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Dynamics of transboundary governance and management of small scale fisheries on Lake Kariba: implications for sustainable use

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ABSTRACT

Lake Kariba and its fisheries are international resources shared by Zambia and Zimbabwe. Despite efforts to harmonize the regulatory system, there are still conflicting approaches of managing the fisheries resources. The paper discusses the divergent approaches and their relation to the sustainable use of the small-scale gill net fishery. Zimbabwe appears to focus on sustainability of the fisheries, and Zambia on maximizing employment opportunities from the fishery. The paper shows that uncoordinated management of the fishery at international level leads to weak local level institutions for managing the fishery.

KEYWORDS

Kariba; gill net; fisheries; Zimbabwe; Zambia

Introduction

The Code of Conduct for Responsible Fisheries paragraph 7.2.1 states that the overriding goal of fisheries management is the long-term sustainable use of the fisheries resources [1]. Sustainable use includes (a) maintaining the target species at or above the level necessary to ensure their continued productivity; (b) maximizing the net incomes of the participating fishermen and (c) maximizing employment opportunities for those dependent on the fishery for their livelihoods [2]. In many cases, meeting these objectives equally is almost impossible. For example, to maximise social objectives such as employment means intensifying production. This may contradict the conservation objective. Yet the three objectives have, to varying degrees, been the basis for managing the small scale gill net fishery on Lake Kariba.

Lake Kariba is jointly owned by Zambia and Zimbabwe. The governments of Zambia and Zimbabwe usurp local level management authorities and pursue different policies, goals and management approaches that have polarised the governance of Lake Kariba's small scale gill net fishery resources. The Zimbabwe government pursued the objective of maintaining the optimal level of target species while Zambia emphasises social considerations such as employment. Zimbabwe emphasized maintaining the compensatory mechanisms

of the target species, but Zambia justified a more intensive rate of exploitation than that warranted on purely biological grounds. As will be shown later, fishermen from either side of the lake particularly those in Basin 1 and 2 exploit the same ecosystem but under different regulatory systems. The efforts by one country to meet its priority actually compromise the welfare of the other.

Game theory predicts that in the absence of communication and cooperation, the dominant strategies of the two governments will be ruinous to both [3]. The prisoners' dilemma also postulates that if the two governments cooperate, they will both have better payoffs [4–6]. In our case, better payoffs would imply a healthy and productive small scale gill net fishery and prosperous fishing communities. Therefore, transboundary governance issues have socio-economic and environmental implications. This paper examines conflicts caused by the transboundary nature of the fisheries resources, and shows how this impacts on sustainable use and the livelihoods of those dependent upon the small-scale gill net fishery.

Study area

Lake Kariba was built in 1958 by damming the Zambezi River. The Lake surface is shared almost equally between Zambia (45%) and Zimbabwe (55%). Figure 1 shows the map of Kariba.

Maintaining sustainable use practices is very important given that Lake Kariba's small scale gill net fishery is the main source of capture fish production in the Zambezi Valley. It produces over 2000 t of fish each year. The fishery represents the most important source of food and much needed animal protein for over one million people living within the

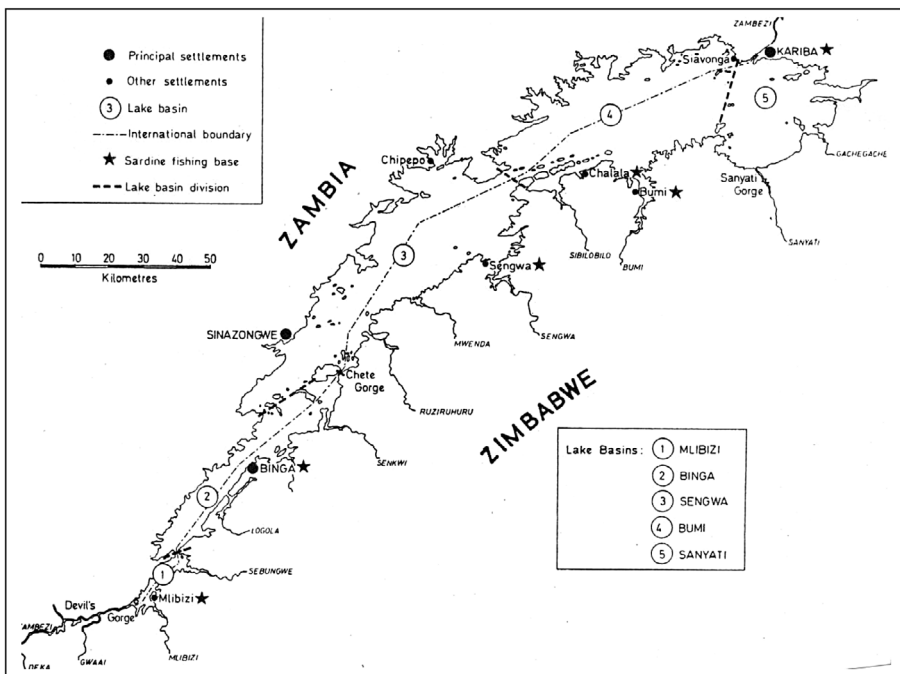


Figure 1. Map of Lake Kariba.

Zambezi Valley. Over 3000 people are employed in the fishing industry alone. The fishery also generates considerable ancillary employment and over 2000 fish traders make a living from the fishery. Fishing is the only lucrative form of business within the Zambezi valley. Fishermen are forbidden to practise any form of agriculture along the shoreline in the case of Zimbabwe and the soils and climatic conditions do not support agriculture. Therefore, the sustainable use of the fish resources and promotion of sustainable livelihoods are necessary.

Research methods

This paper presents a synthesis of preliminary research findings undertaken by the Centre for Applied Social Sciences under the auspices of the Strengthening Aquatic Resource Governance (STARGO) project, which focused on transboundary issues governing the management of Lake Kariba's aquatic ecosystem. Historical analysis was used to assess the causes of change in the fisheries management approaches over time. Events were fixed along a temporal dimension so that some management epochs could be seen as having given rise to subsequent ones. The evidence was obtained from interviewing key informants such as government fisheries officers, fisheries ecologists and economists, leaders of fishermen's associations and local leaders from both Zambia and Zimbabwe. A checklist of questions was developed to guide the discussion with key informants. The questions solicited Key Informants' views on current challenges of managing the fishery; the outcome of the current management arrangements and their view on how to improve upon the governance and management of the fishery. In total we interviewed sixteen key informants, ten from Zimbabwe and six from Zambia.

We also reviewed government documents, policies and statutory instruments governing the management of the Lake's resources. These include draft policy documents, strategic plans, Lake Combination Master Plans, the Zambia Zimbabwe SADC fisheries protocol, minutes of the Zambia Zimbabwe SADC fisheries project (ZZSFP) meetings and workshop reports, Frame Survey reports and ZZSFP reports were also reviewed. Where possible, we also tested for differences in the means of selected indicators between Zambia and Zimbabwe using inferential statistics such as Chi-Squared.

Focus group discussions (FGD) were also conducted in all fishing villages along the two shorelines during the frame surveys. In Zimbabwe, one focus group discussion was held per village – a total of 40 meetings. In Zambia, 35 FGD were held. FGD were held with fish traders, fishermen and people from different population groups (youth, women, men, and elderly). The number of participants at each meeting ranged from 8 to 12. The purpose of the FGD was to elicit the beneficiaries' perceptions regarding the state of the fishery, and the scope and nature of transboundary conflicts between fishermen on either side of the Lake. At the village level, elderly fishermen, and local leaders were also interviewed. These provided the historical and current developments of the artisanal gill net fishery.

Historical developments of the small scale fishery

Before the denudation of the Lake approximately 57,000 Tonga people were living in the Zambezi valley floor of the section that was to be inundated by the Kariba dam [7]. Of these, 22,000 and 35,000 were on the Zimbabwean and Zambian side of the river respectively [8]. Prior to the creation of the Lake in the 1950s, access to the riverine fishery resource was

open to all people on both sides of the Zambezi River. According to Scudder [7] and Balon [9], the Tonga people were seasonal fishermen and fishing was for subsistence purposes only. The idea of commercial fishing or any purpose other than subsistence was unknown to them because they were isolated from the rest of the country such that the demand for fish was low [7]. In addition, they did not have easy access to the modern fishing methods and gear, such as boats and nets. In order to exploit the fish, they used gear made from local materials. Therefore, although the Tonga people were engaged in fishing, this activity was subsidiary and developed only to a subsistence level. Fisheries management was not a key priority because the fishery was not in danger of over-exploitation.

After the creation of the lake an area of 954 km² (about 18%) of the total Lake floor was cleared of timber before flooding in an attempt to establish fishing grounds for small-scale fishermen [9]. This area was made up of 444 km² on the Zimbabwean side of the lake and 510 km² on the Zambian side. The fishery was and is based on the exploitation of fish species that are distributed along the littoral zone of the lake. The most common species are *Distichodus schenga*, *Hydrocynus vittatus*, *Synodontis zambezensis*, *Oreochromis mossambicus*, *Oreochromis niloticus*, *Serranochromis codringtonii*, *Tilapia rendalli*, *Labeo altivelis*, *Momyrops deliciosus*, *Mormyrus longirostris*, *Oreochromis mortimeri*, and *Clarias gariepinus*. These species are localized along each shoreline except in Basin 1 and 2 where the lake has riverine characteristics and is narrow [9]. It is for this reason that the small scale gill net fishery has been managed separately by the two countries [8].

During the first decade of the establishment of the fishery, the Tonga people were reluctant to increase their effort. There was no incentive to do so since the price they received for their fish was low [9]. Fishing was not a lucrative business compared to agriculture. It was not regarded as a full time activity [10]. On the Zimbabwean side, fishing camps emptied during the farming season as the fishermen returned to their homes to prepare their lands for cropping prior to the rains in November [11]. This was also the most important season when most fish species breed. There was, therefore, an unplanned seasonal closure to fishing that assisted in enhancing fish production.

On the Zimbabwean side, the gill net fishery within the Rural District Council areas is being exploited by fishermen resettled from the communities displaced by the impoundment of the lake [10]. They are currently located in over forty fishing villages along the lake. Historically, each displaced chief was allocated a fishing village, which he controlled and which was occupied by his subjects. Each village had an appointed Headman (the Sabhuku) who reported directly to the chief. In Zambia the whole shoreline falls under the jurisdiction of traditional chiefs. Besides recommending on the allocation of fishing licenses, the chief was also supposed to enforce the exclusion of other fishermen from his village. It was reported that there were cases where non-Tonga were not allowed into the fishery [12]. This system, therefore, gave the traditional leaders authority over and responsibilities for fishery management.

Emergence of state management institutions

Soon after the formation of the Lake, there was need to accommodate as many displaced people as possible, because the governments were concerned with curbing the influx of rural people into the towns [13]. On the Zimbabwean side, the number of fishermen was allowed to increase until 1978 when it was realized that although the number of fishermen

was increasing, the total yield was not and individual catches were decreasing [8]. On the Zambian side, anyone (except the non-Tonga immigrants) whom the chief allowed to enter the village could fish.

Despite the fact that Lake Kariba and its fishery resources are international resources shared by the governments of Zambia and Zimbabwe, the artisanal fisheries on either side of the Lake have been managed as separate fisheries. This is based on the notion that there is very minimal interaction among species on either side of the Lake [8]. Although it was acknowledged that in the Western section of the lake small-scale fishermen from both countries exploited the same ecosystem, there were no efforts to coordinate the fishery regulatory framework [14].

Fisheries management

According to Nyikahadzoi and Zamasiya [15], local level traditional institutions governing resource use are not readily visible to the state officials. The state took over the control of small-scale fisheries. In Zimbabwe, for all fishing grounds adjacent to communal areas, the Zimbabwean government delegated the management responsibilities to local authorities (Rural District Councils) and entry into the fishery was controlled [10]. While there was no change in the management arrangements and structures in Zambia, the Zimbabwean government's approach created a huge difference in the management of the small scale gill net fishery between the two countries [16]. Table 1 shows the differences in the entry requirements into the fishery between Zambia and Zimbabwe.

The Zambian Fisheries Policy aims to maximize fish production for the purpose of meeting the food requirement of urban workers and also to ensure employment in rural areas [17]. As many fishermen as can afford to enter the fishery are allowed to engage in gill net fishing and fish anywhere they like. According to the 2011 Frame Survey Report, there are 2716 fishermen on the Zambian side but only 621 are registered [18]. The activity of unlicensed fishermen is accentuated by the fact that the costs of a permit are negligible and not at all an impediment. The 2011 Frame Survey Report shows that 66% of the boats are locally made dug-out canoes. Easy entry and weak enforcement systems have resulted in many fishermen working without a fishing permit. The whole artisanal area of the Lake is open to gill net fishing.

On the Zimbabwean side, entry is controlled through a license system. The license stipulates where one can fish [13]. According to the 2011 Frame Survey Report [19], there are 1300 fishermen on the Zimbabwean side. Certain areas are closed to gill net fishing on the Zimbabwean side. The Lake Captain is the official from the Ministry of Transport who is in charge of Lake Safety on the Zimbabwean side of the lake. This official requires that all

Table 1. Differences in entry requirements between the two countries.

Aspect of management	Zambia	Zimbabwe
Number of fishermen per fishing area	Not defined	Specified by concessions
Entry Requirements	Open but not free	Controlled using permit system
Issuing authority	DoF with recommendation from Traditional leader	Parks on state waters. RDCs in communal areas
Fishing grounds	Allowed to fish anywhere.	Restricted to designated fishing grounds.

Note: DoF – Department of Fisheries, RDC – Rural District Council.

fishing boats should meet the prescribed minimum safety standards before they can fish. Thus, the investment costs and other legal requirements make entry into the fishery fairly difficult. On the Zimbabwean shoreline only 63% of fishable water is available for artisanal gill net fishing while the rest is closed. The closed areas are reserved for tourism and also serve as fish reserves for replenishing and rebuilding stocks in fished areas [20].

These differences in management regulations might not have a negative effect on the fishery and fishermen on either side of the lake, but conflicts have always been recorded in the narrow parts of the lake such as Basin 1 and 2 [14]. Nevertheless, both countries seem to be reluctant to resolve these conflicting approaches to small-scale gill net fishery management.

Gear specifications

Table 2 shows the differences in gear specifications between Zambia and Zimbabwe. The Zimbabwean gill net fishermen are allowed to use five gill nets which are at least 102 mm in mesh size, each net measuring 100 m long. Key informants interviews show that the Zambian fishery regulatory authorities do not stipulate the number of nets that a fisher can use. Consequently, fishermen are allowed to own as many nets as they can afford. Furthermore, the minimum mesh size is smaller than that allowed on the Zimbabwean side of the Lake. On the Zambian side, gillnets of mesh sizes below 63 mm (2.5 inch) were also reported during the 2011 Frame Survey. These nets increased from 51 in the 2006 Frame Survey to 189 in the 2011 Frame Survey [18]. The use of these nets (below 76 mm) is a concern as they are prohibited. Where the lake is narrow, Zambian fishermen will capture the fish that would have escaped gill nets of Zimbabwean fishermen. The Zimbabwean fishermen think that the regulation is not bad if fishermen from either side of the lake comply with it.

A study by Malasha [12], reports that the influx of small sized fish from Zambia infiltrated the Zimbabwean market threatening the viability of fishing in Zimbabwe. The Zambian fish market is over 200 km away from the fishing villages. This leaves the Zambian fishermen with one option of selling their fish through the Zimbabwean market. Zambian fishermen catch large quantities of small fish, which are preferred by most households, and they are ready to sell the fish at very low prices. A leader of one of the Zimbabwean fishing cooperatives working in Basin 1 reported that there were incidents when their catch would go bad as they failed to compete with their Zambian counterparts selling their fish in the Zimbabwean market [14].

Zimbabwean fishermen said that complying with the minimum mesh requirement has a taxing effect on them especially for those that share the ecological system in Basins 1 and 2 with Zambians who use smaller mesh-sized nets. The Zimbabweans argue that if they

Table 2. Differences in gill nets specifications between the two countries.

Aspect	Zambia	Zimbabwe
Minimum legal mesh size	3 inch (76 mm)	4 inch (104 mm)
Maximum length of net	Not specified	100 m
Use of Nylon (monofilament) nets	Not allowed but heavily used	Not allowed
Number of nets per fisher	Not specified	5

Source: Zambia and Zimbabwe Frame Survey, 2011.

use 102 millimetre (4 inch) nets, they catch less fish than their Zambian counterparts who use 76 millimetre (three inch) mesh-sized nets or less. The fishermen argue that the species composition is such that the most important and abundant species such as Imberi (*Brycinus imberi*) and silver catfish (*Schilbe intermedius*) escape through the 102 millimetre nets and these are mostly caught by Zambian fishermen with the smaller mesh nets.

Governance of the gill net fishery

It was realised that unilateral decisions could be ruinous for both countries especially within the Kapenta fishery. The Kapenta (*Limnothrissa miodon*) fishery is based on the exploitation of a freshwater sardine that occupies the pelagic areas of the Lake. The governments of the two countries realised that non-cooperative management of the Kapenta fishery could lead to unsustainable exploitation of the Kapenta fishery resource. But the need for cooperative management of the small scale gill net fishery was not emphasized. In 1991, the Zambia-Zimbabwe SADC Fisheries Project co-funded by Danish International Development Agency (DANIDA) and Norwegian Agency for Development (NORAD), was introduced. The project focused on both the small scale gill net fishery and the Kapenta fishery. This project helped to establish international structures for joint management and also local level structures for ensuring compliance with management regulations.

International institutional set-up

In 1999 a protocol was signed, providing the legal basis for establishing an institution for technical co-operation between Zambia and Zimbabwe. This is the 'Protocol on Economic and Technical Co-operation between the Government of the Republic of Zambia and the Government of the Republic of Zimbabwe concerning the management and development of fisheries on Lake Kariba and transboundary waters on Zambezi River' [21].

The protocol was needed because it was now understood that activities in the section of the river Zambezi shared by both countries would have an impact on the Lake [22]. The protocol formed the legal basis for setting up a joint institution between Zambia and Zimbabwe; and it could govern fiscal allocation from the two countries for collaborative activities [22]. The JFMC (Joint Fisheries Management Committee) is a bi-lateral forum for discussion of fisheries matters related to Lake Kariba. The JFMC is supposed to be supported by a team of technical personnel from the two countries who constitute the JFTC (Joint Fisheries Technical Committee).

Emphasis on the fisheries management agenda of the Protocol seems to be placed on Kapenta, which is a transboundary resource [16]. This could be because Kapenta contributes significantly to the national fish production when compared to the small-scale gill net fishery. Nevertheless the project facilitated the establishment of co-management arrangements for managing the gill net fishery and harmonized the resource monitoring systems.

Local level Institutional set-up

Both countries introduced some co-management arrangements, delegating management responsibility to local level institutions. On the Zambian side, the immediate management objective was to curb the influx of immigrants from other parts of the country [12]. These

illegal fishermen were blamed for bringing illegal gear and fishing methods such as 'kutumbula' (driving fish into stationary gill nets) in the lake [12]. It is alleged that kutumbula disturbs fish that would be spawning. On the Zimbabwean side, the immediate objective was to improve fishermen's compliance with management regulations [10].

In Zambia the new institutions led to the creation of four zones that are administered by Zonal Management Committees (ZMC). The ZMC are chaired by the traditional chiefs and deal with all fisheries related issues and land use planning. The Committees bring about the participation of gill net fishermen, *Kapenta* fishermen and fish traders. In each fishing village and below the zonal management committee, Integrated Village Management Committees (IVMCs) were established. These comprise an elected chairperson from among the fishermen, three elected ordinary members, a village headman, a fisheries assistant and a village scout appointed by Department of Fisheries. The IVMC's mandate was to control access to the fishery by vetting new entrants. The committees were also responsible for enforcing the observation and compliance with management regulations [17].

On the Zimbabwean side, government introduced Sub Area Fishermen's Associations (SAFA). Unlike the ZMC, these associations do not include other resource users in the area and have a specific mandate of assisting with enforcement of management regulations and provision of catch and effort statistics necessary for resource monitoring. Each Sub Area Fishermen's Association was given an exclusive fishing zone to manage. SAFAs are small units composed of four to six adjacent fishing villages. In each village, three people are chosen to serve as resource monitors. The duties of the resource monitors include assisting with law enforcement and collection of catch and effort statistics. Traditional authorities were also consulted to ensure that priority was given to original inhabitants of the Zambezi valley before inundation. This probably was informed by Muriritirwa's observation [21] that if these traditional institutions were marginalized, that could lead to a lack of strong, properly functioning local institutions, able to liaise with government structures and bring people together for more participatory management of the artisanal fishery. We observed that most of these SAFAs ceased to function for lack of external financial support, during Zimbabwe's decade of economic meltdown. Only a few SAFAs are still operational on the Zimbabwean side. Thus, there is an institutional gap that needs to be filled for resource users' participation in fisheries management on the Zimbabwean side [23].

Our discussions with key informants revealed that, in both countries, small-scale fishermen are assisting the government in collecting catch and effort statistics necessary for resource monitoring. The two governments believe that fishermen could improve compliance with management regulations through improved community enforcement [24]. It was also hoped that with an improved sense of resource ownership, fishermen would keep a vigilant eye on free riders and those using illegal fishing methods. We found, however, that there was no effort to harmonize the management regulations on either side of the Lake. The uncoordinated and conflicting management approaches and strategies are likely to have some ruinous environmental and socio-economic outcomes.

Outcomes

The question is whether the new institutional set up can meet the overarching goal of fisheries management: the long term sustainable use of the fishery resources. Sustainability includes sustainable use of the fishery, willingness of the users to comply with management

regulations, and reduction in transboundary conflicts. The discussion is based on both our interpretations of emerging trends of key indicators and discussions with other researchers, government fisheries officers from both Zambia and Zimbabwe, leaders of Fishermen's Associations and Zonal Management Committee chairmen.

Sustainable use of the fish resources

There is debate on whether human activities have an impact on the fish. Some scholars [24–26] argue that in tropical fisheries, the relationship between current behaviour and the size of the future stock is very weak and characterized by uncertainties, such that a fixed level of fishing effort will not lead to a fixed level of fishing mortality. The stock size is influenced by environmental factors such as river flows and lake level that are in turn influenced by the amount of rainfall received upstream.

During the FGD Zimbabwean fishermen reported an increase in catch over the last five years. They attributed this increase in catch to the increase in the number of escapees (Nile Tilapia) from the cage culture project on the Zimbabwean side of the Sanyati (Eastern) Basin (Basin 5). It is therefore envisaged that as cage culture enterprises increase, catches will continue to improve. The exotic Nile Tilapia (*Oreochromis niloticus*), now constitutes more than 50% by weight of the fish caught by the small scale fishermen. In Zimbabwe, while they record the fish only as Bream, a visual observation of the fish as well as feedback from the fishermen, show that the dominant Bream species is the Nile Tilapia. This change has both ecological and socio-economic implications. Admittedly, the introduction of Nile Tilapia reduces biodiversity. But since the occurrence of this species fishermen have changed from using the smaller mesh nets (such as the 76 millimetre/3-inch nets) to the larger mesh nets (such as the 102 millimetre/4 inch and the 127 millimetre/5 inch nets). This is because the exotic Nile Tilapia grows to a larger size than the indigenous Breams such as the Kariba Bream (*Oreochromis mortimeri*) over the same period of time.

Economic sustainability

The ability of the artisanal fisheries resources to support the level of economic production is normally assessed by the question whether the fishermen are exceeding sustainable economic yields [27]. Unfortunately, no economic studies were undertaken that could allow us to measure changes in economic returns from the fishery in the last ten years. It may be said with confidence, however, that if the current densities and rate of increase in gear are not stopped and in some cases reversed, the artisanal fishery will experience gear congestion, transboundary resource use conflict and possible recruitment overfishing.

In Table 3, using Pearson Chi Squared, it can be shown that there is a statistically significant difference in gear congestion between Zambia and Zimbabwe. This implies that gear is more congested on the Zambian side of the Lake than on the Zimbabwean side. In fisheries, gear congestion has been blamed for gear entanglement and loss, and resource wastage [28,29].

As shown in Table 4, the current rate of increase in gear is such that nets and number of fishermen are likely to double in the next five years on the Zambian side. With intensification of exploitation, catch is expected to increase marginally, but catch per fisherman would decrease. In essence, it is likely that economic overfishing will occur before

Table 3. Differences in densities of selected indicators between Zambia and Zimbabwe (2011).

	Zambia density (per km ²)	Zimbabwe density (per km ²)
Fishermen	53	3
Boats	4	1
Nets	52	10

Source: Zambia and Zimbabwe Frame Survey, 2011.
Chi Squared = 8.975, *P* value = 0.0083.

Table 4. Differences in rate of increase of selected indicators between the two countries between 2006 and 2011.

Increase in the last 5 years	Zambia (%)	Zimbabwe (%)
Total number of fishermen	66	-9
Total number of nets	72	41
Total number of boats	1.2	-7

Source: Zambia and Zimbabwe Frame Survey, 2011.
Chi squared = 11.394, *P* value = 0.0013.

recruitment overfishing. In fact, Catch per Unit of Effort is higher on the Zimbabwean side at 1.29 kg/100 m of gill net (Tendaupenyu, *pers. comm.*) than the 0.06 kg/100 m of gill net on the Zambian side [18]. This observation supports the Zambian small scale fishermen's contention that catches are better on the Zimbabwean side than on the Zambian side.

It is evident from current catch per unit of effort trends for most of the Zambian fishermen that fishing households cannot rely solely on economic returns from small-scale fishing. While economic overfishing is localized, some Zambian fishermen usually cross to the Zimbabwean side to fish. According to key informants, there has been an increase in the number of Zambian fishermen caught fishing on the Zimbabwean side. Other economic activities such as farming and livestock rearing on the Zambian side are meant to ease pressure on the gill net fishery resource. The scale and yield of the livestock and crop production is very low, however, and so fishing pressure will continue to increase in the short run.

Although in Zimbabwe catches have been improving over the years, fishermen cited difficulties in translating catch to income because of low prices through low demand. Most fishing villages are in remote areas with very limited accessibility. The few fish traders that frequent these camps usually barter fish for used clothes and basic foodstuffs.

Social sustainability

The sustainability of the social system is normally assessed with the question whether users feel they now have an increased sense of ownership of the resources [30]. This question prompts resource users to be vigilant against free riders and users of destructive fishing gear [10]. It also encourages participation of resource users in the management of the resource and compliance with management regulations. A related question about sustainability is whether the institutional structure can resolve transboundary resource use conflicts. ZMC on the Zambian side address issues related to the Zambian side of the Lake, while SAFA on the Zimbabwean side concentrate on fisheries matters along the Zimbabwean shoreline [14]. The approach is guided by the strong notion that there is no interaction between species on the Zambian and Zimbabwean sides. Co-management arrangements forged under the

ZZSFP are ill-equipped to deal with transboundary management challenges, as they are not extended to include cross-border cooperation (unless issues are referred to the Joint Fisheries Management Committee). Although the Protocol allowed for the co-opting of representatives of the artisanal fishery as ex officio members of the Joint Fisheries Management Committee, such provisions were not implemented, mainly because the Protocol was not fully funded.

As noted in Table 3, the density of fishing gear is higher on the Zambian side than on the Zimbabwean side. In order to ease gear congestion, it has been reported that there is an increase in the number of Zambian fishermen arrested for fishing on the Zimbabwean side, particularly those areas serving as breeding areas and fish reserves. The Zambian authorities alleged that those fishing illegally are the non-Tonga who camp on islands and fish in any part of the lake [16,17]. These fishermen bring smaller mesh-sized nets than those recommended on the Zimbabwean side. It seems the new institutional system is weak in enforcing exclusion of potential new entrants.

In these circumstances, it is difficult to convince Zimbabwean fishermen that they should co-manage the fishery. They do not believe that sustainable benefits will accrue to them alone. Restraints on the exploitation today in the interest of having more tomorrow will result in gains that will be totally dissipated by their Zambian counterparts. Fishermen are therefore aware that individual restraint today cannot be capitalized in individual gain tomorrow. Users in different countries might have a sense of ownership of resources along their national shorelines [10,14]. But users on both sides of the lake feel powerless when it comes to regulating non-sustainable harvesting methods that are practised on either side of the lake. The folding up of most of the SAFAs has left an institutional gap. There is no local level structure to enforce exclusive rights to the fishery resources.

Using Pearson Chi squared test, results in Table 4 show that there is a statistically significant difference in rates at which fishing gear has increased over the years. Although there is a decrease in the number of fishermen on the Zimbabwean side, it is notable that 65% of these joined the fishery less than five years ago [19]. Table 4 shows that there are a high number of new entrants in Zambia. These new entrants were not part of the group that received fisheries management training during the inception of the co-management arrangement. Consequently, these new entrants do not react to given management prescriptions in the same way as their counterparts who received training.

Conclusions

The assertion that exploitation of the gill net fishery on the Zambian side of the Lake does not necessarily have a significant effect upon the harvesting opportunities on the Zimbabwean side is not correct. The governments of the two countries acknowledge that in areas where the Lake is narrow with riverine characteristics such as Basin 1 and parts of Basin 2 (see Figure 1) there is need for cooperation. The statistics in this paper show that Zambian small-scale fishermen exert more fishing effort but catch per unit of effort is much lower than that for Zimbabwean fishermen. If this disparity continues, it is most likely that Zambian fishermen will be worse off. This leads to further encroachment on the Zimbabwean fishing grounds. Therefore management of the small scale fishery as if fish do not cross international boundaries overlooks the fact that fishermen are hunters and will cross these boundaries in search of good catches. Differences in fish distribution are

also likely to introduce strategic fish harvesting techniques leading to more resource use conflicts. It is likely, however, that stock will become less available and thus harvesting costs will increase. It is important, therefore, that both countries adopt an ecosystem approach in the management of the small-scale gill net fishery.

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