

TOWARDS BUI RESERVOIR FISHERIES SUSTAINABILITY: PERSPECTIVES OF RIPARIAN COMMUNITY

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Esther Wahaga¹ewahaga@yahoo.com**(Corresponding author)**CSIR-Food Research Institute, Accra¹**Ruby Asmah²**rbyasmah@yahoo.com**Edward Kofi Abban³**kofi_abban@yahoo.co.ukCSIR-Water Research Institute, Accra^{2,3}*Doi//<https://dx.doi.org/10.4314/gjds.v21i1.6>***ABSTRACT**

Sustainability after the creation of the Bui Dam has been problematic, with the Bui Power Authority (BPA) addressing the environmental, economic, and social concerns related to sustainability. As a result, electricity generation and irrigation are managed to ensure long-term social, economic, and ecological sustainability. The study thus aims to advance societal progress by analysing the impacts of social, economic, and environmental sustainability on both current and future generations, focusing on the concerns of reservoir stakeholders. Approaches used were Formal Surveys guided by semi-structured interviews, Focus Group Discussions (FGDs), and Key Informant Interviews (KII). Qualitative and quantitative data were collected and analysed using the Statistical Package for Social Scientists (SPSS). Evidence showed that fish capture, processing, and trade were critical economic activities that sustained residents and impacted their economic, social, and cultural well-being. Fishers operated daily with unapproved and destructive gear such as hook-and-line traps and beach-seine nets, which were detrimental to the sustainability of the fisheries. The fishing pressure (1,500 fisher population and 2,000 canoes) was hostile towards the sustainability of fishing in the reservoir. Recommendations were to restrict the reserved reservoir component, establish local fish catch monitoring stations, and build local fisher folk capacity to gather critical monitoring information.

Keywords: Fish Catch, Riparian Community, Fish Population, Livelihoods, Fishing Pressure, Fish Trade, Sustainability

INTRODUCTION

Up until the 1970s, dams were essential for providing water and energy. The World Commission on Dams' 2000 report showed most dams underperformed considering their intended use (World Commission on Dams [WCD], 2000). For that matter, dams and reservoirs are a subject of national and international discourse and study because dam and reservoir projects may often cause permanent, multiple, and adverse environmental changes, which have enormous concerns for people's lives and livelihoods. It is argued that dams' social, ecological and economic problems are extensive because of the significant impact on the eco-system, social, economic, and cultural spheres (Manatunge et al., 2009). However, dams and reservoirs play vital roles in economic development and serve as sources of electricity generation, irrigation, and flood control (Nestmann & Stelzer, 2007; Manatunge et al., 2009). Dams and reservoirs also support numerous economic activities that generate employment for local people and immigrants (Manatunge et al., 2009).

The formation of a reservoir on Black Volta, which is part of the River Volta basin in Ghana, was initiated in 2011 by the closure of a dam built across the river at Bui in Northern Ghana. The reservoir was created primarily for hydroelectric power generation (Bui Power Authority Act 740, 2007). Section 27 of the Act mandated the Bui Power Authority (BPA) to manage and control the reservoir's fishery to ensure sustainable fishing in the long term (BPA, 2016) because the potential of fisheries in tropical reservoirs could be a significant social and economic co-product of reservoirs built primarily for other purposes (Bene et al., 2009; Gocking, 2020). The Bui reservoir, with a surface area of 444 km² (Gocking, 2020) at maximum height, has over 90% of it falling within the boundaries of 1,821 km² of Bui National Park (BNP), which existed before the reservoir was initiated. In the park, fishing was prohibited under the Animals Preservation Act of 1961 and the Wildlife Conservation Regulations of 1971 (BPA, 2016), both in Ghana.

A pre-impoundment fisheries assessment of the then future reservoir based on knowledge of fisheries in the Black Volta River and rising waters of the reservoir during 2011 concluded that the potential fish yield of the future reservoir was to be "quite limited". This was based on the low productivity of the Volta Lake, to which the Black Volta River is a major tributary and the situation that only 10% of the reservoir would be outside the reserve area and thus available for fishing (Ofori-Danson et al., 2012). For the sustainability of the reservoir fisheries, the Ofori-Danson et al. (2012) study report recommended the initial limitation of fishing harvests' access to about 40 registered canoes. It implied fewer fishing days in a week of seven days.

Several years into the existence of the Bui reservoir, a part of the reservoir we had yet to be made known to the riparian community as a definite reserve area. There has yet to be a frame survey to estimate the number of canoes and fishers operating on the reservoir. There have also not been any established catch monitoring records to provide indications of catch trends, neither of fish species, relative abundance of species, nor biomass, except the works of Alhassan et al. (2015) and Alhassan et al.

(2017). However, there are indications that the relative fish boom expected during the formation and stabilisation of a new tropical reservoir has 'come and gone' for the Bui Reservoir, thus the need to sustain fisheries in Bui Reservoir.

This study is grounded in development and sustainable development theories, emphasising sustainability across social, economic, and environmental dimensions (Shi et al., 2019). Measuring sustainability involves considering sustainable yields, encompassing regenerative natural resources, societal development, and ecology balance. These components are crucial in evaluating fisheries, as they can be assessed based on yield and their social and economic benefit to communities while also considering the ecological interactions between natural resources and humans (Freedman, 2018). The study thus aims to advance societal progress by analysing the impacts of social, economic, and environmental sustainability on both current and future generations. Literature indicates that sustainability is the capability to sustain goods and services for human society while considering such actions' economic, social, and environmental impacts. According to FAO (2003), an ecosystem-based fisheries management system was created to enforce the best practices that capture fisheries management's environmental, economic, and social impacts. Sustainability is important for economic growth, environmental conservation, and community well-being (Adams, 2006; Al-Mosroori & Bose, 2011) so that people can benefit from and act on ecosystem processes. Where the interactions and trade-offs between environmental, economic and community well-being fail, sustainability is unlikely to succeed. However, sustainability in the fisheries sector has been considered a question of the ecosystem rather than of the community's economic well-being (Chapin et al., 2010). Identifying existing sustainability issues is therefore important in fisheries, and at the same time, not placing high importance on environmental issues can pose future threats and can result in the establishment of inappropriate goals (Alonso et al., 2012).

An FAO report on regional fisheries livelihoods programme for south and southeast Asia-Timor-Leste indicated that the development of fishing cooperatives by development agencies and state institutions needed to be improved. They noted that this was due to the strategy used. The strategies of the cooperatives were inconsistent with the local traditional structures, which were firmly rooted in human well-being and community relations (Alonso et al., 2012).

Key disparities in views on sustainability are centred around the degree to which resource use alters other parts of the ecosystem. In fishery, harvests produce long-term sustainable yields, whereas having fish in abundance in an ecosystem that is not harvested at all will reduce sustainability. However, the unintended catch of other species may reduce the abundance of nontarget species and, locally or globally, go extinct (Matsuda & Abrams, 2006). Fishing alters an ecosystem's structure, and fishing one species could make other species abundant by endangering local or global extinction (Cury et al., 2011; Wilson et al., 2007). Literature indicates that ecosystems subjected to strong fishing pressure show strong declines in the abundance of the target species (Wilson et al., 2007).

The forced settlement of residents due to the Bui Dam project led to national and international conservation groups advocating against the project. The Ghanaian government, however, proceeded with the project, resulting in planning challenges and adverse impacts on settlers due to the non-participatory approach (Tornyie, 2015). Recognising the social challenges of displacement, the BPA pursued Environmental and Social Impact Mitigation Measures stipulated in a Resettlement Planning Framework (January 2007) for the Bui Hydroelectric Project (BPA, 2015a; BPA, 2015b). This plan outlined the processes and principles for resettlement to improve living conditions and create economic opportunities for the affected people affected by the Project. The sustainability of the Bui Dam post-creation has been marred with social, economic, and environmental issues (BPA, 2015a; BPA, 2015b). The BPA often addresses these issues to ensure sustainability. The socio-economic study aimed to document the perspectives of the Bui reservoir riparian community, especially the fisher folk, on fisheries of the reservoir and what may necessarily be done with respect to controlling and managing fisheries of the reservoir towards attaining fishing sustainability. Thus, the study was to undertake a social and economic assessment of the sustainability status of the Bui reservoir fisheries. The methods used for data collection included individual interviews, group discussions, and key informant interviews.

PROFILE OF THE STUDY AREA

The Banda district, a notable part of the Bono Region, is one of the twelve administrative districts in this region of Ghana (figure 1). Banda Ahenkro as its district capital. The district lies within latitudes 7 and 8° 45` North and longitudes 2° 52` and 0° 28` West. It shares boundaries with the Bole District (Savanna Region) to the North, Tain District to the south, La Cote D'Ivoire to the East and Kintampo South to the West. The district covers 2,298.34570 square kilometres out of the regional size of 39,558 square kilometres (Banda District Assembly, 2018).

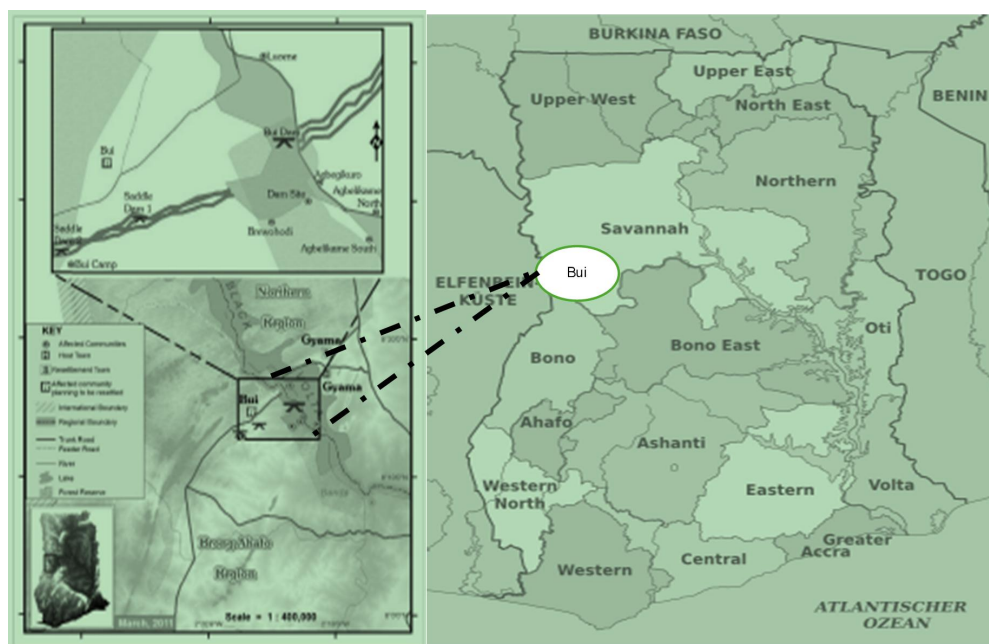


Figure 1a &b: Map of Ghana Showing the Bui Dam**Source: Tornyie (2015) and Wikipidea.**

The district's climatic conditions are significant for development, with the prevailing temperatures essential for growth. The temperature averages about 24.5°C (779oF) throughout the year, with a maximum of 30.9°C and a minimum of 21.2°C. The hottest temperatures are recorded in February, March, and April. Annual rainfall ranges between 1,140 and 1,270mm, with a bio-modal rainfall regime, peaking between April to July and September to late October, followed by a dry season from November to March (Banda District Assembly, 2018).

The Banda district, with its high stretches of mountains serving as basins to the tributaries of the Black Volta, is home to the Bui hydroelectric dam, the second largest in Ghana. This multipurpose dam, which provides water for irrigation and serves as a fishing source, is a testament to the district's unique climatic conditions. The district's population includes 3,671 migrants, with a significant portion of the fishers being migrant fishers (Banda District Assembly, 2018).

MATERIALS AND METHODS

The study employed a comprehensive research approach, primarily using a formal survey guided by a semi-structured questionnaire and FGDs guided by checklists of issues and questions. The study team meticulously prepared, tested, and amended the questionnaire and checklists for administration in the formal survey and FGDs in representative sub-communities of the Bui riparian community. The team also conducted several informal discussions (Key Informant Interviews-KII) with local expert fisherfolk, settlement leaders, and a local expert who described himself as an 'area conservationist' on the study's issues. This expert had firsthand knowledge and experience with fishers and fisheries activities in the study area before and after the reservoir's construction and is currently an 'Assembly man' in the area.

A total of 107 individual interviews were conducted for the formal survey guided by the questionnaire. At the same time, 247 community members, made up of fishers, elders, and fish processors and traders, were involved in five Focal Group Discussion Workshops. Both survey interviews and FGD workshops were undertaken in the communities indicated in Table 1 and Figure 2. There was 1group workshop in each of the five communities under study namely, Glorlekame North (Gborlekame North and South Jama; Jama Resettlement (Agbadzikrom, Dame site, Brehode and Lusene), Dokokyena (Dokokyena; Bongoase; Akanyakron-Bottor; Bui Jama; Jama Resettlement Agbadzikrom, Dame site, Brehode and Lusene), Jama Resettlement Community (Jama Resettlement, Agbadzikrom, Dam site, Brehode and Lusene), Jama Nsuano (Jama Nsuano), and Bongoase Nsuano (Bongoase Nsuano).

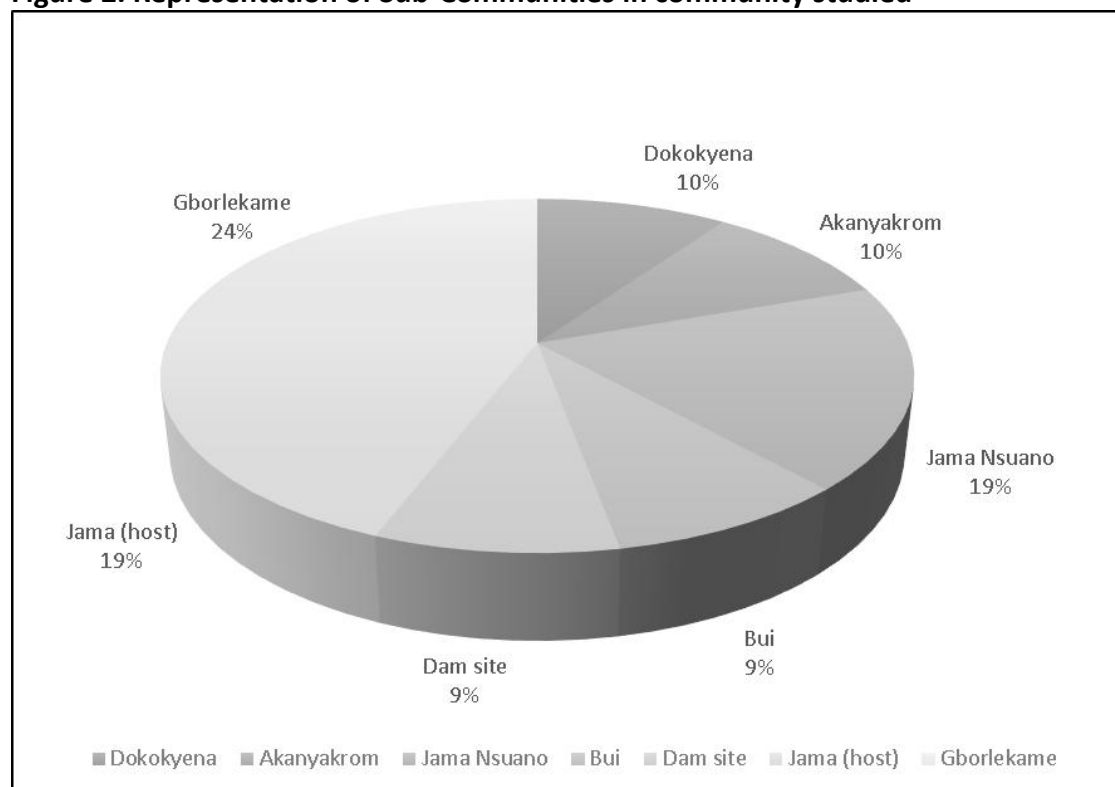
Table 1: Sub-Communities used for survey and Focus Group Discussion Studies

No.	Workshop At	Sub-Communities Involved	Number of participants	
			Male	Female
1	Glorlekame North	Gborlekame North and South	28	20
2	Dokokyena	Dokokyena; Bongoase; Akanyakron-Bottor; Bui	28	20

3	Jama Resettlement	Jama; Jama Resettlement (Agbadzikrom, Dame site, Brehode and Lusene)	28	21
4	Jama Nsuano	Jama Nsuano (BPA unrecognized community)	28	22
5	Bongoase Nsuano	Bongoase Nsuano (BPA unrecognized community)	28	23

Source: Field Data

Figure 2. Representation of Sub-Communities in community studied



Source: Field Data

The data obtained from the questionnaire, which was analysed using the Statistical Package for Social Scientists (SPSS), and the information gathered from the FGDs, which were synthesised and summarised for interpretation, reflect the active participation of the fishing community in this research. This active involvement is a testament to the community's interest and engagement in understanding and addressing the issues and challenges they face.

RESULTS AND DISCUSSION

Biodata of respondents

The outcomes of the formal survey indicate that the age bracket of 31 to 60 years comprised almost 63% of the participants (as shown in Table 2). Significantly, this age group coincided with the focal groups of fishers, fish processors, and traders who joined the workshops to analyse the issues and challenges affecting these occupational categories. Consequently, their role as the main workforce in artisanal fisheries was

recognised. The age group of 15 to 30 years was labelled the 'youth' working group, making up around 37% of the population. According to the gathered data, the vast majority (more than 90%) of the community's fisher folk were engaged in active work, with almost all the male inhabitants occupied with fishing tasks. Therefore, it was reasonable that the community determined the number of fishers as excessive for the reservoir since all the community members were actively working. The group of people older than 60 years was identified as the 'elders,' constituting nearly 5% of the population (as depicted in Table 2). The age distribution was mainly a result of most of the fishing community moving to the Bui reservoir to work.

Table 2: Biodata of respondents

Age(years)	%	Education	%	Sex	%
15 -30	37	Primary	22	Male	68
31 -50	43	JHS	36	Female	32
51 -60	15	SHS	7		
>60	5	None	35		
Total %	100		100		100

Source: Field Data

The Bui riparian fisher folk community's estimated level of formal education ranged from "No formal education" to Primary level and Senior High School (SHS) level, as indicated in Table 2. Notably, the Ghanaian general educational system consists primarily of a six-year Primary, a three-year Junior High School (JHS), another three-year Senior High school (SHS), and, more recently, a variety of Pre-School levels. Thus, Table 2 demonstrates that approximately 65% of the fisher folk living around the Bui reservoir possess some formal education, with approximately 7.5% having obtained SHS-level education.

The community's educational profile was evaluated to facilitate potential planning aspects of capacity-building actions toward their comprehension and implementation of sustainable fisheries practices in the reservoir. The results presented in Table 2 provide two important pieces of information. Firstly, approximately 65% of community members have been exposed to formal education, with almost 8% achieving pre-university education. Secondly, roughly 62% of the surveyed population is over 30 years old.

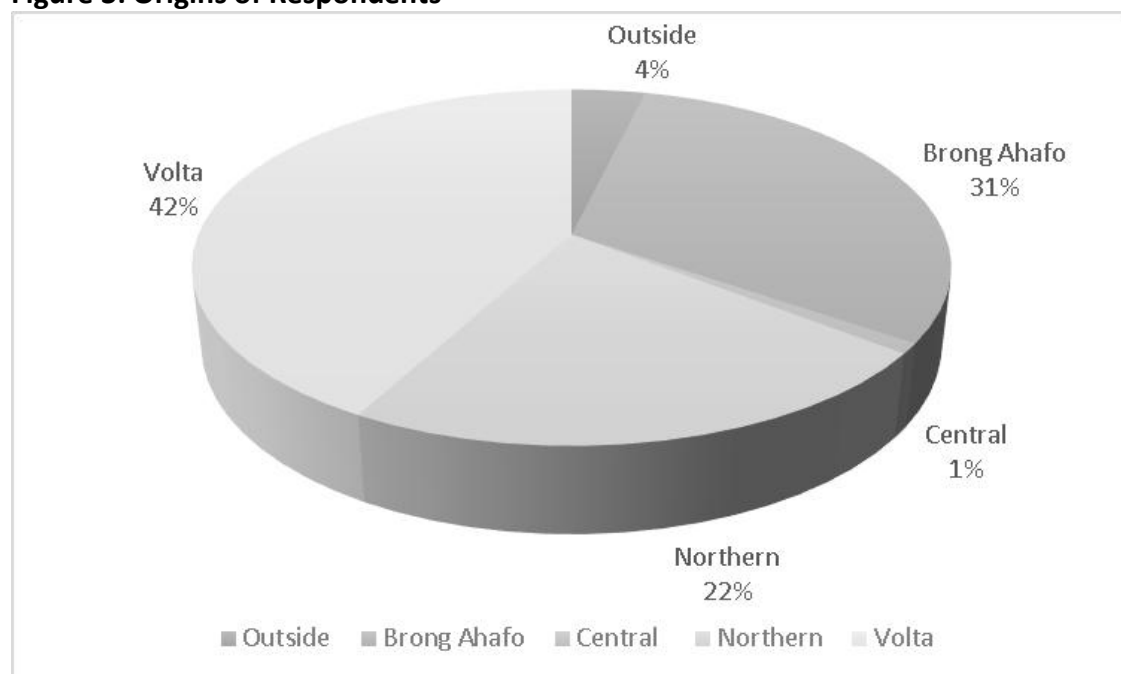
The study involved interviewing a total of 107 individuals in the community, with a nearly 2:1 male-to-female ratio (Table 2). The sex proportions of the FGD participants were not measured, except for the elders, as fishers, fish processors, and traders were invited based on their occupation, which displayed gender biases in the community. For instance, the female gender was predominant among fish processors and traders, while the male gender was among the fishers, as anticipated. This gender bias in occupation is a significant social dynamic that should be considered in capacity-building actions.

Social sustainability

Origins of respondents

Bui area falls within the geographical location of the Savannah Region of Ghana, the south of which shares the border with the Bono and Bono East regions of the country and the north of which shares borders with the Northern, Northeast, and Upper West regions. Concerning the origins of community members surveyed, Figure 3 shows that members of the Bui fisher folk community originated mainly from the Volta, Northern, Savannah, and Bono regions of Ghana, with minor groups from the Central region of Ghana and a collection of individuals from the other West African countries, such as Mali and Burkina Faso. This is usual for fishing communities because individuals who have learnt fishing and fish mongering as a source of livelihood would always migrate. It can be argued that BPA successfully resettled the residents because they are migrant fishers. It gives BPA a chance to continue to manage activities of the reservoir for its sustenance and the well-being of people in the new settlements.

Figure 3: Origins of Respondents



Source: Field Data

The predominance of the Volta Region indigenes among the Bui area fisher folks in the Savannah and Bono Regions of Ghana was attributed mainly to three situations. First, the Volta Region is the predominant inland fisheries-oriented tribe in Ghana, which engages in in-country migration to other regions to settle and work. Second, settlement by indigenes of the Volta regional fisher folk occurs at Bamboi, from which movement to Bui on the formation of the reservoir was anticipated. Fishers of virtually all tribes of Ghana were located at Yeji, on the Volta Lake (Figure 1a), and the presence of some regional tribes at Bui, including those from the Volta Region, chiefly attributed to movements from Yeji.

The significant presence of indigenes from the Savannah and Bono Regions at Bui can be attributed to the geographical proximity of these regions to the Bui reservoir (Figure 1a). However, the fisher community at Bui is not limited to these two regions. The presence of 'outsiders', as indicated in Figure 3, adds a diverse dimension to the community. These 'outsiders' primarily represent nationals from other West African countries, such as Mali and Burkina Faso, whose involvement in fisheries in the Bui area has been previously documented in a BPA 2014 document on their Resettlement Communities and a 2002 pre-impoundment study report regarding the Bui reservoir (Koranteng et al., 2002).

The community described above could be considered as the officially documented riparian community of the Bui reservoir. In recent years, since 2012, when the new reservoir formed, a massive influx of fishers 'invaded' the reservoir area and settled in unofficial and undocumented settlements. Thus, the fishing population of the riparian community during the study consisted of fishers of the community's official and unofficial components. This has negatively impacted the social sustainability of residents, making their daily sustenance difficult due to economic and social issues that arose during the implementation of the reservoir.

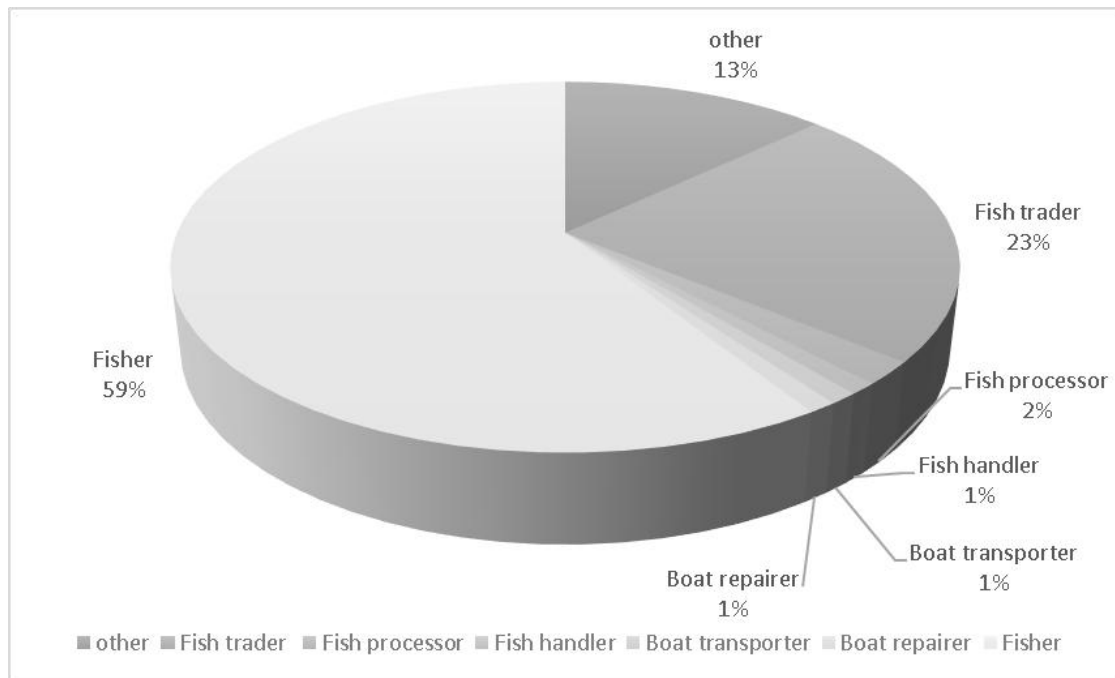
Economic sustainability

Principal occupation

Major occupations of the Bui reservoir riparian community investigated was meant to assess and bring to attention the importance of the relationship between the community and the water body and their social and economic benefits. Thus, there is a need to conserve the water and what it contains. Through both the survey and FGDs, the study recorded and observed that fisheries-related activities, including fishing, fish handling, fish processing, and trading, constituted the major occupation of the community studied as compared to the findings of Atindana et al. (2015), which recorded farming and trading as the main source of livelihoods in both Lucene and Agbegikuro communities before the dam creation. In contrast, farming, fishing, and trading became common after the dam was created. Figure 4 shows that fisheries-related activities were the principal occupation of about 85 % of the surveyed community. Other occupations comprised 13% of the participants, mainly farmers and general traders and 2 % of boat operators who transported goods and people by water.

Generally, communities close to the reservoir, up to about 3 Km from the reservoir, had fisheries-related livelihoods as their principal occupation. In contrast, 'far away' communities, about 4 Km and more from the reservoir, had farming as their primary occupation.

Figure 4: Principal Occupations



Source: Field Data

However, fish processing and trade, as an economic activity, was recorded as the preferred activity of all females irrespective of the distance of their community from the reservoir.

The prevalence of fish processing and trade as a vital economic activity in the study area was evident in the dominance of fish processing products in major local markets. Plates 1a & b provide a glimpse of the diverse range of these products, including dried fish, fish oil, and Fish meal, observed on a market day at Jama-Nsuano market. The significant role of the BPA in spearheading a restructuring initiative is a clear testament to the importance of regulatory bodies in promoting good practices and ensuring the sustainability of local economies and communities (Adams 2006; Al-Mosroori & Bose 2011; FAO, 2003).

Plate 1a & b: Typical fish products on major local markets



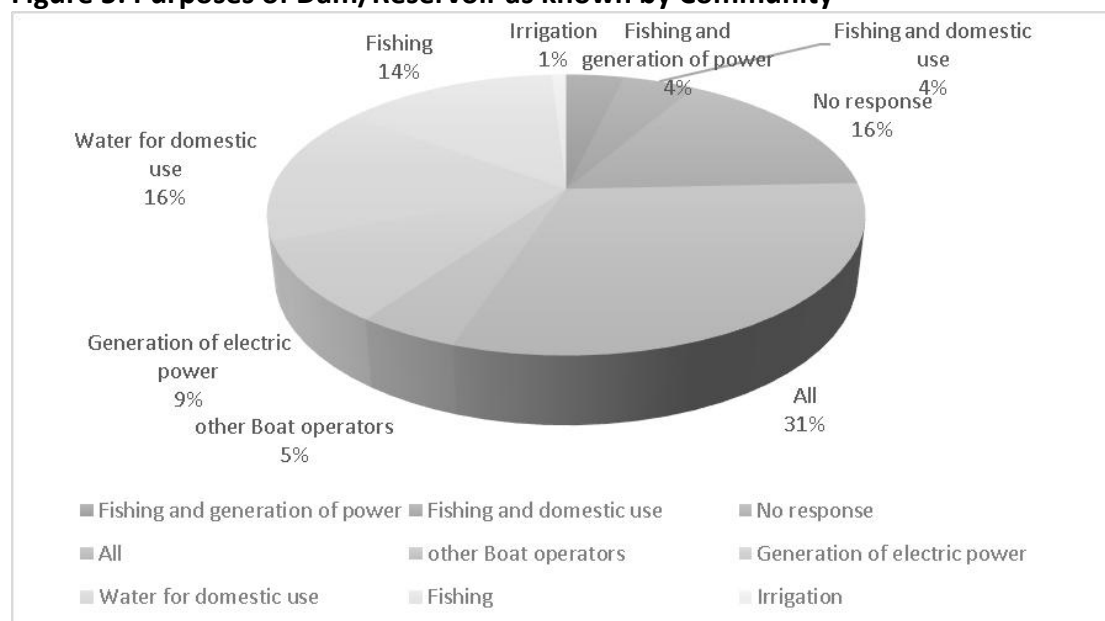
Source: Institute's File Data

It may be expected that recognizing the relevance of a resource to a people could contribute to the conservation of the resource and related ones. Thus, it is hoped that the presentation of observations and results concerning fish as an important occupation and a means of livelihood among the community members will contribute to their willingness to conserve the reservoir and fish resources. Documentation of the situation, stating that big-sized processed fish produced in the Bui area is no longer available in local Bui markets, should heighten local concerns for control of fishing. The appropriate linkage of all operators involved in processed fish production and trade value chain(s) would also contribute to developing sustainable fishing regulations and compliance.

Community awareness of multi-purpose status of reservoir

The study assessed the community's awareness of the multipurpose intentions of the reservoir and the respective constituencies it served. Results, as summarized by Figure 5, revealed that more than 90 % of surveyed community members were aware of the reservoir having been created for more than one purpose. The widely known purposes included hydroelectric power generation, reservoir fish production, and potential fisheries development. However, some community members were unaware that the reservoir was for more than the fish production benefit, and those needing help comprehend the multipurpose concept. Together, they made up about 5 % of the surveyed.

Figure 5: Purposes of Dam/Reservoir as known by Community



Source: Field Data

Other accepted reservoir users to fisher include hydroelectric power generators, the BPA, lake transport operators, fishers from elsewhere and water recreational operators. However, discussions with fishers during four of five FGDs showed that all other users of the reservoir, even BPA, were considered to constitute some

disturbance to fishers' operations. With BPA, fishers accused them of altering the reservoir water levels too often and irregularly, a situation which fishers considered as disrupting the fishes' reproductive biology and eventually on the fishes' population sizes.

The recognition of the multi-purpose intentions of the reservoir by the fishers, and their simultaneous view of all other users as interfering with their operations, was a thought-provoking insight. It's important to note that not all intended users of the reservoir were in operation. Bui Power Authority's comprehensive usage plans for the reservoir, outlined in a 2015 document, included an irrigation scheme to support communities in irrigated farming, the establishment of a legislative Instrument (LI) to allow for a gazette of parts of the reservoir as part of the Bui National Park (BNP) and thus outside fishing limits, and the strengthening of BNP wildlife protection, including wild fish stocks. It is anticipated that when all intended uses are implemented, especially the delimitation of parts of the reservoir as non-fishing areas, tensions between fishers and other users may increase. However, the right population management and educational programs in the communities could lead to increased sustainable yields, ultimately benefiting the economic well-being of the communities.

Major observed social and economic effects of considered impacts

- a) Several women have lost their preferred livelihood of fish processing-cum-trading.
- b) The availability of fish in local markets has reduced its consequences.
- c) Big-sized processed fish is almost non-available on local markets (see Plate 1a & b)
- d) Tension is developing between fisheries communities in BPA-established communities.'

e.g., Jama and Bongoase, and communities not established by BPA, e.g., Jama Nsuano and Bongoase Nsuano.

Environmental Sustainability

Fishing population and potential impacts

Although there had not been a frame survey covering communities around the reservoir to determine the number of fishers, number of canoes in operation, and or fishing gears being deployed, the study obtained informal estimates of numbers through the surveys, observations, and other fisheries related parameters of the riparian community. For example, fishers around the reservoir were estimated to be between 1,300 and 1,500, operating about 2000 canoes in the reservoir area. Key Informant Interviews indicated that the figures were made up of both the BPA-established communities and non-BPA or un-documented settlements. Migration relates to sustainable development by creating well-being and livelihoods and impacts natural resources through adaptation and innovation, which has unforeseen social, economic, and ecological consequences (Adger et al., 2024). Theoretically, renewable resources, when managed to conserve their viability in the long-term, should be extracted to allow renewal within acceptable capacities of the ecosystem, which is key to sustainability (Freedman, 2018).

It was observed that fishers in all the communities around the reservoir fished all seven days of the week. However, prior to the formation of the reservoir in 2011/12 and until the arrival of the unofficial settlers, two-none fishing days per week was a common practice in the communities in the current reservoir area. This shift in fishing patterns highlights the lack of control and the challenges in managing the resettled communities due to new entrants and settlements. The success of the BPA initiatives for resettlement is hinged on sustainability. Well-managed environments pave the way for economic and social sustainability, but environmental sustainability requires cooperation (Zelensky, et al., 2015).

The fishing gears observed and confirmed through interaction with fishers in the Bui reservoir area included Gill nets, Cast nets, Hook-and-line, Traps, Beach-seine nets, and various nets built with mesh-size netting materials below legally proscribed mesh sizes. To enhance its sustainability programmes, BPA should consider collaborating with relevant institutions that can offer expert advice and services. For instance, strong collaborations with the Ministry of Fisheries and Aquaculture Development and Fisheries Commissions could provide financial and physical assistance, including monitoring to ensure adherence to fishing rules and regulations. Training and refresher courses are also crucial in this regard (Freedman, 2018).

Some of these fishing gears were destructive to fisheries and were not allowed to be used or deployed in the manner being done by fisheries regulations of Ghana. In Ghana, all mono-filament netting material below three inches, which was the case in Bui, is not allowed for catching fish. Again, the deployment of beach seine and 'winch' nets in freshwater systems in Ghana, as done in the Bui area, was against the laws and regulations of fishing in Ghana. This is a clear example of a lack of adherence to rules and regulations due to a lack of funds to monitor and offer training and refresher courses or training to fishers.

An estimate of fish caught per canoe, usually operated by two persons, per day, was about 90 Kg to 120 Kg and between 15 and 25 Kg in high catch and low catch periods, respectively, during 2011/2012 (Ofori-Danson et al., 2012), when the reservoir was filling up. However, at the time of this study, information gathered from KII indicated that the average catch per day per canoe, irrespective of season, was about one to two kilograms. Again, there is an issue of lack of sustainability here. When numbers are managed, and rules and regulations followed, as indicated above, it will impact individuals' economic, social, cultural, and environmental well-being and, for that matter sustainability of the reservoir.

The status of fish caught per canoe per day was briefly attributed to the almost 2,000 canoes operating in the reservoir area per day and every day. Second, the numbers and rampant use of unauthorised and destructive fishing gear in the reservoir area since 2012/2013 and third, the general disregard of all fisheries regulations with the arrival of the undocumented settlers could not have happened without negative impacts on fish catch. For some, true sustainability is impossible in small-scale communities where humans live in close contact with the ecosystem. In this case, it is easy to disseminate, and people can easily harmonise with their

natural environment and process (Doncaster and Bullock, 2024). A livelihood greatly influenced by fish catch and availability in fisheries-dependent communities such as those in the Bui area is fish processing and trade. From the reduction in fish catch described above, it could be understood why fish processing and trade had virtually collapsed among the documented official settlements at the time of the study. This was especially so because fishers in the official communities were relatively more law-abiding with respect to fishing regulations compared to those belonging to the undocumented settlements. Thus, fish catch available to processors among the regular communities was apparently lower in support of processing and trade. Sustainable yield comes to lay here. Renewable resources should, therefore, be managed to conserve their long-term viability (Freedman, 2018).

Another impact of low fish catch on the fishing industry in the Bui area was on fishing itself. Information from key informants and group discussions indicated that fish-Mummies, who often pre-financed fishing activities such as obtaining fishing nets, repairing boats, and purchasing fuel for boats using motors, that it was not profitable to invest in fishing based on the catches that were realised. Also, young men who partnered with other fishers as a commercial engagement had started to look for other jobs because of the dwindling catch. Thus, as the catch was reduced, fishers looked to be engaged in other commercial activities such as trading, farming, and other artisanal activities.

Other characteristics of the Bui reservoir riparian community studied for their potential impacts on fisheries sustainability and potential contribution to enhancing sustainability are reported on and discussed.

Community opinion on control and management of fishers towards sustainable fisheries

The study solicited the opinions of fishers, elders, and fish processors and traders as major focus groups in the community separately at the five FGDs (Table 1.) on how fishers could be managed and controlled towards sustainable fisheries on the Bui reservoir. This was because all community residents continuously expressed concern over high fishing intensity and its direct impacts on the reservoir.

Opinions on aspects of fisheries environment

All the focus groups agreed that they had observed the following:

- a) The population of fishers in the reservoir had increased greatly.
- b) Fishing gear used included illegal and destructive gear (Plate 2).
- c) Fishing methods used included destructive and illegal methods.
- d) All parts of the reservoir were open to fishing with no reserve area.

Plate 2: Canoes at a reservoir shore each with bundle(s) of illegal mesh-size net

Source: Institute's File Data

Considered impacts of the fisheries environment

- a) Fish catch has reduced.
- b) Some fish species did not occur in catches as often as previously.
- c) Big-sized fishes were occurring less frequently in catches than previously.

Community suggested actions to control and manage fishers

- a) In reference to population increases of fishers on the reservoir in the BPA non-established communities (i.e., 'Nsuno Communities'),
- b) Fishing gear used included illegal and destructive gear.
- c) Fishing methods used included destructive and illegal methods.
- d) All reservoir parts were open to fishing with no reserve area.

CONCLUSIONS AND RECOMMENDATIONS

The study highlighted the significant increase in the fisher population and the number of canoes, which led to increased fishing pressure and the use of unapproved and destructive fishing gear, negatively impacting the social and economic fabric of the communities. It was noted that addressing these issues requires effective management and regulation to ensure sustainability. Most fishers are migrants with considerable fishing knowledge. This understanding of fishing practices can facilitate training and education on sustainable fishing methods. Emphasis was placed on the need for enforcement to ensure adherence to sustainable practices.

Recommendations from earlier studies suggested controlling fishing efforts by limiting the number of registered canoes and reducing fishing days. The current situation, with almost 2000 canoes operating daily, emphasizes the need for BPA to implement proactive measures for sustainability. We recommend that the reserve component of the reservoir be demarcated; local fish catch monitoring stations should be established using local fishers assisted by external human capacity and build local fisher folk capacity to gather critical monitoring information for the sustainability of fisheries in Bui.

Conclusions emphasized the importance of incorporating theoretical underpinnings related to sustainable resource management, including cooperation and community involvement in preservation efforts. Considering the low productivity potential of the Black Volta, it is evident that fish catch will continue to be a challenge for settlers. Bui Power Authority must adopt modern and sustainable techniques to improve the long-term sustainability of fisheries in the Bui reservoir. These conclusions are related to the study's specific objectives and establish the critical need for broad management strategies to attain sustainable fisheries in the Bui reservoir area.

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