

Community livelihoods and perceptions of the Sikunga Fish Protected Area in the Zambezi Region, Namibia

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Abstract

The Sikunga Fish Protected Area (Sikunga FPA) was established as a management tool to manage and conserve the aquatic biodiversity of the Zambezi River of northeastern Namibia. Monitoring and evaluation are necessary for adaptive management to determine whether such protected areas are effectively meeting their objectives. Thus, this study aimed to assess communities' knowledge about the role and impacts of the Sikunga FPA on their livelihood assets. Furthermore, the study provides insights into communities' attitudes towards its management and views on managing the reserve. A cross-sectional survey was conducted among the riparian community members residing in households within a 15 km radius of the Sikunga FPA in the Zambezi Region. A total of 200 respondents out of a population of 2000 were subjected to semi-structured questionnaires. Descriptive and Inferential statistics were used to assess communities' perceptions and attitudes towards the Sikunga FPA. The results showed that 80% of the respondents knew about the Sikunga FPA but perceived it to negatively impact their livelihoods, probably due to low community participation in establishing the reserve (33%) and management meetings (47%) where decisions concerning the reserve were made. Hence, they felt excluded from an initiative that would significantly impact their well-being and likely to inflict conflicts that would erode the reserve's success. As a result, most respondents (80.7%) prefer that local community members take the lead and initiate future management plans tailored to govern the Sikunga FPA. Finally, Sikunga FPA authorities should consider affected communities as key conservation allies in the future development and management of the Sikunga FPA. This goal may be achieved through an interdisciplinary approach to empower local communities and ensure the successful implementation of the Sikunga FPA.

Keywords: Sikunga FPA, community participation, community perceptions, co-management

Introduction

Freshwater ecosystems are globally faced with many anthropogenic stressors, resulting in a sharp depletion of biological resources (Dudgeon et al., 2006). For instance, India experienced a drastic decline in fish biodiversity due to human and naturally induced factors, resulting in a sizeable portion of freshwater fish being declared threatened (Sarkar et al., 2008). A key component of biological conservation is establishing freshwater-protected areas (Giakoumi et al., 2017), similar to terrestrial or marine protected areas. Many countries have adopted community-based or co-managed freshwater-protected areas for conserving fish stock diversity in river and lake environments, which go by various names, including Community Conserved Zones in the Philippines (Vermeersch, 2014), Fish Conservation Areas in Cambodia (Kwok et al., 2020), Fish Conservation Zones in Lao People's Democratic Republic (Baird et al., 2005), reserves in Thailand (Koning et al., 2020), and Freshwater Fish Safe Zones in India (Gupta et al., 2014).

Freshwater-protected zones have been a successful management strategy for preserving vulnerable fish stocks of commercially and recreationally important species (Acreman et al., 2020). Freshwater ecosystems that are complex and functionally unaltered may supply many commercially valuable goods and long-term services to society (Baron et al., 2002, 2004). In places with a high concentration of species, protected areas have been developed to guarantee the security and well-being of nature's resources worldwide (Numbere et al., 2021). These freshwater-protected areas may be managed under different governance types. These include state-based, community-based, cooperative, traditional, and private management (Borrini et al., 2011; Christie et al., 2003; Christie & White, 2007; McClanahan et al., 2006). Local communities around protected ecosystems play a pivotal role in the success of any conservation endeavor. The perceived benefits and a sense of ownership are critical determinants of the success of the management and conservation of protected ecosystems. The Namibian government encourages Community-Based Natural Resource Management (CBNRM) through legally recognized conservancies permitted to jointly manage their natural resources (Lapeyre, 2013).

Given the importance of freshwater fisheries in the country, the Namibian government developed a policy (the White Paper "Responsible Management of the Inland Fisheries of Namibia") published in 1995 and the Inland Fisheries Resources Act, promulgated in 2003 to safeguard riverine fish stocks. Management approaches include technical measures such as gear restrictions, mesh size regulations, method of capture, and the number and length of gillnets per fisherman (Peel, 2012). According to official regulations, beach seines and gillnets with mesh sizes smaller than 3 inches (73 mm) are forbidden. Destructive fishing gear such as the monofilament gillnets

is equally prohibited by the Fisheries Policy 2003. A closed fishing season is in place and annually spans from the beginning of December to the end of February. Most fishing activities are restricted to traditional fishing methods and recreational angling during this period. Despite these management mechanisms, local fishermen and anglers of the Zambezi/Chobe floodplains have expressed serious concerns over the continued decline in catch rates of the large cichlid species of economic value, such as *Oreochromis andersonii*, *Oreochromis macrochir*, and *Coptodon rendalli*. Local studies have equally shown that there has been a declining trend in fish stocks of economic value in the Zambezi River (Banda et al., 2022; Simasiku et al., 2017), calling for effective management measures. Using locally established freshwater protected areas is a relevant way to reconcile these concerns and respond to local and global fisheries management constraints. As a result, the Sikunga Fish Protected Area (hereafter Sikunga FPA) was established along the Zambezi River in 2012 and officially gazetted in 2015 to restore commercially depleted fish stocks of *Oreochromis andersonii*, *Oreochromis macrochir* and *Coptodon rendalli* (Tweddle et al., 2015). The Sikunga Conservancy authorities govern the reserve. A membership in Namibian conservancies is voluntary and free (NACSO, 2023). To join and participate in conservancy activities, a person must live within the designated conservancy area and register with the community management committee (NACSO, 2023). Trained guards are employed and paid by the conservancies to enforce fisheries regulations. However, the riparian community's (non-conservancy members) perceptions and attitudes towards the existence and governance of the reserve have never been investigated, potentially undermining the success of the intended goals of the Sikunga FPA. Studies on Freshwater-protected areas in the Zambezi Region have focused on understanding ecological and biological conservation issues.

More recently, there has been a recognition of the need to understand better the social and governance issues of FPA. Perception studies of local communities are valuable in enhancing understanding of local communities' views on social, ecological, and governance impacts of Freshwater-protected areas, which can inform adaptive management. Understanding the perceptions of local communities on the impacts of Freshwater-protected areas on their lives and livelihoods is thus important so that management approaches and practices can be adapted to address local and institutional needs (Agardy et al., 2003; Bennett, 2016). Thus, this study aimed to assess the residents' perceptions of the Sikunga FPA's existence, role, and governance of the reserve to strike a balance between conservation and community livelihoods. This study was structured around four specific objectives, which were to (i) explore the degree of the community's involvement in the establishment of the Sikunga FPA, (ii) assess the influence of socio-

demographic variables on community perception towards the reasons for the establishment of the Sikunga FPA, (iii) assess the roles and benefits of the Sikunga FPA and (iv) evaluate the extent of the riparian communities' participation in the governance and management structures of the Sikunga FPA.

Materials and methods

Study site

The study was conducted in the Sikunga area, situated in the eastern arm of the Zambezi Region (Fig. 1). The study area encompasses households along the Sikunga FPA and within the boundaries of the Sikunga Conservancy. Based on the Namibian Statistics Agency (NSA) data, the Sikunga area is home to approximately 2000 residents distributed across several villages, covering an area of approximately 287 square kilometers (Morton, 2018). These inhabitants primarily belong to the Lozi and Masubia tribes and are organized under the leadership of village headmen within their respective wards. The community of Sikunga embraces a traditional rural lifestyle, heavily reliant on subsistence activities, including fishing, crop cultivation, and cattle farming, as essential means of sustenance. Fishing, in particular, is a significant source of employment, encompassing activities such as fishing, processing, and trade (NACSO, 2023). Most harvested fish are preserved by drying them for convenient storage and subsequent sale in distant markets. Within the Sikunga Conservancy (Fig. 1), the region boasts a diverse array of wildlife, featuring species such as hippos, crocodiles, otters, bushbucks, common duiker, black-backed jackals, spring hares, cape hares, vervet monkeys, and occasional sightings of elephants and zebras.

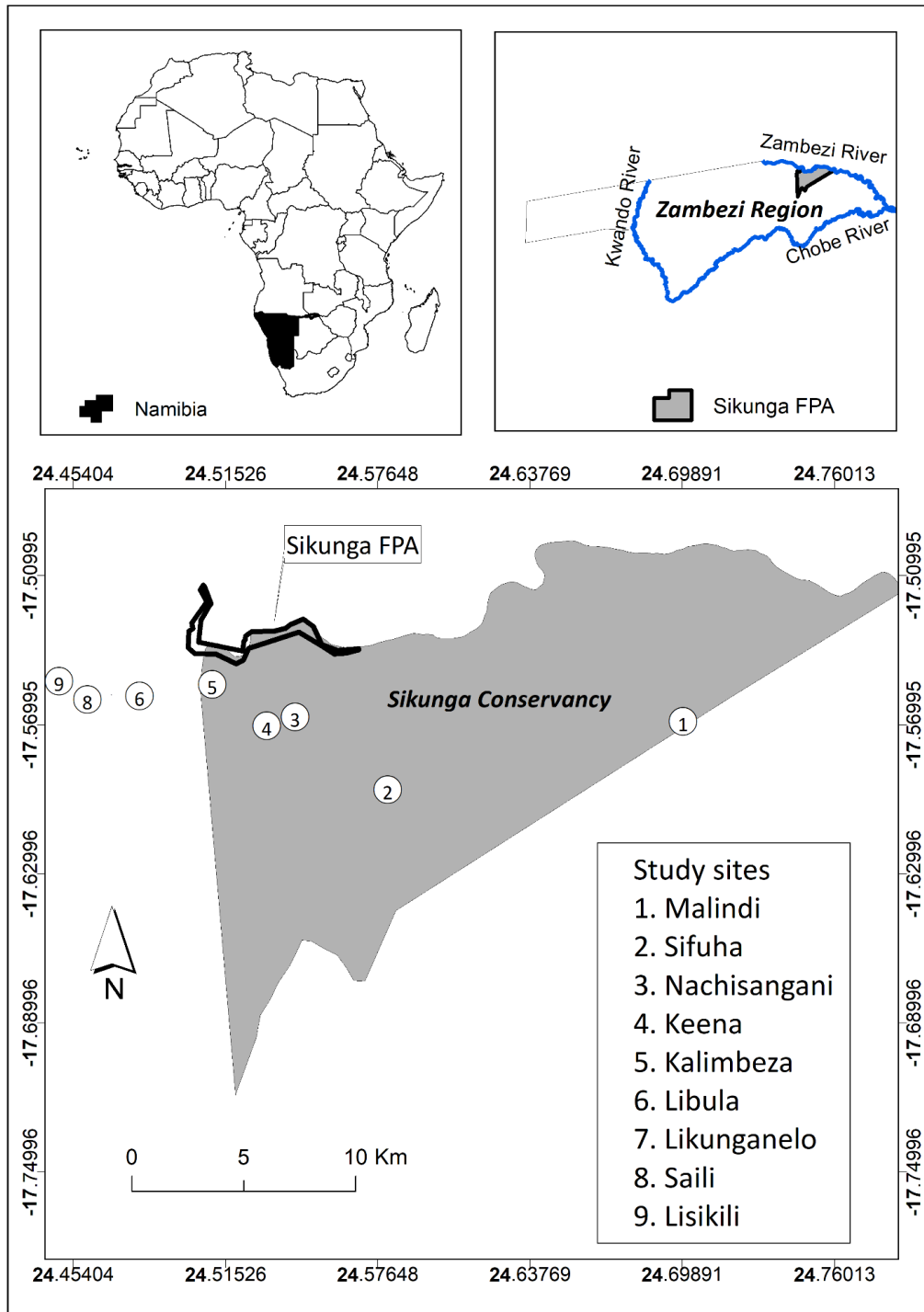


Figure 1. The study area map shows Sikunga FPA and the nine targeted villages in the Zambezi Region.

Notable features within Sikunga Conservancy include the majestic Zambezi River, enhancing the area's natural appeal. The river is home to a captivating array of birdlife and a thriving aquatic ecosystem with fish species such as tiger catfish and tilapia. Climatically, the region falls predominantly under arid conditions, characterized by seasonal summer rainfalls. Over the period from 2014 to 2018, the average annual precipitation ranged from 232.4 mm in 2018 to 675.9 mm

in 2017, with an overall mean of 465.8 mm (Awala et al., 2019; SASSCAL, 2023). Precipitation exhibits significant seasonal variability, with nearly dry conditions prevailing from May to September and the highest monthly precipitation recorded in March at 114.9 mm. Vegetation in the study area predominantly comprises tree-and-shrub savannah, encompassing grasslands and woodlands NACSO (2023), characterized by broad-leaved deciduous trees (Greenway, 1973). The region experiences moderate grazing pressure, and the vegetation is frequently affected by wildfires Burrough & Willis (2015), which can lead to substantial damage and result in the loss of approximately 45% of tree life and 8.2% of browse materials (Mendelsohn et al., 2002).

Data collection

Semi-structured interviews and participatory observation were used to assess and document communities' perceptions towards the Sikunga FPA. Three major categories of questions were designed to assess communities' perceptions towards the Sikunga FPA. The first series of questions were formulated to profile the demography, sources of income, and well-being of the communities along the Sikunga FPA. The second series of questions were formulated to explore the modalities of the Sikunga FPA. These questions probed for communities' responses on their involvement in the establishment and objectives of the Sikunga FPA. The third series of questions was designed to assess perceptions of the values and benefits of the Sikunga FPA. Finally, the last batch of questions inquired about the community's participation in management meetings and governance of the Sikunga FPA. The interview was implemented using the interview guide approach. The strength of this approach is that it relies on the researcher's ability to adapt the interview process to ensure that each participant yields the necessary information about the same topics.

Target population

The target population for this research comprised the Zambezi Region residents within a 15 km radius of the Sikunga FPA. This geographic criterion was set to capture individuals directly impacted by the reserve and its policies. The residents in this area were assumed to have a higher likelihood of interaction with the Sikunga FPA and, thus, a more robust basis for evaluating its role and impact.

Sampling strategy

Choosing an appropriate sampling strategy was crucial to ensure that the research yielded representative and reliable results. In this study, a stratified random sampling approach was employed to select a sample of 200 respondents from the larger population of 2000 community members who lived within a 15 km radius of the Sikunga FPA in the Zambezi Region. The population was stratified into various demographic or geographic categories based on age, gender, education, and proximity to the reserve. Stratification helped to ensure that each subgroup's characteristics were well-represented in the final sample.

Sample size determination

The sample size of 200 was determined using Yaro Yamane's formula, given in equation (1) below. The choice of the error margin $e = 7\%$ was made considering the need to provide a balance between the need for a representative sample and the practical constraints of data collection within the available resources.

$$n = \frac{N}{1+e^2N} \quad (1)$$

Equation 1 yielded a sample size of 185 respondents, to which 40% extra respondents were added to give a sample size of 259 to cater for the non-response rate threshold reported in 2022 by (Holtom et al., 2022). However, a good response rate of 77.22% was reported in the current study, where of the 259 questionnaires administered face to face, 200 agreed to respond. In cases of non-response, researchers have a predefined plan for replacing non-respondents with other eligible individuals from the same stratum to maintain the integrity of the sample and the representation of each subgroup.

Informed consent and ethical considerations

Before data collection, researchers obtained informed consent from the selected respondents. Ethical considerations were paramount, and the research adhered to the highest ethical standards. Respondents' privacy and anonymity were maintained, and they were informed about the research's purpose and how their data would be used.

Data analysis

Data analysis was computed using descriptive statistics (graphical and descriptive measures) to explore the degree of the community's involvement in the establishment of the Sikunga FPA,

assess the roles and benefits of the Sikunga FPA, and evaluate the extent of the riparian communities' participation in the governance and management structures of the Sikunga FPA. Inferential statistics involving multivariate Analysis of Variance (MANOVA) was used to examine socio-demographic variables' influence on the community's perception of the reasons for establishing the Sikunga FPA. The analysis considered various factors, including gender, age group, education level, marital status, and access to resources within the Sikunga FPA. Pillai's Trace was used to evaluate the overall significance, with subsequent tests for individual variables.

Results

Socio-demographic profile of the respondents

The socio-demographic characteristics of the respondents provide valuable insights into the perceptions and livelihoods along the Sikunga FPA (Table 1). Most residents along the Sikunga FPA (91.5%) have been residing in the area for over a decade, with a gender distribution favoring females (64.6%). The age distribution was relatively balanced, with the largest group falling in the 26-35 age range (26.4%). Educational levels varied, with a significant portion having completed secondary education (67.2%), while employment status showed a substantial proportion of self-employed individuals (63.0%). Household monthly income predominantly falls below 5,000 Namibian Dollars (96.3%). Marital status revealed a nearly equal distribution between married (45.5%) and single (37.0%) individuals. These findings reveal that most of the inhabitants of the Sikunga FPA resided in the area for more than a decade; most were married, self-employed young women with secondary education and receiving income below N\$ 5,000.

Table 1. Distribution of respondents by Socio-demographic characteristics.

Socio-demographic variable	Frequency (n)	Percentage (%)
Years residing in Sikunga		
< 5	4	2.1
5 – 10	12	6.4
> 10	173	91.5
Gender		
Male	67	35.4
Female	122	64.6
Age in years		
<25	23	12.2
26 – 35	50	26.4
36 – 45	43	22.8
> 45	73	38.6
Highest education level		
None	9	4.7

Primary	44	23.3
Secondary	127	67.2
Tertiary	9	4.7
Employment status		
Unemployed	58	30.7
Self-employed	119	63.0
Employed	12	6.3
Household income/month		
< 5000	182	96.3
5001 – 10000	6	3.2
> 10000	1	0.5
Marital status		
Married	86	45.5
Single	70	37.0
Co-habiting	4	2.1
Widower	19	10.1
Divorced/Separated	10	5.3

Sources of income and community well-being

A comprehensive overview of the livelihood activities reported by the respondents is displayed in Table 2. Notably, farming emerged as a predominant source of livelihood, with 29.6% of respondents engaged in agricultural activities, followed by business ventures (17.8%), livestock (16.5%), fishing (16.1%) and natural resources utilization (13.7%), cumulatively representing 93.7%. Employment (4.6%) and tourism (1.3%) contributed the least to livelihoods. These findings provided valuable insights into the various dimensions of community livelihoods. They emphasized the importance of considering these diverse activities in the context of the Sikunga FPA and conservation initiatives.

Table 2. Sources of livelihood for the Sikunga community members

Livelihood Activities	Frequency (n)	Percent (%)	Cumulative %
Farming	140	29.6	29.6
Business	84	17.8	47.4
Livestock	78	16.5	63.9
Fishing	76	16.1	80.0
Natural Resource Utilization*	65	13.7	93.7
Employment	22	4.6	98.3
Tourism	6	1.3	99.6
Other	2	0.4	100
Total	473	100	-

* Natural resources include fuelwood, charcoal, and reeds.

Figure 2 presents the status of well-being among the riparian communities along the Sikunga FPA. Respondents were asked to rate their well-being on a semantic differential scale, ranging from "worst" to "best." Most individuals reported an "Average" well-being status, constituting nearly half (49.7%) of the respondents. The "Worst" and "Fine" well-being categories accounted for 13.8% and 21.2% of the respondents. Additionally, "Somewhat bad" and "Best" well-being statuses were less common, representing 9.0% and 6.3% of the participants, respectively. The results of the well-being status showed that half of the respondents had an average well-being status; additionally, more than one-fifth indicated that they were fine.

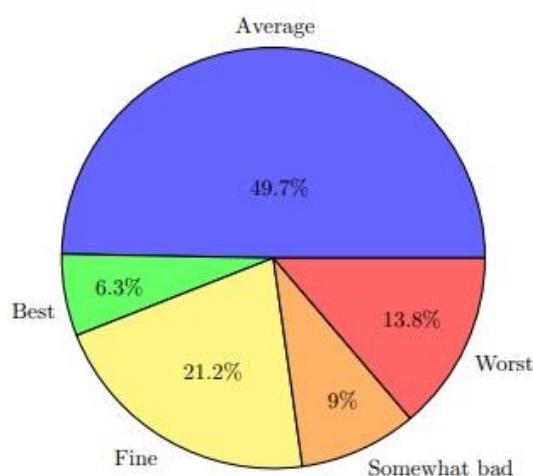


Figure 2. Status of well-being among the riparian communities of the Sikunga FPA.

Institutional Support Towards Community Livelihoods

Table 3 presents the institutional support towards community livelihoods along the Sikunga FPA. The multiple response was used to offer valuable insights into the extent of institutional livelihood support received by the local communities. The results showed that a variety of organizations were actively engaged in providing support, with the most significant contributors being the Sikunga Conservancy itself (23.2%), followed by the Namibia Red Cross Society and the Ministry of Agriculture, Water, and Land Reform (MAWLR) each contributing 21%, and Lodges and Tourist Camps with 13.5%, cumulatively contributing 79%. The least contributors to community livelihoods included the Namibian Development Trust (1%), Kavango Zambezi Trans-frontier Conservation Area (1.5%), and the Namibian Nature Foundation (2.2%). The Ministry of Environment, Forestry and Tourism, and Integrated Rural Development and Nature Conservation (IRDNC) provided intermediate support of 8.5% and 6.7%, respectively.

Table 3. Institutional support towards community livelihoods

Organizations	Frequency (n)	Percent (%)	Cumulative %
Sikunga Conservancy	93	23.2	23.2
Red Cross	86	21.4	44.6
Ministry of Agriculture, Water and Land Reform	85	21.2	65.8
Lodges and Tourist Camps	54	13.5	79.3
Ministry of Environment, Forestry and Tourism	34	8.5	87.8
Integrated Rural Development and Nature Conservation	27	6.7	94.5
Namibian Nature Foundation	9	2.2	96.7
Kavango Zambezi Trans-frontier Conservation Area	6	1.5	98.2
Namibian Development Trust	4	1	99.2
Others	3	0.8	100
Total	401	100	-

Communities' involvement in the establishment of the Sikunga FPA

The community's views about involvement in establishing and owning the Sikunga FPA are presented in Table 4. Most respondents (67.7%) reported not being involved in establishing the reserve. At the same time, a smaller proportion indicated varying degrees of participation, with 17.5% stating that they were involved "a lot," 5.3% "somewhat," and 9.5% indicating that they were involved a "a little". Regarding ownership levels, a significant majority (43.6%) expressed no ownership over the Sikunga FPA, while 35.4% felt a strong sense of ownership, describing their involvement as "a lot."

Table 4. Community's involvement in the establishment and level of ownership

Response categories	Were you involved in the establishment of Sikunga FPA?		What is the level of ownership of the Sikunga FPA?	
	Frequency	%	Frequency	%
None	128	67.7	79	43.6
A lot	33	17.5	64	35.4
A little	18	9.5	23	12.7
Somewhat	10	5.3	15	8.3
Total	189	100	181	100

Community awareness and their perceptions towards the establishment of the Sikunga FPA

The results on community awareness level and perception towards establishing the Sikunga FPA indicated that the proportion of the respondents who were aware of the reserve was higher (151: 80%) than those unaware of its existence (38: 20%). Most respondents expressed that the Sikunga FPA was established to conserve fish in the channel (68.3%) and establish a breeding area (68.8%). A high proportion of respondents perceived that the reserve would enhance ecotourism or recreational benefits (59.8%) and promote environmental benefits (59.5%), with an intent to

maintain sustainable fish harvesting in rivers and lakes (63.5%). The MANOVA revealed that the age group had a statistically significant effect ($F = 2.507$, $p = 0.034$) on community perception of the reasons for establishing the Sikunga FPA (Table 5). Other variables (i.e., gender, educational level, marital status, and access to Sikunga FPA resources) did not show any statistically significant effects on the stated reasons for establishing the Sikunga FPA.

Table 5. The influence of socio-demographic factors on community perception towards the objectives for the establishment of the Sikunga FPA

Source	Pillai's Trace	F	p-value
Wilks' Lambda	0.973		0.438
Gender	0.042		0.438
Age Group (years)	0.958	2.507	0.034
Education Level	0.025		0.714
Marital Status	0.081		0.090
Access to FPA Resources	0.010		0.954

Natural resources accrued from the Sikunga FPA

The respondents were asked to indicate the resources accrued from the Sikunga channel before it was declared an FPA (Table 6). Notably, the most commonly accessed resources were reeds (16.8%), followed by fish (16.8%), and pastures for grazing livestock (16.2%). Water lilies (14.7%) and thatching grass (14.1%) were the intermediary accessible resources, while fruits (10.4%) and wooden poles (9.2%) were the least. Respondents were further asked to rate the impacts of the Sikunga FPA at the individual level (Fig. 3). While most respondents perceived the Sikunga FPA as having no impact (37.7%) or a negative impact (22.01%) on their livelihoods, at least 28.93% of the respondents indicated that the reserve was beneficial. A few respondents (5.03%) felt it had positive and negative impacts.

Table 6. Critical resources that community members attained from Sikunga FPA

Resources	No. of responses (n)	Percentage (%)	Cumulative (%)
Reeds	55	16.8	16.8
Fish	55	16.8	33.6
Livestock grazing	53	16.2	49.8
Water lilies	48	14.7	64.5
Grass	46	14.1	78.6
Fruits	34	10.4	89.0
Wooden poles	30	9.2	98.2
Other	6	1.8	100
Total	372	100	-

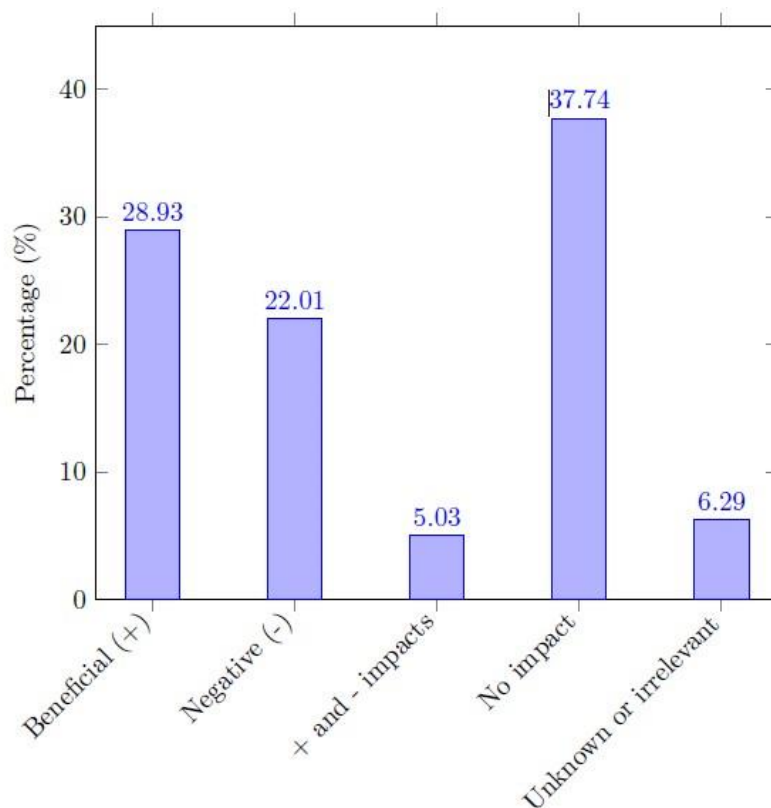


Figure 3. Distribution of respondents based on their perception of benefits and impact of the Sikunga FPA on community livelihoods.

Community involvement in the management of the Sikunga FPA

The attendance rate and involvement of the community in management meetings of the Sikunga FPA are shown in Figure 4. The results showed a lower proportion of participants (47%) compared to non-participants (53%) in meetings (Fig. 4a). Most of those who attended the meetings (55.1%) felt fully involved in discussions, followed by 32.6% who felt partially involved. In comparison, the remaining 12.3% felt they were excluded (Figure 4b) from the management meetings of the Sikunga FPA.

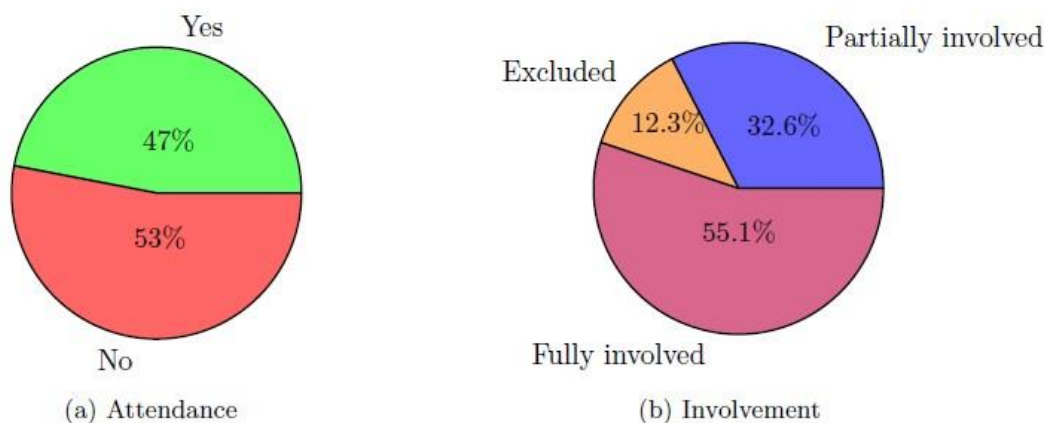


Figure 4. Attendance, (b) Involvement in Management Meetings of riparian communities

Figure 5 depicts the respondents' views on the Sikunga FPA management approach. Most respondents ($n = 109$; 80.7%) supported developing an integrated development and management plan (IDMP) for the Sikunga FPA; similarly, an equally higher number of respondents ($n = 107$; 79.3%) supported promoting the Sikunga FPA to a legally protected national reserve owned (PC) and managed by the community. Also, most respondents ($n = 73$; 56.2%) believed that more restrictions should be imposed (IR), whereas others ($n = 58$; 43.9%) believed that the current restrictions should be relaxed (RR).

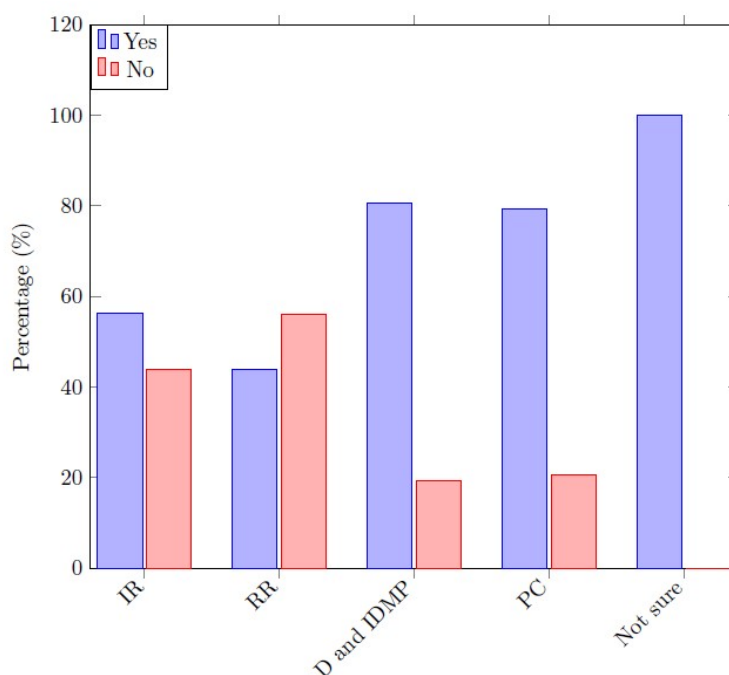


Figure 5. Improving the effective management of Sikunga FPA as perceived by the respondents. IR = Increase restrictions; RR = Reduce the restrictions; D and IDMP = Develop an integrated development and management plan for the Sikunga FPA, and PC = Promote the Sikunga FPA to a community reserve.

Discussion

The success and contribution of fish-protected areas to fisheries management relative to sustainability and biodiversity conservation should consider the socio-cultural and socio-economic contexts in the target area. Thus, the premise of this study was to determine communities' perceptions of the existence of the Sikunga FPA in their vicinity. The most frequently encountered or relevant socio-economic indicators discussed here include the locals' views about benefits derived from the Sikunga FPA, their level of participation in management meetings, their involvement in decision-making, and their income distribution. These perceptions had to be evaluated as an indicator of social acceptance of the Sikunga FPA because failure to take social dimensions into account can erode the legitimacy of a fish reserve.

Impact of Socio-Demographic Factors on the Perceived Socio-Ecological Value of the Sikunga FPA

The observed higher proportion (38.6%) of older respondents (> 45 years) in this study could be attributed to the fact that younger people are more economically active and, in most cases, were absent from home during interviews. However, the dominance of female respondents (64.6%) compared to males (35.4%) may be because females are more involved in household chores than males (Cerrato & Cifre, 2018; Dewi et al., 2021; Midgette, 2019) and thus, are more likely to be available during the day than their male counterparts.

The respondents' observed differences in socio-demographic variables could affect their perceptions of conservation and management approaches of the Sikunga FPA. Driven by the belief in such a hypothesis, the multivariate analysis of variance (MANOVA) conducted to explore the influence of socio-demographic variables on community perceptions towards the establishment of the Sikunga FPA revealed that age group among other factors (i.e., gender, educational level, marital status and access to Sikunga FPA resources) was the only individual predictor with a statistically significant effect. This finding suggests that different age groups within the community hold varying perspectives on conservation and resource management. Age-related differences in attitudes and values may influence the level of support and engagement in activities of the Sikunga FPA. These results contradict former reports on the significant effect of gender differences towards the use of technology Madigan et al. (2007), attitudes and preferences towards the environment (Torgler et al., 2008; van Veldhuizen, 2022), and attitudes towards the conservation of snakes (Pinheiro et al., 2016).

However, the lack of significant difference in levels of awareness of the Sikunga FPA and attendance of management meetings between female and male respondents in this study may imply that both genders within the study area are interested in and value matters related to the Sikunga FPA or the environment in general. This situation may imply equal participation in fishery management decision-making contrary to unequal power relations and lack of adequate and meaningful participation in fishery management, as was observed in Tonle Sap Lake of Cambodia and Lake Victoria in Kenya (Dhenge et al., 2022; Madigan et al., 2007; Pinheiro et al., 2016). The current results signify developments that augur well for women's empowerment (Limuwa & Synnevåg, 2018; Longwe, 2002; Siles et al., 2019) advancing and governance of the Sikunga FPA. However, the observed lack of effective participation in decision-making may lead to non-compliance with protection and conservation rules, as was observed in Solomon Island (Siles et al., 2019). The increased participation of women in fisheries management in low-income earning

opportunities and declining fish production in the Zambezi/Chobe Rivers may be related to a need to improve their livelihoods and a concern for future sustainable fish production.

Community Livelihood, Well-being, and Awareness of the Sikunga FPA

The more significant percentage of respondents who were aware of Sikunga FPA was a predictable outcome because communities are typically interested in issues that affect their lives. Awareness is a social capital that can define the sustainability of Sikunga FPA. Communities around Sikunga FPA rely on diverse economic activities for their livelihoods. Farming is the most dominant economic activity (29.6%), while business, livestock keeping, and fishing activities rank high among other economic ventures. Our study area, relative to other areas in Namibia, receives a substantially high amount of rain of about 650 mm per year Mendelsohn, (2006) and can support farming. Unsurprisingly, farming is a leading economic activity, although the area also experiences droughts (Mendelsohn et al., 2013). Due to droughts, farming may be unreliable, and the community engages in livestock keeping and small-scale businesses such as retail shops to sell fish and vegetables. The floodplains and riparian zones provide grazing pastures and reliable water sources during drought. In order to diversify sources of income, community members ought to engage in other seasonal and annual activities such as fishing and natural resources utilization activities.

The observed low level of employment in the study area is linked to a lack of industries. At the same time, the community members' perceived well-being status as either average or below average implies that the average income from the income-generating activities is typically low. Intervention measures are required to improve the current income levels of the community. These results on low financial gains in this study corroborate Huang et al. (2022) and indicate that communities around the FPA's are generally low-income rural communities, hence their reliance on agriculture for livelihood (Harker et al., 2022).

Organizational and Institutional Support towards Community Livelihoods

Local and national institutions play a critical role in areas surrounding Sikunga FPA by providing access to various resources and public goods and opportunities for community interaction and participation in development projects of interest to the community. The respondents acknowledge some form of livelihood support from several organizations, either cash or kind (refer to Table 2). The Sikunga Conservancy had the highest responses mainly because it is a local institution that operates under the guidance of community members. Any benefits accrued from the economic

activities in the Conservancy (i.e., through game and trophy hunting) are shared among its members, either individually or in a corporate manner. The Namibia Red Cross Society also scored as the second contributor towards the livelihood of the communities in the study area, which could be related to its intervention in providing food relief support during drought and food scarcity. The study area has occasional droughts leading to severe food shortages; hence, organizations, such as the Namibia Red Cross Society, are requested to provide food aid, and such organizations are remembered long after such generosity. The IRDNC is a development organization that works with local communities and conservancies to promote wildlife and nature conservation. This organization is well entrenched in the Zambezi Region. It holds several development meetings, and it was not surprising that it was ranked among those organizations contributing to the community's livelihoods surrounding Sikunga FPA. Lodges and tourist camps are built on land leased from the community, and they make annual payments to the community based on the number of bed nights and charges for other activities. These organizations offer community services as part of their corporate social responsibility (CSR).

The government departments under the MEFT and MAWLR provide advice and other material needed to improve community-based natural resource management and agriculture (e.g., seeds and equipment) and critical interventions for improving community livelihoods and well-being. The relatively high score by these government institutions in contributing to community well-being is apt and befitting. The activities of lower-ranked organizations, such as NDT, NNF, and KAZA TFCA (Table 3), need to be better known in the study area and identify projects that would make the community recognize their contribution. These observations imply that institutions that provide support that is aligned with the Sikunga community's well-being will be viewed positively and likely to lead to achieving the institution's goals. Institutions must identify efforts and interventions to increase community well-being and engender community support for Sikunga FPA, as postulated by Bennett and Dearden (2014).

Sense of Ownership and Involvement in the Establishment of the Sikunga FPA

Only a paltry 17.5% of the respondents perceive that they were fully involved in the initiation and establishment phase of the Sikunga FPA. These results imply that most community members were not involved in establishing the Sikunga FPA, which is likely to affect their sense of ownership and lack of collaboration between reserve management and the local community over the use and management of natural resources. Contrary to these results, the involvement of the local communities and other stakeholders in establishing and managing protected areas has become a

common practice (Abobi & Wolff, 2020; Bekker & Mashaba, 2018; Ezebilo, 2012; Hirschnitz-Garbers & Stoll-Kleemann, 2011; Matiwane & Terblanche, 2012; Naidoo & Ricketts, 2006). A significant proportion (67.7%) of respondents who felt left out in the Sikunga FPA's establishment phase must be addressed for its acceptance and success. The involvement of locals in the establishment of the reserve could inoculate a wealth of indigenous knowledge that could guide the effective conservation of the Sikunga FPA (Naidoo & Ricketts, 2006).

Community Perception of Benefit Acquisitions from the Sikunga FPA

Results show conflicting views among community members regarding the role of Sikunga FPA (Figure 5). The observation that the majority of respondents (61.6%) perceive the Sikunga FPA as having no impact or harming their livelihoods does not augur well for future perfectives of the reserve. Access to or loss of benefits influences the lives of people living in or around protected areas (Rohe et al., 2018) and is the basis of positive or negative perceptions in this study. The Sikunga FPA provides both tangible and intangible benefits, and those who perceive it as influencing their lives may be those who acquire resources therein. The results show that Sikunga FPA is a source of consumptive (fish) and non-consumptive (wooden poles) goods. Those denied free supremacy to obtain resources at any time and in preferred amounts and those highly dependent on resources therein will likely consider the Sikunga FPA a harmful initiative. Such negative perceptions due to denial of uncontrolled exploitation of resources have been observed in residents surrounding Itombwe Nature Reserve in Congo (Mendelsohn, 2006) and in a protected area in Madagascar (Mendelsohn et al., 2013). Some respondents enjoy the resources obtained from the reserve but loathe the rules imposed on their acquisition and would consider Sikunga FPA as both beneficial and harmful. Those who do not obtain physical resources (instrumental goods) from Sikunga FPA may feel that the reserve has no impact or relevance to their lives. These are in the majority, and they need to be educated on the intangible values of the reserve, which undoubtedly has some indirect benefits or influence on their lives. Despite the community seeming to be aware of the reserve, they feel that the establishment of the reserve impedes their livelihood needs.

Socio-economic and Ecological Reasons for Establishing the Sikunga FPA

Most respondents (59.3%) agreed that Sikunga FPA was established for socio-economic and ecological reasons, indicating good knowledge about the role of the reserve. These intriguing results contradict the respondents' negative perception of the impacts of the reserves on their lives.

The reasons for such ambivalent and contradictory responses are challenging to explain. However, they may be related to the need for more clarity on the question of the role of the reserve in the respondents' lives. Based on the high proportion (68%) of respondents who agreed that the reserve was established to conserve fish in the channel and establish a fish breeding area, there is optimism for the support of the reserve by the community who consume and trade in fish. However, to be effective, the management of the Sikunga FPA should take a step further to educate the community on the overall benefits of the reserve's goal of conserving biodiversity, including fish resources while securing social, economic, and environmental benefits. Protected areas are generally faced with limited effectiveness due to ineffective conservation management and unfavorable socio-economic context (Gatiso et al., 2022). Hence, considering the affected communities' socio-economic and ecological concerns could balance community and reserve conservation needs. The Sikunga community's economic welfare can be improved with sound participatory planning, good governance, and appropriate economic policy (Borrini-Feyerabend et al., 2012; Holtom et al., 2022).

Attendance of management meetings and decision-making for the Sikunga FPA

On the other hand, studies have shown that governance, management, ecological outcomes, social impacts, and a fully participatory establishment process are critical considerations in eliciting community support for protected areas (Abukari & Mwalyosi, 2020; Ayivor et al., 2020; Vodouhê et al., 2010). The current results show that several meetings on Sikunga FPA have been held, but less than 50% of the respondents attended such meetings. If indeed notices to attend such meetings were given appropriate lead time, this may imply that most respondents do not consider matters of the reserve a vital activity or a priority. Management meetings on the reserve may not be a priority for many people with competing daily obligations to meet their basic needs. Several factors have been associated with low attendance at development and public meetings, such as lack of awareness, lack of sense of ownership, low efficiency, general lack of interest, poverty, inadequate project information, and poor communication between organizers and community members (Brown & Mickelson, 2019; Kamuiru & Mbwisa, 2014; Kilewo & Frumence, 2015; Kwena, 2013; Lachapelle, 2008; Lauwo & Mkulu, 2021). In the Sikunga community, most low-income members are likely to spend most of their time looking for a living and participate only in meetings that promise some immediate benefits. One way to develop an interest in attending meetings is to enhance the community's economic well-being in the long run so that time is available for other community activities. Our observation is that participation in meetings is

enhanced by offering rewards for participation, as attendance has an opportunity cost (Cai et al., 2021). Such meetings and consultations would draw the reserve's management plans.

Furthermore, there were mixed perceptions about who makes decisions concerning Sikunga FPA's management, ranging from no involvement to complete involvement of local people. The general result was that some respondents felt that outside authorities make decisions indicating a potential conflict in the sustainable management of the reserve. Many development projects that lack local people's ownership structure and involvement and do not address beneficiaries' needs often fail (Bekker & Mashaba, 2018; Ezebilo, 2012; Ezebilo & Mattsson, 2010; Hirschnitz-Garbers & Stoll-Kleemann, 2011), as locals consider themselves alienated, outsiders, and passive onlookers (Bekker & Mashaba, 2018; Chatty & Colchester, 2002). Whereas it may only sometimes be possible to have the local people make all reserve management decisions, the success of any local project or intervention may require the collective participation of the local people in the decision-making process (Conroy & Peterson, 2013). As and where possible, efforts should be made to include the local people in making management decisions about the Sikunga FPA.

Unlocking the potential of the Sikunga FPA for the benefit of the communities

One of the criticisms against the Freshwater-protected areas has been the breadth of activities permitted. Primarily, there should be benefits to the local communities derived from conserving the target species. Such benefits may be directly (e.g., increased tourist activity results in increased community-level expenditures) or indirectly (e.g., decreased localized industrial pollution inputs increase local crop yields). The Zambezi Region is a popular tourist angling destination as it offers diverse angling opportunities, including freshwater angling for freshwater species such as *Hydrocynus vittatus* (Tigerfish), *Serranochromis Robustus* (Nembwe), *Oreochromis andersonii* (Three spotted tilapia), *Oreochromis macrochir* (Greenhead) and *Coptodon rendalli* (Red-breasted tilapia). However, the respondents in this study have yet to cite angling tourism as a source of income, possibly because most anglers that frequent the Sikunga FPA are hotel and lodge tourist guests. These anglers usually pay a fee for angling activities to benefit the lodge owners but to the detriment of the local communities who have sacrificed their fishing zones and embraced the establishment of the Sikunga FPA. This imbalance seriously affects the livelihoods of the local communities who are denied access to fish in the Sikunga FPA. Hence, there is a need to address this matter and explore means of diverging funds generated through angling tourism towards the coffers of the local communities. Such innovation can support livelihoods for

communities that have accepted and embraced the establishment of the Sikunga FPA in their vicinity.

Adaptive Management Strategies for the Sikunga FPA

The general observations from this study show that most of the riparian communities along the Sikunga Fish Protected Area were never engaged and involved in the establishment phase of the reserve. This situation is exacerbated by the fact that only a fraction of those involved confirmed to have actively participated in management meetings of the reserve, and this situation is likely to erode the success rates of the Sikunga FPA shortly (Cai et al., 2021). Senghor et al. (2023) and Sanchirico et al. (2002) similarly affirm that the failure of many aquatic reserves is attributed to a lack of compliance from the users due to the lack of consultation before the regulation is established. Given these scenarios, authorities of the Sikunga FPA are compelled to involve the community in planning, conservation activities, and decision-making as a way of harnessing the vast local knowledge of natural resources as well as the labor force to help in conservation, efforts, and the sustainable use of the Sikunga reserve. Engaging local communities in the designation and enforcement of community-managed protected areas has emerged as a conservation strategy in tropical marine ecosystems (Velez et al., 2014) as well as freshwater environments (Baird et al., 2005; Loury et al., 2018; Vermeersch, 2014). According to Hannah et al. (2019), Vermeersch (2014) and Nasuchon (2009), community participation in resource management is prevalent in Southeast Asia, including the Lower Mekong Basin (LMB) (Hannah et al., 2019; Nasuchon, 2009; Vermeersch, 2014) and has been applied to the management of coastal areas, mangrove forests, wetlands, and riverine deep pools (Baird, 2006; Loury, 2020). Kenya's efforts to improve community involvement in protected areas span from 1990 to 1992 in Africa. This development was attributed to communities' demands for greater involvement in decision-making. Following protests by the locals in 1991, the national government of Kenya attempted to include the local community in management decision-making through the Beach Management Units (BMUs). The BMUs have enabled local communities to create their by-laws for their respective reserves with support from the state and stakeholders such as NGOs with approval from the Department of Fisheries (Cinner et al., 2012).

Subsequently, this has increased participation and minimal conflicts among the local communities in managing their marine areas. The same principle can be adopted to initiate the inclusion of the local communities in the meetings and decision-making of the Sikunga FPA. This initiative will ensure effective and efficient Sikunga FPA governance while maintaining a balance between the

socio-ecological and biological conservation needs of the Sikunga FPA. Outlining clear channels for participation, rights, and duties for all engaged stakeholders can help facilitate the Sikunga community's involvement in achieving conservation objectives (Camargo et al., 2009). Suppose participation is low; potential barriers and incentives for participation can be introduced (Tupper et al., 2015). In that case, This should consider whether people are satisfied with the quality of participation, including factors like opportunities for input and influence, information exchange, fairness, transparency (Dalton et al., 2012), and continuity of participation (Gall & Rodwell, 2016). Community support can assist in the persistence and support of FPA's over the long term, leading to better ecological outcomes (Bennett et al., 2019).

Conclusion

The study's findings revealed that local communities along the Sikunga FPA are conversant with the objectives of the protected area and willing to participate in activities pertinent to its operations. Most respondents showed a high preference for owning and managing the reserve. However, there is a fear of resource abuse if they are allowed access to critical resources. Despite this assumption, community empowerment toward inclusive participatory and natural resource management systems is critical (Phillips, 2003). The fact that most respondents expressed interest in an integrated development and management plan for the Sikunga FPA presents potential optimism for the support of Sikunga FPA. Those who prefer a relaxation of the existing restrictions are in the minority and may indicate that law enforcement of the rules and regulations will most likely not be an onerous task but to be included in the integrated development and management plan for the Sikunga FPA. Apart from boosting the reserve-community relationships, the frequent flow of information between the FPA managers and local communities through outreach is necessary for promoting participatory natural resources governance and conservation education. This approach can be adopted to manage similar African reserves to balance conservation and social and economic needs.

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