Tanzania Journal of Development Studies, Vol. 22, No. 1, 2024: 135–161

Fishing for the Future: Exploring the Effect of Relational Well-being on (Un) Sustainable Practices among Nile Perch Fishers of Lake Victoria, Tanzania

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Abstract

The management of fisheries resources is one of the most challenging endeavours as it deals with human behaviour, which is complex and hard to predict. This study was interested in understanding how social relations within Lake Victoria fishing communities shape the lake's fishery. We applied a mixed methodology approach to explore social relationships within the Nile perch fish value-chain and their effect on fishers' fishing behaviour. Using the relational well-being approach, we highlight why enforcing fishing regulations, curbing illegal fishing, and eliminating activities that violate fisheries management rules are challenging. The findings emphasize how relational well-being influences social relationships and affects fishing behaviours. We conclude that interventions aimed at safeguarding the Nile perch fisheries need to consider such relationships in an attempt to create an environment that supports sustainable fisheries in the Lake.

Keyword: *Nile perch fishery, relational well-being, sustainable fisheries, Lake Victoria, Tanzania*

https://dx.doi.org/10.56279/NJIY8787/TJDS.v22i1.8

Introduction

The world's inland fisheries are important food and nutrient resources, especially for economies in developing countries (Welcomme et al., 2010; Hicks et al., 2019). They are also vital to the society as they contribute to community and cultural identity (Weeratunge et al., 2014; Johnson & Acott, 2018). The fisheries of Lake Victoria in East Africa are crucial for inland small-scale fisheries output, sustaining local fishing sectors and export markets (Njiru et al., 2014; Mutarubukwa & Sokoni, 2018). The lake is shared by three countries: Uganda, Kenya, and Tanzania. The region has one of the highest population densities in Africa (LVFO, 2016). Lake Victoria supports the most significant fishery in Tanzania in terms of quantity and value (Medard et al., 2016; Mutarubukwa & Sokoni, 2018; Brehm et al., 2022). The fishery is based on three main important fish stocks: the Nile perch (*Lates niloticus*), dagaa *(Rastrineobola argentea)* and Nile tilapia (*Oreochromis niloticus*). Over 75 percent of the Nile perch goes directly to the fish processing factories for export (Ibengwe & Kristófersson, 2010).

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The increased population and demand for Nile perch fish for trading have brought significant challenges, such as increased fishing efforts (Nyamweya et al., 2020), and the fisheries—including the Nile perch—are reported to being overfished (Musinguzi et al., 2020; Nyamweya et al., 2020; Natugonza et al., 2022; Nyamweya et al., 2023). This overfishing is largely attributed to illegal fishing gear (carrying nets under 5 inches) and techniques (such as using multiple ply) (Mpomwenda, 2018, 2022; Mpomwenda et al., 2022). Additionally, corruption fuels illegalities and undermines management efforts (Cepić & Nunan, 2017; Nunan et al., 2018), hence threatening the sustainability of Lake Victoria's fishery resources (Luomba et al., 2016; Cepić & Nunan, 2017; 2017; Mpomwenda, 2018, 2022; Nunan et al., 2018; Mpomwenda, et al., 2022).

The increasing demand for Nile perch fish for trading has further redefined social relations, involving a heterogeneous group of people with varied interests (Medard et al., 2016; Mutarubukwa & Sokoni, 2018). For instance, Nile perch export processing factories (EPFs) have penetrated landing sites and formed new structures and institutions through close interconnectivity and networking at landing sites, thereby contributing to changes in how the Nile perch fishery is governed at local levels (Medard, 2015; Mutarubukwa & Sokoni, 2018; Nunan et al., 2020).

Elsewhere, the relational context of fishing activities has been used to explain the relationships that drive the perspectives and actions of fishers, as well as their contribution to well-being, and the sustainability of fisheries (Coulthard et al., 2011; Chuenpagdee et al., 2012; Coulthard, 2012; Mbatha et al., 2012; Britton & Coulthard, 2013; Coulthard et al., 2014; Turner et al., 2014; Pauwelussen, 2016; Gillam & Charles, 2018; Baker et al., 2021; Fabinyi & Barclay, 2022).

A detailed examination of how social relations affect Nile perch fishing practices in Tanzania's Lake Victoria is lacking. This article aims to fill in this gap by investigating the role of social relationships in shaping Nile perch fishers fishing behaviour.

Overview of the Concept of Social Well-being

The articles' conceptual framework draws on the concept of the social well-being approach, particularly relational well-being. Recently, there has been an increasing focus on using a multidimensional conception of well-being to understand the connection between human well-being and resource sustainability. Since fisheries are diverse, complex, and dynamic, a holistic or multidimensional approach such as the social well-being perspective is much needed to understand them (White, 2009; Chuenpagdee et al., 2012; Coulthard, 2012; Mbatha et al., 2012; Britton & Coulthard, 2013; Coulthard et al., 2014; Weeratunge et al., 2014; Coulthard et al., 2015; Biswal et al., 2017; Gillam & Charles, 2018;; Biswal & Johnson, 2023). The conceptualization of social well-being has emerged as a way of understanding fishing activities because it considers objective values (such as

economic contributions), subjective values (such as job satisfaction), and relational values (such as relationships between different groups of people involved in fishery) (Coulthard et al., 2011; Weeratunge et al., 2014; Johnson & Acott, 2018).

According to McGregor (2008) "… well-being is a state of being with others and the natural environment where human needs are met, where one can act meaningfully to pursue one's goals, and where one enjoys a satisfactory quality of life." The concept of well-being is widely accepted and comprises at least three dimensions: material, subjective, and relational (Mcgregor & Sumner, 2010; Coulthard, 2012; Weeratunge et al., 2014; Britton & Coulthard, 2013). The material dimension of well-being focuses on the resources available to a person, household, or community to meet their needs. The relational dimension focuses on the social relationships a person engages in to pursue well-being. In contrast, the subjective dimension addresses how people give meaning to their goals, and the quality of life they attain (McGregor, 2008).

Relational well-being contributes to the quality of life, especially in term of a sense of belonging, community identity, positive and negative reciprocity, and a key determinant of what people choose and are compelled to do (Armitage et al. 2012). Larson et al. (2013) and Hausmann et al. (2016) argue that, along with material well-being, relational well-being is one of the most significant determinants of subjective well-being that resource users acquire from their relationship with the environment.

Relational Well-being Approach as Applied in Fisheries

Relational well-being is critical to comprehending a person's well-being construction (McGregor, 2008) and fisheries governance (Biswal et al., 2017). It pays attention to the social relationships in which fishers participate and interact, which have an impact on decisions related to the use of resources that are significant for the achievement or preservation of well-being (Mcgregor & Sumner, 2010; Britton & Coulthard, 2013; Coulthard et al., 2015). Relationships that influence behaviours via institutions, family, and social structures are examples of this (Bodin & Crona, 2009; Mbatha et al., 2012; Britton & Coulthard, 2013; Turner et al., 2014; Nunan et al., 2017). Among fishers, the 'relational landscape' encompasses all social relationships across various scales, including family, community, market contacts, boat crews and owners, local fishery organizations, and government officers. These relationships impact access to resources, markets, credits, and social norms and values related to fishing practices and well-being (Coulthard et al., 2015; Johnson & Acott, 2018; Nunan et al., 2020).

Relational well-being is particularly relevant because fisheries are not only a source of livelihood and food, but are also deeply connected to social and cultural practices, traditions, and relationships (Deneulin & McGregor, 2010; Mcgregor & Sumner, 2010; White, 2010; Atkinson & Joyce, 2011; Chuenpagdee et al., 2012;

Chan et al., 2016). Research has illustrated the diversity of different social relationships and values—such as obligation, support, dependency, reciprocity, exploitation, and collective action—and their direct influence on fishing behaviours and people's well-being (Coulthard et al., 2011; Coulthard, 2012; Britton & Coulthard, 2013; Chan et al., 2016; Johnson & Acott, 2018). Reciprocity, for example, is an important social response in contexts of uncertainties to gain access to fishing grounds and the benefits associated with participating in fishery (Baker et al., 2021). It plays a vital role in maintaining social relationships and promoting sustainability in fisheries. Reciprocal practices—such as gift-giving and sharing of (sea)food (Song et al., 2013; Jones & Tobin, 2018)—play an essential role in building resilient and adaptable social networks and relationships that help fishing communities cope with the uncertainties and challenges associated with environmental stressors (Pauwelussen, 2016; Gillam & Charles, 2018) .

Moreover, the relational well-being concept recognizes the importance of relational interactions and collective actions among fishers through social networks, especially in reciprocating positively or negatively. These networks work as linkages to facilitate social connections that may create an enabling environment for implementing collective action in complying with, and enforcing, fisheries regulations (Bodin & Crona, 2009; Nunan et al., 2015; Stevens et al., 2015; Nunan et al., 2017). Likewise, reciprocal relationships are based on values like solidarity, trust, and social cohesion (Hudson, 2004; Nunan et al., 2017; Gillam & Charles, 2018; Baker et al., 2021).

The relational lens also applies to the community level because the community is essential for relational well-being (Mccubbin et al., 2013). Fishing communities and their networks of social relations characterize the true identity of the inshore small-scale fishing sector (Symes & Phillipson, 2009), and are often closely tied to cultural identity. Therefore, promoting practices that foster traditional knowledge exchange and practices, provision of credit, social support, etc., can be valuable to the sustainability of fisheries and the community (Nunan et al., 2017; Johnson & Acott, 2018; Brehm et al., 2022).

The relational well-being approach also provides a basis for getting insights into participation, particularly in engaging fishers in fishery governance processes (Trimble & Johnson, 2013). The right to self-determination through the lens of governance and decision-making (Sheremata, 2018) has long been shown to be central to the construction of a person's well-being, and is especially important in relational well-being and the sustainability of fisheries resources (Deneulin & McGregor, 2010; Breslow et al., 2017; Quimby & Levine, 2018; Sheremata, 2018). Thus, when fishers are actively involved in decision-making processes related to fisheries management, they are more likely to feel a sense of connection and belonging to their community. This can strengthen relational well-being as they feel more engaged and valued in their social networks.

This study builds on social well-being approach, particularly relational well-being, in an attempt to explore how relationships in fisheries shape the Nile perch fish value-chain; and their implications on fishers' fishing behaviour in the Lake Victoria fisheries. As it is understood, human interaction with resources shape the way people relate with each other, and with the resources. We considered this approach as vital in illuminating social relations within the Nile perch fisheries as it captures cultural factors that influence community interactions and relations.

Material and Methods

Study Sites

The study was conducted at seven landing sites in the Mwanza and Kagera regions on the Tanzanian side of Lake Victoria. These sites are Kome Island and Ihale in Mwanza region; and Musira Island, Nyabesiga Island, Kerebe Island, Rushala and Igabilo in Kagera region (Figure 1). The study sites were selected based on a criteria that the landing sites were part of the German certification (Naturland) eco-labelling program (Gitonga, 2012).

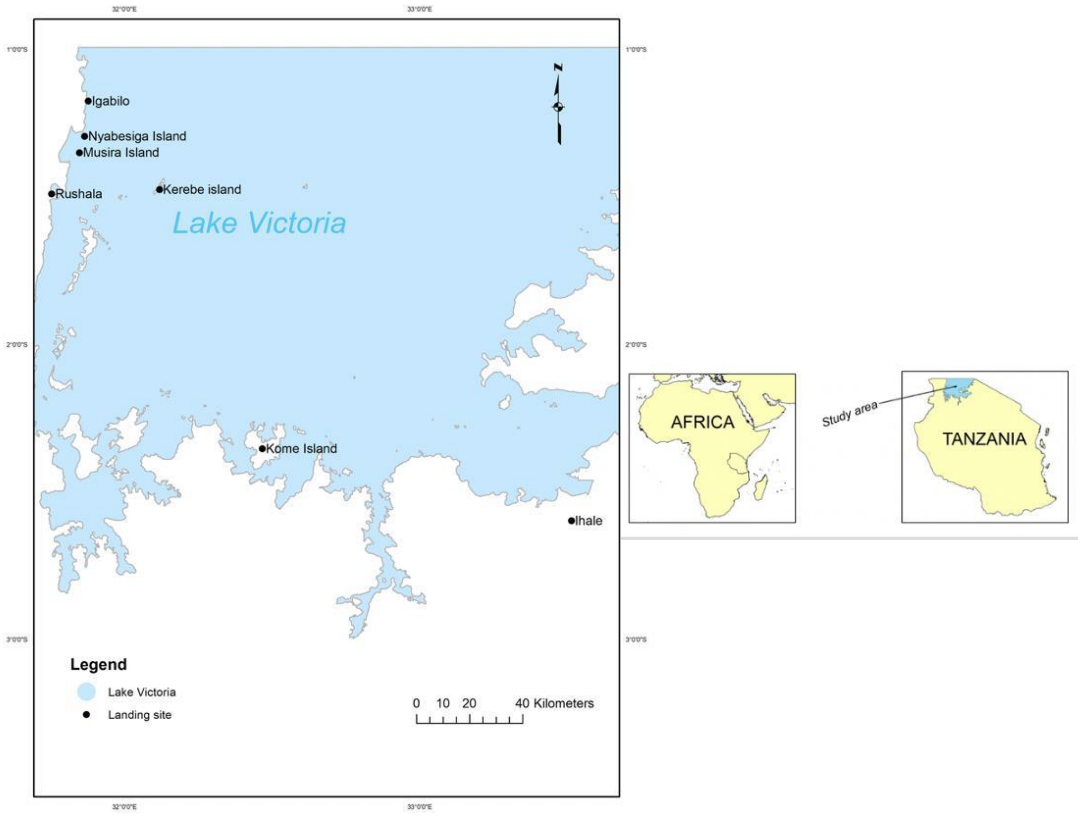

Figure 1: Map of Lake Victoria in Tanzania, Showing Selected Landing Sites (black dots**) Where Fishers Were Interviewed**

The rationale of sampling the landing site is that in the context of the Lake Victoria fisheries, Naturland introduced eco-labelling and certification of the Nile perch in 2009 to counteract unsustainable fishing practices aiming to achieve fisheries sustainability (Gitonga, 2012). Nile perch fishery stakeholders were urged to abide by a set of ecological standards, social standards, economic standards and legal frameworks. The environmental standards guided an environmentally friendly use of fish stocks and the entire ecosystem, avoidance of critical and environmentally harmful fishing methods, and the adoption of ecologically sound processing. The social standards guided on establishing and sustaining formal employment relationships, fair working conditions, and improving living conditions of fish workers. Finally, the economic standards guided on establishing and nurturing "… stable business relationships distinguished by the mutual sense of responsibility of all the members of the value-chain towards each other" (Naturland, 2008; Stefan, 2009).

The Lake Victoria frame survey of 2018 recorded 642 landing sites, of which only 26 specialized in Nile perch fishery. Out of these 26 landing sites, about 14 are involved in the Naturland eco-labelling program; with about 1,000 fishers, and two EPFs and marketing companies. The Naturland eco-labelling program strategically designates fish landing sites based on the EPFs involved in the program. The EPFs have more knowledge about catching trends, which helps them determine where to invest.

Sampling and Data Collection Techniques

Data for this study were generated through a fieldwork conducted between October 2019 and September 2020. The study applied a mixed approach, using qualitative and quantitative approaches. The target population included boat crews, boat owners and fish processors/traders. For quantitative data, a survey technique using questionnaires was employed. The sampling procedure for the quantitative data involved a multi-stage sampling procedure. First, it involved a 50% representation of landing sites participating in the Naturland eco-labelling program, comprising five from Kagera region, and two from Mwanza region. This resulted in 210 respondents from seven study sites, comprising 146 boat crews, 27 boat owners, and 37 processors/fish traders.

Second, for the qualitative data, interviews and focus group discussions (FGDs) techniques were applied. The selection of the individuals to participate in interviews was done at the study sites with the assistance of leaders of beach management units (BMUs), local village leaders, and fisheries officers. The target population included boat crews, boat owners, and fish processors/traders.

The respondents were purposively selected based on the criterion of having been in the Nile perch fishery for more than ten years. The study assumed that ten years of experience was sufficient for one to be considered a local expert, and to possess a greater understanding of Nile perch fishing and management. One FGD was conducted for each fisher category at every study site, with about 5–8 participants

in each group. The participants in the FGDs were not the same individuals who took part in the interview survey. They were sampled through convenience and non-random sampling with a stratified sampling approach based on fishers' occupation and experience of more than ten years in Nile perch fishing. A total of 21 FGDs were conducted; involving 133 participants, 56 boat crews, 35 boat owners, and 42 processors. The number of informants is summarized in Table 1.

Table 1: Number of Interviews and Focus Group Discussions, Their Distribution in Different Categories of Informants

	Respondent Category	Number of Interview/ Questionnaire Respondents	Number Involved in the Focus Group Discussion
1	Boat crews	146	56
2	Boat owners	27	35
3	Processors/fish traders	37	42

The discussion questions primarily revolved around exploring the important social relationships that influence behaviour, social relationships of obligation, networks of support, etc. One researcher was assigned as the note-taker in each FGD to ensure that all information was captured.

Data Analysis

The collected qualitative data were analysed using content analysis (Bengtsson, 2016; Erlingsson & Brysiewicz, 2017). It involved reading the data thoroughly then extracting relevant quotes and conversations from individual interviews, FGDs, and insights from the literature on relational well-being. These were used to create themes and sub-themes. Also, the data were narrowed down to generate small units or concepts that summarized respondents' perceptions of relationships, and examples of how various social relationship values impacted their well-being.

Quantitative data analysis used SPSS, version 25, to compute descriptive and inferential statistics, generating percentages and means. The socio-demographic variables of respondents' and fishers perceptions of important social relationships that influence fishing behaviour were analysed as percentages. The results were presented in the form of tables and figures.

Results

Socio-economic and Demographic Characteristics of Fishers in the Study Area

The results of the socio-demographic characteristics of the study respondents—including their gender, educational level, years of experience in fisheries, etc.—are presented in Table 2. Fishing activities were predominantly male-dominated, as is typical for fishers in Tanzania. The vast majority of fishers (over 81%) had a primary school education; and relied solely on fishing as their primary source of income without engaging in other economic activities. The majority of the participants (over 62%) in the study area had a work experience of 10–15 years in the Nile perch fisheries industry.

Table 2: Socio-demographic Characteristics of the Respondents in the Study Area

Variable	Category	Boat Crew, N = 146	Processors/ Fish Traders n = 37	Boat Owners n = 27
		Responses in %		
Gender	Male	100	62	100
	Female	-	38	-
	no school	5	3	7
	primary	90	86	81
Education level	secondary	5	8	7
	College	-	3	4
Marital status	single	11	11	4
	married	86	73	89
	divorced	2	11	7
	widowed	1	5	-
Years in fisheries	10-15 years	72	62	74
	16-25 years	26	38	26
	26-35 years	2	-	-
Participating in the ecolabel program	Registered	53	16	63
	Not registered	47	84	37
BMU membership	Member	52	32	85
	Not a member	48	68	15
Other economic activities outside of fishing	Yes	14	5	26
	No	86	95	74
Connection to seek the job	Yes	59	73	74
	No	41	27	26
Able to receive help from a relative	Yes	38	27	59
	No	62	73	41

Source: Field Data

The study noted that more than 59% of fishers had connections that allowed them to seek and access information (informal) on matters such as where to find a job, fishing grounds with fish availability, landing sites offering high fish prices, etc. This connection was observed during the field survey in the Kagera region when most boat crew respondents commented that they came there after being informed by their friends about the fishing opportunities in the Kagera waters. Also, a significant proportion of boat owners (59%) said they could receive assistance from relatives in terms of help to pay children's school fees, remittances from relatives outside the fishing village, etc., compared to the other two groups.

Additionally, most boat crews (53%) and owners (63%) had participated in the Naturland fisheries eco-labelling program. In contrast, most processors/fish traders (84%) had not participated in the program, with some individuals citing the lack of information as the reason for not participating as they were unaware of it, and some citing having incomplete information about it. Boat crews (48%) and processors/fish traders (68%) constituted a substantial percentage that was not registered in BMUs, and even the registered ones did not perceive themselves as

benefiting from their membership. These socio-demographic characteristics provide a foundation for discussing the relational well-being and sustainability of the fishery in the present work.

Relationships Domains in the Nile Perch Fishery

In order to understand the relational well-being that influence fishing practice and Nile perch value-chain in Lake Victoria, respondents were asked to express the relationships that existed in the study area.

Respondents identified nine domains of relationships, including relationships with:

(a) enforcers of fishing rules and regulations, which comprised fisheries officers at both the central and local government levels;
(b) governing authorities, such as the fisheries department under the Ministry of Livestock and Fisheries, as well as regional and district fisheries departments under the local government authorities and BMUs (community-level fisheries co-management for small-scale fisheries);
(c) financial institutions, including banks and credit facilities like community microfinance groups (CMGs), as well as informal financial supports, such as when processors or fish traders financially support boat crews;
(d) boat owners;
(e) boat crews;
(f) processors/fish traders;
(g) fish processing factories;
(h) fisher's associations; and
(i) family relationships (as depicted in Figure 2 and 3).

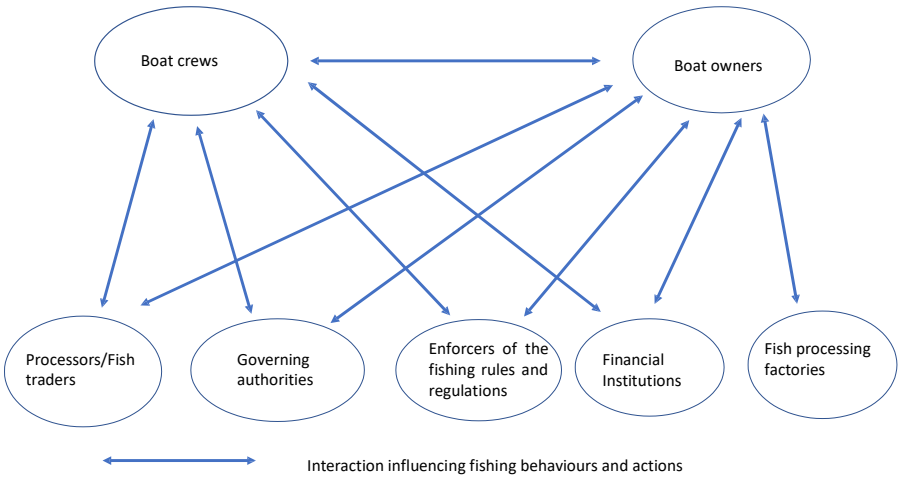

Figure 2: **The Relational Landscape in the Lake Victoria Nile Perch Fishery (**Underscoring domains of relationships that fishers engage in as they interact in various aspects)

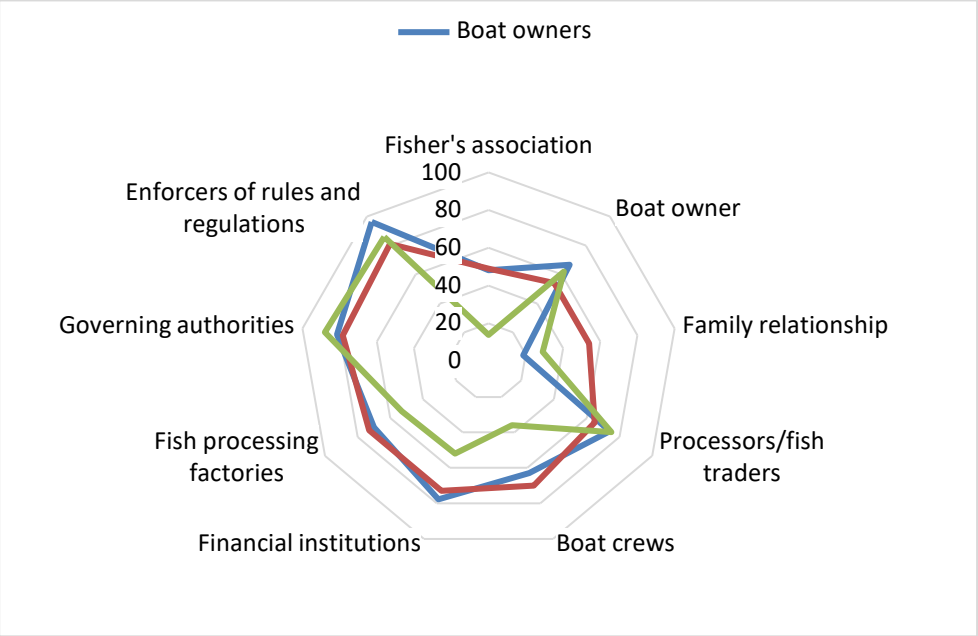

Figure 3: **A Radar Diagram Demonstrating the Relationship Domain**
(In percentage for each fisher category that was reported to influence fishing behaviour in the study area)

Once these relationships were identified, respondents were asked to choose their top five relationships in terms of importance. The study's findings revealed that the most significant relationships, as perceived by different categories of respondents in influencing their fishing decisions, are summarized in the Table 3.

Table 3: Ranking of Relationships Influencing Fishing Decisions in the Study Area

S/N	Respondent category	Ranking of relationships
1	Boat crews	1. Governing authorities
		2. Enforcers of fishing rules and regulations
		3. Processors or fish traders
		4. Boat owners
		5. Fish processing factories
2	Boat owners	1. Enforcers of fishing rules and regulations
		2. Governing authorities
		3. Financial institutions
		4. Processors or fish traders
		5. Fish processing factories
3	Processors or fish traders	1. Enforcers of fishing rules and regulations
		2. Governing authorities
		3. Fish processing factories
		4. Financial institutions
		5. Boat crews

Fishers' Perceptions of the Interactions with Governing Authorities and the Enforcers of Fishing Rules and Regulations

The results in Table 3 and Figure 3 reveal that the relationships most frequently mentioned in terms of the strengths of influence were with the enforcers of fishing rules and regulations (86%), and the governing authorities (85%). Fishers ranked these two relationships as their top two most important, finding them relevant in influencing their fishing decisions and well-being.

The likelihood of fishers complying with sustainable fishing practices depends on the valued relationship between them and the enforcers of regulations. This relationship, in turn, shape fishing behaviours and actions that lead to either sustainable or unsustainable fisheries. Differences in satisfaction levels among fisher groups highlight the problems they face while interacting with enforcers of fishing rules and regulations (see Table 4). The qualitative evidence indicates that weak enforcement, failed monitoring and sanctioning mechanisms (including confiscating illegal gear and arrests), corrupt individuals, and economic inequality: all these can significantly impact fisheries and the well-being of fishers. These issues, for example, had disincentivized boat crews from obstructing illegal activities, making them continue engaging in illegal fishing practices. However, they acknowledged that it was against their moral codes. The fact of the matter is that boat crew cannot rectify the situation if boat owners possess illegal gear. The crew may wish to limit their fishing by using legal gear but cannot confront boat owners about their use of illegal gear. Most of the boat crews (86%) expressed dissatisfaction with their relationship with the enforcers of fishing rules and regulations, scoring 2.2 out of 5. The following quote, echoed by participants in the FGDs involving boat crews at Kerebe, depicts this dissatisfaction:

> *We are not ready to report the use of illegal gear to enforcers of fisheries regulations because we face the challenge of boat owners equipping their vessels with illegal nets. We only care about having a job, even if we work with illegal gear. We do not want to express our views or comments for fear of being fired* [Boat Crew_BCKRB2, Kerebe Island, 2020].

Similarly, another boat crew member who did not endorse the behaviour of most enforcers stated:

> *The situation in the lake was terrible: fish were hard to find, and poor management made it challenging for people to obey the law. Some enforcers had made the issue of illegal fishing their business, confiscating gear from one fisher and selling it elsewhere around the lake. Corruption had also risen among enforcers and boat owners, and most owners owned illegal gear* [FGD, Boat Crew_BCNYB1, Nyabesiga Island, 2020].

Another boat crew key informant highlighted the ineffectiveness of enforcers of fisheries regulations, who perpetuate the use of gear illegal thus:

> *Boat owners supplied their boats with different-sized nets (legal and illegal). The aim is to maximize income, catching fish of all sizes, and selling undersized fish to women traders or processing factories, which then sell them to neighbouring countries* [Boat Crew_BCNYB2, Nyabesiga Island, 2020].

The above quotes imply that the existing relationships in the fishing communities, particularly between fishers and enforcers of fisheries regulation, shape the persisting fishing practices. For example, the failure of enforcers to enforce fishery rules and regulations, may contribute to the persistence of illegal fishing practices.

On the other hand, 96% (Figure 3) of the interviewed boat owners felt that the current policies and rules enforced by the fishing rules and regulations cause conflicts of knowledge, which in turn negatively affect their well-being and contribute to their dissatisfaction with the enforcers (a score of 2.1 out of 5 (Table 4). This is because the Nile perch fishing provides an opportunity to reinforce the use of local and cultural knowledge, which is important for maintaining relational well-being. Fishing with gill nets having a mesh size of under five inches is a traditional practice in many major lakes in Tanzania, demonstrating cultural identities and practices (Brehm et al., 2022; Medard et al., 2016; Mutarubukwa & Sokoni, 2018). However, carrying multiple ply and nets under 5 inches is illegal under current fishing rules and regulations, leading to a clash between traditional fishing practices and the current ('modern') ones.

Table 4: Relationships Identified by Fishers as Being Important for Fishing and Average Scored Satisfaction Level During FGDS and Interviews

Fishers relationship domains	Overall (%) n =210	Mean Satisfaction Level		
		Boat Crews, n = 146	*Processors, n = 37*	*Boat Owners, n =27*
Enforcers of fishing rules and regulations	86	2.2	3.0	2.1
Governing authorities	85	2.1	3.3	2.5
Financial institutions	75	1.7	2.0	2.5
Processors/fish traders	72	4.0	3.8	4.0
Fish processing factories	67	2.0	1.9	2.2
Boat owners	61	2.4	3.5	4.8
Family relationships	60	4.6	4.8	5.0
Boat crews	52	4.1	3.7	2.4
Fisher's association	45	2.9	2.8	2.8

Notes: Likert scale 5 = Very satisfied, 4 = Satisfied, 3 = Least satisfied (neutral feeling), 2 = Dissatisfied and 1= unsatisfied

It was reported that the regulations on fishing with multiple ply were sometimes permitted. Boat owners argued that these frequent regulation changes have led to the confiscation of fishing nets, resulting in economic losses and conflicts between them and the enforcers. They also believe fishing with nets under five inches should not be illegal. In an interview session, one respondent had the following to say:

> *The government doesn't listen to us and does things how it sees fit. Enforcers believe fishing with a single panel net in deeper water is feasible, which may not be true be in shallow waters. Also, mesh sizes above five inches decrease the ability to catch fish, leading to low fish catches as the legally required fish size is unavailable in the lake* [Boat Owner_BOMUS1, Musira Island, 2020].

Additionally, the study demonstrated the significance of good relationships with governing authorities, particularly for boat crews who expressed dissatisfaction with their ability to participate meaningfully in decision-making related to fisheries

management. The boat crews disagreed on the likelihood of their opinions being heard in decisions that affect them. They highlighted the failure of governing authorities to facilitate meaningful participation in decision-making, which has significantly impacted their relational well-being; with some feeling marginalized and undervalued:

> *We are not fully engaged and properly represented in making any decisions. We are told what will be done; if we get involved, it is only partially. (Concerning) BMUs, (it is) as if they do not exist. They cooperate with influential people, the majority of whom are boat owners. There is no avenue for us to express our ideas. BMUs do neither have any influence to defend our interests, nor do they have the capability to combat illegal fishing* [Boat Crew_BCMUS3, Musira Island, 2020].

> *We are marginalized and receive very little recognition, and our contributions to the sectors' development are undervalued. Our voices do not matter during stakeholders' meetings. If you don't own a boat, you don't have the authority to make an argument* [Boat Crew_BCKOM2, Kome Island, 2020].

The above quotes imply that the dissatisfaction of boat crews with the governing authorities, as far as the fishing practices are concerned, reflects the failure or inaction by responsible authorities—such as BMUs—to protect their rights. The situation is no better concerning the right to freedom of speech.

Fishers' Perceptions of the Interactions with Fish Processing Factories, Financial Institutions, Processors/Fish Traders, Boat Owners and Crews

The study results further revealed that fishers relationships with processors/fish traders, boat owners/crews, financial institutions, and fish processing factories significantly influenced their fishing activities. The satisfaction levels varied across different categories of fishers. For example, boat crews (75%; Figure 3) expressed satisfaction (a score of 3.7 out of 5; Table 4); with processors/fish traders, highlighting the presence of reciprocal exchange, credit-dependent relationships, and trust. Boat crew informants reported that they often rely on boat owners to provide them with loans in the form of salary advances, which they repay using revenue generated from fishing. However, the significant decline in catches of big fish (i.e., fish above 50cm) has led to a decrease in income. Hence, since the repayment methods still rely on big fish catches, this has resulted into many individuals falling into debt.

The relationship between boat crews and women processors/fish traders is particularly significant, as boat crews normally borrow money from women fish processors under an agreement to sell them undersized fish, which reduces the dependence on boat owners. Processors/fish traders provide a market for undersized fish once they are landed, and boat crews can also access other valuable benefits from them, including credit. Nevertheless, the following quotes highlight the negative impact that the decline in fish-catch has had on this relationship:

> *The women processors hold significant roles at the landing sites, as we often bring undersized fish (fish less than 50cm) from fishing. Consequently, we are compelled to sell our catch to these women traders. Despite being our primary sponsors, these women inadvertently contribute to the promotion of illegal fishing* [Boat Crew_BCMUS2, Musira Island, 2020].

Also, another informant added:

> *The women processors/fish traders incite opposition against boat owners by introducing fish price competition at landing sites. This competition causes the prices of undersized fish to rise, thereby boosting our revenue* [Boat Crew_BCIGB2, Igabilo, 2020].

Additionally, it was revealed that boat owners serve as intermediaries between fish traders and processing factories. Boat owners purchase fish from traders, store them in ice, and then later sell them to the factories. Key informants elaborated that this practice relies mainly on trust: the habit of reciprocating, sharing, and credit-dependent relationships, as summed below:

> *The boat owner is placed in the middle. You have the processing factory on one side, and the processors/fish traders and boat crews on the other. The boat owner acts as a sponsor by lending money or fishing gear (such as engines, hooks, gillnets, and sometimes boats) to fish traders. In other circumstances, a processing factory might lend a boat owner the money to buy gears and boats, provide ice to prevent spoilage, and enter an agreement to sell fish to them. Boat crews access the fishery through employment by boat owners or fish traders. They are migrating from one landing site to another in search of better catches and remunerations* [Fish Trader_FTKRB1, Kerebe Island, 2020].

Similarly, this was echoed by key informants at Kome:

> *Most of us do not own boats. Instead, we access the fishery using fishing equipment owned by boat owners, and sell all our catches to them at prices set by them. We also contract boat crews to work on the boats and sell the catches at quoted prices. The boat owners use this contracting system to pass on boat fuel, gear repair, and other expenses associated with using their fishing equipment* [Fish Trader_FTKOM1, Kome Island, 2020].

The quotes above show that the relationships among different fisher categories facilitated the existing fishing practice in the study area. As indicate, these relationships primarily rely on trust, reciprocation, sharing, and credit-dependent interactions.

Despite the above-noted positive relationships between boat crews and women fish processors/traders, some informants mentioned the existence of mistrust between women fish traders, boat owners and boat crews. In interactions with boat owners, some mentioned the problem of mistrust among fishers thus:

> *Women facilitate boat crews with money for subsistence and leisure (to buy cigarettes and refreshments) under an informal agreement of selling undersized fish to them. Thus, boat owners sponsoring these boat crews with fishing equipment feel cheated because these boat crews pay these women first when they come from fishing; hence, at the end of the day, boat crews report fewer kg of fish than what they actually caught on that day. Also, women fish traders are given undersized fish on loan to sell by boat owners. In most cases, they do not return the money after selling the fish* [Boat Owner_BORUS1, Rushala, 2019].

The mistrust between boat crews and boat owners is also reflected in the following quote:

> *Weighing scales at the landing sites are not well calibrated as they belong to boat owners; hence, we feel cheated about the correct weight of the fish caught* [Boat Crew_BCIGB1, Igabilo, 2019].

This implies that although the relationship between women fish processors and boat owners facilitated fishing in the lake and is of benefit to the two groups, their relationship was perceived by boat owners as resulting into negative impacts. Boat owners felt that they were disadvantaged by the relationship between women processors/traders and boat crews. As a result, there was mistrust between boat owners, boat crews and women processors/traders.

The interviews also revealed that boat crews were dissatisfied with their relationship with boat owners. This finding correlates with the findings of quantitative data in Table 4. This dissatisfaction was evident in their reliance on an informal working contract, which directly impacted their well-being; and further exacerbated the fishing of undersized fish:

> *Fishing with a net has become a labour-intensive occupation. In the past, gears were single-ply 3.5–4.5 inches with 40 pieces of nets; but currently, boats carry 75–100 pieces of nets with multiple-ply and mixed net mesh sizes of 7, 6, 5, and less than 5 inches. The aim is to catch fish of different sizes. Also, crew members must be employed under an informal contract of either 30 or 60 days. The contract stipulates that running expenses such as petrol and food must be deducted, regardless of whether or not fish is caught. After these expenses are deducted, the revenue is shared at a ratio of 2:3 in favour of the boat owner. Revenue is calculated for catches of larger fishes, i.e., fish above 50cm; while catches of undersized fish are treated as an allowance for boat crews, commonly known as 'pesa ya chai.' When undersized fish are caught, the sharing favours the boat crew at a ratio 2:3.* [Boat Crew_BCKRB1, Kerebe, 2019].

Furthermore, other respondents expressed concerns about poor working conditions that was considered to jeopardize their social well-being, as members of boat crew said:

> *We wished for a just and honest working relationship that would guarantee our rights as fish workers, including good work contracts, compensation for accidents and emergencies* [Boat Crew_BCKRB3, Kerebe Island, 2020].

Additionally, in discussions with key informants, boat crews and fish processors expressed their dissatisfaction with fish factories. They lamented on the factories' low prices and the selective disclosure of crucial pricing and global marketing information exclusively to boat owners. The sentiment echoed by FGD participants, involving the boat crews and processors/fish traders, explained this dissatisfaction as follows:

> *We need significant changes in the fishery industry to ensure fairness, equity, and justice for all stakeholders. We advocate for transparency in fish prices, urging boat owners and processing factories to provide a weekly report on fish prices and market information* [Fish Trader_FTRUS1, Rushala, 2019].

Another added:

> *In sharing fisheries benefits, the most important thing for me is to know the price of fish per kg at the processing factory so that I can make well-informed arrangements during salary negotiations* [Boat Crew_BCKOM1, Kome Island, 2020].

Table 1: Relationships Emerged as Significant to Fishers in Nile Perch Fishery with Brief Explanations

Relationship domain	Relationship value	Fisher's expression of the value associated with the relationship and its importance (or not) to relational well-being and fisheries sustainability
(1) Relationship between boat crews and processors/fish traders, especially women	Reciprocity/social cohesion/social support/ trust	Related to the practices of boat crews depending on women fish traders to provide them with money for subsistence and leisure or as loans during difficult times when sharing and exchanging undersized fish, the practice may foster positive conditions for relational well-being. However, it also has a detrimental impact on the future of the Nile perch fishery.
(2) Relationship between boat crews and fellow boat crews	Reciprocity/social cohesion/sense of community/identity	Related to the practices of sharing information about better fishing grounds and landing sites with higher fish prices. This practice creates a strong sense of community and fosters social cohesion by bringing fishers together, encourages collaboration, and facilitates knowledge exchange, all of which can contribute to overall relational well-being. However, this practice also has the potential to result in increased fishing efforts concentrated in specific areas. Such concentration may adversely affect the sustainability of the Nile perch fishery.
(3) Relationship between boat crews and boat owners, and fish traders	Social cohesion/Reciprocity/sense of belonging/credit dependency/social support	Related to the practices of boat owners or fish traders employing boat crews to work on their boats. Providing employment builds a sense of belonging, reciprocity and shared purpose among fishers and contributes to the fishing community's overall resilience and sustainability and creates positive momentum for relational well-being. However, informal working contracts perpetuate injustice and impose limitations on boat crews' material and financial security.
(4) Relationship between boat crews and governing authorities and enforcers of the fishing rules and regulation	Self-determination and collective actions	Related to the practices of failure to absorb meaningful participation in decision-making. The practice can lead to the disruption of fishers' self-determination. Boat crews were deprived of the chance to express their opinions, contribute their perspectives, and influence the outcomes directly impacting the fishery. This disruption erodes relational well-being and leads to frustration and alienation, negatively influencing collective action in fisheries management. It also relates to the influence of boat owners over the BMUs and enforcers of fishing rules and regulations disincentivizing boat crews from obstructing illegal activities.

(5) Relationship between boat owners and governing authorities and enforcers of the fishing rules and regulation	Cultural identity, social cohesion and sense of belonging	Related to the conflict of knowledge between the enforcers of the fishing rules and regulations and boat owners and the desire of boat owners to incorporate their local knowledge into management decisions. This practice promotes cultural practices by recognizing and valuing local ecological knowledge, which, in turn, fosters relational well-being, creates a sense of ownership and pride within the community, and enhances social cohesion. Overall, it significantly improves the effectiveness of fisheries management by integrating fishers' insights into ecosystem knowledge and sustainable harvesting practices.
(6) Relationship between boat owners and processor/ fish traders	Social cohesion/ Reciprocity/sense of belonging/credit dependency	Related to practices of contracting fishing equipment owned by boat owners. Same narrative as in (3)
(7) Relationship between boat owners and processors/fish traders, especially women	Reciprocity/social cohesion/trust	Related to the practices of boat owners giving women fish traders undersized fish to sell and bring money to boat owners. Same narrative as in (1)

Dissatisfaction with boat owners, as far as fishing practices are concerned, reflects the desire for honest business relationship that would further strengthens relational well-being among Nile perch fishers. Unjust work relations within the supply chain—particularly concerning informal work contracts and fish prices information—have marginalized women processors and boat crews, forcing them into illegal activities. For boat crews, having formal working contracts is also essential for the freedom to demand justice, and have their voices heard. Clear and effective platforms for information-sharing can enhance the factors contributing to fishers well-being, which was not observed in our study. Bavinck et al. (2018) argue that addressing distributional justice concerns may be necessary for achieving sustainable human-nature relations. Similarly, promoting equity and justice ensures that fair and equitable fishing practices can help foster a sense of belonging and ownership among fishing communities, while reducing social and economic disparities (Song et al., 2013; FAO, 2014).

The quantitative data on Table 4 also revealed some similarities with the qualitative data discussed above. Throughout the survey, fishers expressed various social relationship values—such as reciprocity, support, dependency, social cohesion, sense of belonging, etc.—which were closely tied to various practices while exploiting fisheries. These relationships were found to play a pivotal role in influencing fishing practices in the Lake.

Discussion

The findings of this study demonstrate the social relationships that Nile perch fishers have established while exploiting fishery resources. The findings reveal a varied set of relationships that existed in the study area. These relationships explain the relational well-being manifested in a web of interactions among and between different groups. The observed relationships act as vehicles that assist them in developing and sustaining themselves within the community, and facilitated their exploitation of fish resources.

Moreover, the study findings indicate that access to fish in the lake and financial capability are entitlements necessary for relational well-being. In this respect, boat owners wield substantial influence compared to other actors. Their financial capability controls access and production relations, making boat crews and processors/fish traders dependent on them. Their influence plays a vital role in explaining the missing contribution of management interventions to ensure the sustainability of fisheries through the multiple values fishers associate with each other. Also, the influence of boat owners is more vivid with the persistence and increased fishing of undersized fish in the lake. Other studies conducted in Lake Victoria have indicated the influence of boat owners over BMUs that reduces the roles of BMUs in curbing the use and spread of illegal fishing (Njaya et al., 2012; Cepić & Nunan, 2017; Nunan et al., 2018; Quimby & Levine, 2018); while at the same time interfering with participatory fisheries management (Mosepele &

Kolawole, 2017; Mozumder et al., 2020). Our analysis indicates that boat owners' influence over BMUs is actually fuelled by a 'hidden' force of women fish processors and traders who work behind boat crews.

The findings further underscore the linkages between the literature on relational well-being and the values in the rules that govern relationships, representation, and participation; which have long been shown to be central to constructing a person's well-being. While there are claims of participatory and socially inclusive approaches to fisheries management through BMUs, such processes in the present study did not facilitate sustainable fishing practices. The failure to absorb meaningful participation in decision-making has led to a growing crisis and decline in Nile perch fishery, which have in turn led to disempowerment, frustration, and resentment.

The relational well-being of Nile perch fishers is further built on social relationships through reciprocity and reciprocal exchange, which facilitates both positive and negative social relations. For example, negative reciprocity fosters unsustainable fishing when boat crews and owners indicate satisfaction with women fish traders/ processors; claiming to receive financial remuneration from such a relationship. However, though this relationship facilitates their access and benefits from fish resources, it promotes illegal and unsustainable fisheries. Positive reciprocity is seen through reciprocal practices of information-sharing, such as when boat crews use social connections to identify better fishing grounds and areas of higher fish prices. Also, social support—such as credit provision when boat owners and women fish traders provide credit/loans to boat crews—acts as a safety net (Sterling et al., 2020).

The relational well-being of Nile perch fishers is further enhanced by their desire to access financial services and support, enabling them to obtain formal and affordable credit/loans for economic growth and sustainable fishing operations. Insufficient capital in finance and investments due to the lack of access to loans or credit reduces the chances to improve well-being with regard to access to fishery resources and markets, especially for boat crews and processors/fish traders. The implications of these findings on sustainable fishing, related to the relationship value placed on financial institutions, are seen in unsustainable fishing behaviours. Financial capability gives individuals the power and voice to influence resource management decisions and combat illegal fishing behaviour, as reported by boat crews who complained of inadequate representation in the negotiation fora. This lack of a voice in decision-making negatively influences collective action in fisheries management, leading to poverty and social marginalization (Mcgregor & Sumner, 2010).

These findings concur with the requirements under the Food and Agriculture Organization (FAO) of the United Nations Voluntary Guidelines for Securing Small-Scale Sustainable Fisheries in the Context of Food Security and Poverty Eradication (FAO, 2014). These guidelines provide ethical guidance relevant to small-scale fishers, including a decent working environment and conditions onboard fishing vessels, power relationships, and access to resources; including finance and market,

just to name a few (ibid.). The guidelines are expected to encourage the protection of small-scale fishers, particularly boat crews and processors/fish traders, who are viewed as less resourceful actors (Jentoft, 2017).

Conclusion

The study highlights the significance of social relationships in the context of Nile perch fisheries and their impact on relational well-being. The findings reveal a complex web of relationships among fisher groups involved in the fishery, which influence fishing behaviour. It is crucial for interventions aimed at safeguarding Nile perch fisheries to consider these existing relationships and create an environment that supports sustainability in the short- and long-term. The study emphasizes the importance of positive reciprocity, such as information-sharing and social support, in fostering social cohesion and trust among fishers. On the other hand, negative reciprocity, driven by illegal activities and unsustainable practices, poses challenges to the sustainability of the fishery. The study also underscores the influential role of boat owners that hinders participatory fisheries management, and their negative influences on the relationship by imposing limitations on material and financial security. Furthermore, the research highlights the need to promote and incorporate local knowledge, establish honest business relationships, address distributional justice concerns, and provide access to financial services: all of which are essential for the sustainable development and well-being of Nile perch fishers. There is a greater likelihood of achieving sustainable fisheries practices and fostering a sense of belonging and ownership within fishing communities if these relational values are considered and incorporated into management interventions.

Acknowledgments

I sincerely thank all fishers, individuals and fishing communities in Kagera and Mwanza regions who provided information for this study. I would also like to acknowledge the financial support of the Tanzania Commission for Science and Technology (COSTECH) for funding the research that led to this paper.

Declarations

Competing Interests

The authors declare that there are no conflicts of interest.

Ethical Approval

The study leading to this paper was done in compliance with the University of Dar ss Salaam (UDSM) and Tanzania Commission for Science and Technology (COSTECH) guidelines for studies of human subjects and research standards. Also, the UDSM research clearance committee reviewed and approved this study; and the COSTECH subsequently approved the research permit.

Data Availability

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

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