once the VFMC leadership has been installed;

Most times, they say that we the village leaders are the overseers, that we are the overall boss. But when we want to get involved in a matter they say no, we are not supposed to be involved. Now they don’t know that things can go wrong. Because if they allow us to be part of the VFMCs, we would know how things are moving…Now most times they like telling us we are the overseer, we are the overall boss. But when the overall boss wants to exercise the authority as a boss, they are not allowed.

He further complained about the lack of consensus with the VFMC regarding the fate of materials confiscated during patrols. The power struggles among the local institutions have resulted from unclearly defined roles of the traditional authorities.

4.2.5. Penalty system

The Fisheries Act No. 22 of 2011 in Section (15) subsection (3) of Part III provides the penalty of “a fine not exceeding three hundred thousand penalty units or to imprisonment for a period not exceeding three years or to both” to any individual engaged in various prohibited fishing methods such as ‘use of explosives, firearm, poison, chemical or noxious substances, electrical devices or use of trawl net, bottom drag net or any net with mesh size which does not conform to the prescribed minimum mesh size’ for that particular area’ (Government of Zambia, 2011). According to a key interviewee, the Department of Fisheries takes action when committee members contravene the Fisheries Act by investigating and expelling those found wanting.

VFMC members explained during their FGD that at the village level, the committee takes disciplinary action on its members who commit offences such as use of prohibited gear. Sanctions include verbal or written warnings, penalty charges, suspension and in some instances expulsion from the committee. The VFMC impose a less stiff penalty (compared to that stipulated in the Fisheries Act) of confiscating the fishing gear of fishers who are found contravening the Fisheries Act. However, the gear can be repossessed by the owner upon payment of a penalty charge (minimum of ZMW 200). On the other hand, offenders who are apprehended by the Department of Fisheries or marine soldiers during their patrols are handed over to the police and prosecuted accordingly.

During FGDs, fishers argued that the penalty system imposed by the VFMC fails to deter offenders as most fishers have the capacity to settle the fines. Moreover, the penalties that are sanctioned on fishers have not been clearly documented instead they are passed on to fishers orally, leaving fishers with no avenue of questioning their credibility. Wilson et al (2010) suggested that procedures for enforcement, including the use of proceeds from fines and confiscations, should be formal and standard across all national fisheries.

4.2.6. Internal conflict resolution mechanism

The Department of Fisheries is responsible for resolving disputes among VFMC members. According to committee members, most matters have to be reported to the District office in Nchelenge and often receive slow response. This was attributed to the absence of fisheries officers at the fishing camp level. As a result, conflicts among committee members are locally resolved with minimal involvement of the Department of Fisheries.

4.2.7. Recognition of rights to organize

In formulating fisheries laws, consultations with various stakeholders are conducted and laws are enacted by Parliament. A key interviewee asserted that fishers are consulted through their local leaders when formulating fisheries laws and/or regulations. More than a third of the
respondents recognized the Department of Fisheries as the leading institution responsible for formulating fisheries laws while a third through the VFMC (Figure 2).

Local operational rules have been formulated by fishers, VFMCs, Fishing Association and Traditional Authorities in Mweru- Luapula fishery. According to a key interviewee, the rules guide interactions of resource users and do not apply in other fishing camps. Rules such as prohibition of Chisense fishers from selling their catch in the night, taking intoxicating substances, or using vulgar language during fishing are in place. Upon breaking these rules, a fisher can be suspended from fishing on the Lake for a stipulated period by the FA committee whose mandate, among others, is to guide the conduct of fishers. However, during the FGD, some respondents refuted participating in the design of the above-mentioned local rules.

Similar studies on Lake Tanganyika (Banda et al., 2015) revealed that majority (79%) of respondents viewed fishery stakeholders, including Village Community and Development Committee (VCDCs), as having no powers to formulate fishery laws. Another 67% of respondents alluded that their local leadership were lacking the authority to formulate fishery by-laws. These findings suggest a weak decentralization process where fisheries regulations are externally formulated by experts and other authorities.

4.2.8. Nested enterprises

The different layers that form the co-management system, i.e. criteria of selecting VFMC leaders, functions and incentives, collective action and accountability, penalty system and internal conflict resolution mechanism and recognition of rights to organize lack cohesion. This arises from the disparity of ‘interests’ among stakeholders.

On one hand, the state holds onto power over resources by enforcing the annual fish ban through local institutions such as the VFMC while abrogating its role of facilitating fair elections of the same institutions. On the other hand, the local elite hold onto leadership positions at the expense of ordinary fishers and resource-rich fishers capitalizing on the weak enforcement mechanisms to increase their profit margin. As Ostrom (1990, p.77) notes “Establishing rules at one level without rules at the other levels will produce an incomplete system that may not endure over the long run”.

As a result, the performance of local institutions such as the VFMC has taken on a ‘top-down’ approach which has potential to defeat the ideologies of collaborative management by neglecting the role of the local communities in managing the resource.

4.3. Participation of fishers in management activities

The majority (63%) of respondents identified elections as the selection criterion for becoming a committee member of the Fishing Association. Only 28% reported having participated in electing committee members for the Fishing Association. No fisher acknowledged to have participated in elections for the VFMCs. According to a key interviewee, the last installation of the VFMC members had occurred in 2011. During FGDs with fishers, they alleged that local leaders chose themselves, indicating a sense of disengagement from the electoral process. This indicates a Nominal form of participation in the electoral process, where elections are a ‘display’ by local leaders to retain personal benefits and maintain legitimacy without real intentions of relinquishing power.

A key interviewee from the Department of Fisheries identified the VFMCs, Fishing Association, marine soldiers and the Department of Fisheries as the main actors responsible for conducting patrols on Mweru- Luapula fishery. Field observations along the lake shore by the first author revealed that when the VFMC and Fishing Association representatives are not conducting patrols, fishers are unrestrained from engaging in illegal fishing practices. It was noted during FGDs with fishers that fishers do not report fellow fishers who engage in illegal fishing practices, citing that such an act would be detrimental to their counterparts’ livelihood. Similarly, Banda et al. (2015) reported a lack of involvement of local fishers in monitoring and surveillance activities on Lake Tanganyika. The lack of engagement with fishers in monitoring activities has arguably promoted the continued use of unsustainable fishing practices in the fishery.

4.4. Compliance of fisheries regulations by fishers

As earlier mentioned, Mweru- Luapula fishery comprises three categories of fisheries namely; Chisense fishery, gill net and long line fishery (see Figures 3 and 4 below). Three management tools have been instituted in the fishery namely; (i) Sanctuary areas, (ii) Closed fishing season and (iii) Prohibition of selected fishing gear and fishing methods.

4.4.1. Fishing from sanctuary areas

A total of 95% of respondents identified Kalungwishi, Mwatishi and Mifimbo as restricted fish breeding areas within the fishery. The Mifimbo fish breeding area, also referred to as “the mother” or “the womb” of the fishery is a rich breeding ground for several fish species. A key interviewee explained however, that villages have been established on Kanakashi Island, one of the main islands within Mifimbo. Relocation of settlers from the breeding site had failed.

4.4.2. Closed fishing season

According to the Fisheries Regulations SI No. 24 of 2012, First Schedule (B), the whole of Mweru- Luapula fishery is closed to fishing activities beginning 1st December to the last day of February. Compliance by fishers to the seasonal fish ban is low. This was attributed to
inconsistent patrols by VFMC members. Moreover, VFMC members contended that inadequate resources availed to them to conduct patrols hinder effective enforcement of the fish ban and consequently conservation of fish. Equally, the Department of Fisheries is constrained by inadequate resources, thus monitoring by the Department and marine soldiers is intermittently carried out. In addition, the weak penalty system by the VFMCs fails to deter would-be offenders from breaking fishery’s laws. The respondents also contended that observing the fishing ban on the Zambian side of the Lake while fishing on the DRC continued was ineffective. For example, According to a key interviewee from the Department of Fisheries, the 2019 fishing ban was not observed on the DRC side of the Lake.

4.4.3. Prohibited fishing gear and fishing methods

A total of 92% of respondents were aware of the prescribed gear outlined as follows: plank boats of sizes between 5 and 7 m in length; Monofilament (Gill) nets of 128 mm and above, Multifilament nets of 64 mm–128 mm, mesh less sized Chiiese nets and tilley lamps. Motorized engines and sails are to be used to propel plank boats. The use of some prohibited equipment such as mosquito nets was very common (Table 6).

Despite being aware of the proscribed gear, respondents continued to use some of it, attributing its use to low fines imposed on offenders. This is exacerbated by the lack of involvement of fishers in monitoring fellow fishers’ activities as well as high dependence on VFMCs and Department of Fisheries to impose sanctions. The use of beach seine nets is common in the fishery especially in the northern tip. Nets of prohibited sizes are locally made by fishers themselves in various sizes and are used as beach seines on shallow waters.

Mosquito nets are also rampantly used for fishing. These are sown together and used as drag nets to harvest various types of fish. Monofilament nets of mesh size less than 127 mm are prohibited fishing equipment on Lake Mweru. However, these nets are currently in use. Respondents attributed the wide use of these prohibited gear to easy availability and accessibility by fishers compared to the prescribed type of nets. These fishing equipment have destructive consequences on the Mweru- Luapula ecosystem as small fish and other aquatic species such as snails are harvested. The Fisheries Act of 2011 prohibits Kutumpula (Government of Zambia, 2011 Section 15 (1) (d) Part III). Kutumpula refers to “any fishing method whereby fish are driven or directed into a stationary net or monofilament net or trap” (Government of Zambia, 2012 Section 7 Part II). A focus group discussant admitted that fishers use Kutumpula method and justified their actions that ‘for them to catch any fish, the water needs to be agitated’. However, the other discussants were quick to acknowledge the severity of the punishment that accompanies the violation of this regulation. Despite the documented use of poisonous plants in fishing activities among fishers during the pre-colonial era (Chilonge, 2011), no fishers on Mweru- Luapula fishery acknowledged incorporating this method in current fishing practices.

Low compliance to fisheries regulations weakens trust among the various actors (between fishers as well as fishers and the enforcement teams) in the co-management system. An erosion of trust further disincentivizes fishers from complying with regulations, citing dishonesty of other fishers and enforcement teams engaged in monitoring. This ultimately leads to an upsurge of illegalities that hinder collective action and deplete resource units. Moreover, the erosion of trust among stakeholders weakens their confidence in the co-management system which eventually ceases to function.

5. Conclusion

Implementation of co-management on Mweru- Luapula fishery has had minor positive outcomes. This has been shown by the weak performance of the Village Fisheries Management Committees indicated by the absence of key principles that support co-management. There is a mismatch between appropriation and duties for community representatives; low participation in decision-making by fishers; lack of upward and downward accountability; absence of conflict resolution mechanisms and a weak sanctioning system in Mweru- Luapula Fishery. The weak enforcement of fisheries regulations and infrequent patrols by the VFMC have failed to deter fishers from engaging in unsustainable fishing practices that compromise the state of the fishery. The creation of co-management institutions such as management committees to manage conflicts and penalize fisheries law breakers at their discretion provides opportunities for elite capture and other illegalities to persist. The establishment of local institutions without mechanisms for generating self-sustaining resources has not produced the desired results.

Passive participation by fishers in selection of community representatives and lack of participation in fisheries monitoring activities suggests that fishers do not perceive that the fishery is presently held under a common property regime but continue to view it as a public resource under de jure control of the Department of Fisheries. The lackluster performance of co-management is further attributed to lack of capacity by the Department of Fisheries to enforce the provisions of the fisheries legislation as well as the low economic capabilities of the fishers.

These results are insightful and of potential benefits to other areas of the world as they indicate how co-management regimes may not perform well due to the institutional set up. This study recommends that fishers through their respective villages could form cooperatives or small groups, mark out fishing boundaries, create their boundary rules and tax immigrant fishers for fishing in their jurisdiction. This would enhance their sense of ownership and incentivize their participation in fisheries management. Financial resources can be raised through these taxes for monitoring and surveillance while the State and other organizations could provide technical assistance. Other activities such as cage culture could be experimented with.

Furthermore, the study recommends introducing Participatory workshops where all stakeholders can be trained in fishery conservation practices and engage in planning and decision-making at the communal level. Lastly, the study recommends the implementation of a Regional Fisheries Management Board constituting members from Zambia and the

Table 6. Compliance on prohibited fishing equipment.

| Prohibited fishing equipment* | In Use | Not in Use |
|------------------------------|--------|-----------|
| Explosive or firearm         | √      |           |
| Trawl or bottom drag net     |        | √         |
| Poisonous, Chemical or Noxious substances | Data not available | |
| Electrical device            |        | √         |
| Mosquito nets                |        | √         |
| Draw/Beach seine nets (except for Chisense) | √ | |
| Gill net of a mesh size less than 63 mm | √ | |
| Monofilament net of a mesh size less than 127 mm | √ | |

* List of prohibited equipment based on Fisheries Act No. 22 of 2011 and SI. No. 24 of 2012.
DRC to superintend exploitation and management activities on both sides of the Lake.

Declarations

Author contribution statement

Ketive Kaluma: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Bridget Bwalya Umar: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

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