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## Co-management driven enforcement of rules and regulations on Lake Tanganyika, Zambia

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### Abstract

The economic gains from illegal fishing are high in the face of growing demand for fish. Resources are declining; fisher community conflicts are increasing. Increased enforcement is the policy option chosen to improve compliance with rules-in-use among fishers. A study was conducted to investigate effectiveness of enforcement of rules and regulations under co-management on Tanganyika. The study was conducted in the two districts of Mpulungu and Nsama in Zambia. A total of 568 respondents were sampled at 5% confidence interval and 95% levels of confidence. Information/data was collected using structured and semi-structured interviews, and focus group discussions. Analyses were run using SPSS computer software and Classical Content Analysis. Results of the study revealed that the policy option is faced by challenges associated with resource (human and financial) availability. The study recommends appropriate organisational and institutional structural development adequately tailored to drawing fishers into processes of management for improved compliance behaviour.

**Keywords:** Stakeholder, co-management, compliance, enforcement, regulations

### 1. Introduction

Resources of Lake Tanganyika are not isolated from overexploitation, a source of common negative consequences for most fisheries in the country. Reports have confirmed that fish catches have declined over the years <sup>[1, 2, 3]</sup>. Among the major explanations for this decline is probably excessive fishing effort, coupled with destructive fishing practices <sup>[4, 5]</sup> resulting from common-property of and free access to the resources. Excessive fishing effort leads to economic overfishing which if not checked tends to result in biological overfishing. Further, studies conducted on Lake Tanganyika have also linked the decline in fish catches (e.g. the Lake Tanganyika clupeid species) to decrease in primary productivity associated with the strength and timing of nutrient upwelling and related plankton succession attributable to climate change effects <sup>[1, 5, 6]</sup>.

The past decade or so has witnessed the introduction of more progressive and efficient fishing techniques that demand more acute stock management policies <sup>[7]</sup>. A major challenge associated with fisheries rules and regulations worldwide is to find better ways of enforcement to facilitate resource sustainability and promote economic efficiency. A fact well known in fisheries is that if fishers are intent on circumventing the regulations, they can hardly be stopped, irrespective of the stringency of the regulatory system. Rules on fishing begun with the colonial masters though at the time demand for fish and population density were low – meaning that pressure on the resource was proportionally low as most fishing was primarily for subsistence. The Fisheries Act of 1974 placed fishery management responsibilities in the national government, with no provisions for community involvement. However, all types of fisheries regulations have to be based on a minimum of legitimacy in order to be effective <sup>[8]</sup>. The creation of legislation which is either unenforceable or incomprehensible or unacceptable by fishers has also been shown to have the potential to rapidly destroy the credibility and support for government in its efforts to conserve fisheries resources <sup>[9]</sup>.

Among other drivers, on theoretical assumption that fisheries co-management interventions put local resource users in a pro-active role, Zambia adopted fisheries co-management approach to fisheries management on Lake Tanganyika in the 1990s under the auspices of the Lake Tanganyika Biodiversity Project (LTBP). The project facilitated formation of Village Conservation and Development Committees (VCDCs) in lakeshore communities <sup>[10]</sup> with a

view to improve the fish stocks through local resource user enforcement of fishery management regulations. However, overfishing and use of unsustainable fishing methods by local and industrial fleets <sup>[4]</sup> leading to progressive decline in catches, disappearance of valuable species and existence of resource use conflicts have continued in the presence of currently prescribed management possibilities. This study aimed at determining the extent of effectiveness of fisheries co-management institutional structures in enforcing rules and regulations on Lake Tanganyika, Zambia. It provides some insights into challenges and proposes some ways forward.

## 2. Materials and methods

### 2.1 Study area

This study was conducted in the two districts of Mpulungu and Nsama accommodating 83 riparian fishing villages with 98 fish landing sites dotted along southern Lake Tanganyika on the Zambian water front. The shoreline is not only divided into four strata between the two districts but also shared among six Chiefs namely; Tafuna, Chitimbwa, Nsama, Zombe, Teleka and Chomba Wakasaba.

### 2.2 Sampling protocols

The study sampled both fishers and non-fishers using Rea and Parker's <sup>[11]</sup> table of number of respondents to interview. A total of 568 respondents were sampled at 5% confidence interval and 95% levels of confidence in order for the results to be used to generalize to the population and to make data-driven decisions. The study capitalized on the existence of strata for more statistical precision by sampling proportional to strata populations. Besides respondents for the fisher and non-fisher surveys in fishing villages, 36 key informants were purposively sampled in the research site. To overcome the statistical weakness of non-random sampling, the researchers selected respondents who represented different perceptions and viewpoints. This increased confidence that the information captured represented the whole group. This approach was most useful for the six focus group discussions (FGD) composed of village elderly men and women, youths, traders, transporters, community leaders and fishers. The obvious limitation to this approach is the possibility of bias in the selection of people. Information/data on rules and regulations, use rights, leadership, conflict, surveillance, enforcement, and compliance was collected using structured and semi-structured interviews, and focus group discussions over a 12 month period between January 2014 and February 2015.

### 2.3 Data analysis

In analyzing the information/data, more attention was paid to attaining a basic understanding of trends and changes affecting fisheries and less on highly quantitative models. This was on the basis that some fisheries stakeholders expressed the opinion that it appears that scientists are only interested in the data but not the knowledge that underpins it <sup>[12]</sup>. Most analyses for this study were run using SPSS to generate frequency counts and percentages. FGD data was analyzed using Classical Content Analysis by way of the content of discussions examined for meaning and particular implication.

## 3. Results and Discussion

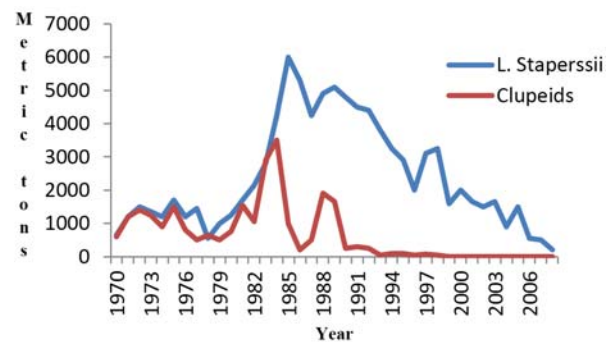
### 3.1 Fish catch, variety of fish, gear and fishers

Present-day fishing operations on the Tanganyika primarily exploit six endemic species of which the two are schooling clupeids namely; *Limnothrissa miodon* and *Stolothrissa*

*tanganicae*, and the four are centropomids of the genus *Lates* namely; *L. stappersii*, *L. angustifrons*, *L. mariae* and *L. microlepis*. Of the *Lates* species, the last three are progressively diminishing in the catch. However, obtaining reliable catch and effort data has been a challenge especially on the small-scale fisheries of Lake Tanganyika.

Most of the shifts notable on Lake Tanganyika are realized through frame surveys. Successful frame surveys conducted on Lake Tanganyika were by regional projects in 1993 and 1997 with an inconclusive one done by DoF in 2005 and then the recent one in 2011. This study compares some of the findings from the frame surveys of 1997 and 2011. The number of fishers on the fishery increased by over 100% from 4118 in 1997 survey to 8430 in 2011 survey. FGDs pointed out that the numbers of Ring, gill and Mutobi nets have also increased tremendously alongside the traditional units (longlines and hook and line) that dominate fishing types. The fishers have over the last decade devised mechanisms that have remarkably increased efficiency of single units. This implies a drastic increase in fishing effort on the fishery. In 2011, the fishery had 2,327 active boats, of which 258 were motorized (11.1%) and 111 of the marine engines were in stratum II, an area covering most of the fishing villages within and around Mpulungu Township, representing 43%. This was mainly attributed to increased growth in the lake basin population.

Figure 1 below gives indication of the state of affairs on the basis of industrial catches for commercially caught fish in Lake Tanganyika, based on data captured for the period 1970 - 2008. The data set represents a period pre- and post-co-management implementation. Two scenarios characterize the period; a drastic increase in catches pre-implementation followed by a drastic decline post-implementation of the initiative.



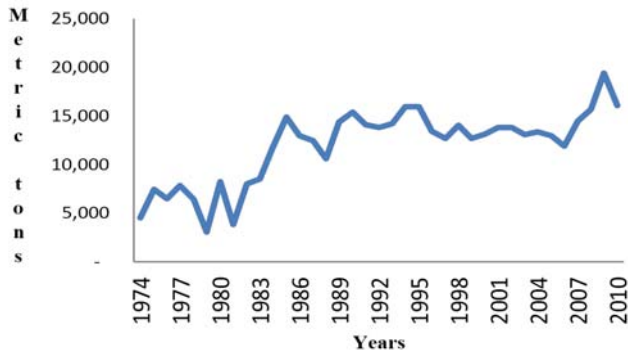
**Fig 1:** Fish catches in Zambian waters of Lake Tanganyika in respect of Mpulungu industrial fishery (1970 - 2008)

**Source:** Kangwa *et al.* <sup>[14]</sup>

The first impression given by the figure is that species in question are depleting and under very high fishing pressure. However, key informants attribute the behavior of the curve to recruitment of commercial fishers (e.g. from 3 to 23 active commercial units around 1983) and their subsequent withdrawal due to declining profitability and increasing competition with the artisanal fishers in the deep waters that were previously monopolized by the commercials alone (per. com. by Mr. Rodwell Chifunda, Fishery Committee Chairperson, 2014). The drop is a data disparity i.e. data collected from the commercials dropped because they slowly begun to withdraw from fishing. In the study site, over 90% of industrial fishers have stopped fishing. This crudely implies that the stock levels got so low that it was then uneconomical

for most of the industrial fishers to go fishing. They resorted to buying fresh fish from the small scale commercial Ring and Mutobi net fishers. As a result, the number of Ring and Mutobi net fishers has increased immensely and have virtually replaced the commercial fishers. Although the Ring and Mutobi net fishers may claim the availability of cheap labour and shared cost of operation, the majority are illiterate to fully understand and appreciate profitability.

Figure 2 combines small-scale and commercial catch and gives an impression that the fishery is well. For example, the sharp increase in the curve between 2007 and 2009 was attributed to an inflow of foreign fish from neighboring Tanzania because it fetched good prices and size restrictions were loosely observed in Zambia.



**Fig 2:** Commercial and small-scale fish catches in Lake Tanganyika in respect of Zambia (1974 - 2010)

FGDs, through a matrix timeline, indicated that fish catches have declined progressively over the last 15 to 20 years. They referred to declining catch per unit effort (CpUE) i.e. how much fish goes to every fisher on every fishing trip has reduced drastically. Therefore, although total catches show an increasing trend (fig. 2), CpUE for industrial units had been declining<sup>[1]</sup>. For example, the nightly CpUE of industrial units in Mpulungu dropped from 877 kg in 1994 to 535 kg in 1996 and the trend virtually continued to 45.25 kg in 2014<sup>[1, 15]</sup>. Declining catchable stocks of *L. stappersii* in southern waters, especially around the vicinity of Mpulungu, are reflective in the significant withdraw of industrial fishing companies due to declining CpUE, increased duration of fishing trips and juveniles accounting for most of the catch. In this case, although data shows that catches increased per unit effort, fisheries informants attributed this increase to an increase in the data collection horizon via the massive emergence of small-scale commercial fishery based on Ring and Mutobi nets.

Conventional management thinking tends to consider growth of effort as inevitable and relates it to social factors such as demographic growth (population driven) and an expanding demand for fish (investment-driven)<sup>[16]</sup>. Fishing regulations on the Zambian shoreline do not place any limit to the number of nets a fishermen can own. Rather, they have been “open access”, free for all entrants. There are now more gears and fishers than the fishery can possibly sustain... Banda *et al.*<sup>[17]</sup> stated that when a fishery is “everyone’s property, it is no one’s responsibility”, the “tragedy of the commons” sets in. There is a need, therefore, to revisit the license revenue system as a tax base for funding rehabilitation of the fisheries<sup>[17]</sup>.

Fishing gear technology is also advancing in efforts to improve individual’s catch. FGDs revealed that most of the nets had illegal mesh sizes. As a result, catches are dominated

by juveniles and immature fish. If not checked, these have the potential to reduce future production levels besides eliminating breeding stocks. The rampant use of illegal gear on stock that already suffered excessive exploitation is an indicator of poor enforcement of regulations by enforcement agents and this implies failure of co-management institutions to regulate fishing effectively.

### 3.2 Rules and regulations

Oral history revealed that rules on fishing begun with the colonial masters. In exercise of the powers contained in section sixty-seven of the Fisheries Act of 2011, a statutory instrument<sup>[15]</sup> was made so as to make regulations for better carrying into effect of the provisions of the Act. Besides the provisions of the Act, the study revealed that there were also location specific rules in isolated fishing villages on Lake Tanganyika. Key informants stated that rules and regulations have over time gained flexibility to address need for change yet some have not been simple. However, simple regulations and rules would assist those affected to easily understand and possibly comply. Strong demands were made by FGDs towards the need for good communication between the enforcement unit(s) and the Tanganyika resource user groups.

The commonly observed rules and regulations as spelt out by the key informants and focus groups include the following: i) prohibited fishing methods that include beach seining, fish poisoning, “Kutumpula” and use of explosives. According to the Fisheries Act, “Kutumpula” means any fishing method whereby fish are driven into a stationary net or monofilament net or trap. Beach seines are non-selective draw nets. Ring and Mutobi nets are sometimes being used as drag nets. Gill nets have been combined with methods that scare fish into such nets – e.g. “Kutumpula” method; ii) prohibited fishing equipment includes mosquito nets, empty potato bags, chitenge materials, beach seines, monofilament gill nets and undersized meshes. Prohibited fishing equipments are in rampant use in some portions of the lake especially where monitoring for defaulters is poor. The effects of their use are devastating on both the species and the environment. However, this study revealed that where enforcement units have had impact, fishers have in fact given up prohibited gears and resorted to owning more of the other gears – taking advantage of the fact that there is no limit on the number of gears an individual would possess. This is a compensatory effect for loss of prohibited gear; iii) prohibited fishing areas are provided for in the Fisheries Act. Chitili, Kasakalabwe and Nsumbu National Park are the gazetted fish sanctuaries on Lake Tanganyika. Chituta bay is traditionally known to have been a prohibited fishing area which has now been encroached and not considered as one anymore because it happens to be one of the critical production areas on the lake hosting an overwhelming gillnetting fishery for bream species. Similarly, Kasakalabwe bay riparian community has generally not observed it as a breeding area. This is attributed to non-general consensus towards its establishment. Perhaps the major reason for its choice as such was on the basis of its being a beautiful site for conducting most under water research works by visiting researchers mainly from Switzerland, Austria and Japan who have signed Memoranda of Understanding with the Zambian government. A few other potential sites for sanctuaries were mentioned during FGDs - this somewhat gave indication of an understanding of the importance of such areas (e.g. fish breeding areas) on a fishery like Tanganyika that does not observe fishing ban at any point in a given year

except for lunar breaks. It was also felt that if the locals themselves see the need to designate such areas, they would observe and monitor the activities around them.

Compliance with acquisition of licenses is poor and this was explained by lack of regular monitoring. Although not substantiated with good enough facts, most fishers using ring nets have complained about the annual license fee of around US\$ 200 as being exorbitant. Ring netters operate at a large scale considering that they use motorized vessels and invest heavily in terms of amounts of fuels used, long distances covered to fishing grounds and huge numbers of crew. Mutobi and gill net operators are charged around US\$ 20. Those using hooks and lines and other very traditional methods, though covered in the SI, have been very difficult to deal with except for those that are into recreational fishing.

In the political ecology context, Johnson<sup>[18]</sup> emphasizes that it is important to realise that natural resources are not simply limited goods whose access is unrestricted and open to everyone, but that they are 'governed by rules of common property.' On Lake Tanganyika, rules are somewhat nested in other sets of rules, formal and informal, that define their success with regards how they are observed.

### 3.3 Enforcers of rules and regulations

Enforcement is obviously needed to make rules and regulations effective. The study revealed 92.3% of the fishers claiming that Department of Fisheries (DoF) enforces the rules and regulations that are meant for implementation whereas Police (2.4%), local leaders (3.7%) and members of local co-management organizations (e.g. VCDCs) (1.6%) contribute their efforts minimally. A similar pattern was revealed by non-fishers where 86.8% claimed that DoF enforces the rules and regulations, 4.2% Police, 4.2% local leaders and 4.2% VCDCs.

In agreement with claims by one-on-one interview respondents, key informants pointed out that DoF is to-date perceived by most fishers as the legitimate owner of fishery resources and hence the strong feeling that they should enforce. More so the DoF is responsible for the enforcement and regulation of the Fisheries Act cap 22 of 2011 of the Laws of Zambia. Key informants claimed that DoF is an authority to procedure pertaining to enforcement while the other players would only come in to assist. For example most local co-management groups often claim they are enforcing on behalf of government. In some instances fishers, with prior experience in traditional community-based systems, have instituted penalties in their communities within their own by-laws. Key informants insist that for enforcement at village level to be effective, volunteer scouts or VCDC members should be motivated by way of especially an allowance when they have brought wrong doers to book. They claim that the job of enforcement can be risky. This is in line with findings by Pomeroy *et al.*<sup>[16]</sup> that the success of co-management hinges directly on an incentive structure that induces various individuals to participate considering the high costs in terms of lost income or voluntary labour.

The informants blame the poor commitment by especially the VCDCs largely on insufficient involvement of local resource users by the authorities. However, focus groups seemed to realize that vigorous, fair and sustained law enforcement requires collaborative participation of all fishery stakeholders i.e. local informal enforcers (e.g. local leaders) and formal enforcers (e.g. DoF, police, Zambia Wildlife Authority (ZAWA)). DoF has been challenged by a situation where

officers have dual functions of extension and those of enforcement. This has tended to create conflicting reactions from the communities. These two functions are better separated - by creating a standalone enforcement unit in order to maintain necessary working relationships. Police should actively be co-opted due to the perceived risk of undertaking law enforcement patrols, especially during night time, unarmed. This should be more so because policemen are specially trained to handle uncompromising situations. While advocating local participation, to ensure objectivity, key informants emphasized the need to always back up local enforcers stating that the willingness to comply has more to do with the perceived legitimacy of the authorities charged with implementing the laid down regulations.

### 3.4 Cost of Enforcement

Enforcement has a cost to it but if ignored the entire management system can be endangered. Respondents had a mixed perception based mostly on location of stratum or fishing village proportional to the DoF offices. More knowledge of cost was dependent on the relative interaction between DoF officials and the fishers. Villages with active VCDCs also seemed to hold information about the cost to enforcement. The study revealed 10% of fishers and non-fishers claiming that the cost of enforcement is very high, 37 - 44% that it's high, 25 - 27% that it's low, 11 - 12% that it's very low and 8 - 16% that they did not have clear knowledge relating to cost.

Similar to findings by Ali and Abdullah<sup>[7]</sup>, DoF staff interviewed pointed out that increased enforcement activities can remarkably reduce non-compliance behavior among fishers but there are resource limitations. These informants attributed high enforcement or policing costs to extensive policing areas, e.g. a round trip covering the stretch of the lake on the Zambian side demands roughly up to US\$ 15,000 in fuels, allowances and other provisions. However, the budgetary allocation to DoF for enforcement is so low that the task is always poorly addressed.

Currently, the fishing community is presumably the primary beneficiary from the fishery resources while the predominant provider of services is the government via DoF, which also, bears most if not all of the costs. Links between the costs and benefits of fisheries management are largely absent but surely need to be established. Key informants claimed that what is needed is to implement enforcement more effectively through the existing mechanisms. For this to be possible there is need for institutional support via training and funding.

### 3.5 Punishment of law breakers

Since it is difficult to physically bar potential beneficiaries from accessing the resource, human beings will remain morally imperfect and should be disciplined. FGDs pointed out that in the presence of over-capacity, the economic motive increases the probability of violation via illegal fishing. This implies that the urge to increase profit can be a driving force for violation. In Part IX (General Provisions), Section 61, the Fisheries Act No. 22 of 2011 provides a general penalty for breach of the Fisheries Regulations. These range from fines to imprisonment or both depending on the gravity of the violation and the discretion of the judge. The one-on-one study results revealed 10 - 13% fisher and non-fisher respondents claiming that punishment of law breakers was very severe, 35 - 42% severe, 26 - 29% mild and 27% absent. Severity was measured from a few 'unlucky' fishers that respondents cited as

examples within their localities. They indicated that this was, however, a rare occurrence because it takes DoF officials a very long time to organize and undertake law enforcement patrols. Key informants revealed that the decision to break law was based on an individual's calculation of the economic gain they would obtain from by-passing the regulation compared to the likelihood of detection despite the severity of the punishment.

Despite severe punishments instituted on the culprits caught in the reserve for example, numbers of violators are not reducing. The Officer in Charge of ZAWA in Nsumbu National Park stated that mere entry into the national park attracts two years imprisonment and being found with an article attracts five years. However, this is at the discretion of the magistrate. Some of the offenders only receive education about facts of the rules of the game pertaining to national parks and lake reserve areas. The typical odds of being caught violating fishery regulations by DoF are very low and relatively higher by ZAWA when a fisher operates in the fish reserve area in Nsumbu National Park. Monetary penalties have generally not been large relative to illegal gains. For example, in the beach seine fishery, it is estimated that violators gross between US\$ 3,500 and US\$ 7,000 per trip. When caught and sanctioned for such violations, the typical maximum penalty on the basis of the Act is US\$ 3,000 in monetary fines. FGDs confirmed that no one has ever been charged anything close to that amount. This therefore, implies that the illegal gains are greater than the gains from legal fishing.

Violators on Lake Tanganyika have in the recent past often been charged minimal penalty fines or their gears and undersized fish confiscated. Keeping violators off the water for a few weeks during the fishing season is a common penalty used especially on those fishers found fishing in prohibited areas or practicing illegal fishing using legal gear. This is more of a direct economic penalty as a consequence of breaking rules. Together with the Police and Courts, DoF disposes off some of such articles. Disposal of illegal gears though ordered by the court of law or Council Secretary (class three magistrate), their destruction would normally be done by the royal highnesses. Mere people, including fisheries officers, have received threats of being bewitched if they ever burnt such gears. Nonetheless, the ultimate implication, as drawn from the assumption of regulatory imperfection is that not all violators are punished, especially those fishers violating for the first time. The local court is not willing to mete out sanctions perceived as excessively severe so as to cause social harm.

Fishers are capable of corruption in the midst of weakness among enforcers. FGDs suggested the possibility of mobile fast track courts in order to instantly pass judgment upon the culprits. This follows observation where illegal gears that are confiscated are sold by arresting officials and are sooner or later seen again on the lake. A lasting solution is required in order to bring to book every wrong doer along the entire process. Perhaps there is need for stiffer penalties to both the fishers and the law enforcers when found wanting. This is because individual's perception about the other person's violations influences the decisions to violate.

### 3.6 Resource use rights

Laws, traditions and customs are equally important on Lake Tanganyika. The Fisheries Act designates rights to a Fisheries Management Area. In principle this implies that fishers of a particular fishing village, under the leadership of a VCDC, are granted rights to fish in the fishing grounds belonging to that

village. Such grounds are usually restricted to near vicinities of the shoreline. However, these rights extend beyond village boundaries as fishers, under open access conditions, are free to fish anywhere on the lake except in restricted areas such as the national park and other designated fish breeding areas. This right is compounded by acquisition of a fishing license that permits or rather grants power to fish anywhere within the boundaries of the fishery's waters.

Written laws seem to override non written customary rules and procedures in controlling tenure rights in Zambia. It should, however, be noted that the governance of fisheries tenure has sometimes been a customary matter regulated by the rules of local customs and approaches. The two systems have operated in parallel except the formal system is more in areas that are frequented by fisheries officers. The two systems overlap, with formal ownership established under the legal system, but customary rights applying effectively in some areas. With establishment of the Ministry of Chiefs and Traditional Affairs, it is envisaged that customary systems and institutions might receive attention pertaining to statutory frameworks. Fishing communities need secure use rights to the fishery resources that form the basis of their livelihoods. These rights should include both use rights and management rights. Management rights involve the right to participate in the management of a fishery.

### 3.7 Boundary-based enforcement of use rights

Though not clear, through co-management, communities of resource users are given the power to control use rights. VCDCs and village heads maintain registers of fishers in their respective villages. These are considered legal fishers because by virtual of belonging, they are agreeing to the terms and conditions of conduct towards resources as defined by that fishing village. Village boundaries are normally clearly defined on land but not on water. Some people would want to fish without restrictions claiming that fish is God given and therefore meant for whoever lives by the shorelines and beyond. However, despite its apparent plenitude in the eyes of such proclamation, fish is a finite resource, and the reality of this fact is becoming increasingly tangible in most attractive fishery areas on the lake. In any case, without legally supported property rights, resource users have no standing to enforce their claim over the resource against outsiders <sup>[19]</sup>.

### 3.8 Conflicts with regards use rights

Fisheries resources of the Tanganyika are multi-species and are harvested by a heterogeneous ethnicity as well as a multi-gear fleet. Fishing has become highly competitive and arguably beginning to have an inherent tendency to generate conflict over access to resources and fishing grounds among those operating in the fishery. Among the fishery groups there is conflict between the Ring net operators and fishermen using other gears. The other fishers leaving aside their own illegal practices blame the marked depletion of fisheries resources and destruction of critical habitats on Ring net and beach seine operators. Conflict has arisen between beach seine and gill net operators. Beach seine operators have often times dragged gill nets in their way during operations. There is also mounting conflict between ring net operators using generators and those using Tilley lamps for light fishing. There are huge claims that those using 'gen-sets' are causing damage to the stocks by attracting too much fish via their high light intensity. The informants argue that conflict among fishermen has intensified with the fish output becoming increasingly unsatisfactory.

Other sources of conflict have arisen due to massive migratory movements of fishers in pursuit of fish. Some of such migrant fishers have struck private deals with village leaders to gain access to fishing grounds. There is sometimes little or no accountability by leaders or heads granting such rights to operate. Sometimes migrant fishers get rights to operate illegal gear or even use wrong fishing methods. Other community members are not happy with such discretionary powers handed to leaders and heads. Such practices are also against odds of the DoF. Key informants lament that even local community leaders are sometimes engaged in the illegal activities that are undertaken on the lake yet expected to be lead persons in ensuring that illegalities are contained. This represents conflict of interest. These conflicts have occasionally spilled over into physical violence.

This study uncovers a chieftainship wrangle between His Royal Highness Senior Chief Nsama and 'Sub Chief' Teleka of Nsama district over jurisdictional powers of stratum IV of the lake. Another area of conflict is in the perceived non-equal justice on violators. Politicians inciting fishers to disobey regulations especially during campaign periods challenges implementation of regulations and rules by DoF. However, Zwieten *et al.* [6] claims that any management regime is political in the sense that it includes some and excludes others from access to valuable resources and that this is an ongoing struggle in all types of fisheries. However, the absence of internal disruptions rooted in political, social and economic factors is a condition for successful co-management [19].

### 3.9 Conflict resolution process

While conflicts are a normal part of human existence, there is need to consider arbitration and resolution when such conflicts arise over co-management and/or institutional arrangements. Most conflicts are reported to government (i.e. DoF and Police) with some presided over by the village committee headed by village heads, VCDC leaders or neighborhood watch groups as mediators who can objectively assess and propose solutions. FGDs criticize heavy reliance on the government to resolve conflicts revealing that most conflicts have gone unresolved due to long distances to government institutions located at district civic centres. While discussions suggest that the government be used as an appeal body, FGDs composed of informants based within near vicinities to civic centres find it worthwhile to use such institutions more often. However, an effective dispute resolution mechanism needs to be available for issues that cannot be resolved through a consensus-based consultation process. The mechanism thereof should contain skills that can help people to express their differences and solve their problems for mutually beneficial outcomes. For instance, interference by politicians in the operations of DoF should be checked. It appears there is need to consider the political changes that are necessary for power devolution because the success of compliance and enforcement models is directly related to organizational capacity.

### 3.10 Monitoring mechanism

Fisheries monitoring is important to make sure there are no violations of government or community rules in order that the stock is not over-fished. Monitoring the system of users allows for communication, adaptation and change. The study revealed 41 - 44% fishers and non-fishers claiming that there are monitoring mechanisms as an enforcement strategy in the fishery, 41 - 42% claimed that mechanisms did not exist while 13 - 15% claimed that mechanisms did exist but that they were

not effective. On Lake Tanganyika, respondents referred to the presence of active VCDCs, stratum committees, fishery committees, headmen's committees, neighborhood watch groups, etc, serving as eyes of the regulators (DoF, ZAWA and Police). Most of the aforementioned groups, especially VCDCs, are inactive in a majority of fishing villages. The 'regulators' are in most cases faced by challenges relating to finances, manpower and equipment. For example, ZAWA has been financially supported by donors through the Conservation Lake Tanganyika Project. They have supported quite some activities within the work plans of ZAWA that include patrols, rations and bonuses. However, according to Mr. Chocha, OIC Nsumbu National Park, numbers of violators are escalating and currently averaging seven apprehensions per month. ZAWA has devised a mechanism where all fishers that enter the national park for the six months open fishing period are allocated numbers that are labeled on the craft. This assists in tracking boat owners in events that such culprits escape being caught during patrols. Discussions revealed that law enforcement plans by DoF have in some instances been sabotaged by fisheries officers who also own fishing units. They have alerted law breakers of intentions by DoF to undertake a patrol. In any case, demography and the geographical dispersal of the fishery remains a challenge to effective monitoring.

Identifying the most appropriate monitoring strategy is a key component of a successful and efficient monitoring system. Regulatory enforcement, through monitoring and punishment when violation is detected, is considered an integral part of successful conservation and natural resource management. However, monitoring programs need to consider costs of implementation because there is no inexpensive way of monitoring resource users. Periodic review of a monitoring program is needed to improve the system and adapt to behavioural dynamics of the fishers. Monitoring is part of management where fishers and the other stakeholders should be involved actively. It should not simply entail observing for wrong doers but also user group participation in collecting information needed for evaluation of the status of the fishery and development of appropriate regulations, a vital part for creation of local sense of ownership.

### 3.11 Local Leadership

The influence of local leadership is critical and a necessary condition for effective law enforcement and ultimately the success of co-management. Among fishers and non-fishers the study revealed that 2 - 3% of the organizations associated with co-management exhibited autocratic, 62 - 65% democratic and 32 - 35% lazzie faire leadership. When leadership e.g. the VCDC chair or headman is strict, wrong fishing practices will normally be done in neighborhoods where leadership is weak. The study revealed that most of the organizations were characterized by democratic leadership were players were expected to freely take part in the decisions at village level. The headman for Chitili fishing village is a very good example of a tough leader. While fishing is open to all fishermen registered in the village, the local community has reserved a specific area. Chitili did observe a fish sanctuary within their fishing grounds for several years before it was gazetted as a breeding area in the fisheries regulations, SI No. 24 of 2012. Chitili village headman's positive attitude towards resources coupled with his authoritarian style of management of his subjects has yielded positive results. While local successes are good, Mackinson *et al.* [12] emphasize the need for longer term

sustainability which relies on scaling up e.g. from a fishing village to a stratum to a fishery level. Pomeroy *et al.* [19] also observed that local leaders set an example for others to follow, set out courses of action, and provide energy and direction for the co-management process.

These leaders need to be acceptable and respected by their subjects. However, group discussions heavily criticized DoF for the generally poor institutional leadership towards effectiveness of enforcement claiming that the department has not led by good example due to their non-availability at times of need. Key informants attributed this to poor disbursement of funds by central government to sustain contact between fisher communities and DoF staff. It is therefore necessary to consider training and education efforts in order to build and develop leadership skills among several potential leaders in the community so that co-management has a pool from which to pick leaders. The FGDs also suggested the need for exchange visits of leaders and their management committees especially during meetings and/or law enforcement operations. This would create enthusiasm to embark on similar activities in respective localities pertaining to awareness campaigns and outreach efforts.

### 3.12 Levels of compliance

The integrity and effectiveness of fisheries regulations is highly dependent on compliance with requirements. Compliance is about fishermen accepting to follow set fishing rules and regulations. Compliance involves both creating the conditions for people to behave appropriately, and developing mechanisms to catch and punish violators. Analysis of compliance on the basis of perception of fishers and non-fishers revealed up to 38.3% of the respondents indicating that compliance was poor, 27.0% fair, 21 - 28% good, 1 - 3% very good and 2 - 4% excellent. The highest percentage indicated that compliance with rules and regulations was poor. FGDs and key informants attributed this to several factors. Inadequate formal recognition of local enforcers as legitimate i.e. local enforcers can be very effective if they are formally legitimized. Insufficient understanding of especially the formal rules i.e. rules should be in simple language or better still translated into vernacular so that those affected can easily understand and comply. An individual's perspective of the fairness and appropriateness of the law and its institutions was also noted to be important for achieving compliance. Some regulations are not accepted among the fishers e.g. mesh sizes specified for Mutobi and Ring nets. FGDs also revealed that levels of compliance vary with such factors as variability in market for preferred fish. When demand for fish increases, compliance decreases.

Ali and Abdullah [7] advanced two explanatory lines of argument in efforts to address concerns of compliance with fisheries regulations i.e. the deterrent and normative theories. The deterrent theory considers that the higher the probability of detection and the rate of fines imposed, the lower the rate of violations committed. The normative theory considers the use of factors such as the fishermen's personal characteristics, their "psychological/attitudinal" orientations, and existing fishery policies to cause fishermen to become conscious of the fisheries regulations. Ali and Abdullah further noted that attributes such as fishermen's age, experience, income, household characteristics, their perceived attitudes toward the regulator and the regulations, moral values as well as their perception of other fishermen's compliance activity affect their own compliance with fishery regulations. However, if

punishment makes violation costly and compliance more profitable than a fisher's preference would be to comply.

In order to achieve reasonable levels of compliance among users, there is need to design communication strategies and develop public education programs to enhance interaction between fishers and DoF officials. Greater understanding of environmental protection and regulation would then be encouraged beyond mere provisions of law. This could promote stewardship, partnerships and planning for resource management in a manner that reinforces compliance outcomes.

### 4. Conclusions and recommendations

The fisheries of Tanganyika are a common resource and characterized by destructive and illegal fishing activities as major threats to the recovery of fish stocks and sustainability of the fishery industry. Although regulatory enforcement is found to be a long term solution to this commons dilemma, community members are reluctant to invest time and effort in it. A poor sense of ownership of the fishery resources by local resource users is known to result from the people's habitual reliance on government authorities to address fishery management issues. Fishing has become highly competitive and a source of conflict over access. Conflicts may not always yield negative outcomes and hence not all disputes are candidates for conflict management. In some instances they should be considered early warning signs for revisiting power relationships leading to policy improvement.

The study recommends need for heavy penalties on rule breakers for the good of everyone else's perception of non-compliance. In this way, violators' expectation of gains from illegal activity will be countered by an expectation that some violators are caught and severely punished. Therefore enforcement should be executed with diligence and courts should also impose punishments good enough to deter potential offenders. Considering that local enforcers encounter defaulters more often than 'external' agencies such as DoF, it is estimated that the number of violations following strengthening of local enforcement will reduce substantially because the probability of detection and conviction will increase. This study proposes a traditional enforcement policy that will support local level enforcement agencies. In light of over-fishing and the depletion of fish species of commercial and economic importance, regular monitoring and impact assessments are a necessary condition in suggesting timely management measures. Effective monitoring is necessary for the appraisal of fisheries policies and management plans. For this reason, monitoring should be given priority with available funds if timely adjustment of measures and strategies are to be implemented for the success of co-management on Lake Tanganyika. Special efforts should be made to reach out to the group of fishermen who are not participating in management through awareness campaigns and community surveillance operations.

FGDs and key informants raised an important observation with regards a widely held belief by fishers that they are rarely valued for the experience and information that they have. They made a strong appeal that representation during formulation of regulations at national level should fully involve fisher representatives where their voice could be heard and concerns taken good care of. The best approach to compliance is to involve fishermen in the rule-making process. This way, they will make sure the fishing rules are right and that they clearly understand how the rules will be implemented and enforced. Compliance and enforcement strategies, and monitoring and

performance evaluation procedures need to be outlined, made accessible, and communicated clearly to all stakeholders.

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