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Marine resources, multi-stakeholder governance, and local livelihoods in Ghana: A case study from Ghana's Muni-Pomadze Ramsar site

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Abstract

This study investigates the interconnections between marine resource management, local livelihoods, and governance structures at the Muni-Pomadze Ramsar Site in Ghana. Employing a mixed-methods approach guided by the Social-Ecological Systems (SES) Framework, the study combines qualitative interviews and focus group discussions with quantitative survey data from 302 respondents across three coastal communities. Findings reveal that marine resources, particularly fishing, are central to the socioeconomic fabric of these communities. Livelihood outcomes are significantly influenced by financial, natural, human, social, and physical capital, with financial capital emerging as the strongest predictor of these outcomes. However, challenges such as institutional overlaps, inadequate infrastructure, limited access to credit, and exclusion of women and youth from decision-making constrain sustainable governance. The study emphasizes the necessity for an inclusive, decentralized co-governance framework that combines traditional conservation practices with contemporary regulatory systems. Policy recommendations include the formation of a Multi-Stakeholder Lagoon Management Board, community-based monitoring, microcredit schemes, and investments in cold storage and aquaculture. These findings offer actionable pathways for enhancing ecological resilience and improving the livelihoods of coastal populations.

Keywords Livelihoods, Governance, Wetland conservation, Ecological sustainability, Muni Pomadze Ramsar site, Ghana

1 Introduction

Wetlands (lagoons) can be found worldwide, except Antarctica (Mitsch et al., 2009). The landmass of the Earth's surface occupied by wetlands is challenging to determine. Coastal lagoons cover approximately 13% of the world's coastlines and around 5.5% of the European

coast (Razinkovas et al. 2008), where they are particularly abundant around the Mediterranean Sea and the South-eastern Baltic coasts. Their wetlands become conducive environments for human development; lagoons have multiple uses, including fisheries, aquaculture, recreation, and tourism (Anthony et al. 2009).

In the context of Africa, there is a tremendous geographical spread in terms of marine resources found in coastal lagoons, stretching from the Atlantic Ocean along the western coastline of Morocco, southwards to the Mediterranean Sea's southern coastline through Morocco, Algeria, Ghana, Tunisia, Libya, and Egypt (Newton et al. 2014). Ghana is one of the countries located in West Africa, with a coastline stretching approximately 550 km, enriched by various unique coastal ecosystems (Alves

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et al. 2020). The topography varies distinctly across four coastal regions: Volta, Greater Accra, Central, and Western Regions. The longest coastline, spanning 150 km, lies in the Central Region. The Muni-Pomadze, located in the Central Region of Ghana, was designated as a Ramsar site in 1992 under the International Convention on Wetlands (Boanu et al. 2022).

Today, most of these wetlands are deteriorating due to the emergence of urbanization. The Muni Pomadze lagoon in Ghana is one of the wetlands threatened by human activities. According to Erostate et al. (2022), lagoons and their catchment areas have been touted as the most exploited and degraded lagoons in most countries, despite the numerous services they provide to the surrounding communities and beyond. Indeed, there has been a debate among scholars and government institutions in recent times as to whether the Muni lagoon should be declared an endangered zone (Adu-Boahen et al. 2018). Several areas in the lagoon catchment have been reclaimed and utilized for crop production, including green peppers, okra, and tomatoes (Ntiemoa-Baidu & Gordon 1991). These activities reduce the amount of water that ultimately enters wetlands, contributing to siltation (Majumdar et al. 2020). Again, the catchment area of the Muni Pomadze wetland is inundated with human settlements, which generate a large quantity of waste daily, and these pollutants end up in the wetland without any treatment. Human activities increase the metal influx, which enters the wetland through surface water erosion or runoff, thereby increasing the metal concentration in the area. The continuous accumulation of these heavy metals results in a large quantity and poses serious health hazards to both humans and animals (Okyere et al. 2023).

The ecosystem services provided by wetlands, from time immemorial, have been vital in several spheres of human growth and development. For instance, Babuponnusami et al. (2023) opined that lagoons reduce the harmful effects of pollutants on the environment by ensuring the safety of water bodies. This is done by lowering the chemical composition of the contaminants. Apart from immobilizing the toxin, they also provide fertile land for agricultural activities, a nesting site for migratory birds and wildlife, trees for timber and firewood, and a recreational site, among other benefits for humans (Martinez 2014).

Livelihoods are defined here as much more than just income generation and sustenance; they represent the outcome of a wide range of factors that determine people's overall strategy for securing their means of sustaining themselves and their dependents (Narayan et al. 2000; Sen, 1981). A livelihood encompasses capabilities, material and social assets, and activities needed for sustenance. A sustainable livelihood should be able to absorb shocks and recover, while maintaining capabilities

without eroding the natural resource base, which involves conserving assets (Rakodi 2014).

Marine resource management governance refers to the various processes, arrangements, and mechanisms through which decisions for the sustainable management of aquatic resources are made and implemented (Kooiman 2003). Like an adaptation process, it must involve people at different levels and across various sectors, including government, the private sector, and civil society organizations (Folke et al. 2005). Sound governance consists of creating institutions that are central to setting standards, implementing and monitoring compliance with those standards, and providing a forum in which stakeholders can participate in deciding how resources are allocated in ways that are both fair and do not harm the environment (Bavinck et al. 2005). Some of the primary interventions comprise establishing Marine Protected Areas (MPAs), elaborating fishery management measures, and community structures and participation (Gelcich et al. 2010). Moreover, adaptive management frameworks are necessary to address the level of unpredictability and changing environmental conditions in marine habitats and coastal societies (Armitage et al. 2009).

Coastal lagoon management has received considerable interest, particularly in the international and local scenes, mainly to provide the backdrop for various economic activities (Adu-Boahen et al. 2018). As population growth led to increased utilization of the lagoon for fishing and hunting, and the calculus for tourism activities due to urbanization, it has added complexity to finding a sustainable management option for the lagoon, given the different end-users. This research noted the dearth of success stories for coastal management in developing nations, including Ghana, thus emphasizing the shift of sectoral focus in coastal governance steering and the re-orientation of governance in an integrated and efficient management of costs.

Resources management in coastal lagoons and wetlands have been the subject of several research and management analyses. For example, Adu-Boahen et al. (2018) carried out a study on customary practices and wetland management in Ghana, focusing on the Muni Lagoon Ramsar site in the central region. Thus, Atubiga and Donkor (2022) also investigated the decline in lagoon services within this region due to urbanization invasion. Most of the physico-chemical characteristics of the Muni-Pomadze Ramsar site and its catchment in Winneba were described by Boanu et al. (2022), and Okyere (2023) also studied heavy metal pollution in the lagoon. Proper governance is critical for the sustainable utilization of resources, as well as the reduction of impacts on the marine environment, and the provision of all interests in an appropriate manner. Hence, the research's goal is to comprehensively analyze

the Muni-Pomadze Ramsar site, including how marine resources affect the livelihoods of local inhabitants and the governance that safeguards the lagoon.

1.1 The Social-Ecological Systems (SES) framework

The Muni-Pomadze Wetland in Ghana provides an avenue to observe the relationships between people and nature, using the Social-Ecological Systems Framework theory to explain these connections. Humans rely on each other, along with their natural environment, to create resource management systems that result in income generation and effective governance structures. The Muni-Pomadze Wetland provides essential ecological benefits by delivering clear water, supporting fish species, and serving as a habitat for biodiversity. The wetland provides essential environmental services that concurrently support the survival of residents as they extract fish, farm, and engage in various other activities within this ecosystem. The SES Framework illustrates how the health of the wetland directly impacts community development, as poor wetland management causes problems for both nature and residents, according to Ostrom (2009) and Berkes and Folke (1998).

The SES Framework demonstrates how proper governance structures should be implemented to manage resources, such as the Muni-Pomadze Wetland. Managers within governments and communities, alongside other stakeholders, create rules and policies through decisions to determine resource use, along with protection strategies. Proper governance of the lagoon must be implemented to protect it from excessive fishing, pollution, and damaging human activities. When governance structures incorporate community members who interact directly with the wetland, they tend to succeed better, as people who rely on the wetland tend to understand its value and contribute to its protection. Local fishers participate in decision-making processes by sharing their expertise on the lagoon, which enables them to provide sustainable recommendations (Ostrom 2009; Folke et al. 2005). Through inclusive governance, the wetland remains sustainable because it preserves its ecological value while supporting the livelihoods of its population in the future.

Using the SES Framework helps achieve the research aims, as it demonstrates that the Muni-Pomadze Wetland exists as a complex, multi-layered system of social and ecological relationships. The lagoon serves as more than just a water source, providing sustenance, financial benefits, and cultural connections for all individuals living in the nearby communities. The health status and capacity to offer benefits to the community directly result from how people interact with the lagoon. The ecosystem of the lagoon suffers damage when people overfish or

pollute the water, as this negatively impacts the humans who depend on it as their primary source of livelihood. The SES Framework enables us to understand how these relationships function between human needs and environmental wellness through strategies that maintain equilibrium. Applying this theory will demonstrate methods of sustainable Muni-Pomadze Wetland management that enhance both governance systems and local living standards, while preserving the ecosystem (Ostrom 2009).

While the SES Framework provided a valuable lens for analyzing the interconnections between livelihoods, governance, and ecological health at the Muni-Pomadze Ramsar Site, its application has limitations in the Ghanaian context. The framework tends to emphasize generalized variables (e.g., resource units, governance systems, and users) and can understate the importance of historical, cultural, and political power dynamics that strongly shape resource management in local settings (Clever 2012; Cinner et al. 2018b). For instance, the SES model does not fully capture how traditional taboos, chieftaincy authority, and gendered divisions of labour influence compliance and governance outcomes. Similarly, institutional overlaps among Ghanaian agencies often reflect political contestations that extend beyond the rational-choice assumptions embedded in SES theory. Locally adapting the framework, therefore, requires supplementing it with insights from customary governance systems, equity considerations, and participatory development perspectives. By integrating these culturally grounded elements, the SES Framework can be made more responsive to the realities of Ghana's coastal communities, ensuring that governance models not only protect ecosystems but also reflect local institutions and values.

1.2 Marine resources on livelihoods and governance

Marine and coastal resources are fundamental to the livelihoods of coastal populations, providing food, income, and ecosystem services (Lau et al. 2019). Yet, these resources are increasingly under stress from overexploitation, ecological shocks, and weak governance arrangements (Young 2010; Van Assche et al. 2022). Globally, the FAO (2020) reports that more than one-third of fish stocks are overfished, underscoring the urgency of governance systems that can reconcile ecological sustainability with livelihood security. For communities in the Global South, where dependence on small-scale fisheries is exceptionally high, this tension highlights the need for frameworks that integrate ecological realities with the socioeconomic vulnerabilities of coastal households (Béné et al. 2016; Lau et al. 2019).

The complexity of coastal livelihoods extends beyond income measures, involving dynamic interactions among natural, financial, social, human, and physical capital

(Carney et al. 1999; Chambers & Conway 1992). However, without robust governance structures, these livelihood assets remain highly exposed to shocks. As Folke et al. (2005) emphasize, adaptive governance is crucial because it links ecological systems with institutions across multiple scales, thereby creating the flexibility necessary to respond to uncertainty. In Ghana, where statutory institutions coexist with traditional authorities, the absence of such adaptive governance has often resulted in fragmented interventions, weakened compliance, and resource decline (Johnson 2017).

Research on Ghanaian coastal wetlands has documented these shortcomings. Donatus et al. (2022) noted that poorly defined institutional mandates and ineffective enforcement structures undermine fisheries management, while Boateng (2006) highlights how overlapping roles among regulatory agencies generate confusion and erode trust. Although Integrated Coastal Zone Management (ICZM) has been promoted as a holistic response, in Ghana it has been critiqued for being donor-driven and insufficiently rooted in local socio-cultural realities (Kendie 1997; Armah & Amlalo 1998). Similarly, while co-management frameworks are widely advocated, in practice, they often fail to recognize the authority of traditional leaders or include marginalized groups such as women and youth (Adu-Boahen et al. 2018; Ayilu et al. 2023).

Globally, experiences with co-governance and small-scale fisheries provide valuable lessons for the Ghanaian context. In Chile, co-management of benthic resources has demonstrated that shared authority between government and local fishers can improve compliance and ecological outcomes (Gelcich et al. 2010). In Madagascar, community-based co-management initiatives have increased local stewardship while enhancing food security (Rasolofoniaina et al. 2017). Similarly, in Southeast Asia, participatory approaches to small-scale fisheries have demonstrated how inclusive governance can reduce conflict and enhance resilience (Pomeroy et al. 2004; Cinner et al. 2018a). These cases reinforce the argument that successful marine governance depends not only on institutional design but also on legitimacy, trust, and equitable participation across stakeholder groups (Berkes, 2009; Gutiérrez et al. 2011).

Despite these insights, empirical research in West Africa has paid limited attention to how overlapping statutory and customary systems interact in wetland governance, or how exclusion and power asymmetries shape compliance. Much of the Ghanaian literature focuses on ecological degradation and livelihood vulnerability, but with minimal critique of governance models such as ICZM or co-management. This study addresses that gap by examining the Muni-Pomadze Ramsar Site as a case of multi-stakeholder governance.

By analyzing how statutory authorities, traditional leaders, and community actors negotiate power, enforcement, and participation, the study contributes to broader debates on participatory marine management. It demonstrates how adaptive co-governance principles can be locally grounded in the Ghanaian context.

2 Materials and methods

2.1 Profile of the study area

The Muni Pomadze Lagoon (MPL) is situated in the central part of the Ghanaian coastal belt, just at Winneba, about sixty kilometers west of Ghana's capital city, Accra. It is bounded to the North by Agona Swedru. It has approximately 60,000 inhabitants, and the University of Education-Winneba is located in the region. The city is considered one of growth, with increased population density over the years. Unfortunately, this growth has led to increased contamination of the lagoon from community runoff, resulting in declining water quality Fig. 1.

The water height of the lagoon is 2 m maximum, while at the end of primary wet season (end of June), the lagoon has a total area of 1000 hectares of water body. At the end of the dry season, the total area covered by the water body of the lagoon is only 100 hectares, and the total salt content at this time can go up to 165. (Gordon et al. 2000). Erosion at the western end of the barrier occurs towards the end of the two rainy seasons, or roughly once every ten years (Gordon et al. 2000), to create a tidal inlet when the water level of the lagoon is most elevated. Subsequently, the fresh water is released, and the inlet is quickly closed by deposition of sand, which the longshore currents bring from the west (Ly 1980).

There are threats to the lagoon environment resulting from illegal mangrove cutting and the construction of building structures along the lagoon's shore (Okyere 2024). Characterized by medium wave energy and an average tidal range of about 1 m, the area experiences two wet seasons annually, from March to July, and the second, though not as intense, is from September to November.

2.2 Research design

This study examined marine resources, multi-stakeholder governance, and local livelihoods in Ghana using a mixed-methods approach that combined qualitative and quantitative data. The qualitative phase, involving interviews and focus groups with fisherfolk, community leaders, and government officials, provided in-depth insights into the social, economic, and political aspects of marine resource management. These findings informed

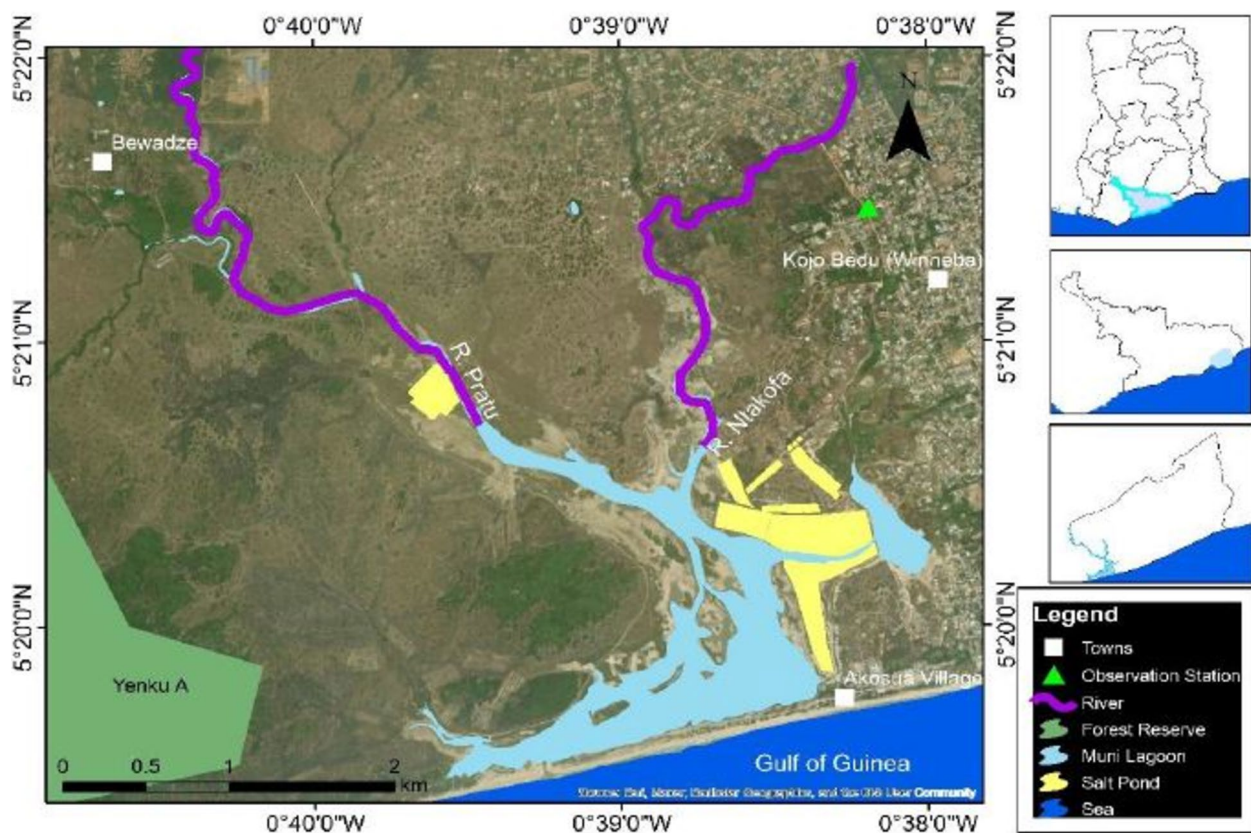


Fig. 1 Map of the study area. Source: Okyere (2024)

the development of a structured survey for the quantitative phase, which quantified economic contributions, governance structures, and resource use. Adopting an exploratory sequential design, the study integrated both data types to offer a comprehensive understanding of the research questions and support evidence-based policy and sustainable management strategies.

2.3 Sampling and recruitment

2.3.1 Qualitative phase

The qualitative phase engaged diverse stakeholders, including local fisherfolk (through separate focus group discussions for males and females), community leaders such as traditional authorities and assembly members, and government officials from the Environmental Protection Agency, Forestry Commission, and Water Resources Commission.

Key informant interviews The qualitative component focused on engaging key individuals and organizations central to the research, such as the Chief and elders of Winneba, the official of the Environmental Protection Agency, and officials from the Wildlife Division of

the Forestry Commission, fishermen, and community assembly members from Akosua Village, Bewadze, and Mankoadze in the Effutu municipality (See Table 1). Additional insights were gathered from knowledgeable residents within these communities. The purposive sampling approach ensured inclusion of stakeholders with direct relevance to the study objectives, providing in-depth perspectives on marine resource management, governance, and livelihoods in the area.

Focus Group Discussions (FGDs) and sample size To complement the key informant interviews and ensure diverse community perspectives, Focus Group Discussions (FGDs) were employed as a qualitative method to explore collective experiences, social dynamics, and shared understandings of wetland governance and livelihood issues. Following Manoranjitham et al. (2007), who recommend an optimal focus group size of eight to ten participants, this study convened groups of ten men and ten women fisherfolk from each of the three study communities, namely, Mankoadze, Akosua Village, and Bewadze.

Participants were purposively selected based on their long-term residency (at least ten years) and

Table 1 Sample units and the number of key informants interviewed

Key informants	Number of key informants interviewed
Traditional leaders	3
Official from the Physical Planning Unit	1
Official from the Development Planning Unit	1
Official from the Environmental Protection Agency	1
Official from the Water Resources Commission	1
Official from Forestry Commission	1

Table 2 Sample size for the focus group discussion

Respondents	Sample Size
Women	9
Men	9

active involvement in lagoon-related livelihoods such as fishing, fish processing, or trading. This criterion ensured that participants possessed adequate experiential knowledge to contribute meaningfully to the discussions. Separate FGDs were organized for men and women to provide a safe and comfortable environment for open dialogue and to capture gendered dimensions of governance. In total, six FGDs were conducted, three male and three female groups, one of each per community (see Table 2).

An interview guide was used to facilitate discussions on themes such as marine resource management, local governance structures, enforcement challenges, and livelihood sustainability. The research team consisted of the lead investigator and three trained field assistants: one interpreter who translated questions and responses, one note-taker, and one observer responsible for monitoring participation and recording the sessions.

Data saturation was achieved when successive FGDs produced no new themes or insights, indicating that participants' perspectives had reached conceptual redundancy. This was confirmed after the sixth FGD, as the responses began to overlap significantly across communities and gender groups. The triangulation of findings from both male and female FGDs enhanced the credibility, reliability, and depth of the qualitative data.

2.3.2 Quantitative phase

Total households, sample size and sampling techniques of the survey The population data for each selected

community was sourced from the district Medium Term Development Plan (MTDP). The total population across the study area was 3,583, distributed among Mankoadze (1,991 residents), Akosua Village (568 residents), and Bewadze (1,024 residents). Using projections from the 2021 Population and Housing Census, these populations formed the basis for determining a sufficient sample size.

To calculate the total number of households in each community (sampling frame), the population of each village was divided by the average household size of the region, which is 2.9, as district-specific household size data were unavailable. This yielded household counts of 196 in Akosua Village, 353 in Bewadze, and 687 in Mankoadze, amounting to a total of 1,236 households across the three communities. Using the formulas from Yamane (1967).

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

Where n = sample size.

N = population size (total households = 1,236).

e = level of precision or sampling error. $\pm 5\%$ or 0.05

$$n = \frac{1236}{1 + 1236(5\%)^2}$$

$$n = \frac{1236}{1 + 1236(0.0025)}$$

$$n = \frac{1236}{1 + 3.09}$$

$$n = \frac{1236}{4.09}$$

$$302.20$$

$$n = 302$$

To ensure fair representation, the commuted sample size (302) was proportionally allocated among the communities based on their household counts: 48 respondents from Akosua Village, 86 from Bewadze, and 168 from Mankoadze. These communities were selected due to their proximity to the Muni-Pomadze Lagoon (see Table 3).

The sampling procedure for the quantitative component of the study combined stratified sampling and simple random sampling techniques. Stratified sampling was used to divide the population into three distinct strata (Mankoadze, Akosua Village, and Bewadze), ensuring that each community was adequately represented.

Within each stratum, simple random sampling (random selection without replacement) was employed to select households.

2.4 Instruments of data collection

The instruments used for data collection in this study were a semi-structured questionnaire and an interview guide.

2.4.1 Semi-structured questionnaire

The instrument used for data collection in the household survey was a semi-structured questionnaire. Both closed and open-ended questions were used to address the research objectives. For closed-ended questions, respondents were asked to provide their responses by simply ticking the spaces, while they were asked to provide answers to the open-ended questions.

The questionnaire was custom crafted for this study, focusing on various dimensions of livelihoods and encompassing aspects such as human, natural, financial, social, and physical capital. The questionnaire was systematically organized into six key sections to obtain comprehensive data, which included demographic information, focusing on human capital (Education levels, vocational skills, and access to training programs), natural capital (Availability and accessibility of marine resources, fishing areas, and environmental challenges), financial capital (Income levels, savings, access to credit, and financial support structures), Social Capital (Community networks, participation in cooperatives, and institutional support) and physical capital (Availability of infrastructure, tools, and equipment necessary for marine-based livelihoods).

To assess participants' perceptions regarding livelihood sustainability, the questionnaire utilised a Five-Point Likert scale, allowing for nuanced responses. This scale enabled the study to capture the participants' views on different aspects of sustainability, ranging from strong disagreement to strong agreement. A vital aspect of ensuring the instrument's effectiveness involved a thorough validation process; before the main data collection,

the questionnaire underwent pilot testing with a sample of 30 respondents to identify ambiguities in the questions and refine the instrument. Additionally, the questionnaire underwent expert reviews to ensure its relevance, clarity, and alignment with the study's objectives. The administration of the questionnaire was conducted through a face-to-face approach, a method selected to ensure inclusivity and accessibility, particularly for participants with limited literacy skills. By engaging participants in person, the researchers were able to provide real-time clarifications and support to ensure that respondents fully understood and accurately completed the questionnaire.

2.4.2 Interview guide

The main goal of an in-depth interview is to solicit extensive and detailed information that can be used to explain or analyze phenomenon. An interview guide was created for conducting key informant interviews with a diverse range of stakeholders, including chiefs, elders, and fishermen. These individuals were deemed essential for providing qualitative insights into the management and governance of marine resources within the wetland. The interviews were designed to elicit in-depth perspectives on the challenges faced by the community regarding marine resource management, as well as their experiences with both traditional and modern governance practices. Furthermore, the interviews allowed exploration of how community members perceive the effectiveness of governance structures in promoting sustainable resource management and addressing livelihood issues.

An interview guide was developed for the focus group discussions (male and female) and key informant interviews. Written and verbal consent was obtained from all participants, and confidentiality was assured. The discussions were primarily conducted in the local dialect (Fante), with discussions involving directors and heads of agencies occurring in English. The interviews and discussions typically lasted about 75 min and concluded once data saturation was achieved. A pilot test was performed to refine the process, and the moderator facilitated the discussions rather than leading them. With participants' consent, the interviews and discussions were audio-recorded, and additional field notes were taken to ensure rigor and trustworthiness throughout the data collection process.

2.5 Data presentation and analysis

The qualitative data were analysed using Braun and Clarke's (2006) six-phase thematic analysis, which offered a systematic approach for identifying and interpreting key patterns. The process began with thorough familiarisation, where all interviews and focus group discussions

Table 3 Study population and sample size

	Population	Average household size	Sampling frame	Sample size
Akosua Village	568	2.9	196	48
Bewadze	1024	2.9	353	86
Mankoadze	1991	2.9	687	168
Total	3583		1236	302

Source: (DPCU 2022)

were transcribed verbatim and reviewed multiple times to ensure deep contextual understanding.

Initial coding was conducted both manually and with QDA Miner software (version 5.0), combining inductive codes from participants' narratives and deductive codes based on the study's conceptual framework. These codes were organized into subthemes and refined into broader themes reflecting institutional and community perspectives on lagoon management. An iterative review process helped maintain internal consistency and minimize bias.

Theme validation involved peer debriefing with independent researchers and member checking with key informants and community representatives, ensuring the findings authentically represented participants' experiences. Triangulation across stakeholder groups, including traditional leaders, government officials, and focus groups revealed converging and diverging views shaped by institutional overlaps, power dynamics, and socio-cultural norms. Secondary data, such as policy documents, further enriched the analysis, providing a holistic view of governance at Muni-Pomadze Lagoon.

The analysis identified key themes: Authority and Legitimacy (statutory versus traditional power); Enforcement and Livelihood Tensions (balancing conservation with community needs); Inclusion and Exclusion in Governance (gender and generational disparities); Natural Capital and Livelihood Sustainability; Financial Capital and Economic Stability; Social Capital and Community Support; and Physical Capital and Infrastructure Development.

Quantitative data were collected and analyzed utilizing the Statistical Package for the Social Sciences (SPSS) version 21. The analysis employed both descriptive and inferential statistics to evaluate the data comprehensively. Descriptive statistics, including frequencies and percentages, were used to analyze the socio-demographic characteristics of the respondents. To investigate the relationships between different capital (assets), specifically human, natural, financial, social, and physical, and livelihood outcomes within coastal communities, multiple regression analysis was performed. Furthermore, Pearson correlation coefficients were calculated to assess the associations between livelihood assets and overall livelihood outcomes. This analysis offered a nuanced understanding of governance at Muni-Pomadze Lagoon, integrating socio-political and cultural insights that complemented the quantitative data.

2.6 Ethics approval and participant consent

The methods employed in this study adhered to relevant guidelines and regulations. The Ghana Health Service Ethics Review Committee exempted the study

from ethical approval, considering it a general qualitative inquiry involving voluntary participation, in accordance with the 2015 Standard Operating Procedures. Before engaging in any research activities, all participants provided written informed consent. They were fully informed about the study's purpose and procedures. Additionally, participants consented to the publication of the study's findings. Ensuring the dignity, safety, and well-being of the interviewees was of paramount importance. Participation in the study was entirely voluntary, and no identifying or sensitive information was documented.

2.7 Limitations of the study

Despite the rigorous mixed-methods design, this study has certain limitations. The use of purposive sampling limits the generalizability of findings beyond the selected communities and focus group settings may have introduced some social desirability bias despite separating male and female groups to promote openness. Researcher bias is also a potential limitation, although it was minimized through triangulation, peer debriefing, and member checking.

Ethically, while informed consent and confidentiality were ensured, the sensitive nature of governance and power-related discussions may have caused some participants to withhold critical views. Nonetheless, the integration of qualitative and quantitative data enhanced the study's credibility and strengthened the reliability of its conclusions.

3 Results

3.1 Socio-demographic characteristics of the respondents

The investigation examined several demographic factors that are presumed to be associated with individuals' opinions and worldviews. Gender, age, education, income, and occupation are a few of these. Table 4 presents the data on respondents' sex, comprising a total of 302 respondents. Specifically, 35% of respondents are female ($n=107$), and 65% are male ($n=196$). The table also indicates the number of years respondents have been living in the community. The result shows that 302 respondents have been living in the community for 10–20 years, while 31–40 years and more than 41 years were the least among the overall population.

Furthermore, according to the level of education, occupation, and income indicated in Table 5, it was deemed that education would improve one's understanding and attitudes towards the management of marine resources in MPL, education is a means of acquiring knowledge. Regarding the level of education, 125 respondents (41%) had no formal education, while 76 respondents (25%) had completed primary education, and 57 respondents (19%)

Table 4 Demographic characteristics of respondents

Gender of Respondents	Frequency	Percentage (%)
Male	196	65
Female	107	35
Duration of stay		
10-20	208	69
21-30	38	13
31-40	45	15
41 and above	11	4
Level of Education		
No Formal Education	26	9
Primary	125	41
Middle	76	25
Secondary	57	19
Tertiary	19	6
Occupation		
Fishing	91	30
Farming	42	14
Fishing and Farming	91	30
Fish Mongering	60	20
Fish Farming and Mongering	15	5
Fish mongering and aquaculture	4	1
Income (GHC)		
100-500	64	21
500-1000	91	30
1000-3000	106	35
3000 and above	42	14
Total	302	100

Table 5 Coordination, participation, and implementation of policies among stakeholders

Variable	B	Std. Error	t-value	p-value
Constant	1.14	0.27	4.22	0.000
Coordination	0.32	0.08	4.00	0.000
Participation	0.28	0.07	4.00	0.001
Policy Implementation	0.35	0.06	5.83	0.000

had completed middle school. Only 19 respondents (6%) had secondary education, and 26 respondents (9%) attained tertiary education. This implies that the educational level among respondents is generally low, with the majority lacking formal academic qualifications.

It was discovered that 91 respondents (30%) reported engagement in fishing activities. 42 of the respondents, representing 14%, were farmers. Fishing activities, which comprise fishmongering and fish farming, accounted for 5% of respondents (15 out of 91), representing 15

respondents, and 20% of respondents (60 out of 91), representing 60 respondents, respectively. Aquaculture accounted for 1% of all other jobs, with four respondents.

3.2 Nature of multi-stakeholder governance mechanisms in the management of the Muni-Pomadze Ramsar site

The regression analysis results aimed to assess the nature and effectiveness of multi-stakeholder governance mechanisms in managing the Muni-Pomadze Ramsar Site. Drawing responses from 302 participants, including local community members, government officials, traditional authorities, and fisher associations, the analysis explored how coordination, participation, and policy implementation shape governance outcomes.

A composite index was developed to measure governance effectiveness, capturing dimensions such as transparency, conflict resolution, rule compliance, and conservation outcomes. The study employed multiple regression analysis, which revealed that all three independent variables —coordination, participation, and policy implementation significantly contributed to governance effectiveness. Policy implementation emerged as the strongest predictor ($B=0.35$, $p<0.001$), underscoring the importance of rule enforcement, adequate funding, and consistent follow-through on governance strategies. Coordination also had a notable positive impact ($B=0.32$, $p<0.001$), indicating that frequent and high-quality collaboration among stakeholders improves governance outcomes. Participation was also significant ($B=0.28$, $p=0.001$), suggesting that inclusive and active community engagement in decision-making fosters more effective site management. The regression model explained 62% of the variance in governance effectiveness ($R^2=0.62$), indicating a robust fit.

3.3 Marine resources management and governance in the MPL

This section examines the perceptions of three villages surrounding the Muni-Pomadze Lagoon (MPL), with a focus on government institutions, institutional frameworks, traditional norms, and community engagement in managing the Marine Protected Resource System (MPRS). Analysis of stakeholder interviews and focus group discussions revealed three interrelated themes that shape governance outcomes at the Muni-Pomadze Lagoon: authority and legitimacy, enforcement and livelihood tensions, and inclusion and exclusion in governance.

3.3.1 Authority and legitimacy

Governance of the Muni-Pomadze Lagoon (MPL) is shaped by the complex interaction between two

overlapping authority systems: formal statutory institutions and traditional leadership structures. Formal authorities derive their legitimacy from legal mandates and national policies, while conventional leaders are grounded in cultural heritage and community trust. This coexistence creates a dynamic in which governance outcomes are influenced by negotiated, overlapping, and sometimes competing powers.

An official from the Physical Planning Department described the challenges faced in applying state regulations within customary land areas:

“Our mandate is to control physical development within the Ramsar buffer zone. However, we sometimes face resistance when our planning schemes clash with community land-use decisions led by chiefs. It is not always easy to enforce planning regulations when the land itself is under customary ownership.”

This highlights how formal legal authority often encounters limits when confronting traditional land tenure systems, as chiefs maintain strong local legitimacy and influence over land use.

Similarly, an Environmental Protection Agency (EPA) official recognized that legal authority alone is insufficient without the support of traditional leaders:

“We have the authority to issue environmental permits and enforce compliance, but without the chiefs’ cooperation, enforcement is very difficult. The people listen to their traditional leaders more than to government officers.”

This emphasises that effective governance depends on the relational power between state institutions and traditional custodians, with chiefs acting as vital intermediaries who shape community compliance.

The Forestry Commission added that tensions arise where conservation objectives conflict with community livelihoods:

“Our laws prohibit any exploitation within the Ramsar core area, but traditional leaders sometimes give out lands to support people’s livelihoods. We understand their position, but this undermines the ecological objectives we are mandated to protect.”

This highlights the negotiated nature of power, where traditional authorities strike a balance between environmental goals and the subsistence needs of local populations.

The Water Resources Commission (WRC) discussed the institutional complexities generated by overlapping jurisdictions:

“We regulate water use and protect the hydrological integrity of the lagoon, but decisions about access to the resource are often taken without our input. Chiefs sometimes allocate land or authorize activities near water bodies without consulting us.”

This reveals a fragmentation of authority, with traditional leaders exercising control over resource access in ways that bypass formal state mechanisms.

An Assembly Member also reflected on the coordination gap between local government and other institutions in lagoon governance:

“As local representatives, we are supposed to connect the community to government programs, but sometimes agencies act independently without informing us or the chiefs. This makes people feel decisions are imposed from above rather than discussed with them.”

This statement highlights how local government structures, intended to serve as a bridge between communities and state agencies, are often sidelined, thereby weakening participatory governance and local accountability.

From the perspective of traditional leaders, authority rests on ancestral custodianship and moral responsibility rather than formal administration. One chief explained:

“The lagoon is part of our heritage. We are its custodians. We enforce taboos and seasonal bans to protect it. However, sometimes, government officials act as if they own the lagoon, forgetting that our people have protected it for generations.”

This highlights that traditional authority holds enduring legitimacy based on history, culture, and collective identity, sustaining local conservation practices that pre-date formal governance.

Community voices reflect how these intersecting power systems affect everyday resource users. A male focus group participant observed:

“The Wildlife Division, EPA, and the chiefs have all the power. They make decisions for us without asking what we go through to survive. The laws favour the government more than the people.”

This highlights power asymmetries that leave small-scale fishers excluded from critical decision-making processes. A female participant highlighted the gendered nature of these dynamics:

“The men and the chiefs decide when fishing stops or starts, but women are the ones who process and sell the fish. We should have a voice because our livelihoods depend on what happens to the lagoon.”

This highlights how governance marginalises women despite their central economic roles, perpetuating unequal participation.

3.3.2 Enforcement and livelihood tensions

A key theme across interviews was the uneven distribution of power and its impact on enforcement practices and local livelihoods. Stakeholders consistently highlighted how enforcement of environmental laws is shaped by competing interests and negotiation between formal institutions and traditional authorities.

An official from the Physical Planning Department described the bureaucratic difficulties encountered when state development controls conflict with customary land allocation:

"We have the authority to regulate development within the Ramsar buffer zone, but chiefs still allocate land to people for farming and housing. When this happens, our hands are tied, because enforcing demolition or relocation creates conflict with the traditional council."

This statement highlights how formal enforcement is limited by the political and cultural influence of traditional leaders, who continue to hold significant control over land use.

Similarly, the Environmental Protection Agency (EPA) acknowledged that effective enforcement depends heavily on the cooperation of traditional leaders:

"We enforce environmental standards, but without the chiefs' backing, community members do not always comply. People obey their traditional leaders more than they fear the EPA's sanctions."

This underscores that legal authority is insufficient without traditional legitimacy to ensure community adherence.

An official from the Forestry Commission highlighted how livelihood pressures influence compliance and complicate enforcement roles:

"Our law prohibits any form of exploitation within sections of the Ramsar site, but sometimes when you catch people, they call on the traditional leaders to rescue them. This creates confusion because when we enforce the rules, the community sees us as being against their chiefs."

Here, power struggles emerge as traditional leaders mediate conservation mandates and community subsistence needs, complicating statutory enforcement.

The Water Resources Commission (WRC) pointed to coordination challenges due to overlapping mandates:

"We are responsible for protecting water resources, but often decisions about access to the lagoon or nearby lands are made without consulting us. A section of the royal family sometimes permit sand winning or irrigation activities without our knowledge, which weakens enforcement."

An Assembly Member also reflected on how these enforcement challenges manifest at the local level, emphasising the lack of collaboration between government agencies and community representatives:

"We are the link between the people and the government, but many times, enforcement decisions are made without informing us or involving the community. When agencies come to enforce the law without explanation, people resist because they feel left out of the process."

This statement highlights how poor coordination and weak communication between enforcement bodies and local representatives can erode trust, legitimacy, and compliance.

Traditional leaders justified their decisions by emphasising their accountability to community welfare over bureaucratic rules:

"We are caretakers of the lagoon. People come to us first before they go to government officers. If a mother cannot feed her family because fishing is prohibited, we must find a way to help her. The government focuses on laws, but we focus on our people's welfare."

This reflects the moral and cultural dimensions of traditional power, where leaders seek to balance ecological protections with urgent livelihood needs.

Voices from the community echoed frustrations about power imbalances in enforcement and decision-making. A male focus group participant stated:

"The Wildlife Division, the EPA, and the chiefs all have power, but none of them think about how we survive when they stop us from fishing. They make the rules, but we bear the suffering."

This reveals a sense of exclusion and hardship among resource users who feel marginalized by governance decisions.

A female participant highlighted the gendered and institutional nature of these disparities:

"It is the men and the leaders who meet to decide what happens with the lagoon. However, it is we, the women, who feel it most when there is no fish to

sell. We should be part of the discussions, not only affected by them."

This highlights the exclusion of women from decision-making, despite their crucial role in processing and selling fish, and underscores the need for more inclusive and participatory governance.

3.3.3 Inclusion and exclusion in governance

Power and legitimacy among traditional and formal authorities significantly shape who participates in Muni-Pomadze Lagoon (MPL) governance and whose voices are sidelined. Although governance structures aim to be participatory, decision-making is frequently dominated by male elites within both statutory and customary institutions, leaving women and youth with limited opportunities to engage despite their essential roles in fisheries, processing, and trading.

An official from the Physical Planning Department highlighted how institutional processes tend to prioritise chiefs over broader community involvement:

"When we organise stakeholder meetings, the invitations usually go to the traditional council and local opinion leaders. We do not always have representatives for women or youth because most of our communication is through the chiefs."

This approach reinforces a hierarchical authority structure where chiefs control access between government institutions and community members.

The Environmental Protection Agency (EPA) echoed this, noting reliance on traditional structures for legitimising consultations:

"We depend on the chiefs to bring people together for meetings. However, sometimes, they select the same few men every time, so women and young people are rarely in the discussions."

This pattern limits diversity and excludes important demographic groups from governance dialogues.

A Forestry Commission official reflected on how this exclusion undermines community support for conservation:

"When women and youth are excluded, the community does not fully support our interventions. The men who attend meetings may agree with us, but others feel the process does not represent them."

Participation gaps reduce the legitimacy and effectiveness of environmental interventions.

The Water Resources Commission (WRC) described how formal coordination among agencies can unintentionally perpetuate exclusion by focusing on institutional actors rather than inclusive community representation:

"Our joint meetings involve the District Assembly, EPA, and chiefs. We hardly see women or youth representatives at those tables. Sometimes it feels like governance is a discussion among institutions, not among people."

An Assembly Member also reflected on this exclusion, emphasising the disconnect between formal governance structures and the broader community:

"As local representatives, we try to bring community voices into decision-making, but sometimes agencies meet with the chiefs and make decisions without informing us or the people. This makes it seem like governance is for the few, not for everyone."

This statement reveals how even elected local officials—whose roles are to represent community interests—are sometimes bypassed, reinforcing the concentration of decision-making power among traditional and institutional elites.

Traditional leaders defended their approach to participation but revealed how customary norms shape access to decision-making:

"We invite those who matter, the elders, fishermen, and family heads. This view reflects cultural traditions that marginalize women and youth from active roles, even when their livelihoods depend directly on the lagoon's health."

During a male focus group, participants voiced frustration at their lack of influence over decisions made by both government and traditional authorities:

"The Wildlife Division, the EPA, and the chiefs control everything. They do not ask for our opinions. We only hear about decisions after they are made."

This suggests a top-down governance style that excludes everyday resource users from meaningful participation.

In contrast, women in a female focus group emphasized their exclusion and called for greater acknowledgment of their ecological knowledge and contributions:

"We are not just users of the lagoon, we are caretakers too. We notice when the water changes, when fish stocks decline, or when pollution levels increase. However, we are hardly called to decide what to do."

This highlights the need for incorporating women's perspectives to achieve more inclusive and effective governance.

3.4 Effects of marine resources conservation practices on the livelihood of the host community

This section examines the effects of marine resources conservation practices on livelihoods within the framework of the Marine Protected Area (MPA). The relationship between different forms of capital — human, natural, financial, social, physical, and livelihood outcomes — in coastal communities was assessed using multiple regression analysis. The findings reveal a strong and statistically significant association between these capital forms and the livelihoods of individuals in coastal areas (Table 6).

3.4.1 Human capital

The study finds that human capital has a significant influence on livelihood outcomes, with a standardised regression coefficient of $B=0.28$ ($SE=0.07$, $t=4.00$, $p=0.001$). Enhanced education, skills, and knowledge empower individuals to secure sustainable incomes and adapt to environmental changes.

A male participant from the focus group discussion highlighted the importance of education in improving fishing practices, stating:

"Many of us depend on traditional fishing knowledge passed down through generations, but without proper education on modern fishing techniques and conservation practices, we struggle to adapt to changes in marine resources."

Similarly, a female participant emphasised the role of education in improving economic resilience:

"Women who engage in fish processing and trade need training in financial literacy and business skills to improve our incomes and support our families."

These qualitative insights underscore the necessity of education and training programs tailored to both men and women in coastal communities to enhance livelihood sustainability.

3.4.2 Natural capital and livelihood sustainability

Natural capital, represented by marine and coastal resources, plays a crucial role in sustaining economic activities within coastal communities. The regression analysis yields a coefficient of $B=0.35$ ($SE=0.06$, $t=5.83$, $p<0.000$), indicating a strong relationship between natural capital and livelihood outcomes.

A Traditional Leader articulated the importance of marine resources for community well-being:

"The lagoon and ocean have sustained our people for generations. If these resources are not well-managed, our children will have nothing left."

A male fisherman also underscored the impact of environmental degradation on their way of life:

"When fish stocks decline due to overfishing or pollution, our entire way of life is threatened."

Furthermore, a female participant highlighted the ecological importance of mangroves:

"The mangroves are crucial for protecting our homes from floods, yet we see them being cut down without replacement."

These findings emphasise the necessity of sustainable marine resource management and conservation efforts.

3.4.3 Financial capital and economic stability

Among the various forms of capital, financial capital emerged as the most significant determinant of livelihood outcomes, with a coefficient of $B=0.41$ ($SE=0.05$, $t=8.20$, $p=0.000$). Access to financial resources is crucial for business expansion and economic stability.

A female fish trader expressed the challenges of inadequate financial support:

"Without financial support, we cannot expand our businesses. Loans with high interest rates make it difficult for us to invest in better processing techniques."

A male participant also highlighted financial constraints affecting fishermen:

"Many of us lack the money to buy modern fishing equipment, which affects our catch and income."

A female participant emphasised the importance of microfinance institutions in economic empowerment:

"Microfinance institutions should prioritise women because we reinvest our earnings into our families and communities."

Table 6 Results of the regression analysis

Variable	Coefficient (B)	Standard Error	t-value	p-value
Constant	1.25	0.31	4.03	0.000
Human Capital	0.28	0.07	4.00	0.001
Natural Capital	0.35	0.06	5.83	0.000
Financial Capital	0.41	0.05	8.20	0.000
Social Capital	0.29	0.07	4.14	0.001
Physical Capital	0.33	0.07	5.00	0.000

These findings underscore the crucial role of financial accessibility in enhancing livelihood security within MPAs.

3.4.4 Social capital and community support

The regression analysis indicates that social capital significantly contributes to livelihood sustainability, with $B=0.29$ ($SE=0.07$, $t=4.14$, $p=0.001$). Strong community networks and cooperative groups provide essential support for individuals in coastal communities.

A Traditional Leader emphasized the importance of social cohesion:

"Our community thrives when we work together. We have traditional savings groups that help members during hard times."

A male participant highlighted the benefits of fishing cooperatives:

"Fishing cooperatives help us secure fair prices and market access."

Additionally, a female participant pointed out the vital role of women's groups in supporting economic activities:

"Women's groups play a vital role in helping us pool resources for fish processing and trade."

These insights highlight the importance of social capital in fostering resilience and economic collaboration.

3.4.5 Physical capital and infrastructure development

Physical capital, encompassing infrastructure and technology, is another crucial determinant of livelihood outcomes. The study reports a coefficient of $B=0.33$ ($SE=0.07$, $t=5.00$, $p=0.000$).

A male fisherman pointed out the impact of poor infrastructure on livelihood sustainability:

"Our roads are in poor condition, making it hard to transport fish to the market before they spoil."

A female fish processor emphasized the need for improved storage facilities:

"We need better storage facilities and cold rooms to reduce post-harvest losses."

A Traditional Leader suggested targeted investments in modern fishing infrastructure:

"Investment in modern fishing docks and equipment would greatly improve the sustainability of our livelihoods."

These findings highlight the need for enhanced infrastructure to support coastal economies effectively.

Table 7 The Pearson correlation analysis

Variable Pair	Pearson Correlation (r)	p-value
Human Capital & Livelihood Outcome	0.58	0.000
Natural Capital & Livelihood Outcome	0.62	0.000
Financial Capital & Livelihood Outcome	0.74	0.000
Social Capital & Livelihood Outcome	0.56	0.000
Physical Capital & Livelihood Outcome	0.61	0.000

3.4.6 Correlation between different livelihood assets and overall livelihood outcomes

The Pearson correlation analysis revealed significant relationships between different livelihood assets and overall livelihood outcomes, with all correlations being statistically significant ($p<0.001$). Among these, financial capital exhibited the strongest positive correlation with livelihood outcomes ($r=0.74$), highlighting the critical role of income-generating activities, such as fishing, aquaculture, and tourism, in sustaining coastal communities. Natural capital ($r=0.62$) and physical capital ($r=0.61$) also demonstrated strong associations with livelihood outcomes, underscoring the importance of sustainable resource management and infrastructure development in economic stability. Additionally, human capital ($r=0.58$) and social capital ($r=0.56$) were positively correlated with livelihood outcomes, highlighting the significance of education, skills development, and social networks in enhancing economic resilience (Table 7).

The regression analysis further validated these relationships, showing that financial capital ($B=0.41$) had the most substantial impact on livelihoods, thereby reinforcing the need for financial investments, such as credit access and market expansion, to support economic growth. Natural capital ($B=0.35$) played a significant role in maintaining livelihood stability, underscoring the importance of marine conservation policies and responsible resource management. Physical capital ($B=0.33$) was equally vital, as infrastructure, including boats, processing facilities, and transportation, contributed to economic efficiency and resilience. Social capital ($B=0.29$) and human capital ($B=0.28$) also had notable influences, highlighting the importance of community cooperation, training programs, and education in strengthening economic opportunities.

The findings suggest that livelihood sustainability in coastal communities is shaped by a combination of financial, natural, physical, social, and human capital. While financial capital exerts the most decisive influence, the role of natural and physical capital in ensuring long-term resilience cannot be overlooked. These results call for integrated policy interventions that enhance financial

access, support marine conservation, improve infrastructure, and promote social and educational initiatives. A holistic approach to strengthening these capital assets will contribute to more sustainable and resilient livelihoods in coastal regions.

4 Discussion

The demographic profile reveals a gendered division of labour, with men primarily engaged in fishing and women involved in processing and trading, consistent with Bene et al. (2016), who highlighted the undervalued role of women in post-harvest activities. Low educational attainment among respondents hinders the adoption of sustainable fishing techniques, as noted by Pauly & Zeller (2017), limiting access to alternative livelihoods and increasing vulnerability to resource depletion.

Long-term residence in the study areas reflects strong socio-economic ties to fishing, aligning with Cinner et al. (2018a), who found that such communities often resist conservation policies without viable alternatives. Despite its potential, aquaculture adoption remains low due to financial barriers, lack of expertise, and cultural preferences for wild-caught fish, as highlighted by Brugère et al. (2021). Addressing these challenges through capacity-building and financial incentives could promote livelihood diversification and reduce pressure on wild fish stocks. Through the SES Framework, researchers demonstrate that cultural preferences, together with economic limitations, merge with fish resources and water ecological health. Massively catching wild fish exceeds cultural tradition, as it represents the health condition of the lagoon system, which currently faces environmental risks. The essential connection between social needs and natural preservation underscores the need for governance methods that reconcile these demands (Berkes & Folke 1998).

Marine resources remain the backbone of local livelihoods, but declining fish stocks, habitat degradation, and financial constraints present significant economic risks. The decline in fish stocks observed in this study is consistent with global trends reported by FAO (2020), which indicate that over 34% of fish stocks are overfished, threatening food security and economic stability in fishing-dependent communities. Respondents expressed concerns about dwindling incomes, which align with findings by Allison & Ellis (2001) that highlight the vulnerability of small-scale fishers to environmental and economic shocks. From an SES viewpoint, the study demonstrates a strong connection between human livelihoods and social income, as well as the health of fish resources and marine habitats. A decrease in fish stocks has negative impacts on ecosystem health, leading to disruptions in community stability and economic instability, according to an SES perspective (Folke et al. 2005).

Financial capital is critical for sustaining marine-based livelihoods, yet access to credit remains limited. Studies by Ayilu et al. (2023) confirm that financial exclusion is a significant constraint for fishers in Ghana, limiting their ability to invest in better equipment or diversify their income sources. The lack of alternative income-generating activities exacerbates the issue, rendering communities highly dependent on marine resources despite the decline in their availability. As noted by Béné et al. (2016), introducing microfinance schemes and cooperative savings programs tailored to fishers could alleviate financial barriers and promote economic resilience. According to the SES Framework, social systems together with governance frameworks influence either positive or negative impacts on ecological sustainability. The inability of the community to obtain financial services reduces their ability to engage in sustainable practices, thus leading to increased resource depletion. Both social systems and ecological systems require integrated solutions, as outlined in the SES Framework (Ostrom 2009).

Natural resource depletion remains a significant concern, with respondents citing overfishing, mangrove destruction, and pollution as key threats to their livelihoods. This is consistent with studies by Worm et al. (2006), who emphasise that habitat degradation accelerates fish stock depletion, reducing long-term economic viability. The relatively low adoption of aquaculture, as observed in the study, further underscores the need for targeted interventions to promote sustainable alternatives. As Brugère et al. (2021) suggest, providing technical training, improving access to markets, and integrating aquaculture with traditional fishing practices can help communities transition towards more sustainable livelihoods. The SES Framework demonstrates that environmental harm from mangrove destruction produces immediate effects on population survival methods and food availability. The low adoption of aquaculture demonstrates an inadequate link between social needs and suitable ecological solutions, highlighting the need for governance strategies that address this disconnect. Traditional knowledge systems, when combined with scientific conservation practices, enable a pathway to sustainable solutions that local communities will accept (Berkes et al. 2003).

The governance of marine resources in the Muni-Pomadze Lagoon highlights tensions between formal conservation policies and traditional management practices. Respondents reported dissatisfaction with strict regulatory measures, which they perceive as disruptive to their economic activities. This aligns with the findings of Ostrom (1990), who argues that top-down governance structures often fail when they do not take into account local socio-economic realities. Effective resource management, therefore, requires a participatory approach where local fishers are actively involved in

decision-making. The qualitative findings highlight three interrelated themes shaping governance at the Muni-Pomadze Lagoon. First, the coexistence of statutory and traditional authorities reflects overlapping claims to legitimacy, which can create friction when formal regulations disregard customary norms (Ostrom, 1990; Cinner et al. 2018b). Second, tensions between enforcement and livelihoods underscore that strict ecological protection without socioeconomic support risks undermining compliance, a pattern also observed in small-scale fisheries elsewhere (Allison & Ellis 2001; Béné et al. 2016). Third, the exclusion of women and youth weakens governance legitimacy and adaptive capacity, consistent with findings that inclusive participation enhances compliance and resilience (Folke et al. 2005; Allison et al. 2009). This can be supported by the SES Framework, which highlights the need for governance systems that integrate social structures with ecological systems. Decisions made without community involvement often result in breakdowns of conservation policies, as they neglect the genuine resource usage needs of affected individuals. Successful governance must achieve both ecological targets and meet social needs, while also increasing participation, as noted by Ostrom (2009).

The findings further demonstrate that governance outcomes are not only a function of institutional presence but also of power dynamics between statutory and traditional authorities. Where formal institutions exercise top-down regulatory power without adequately engaging local leadership, resistance and weak compliance often follow. Conversely, when statutory frameworks recognise the cultural legitimacy of traditional custodians and incorporate their conservation practices, governance gains both effectiveness and legitimacy. This is consistent with Ostrom's (1990, 2009) assertion that locally embedded institutions play a critical role in sustaining common-pool resources, and with Folke et al. (2005), who emphasise the importance of adaptive governance that bridges multiple knowledge systems. By highlighting how traditional authority and state power interact in the Muni-Pomadze case, this study contributes to the broader evidence (Berkes, 1998; Cinner et al. 2018b) that co-governance arrangements grounded in shared authority yield more resilient socio-ecological outcomes.

Institutional overlaps and enforcement challenges further complicate marine governance. Studies by Boateng (2006) suggest that conflicting roles among regulatory bodies in Ghana often result in weak enforcement of conservation measures, thereby reducing the effectiveness of these measures. Traditional conservation practices, such as seasonal fishing bans, continue to play a role in resource management. However, as noted by Cinner et al. (2018a, 2018b), integrating these indigenous practices

with scientific conservation strategies could enhance compliance and sustainability. Adaptive governance systems require both traditional and scientific knowledge, as outlined in the SES Framework. The seasonal fishing bans derive their meaning from ecological knowledge about natural cycles, although their success depends on social compliance and monitoring protocols. Sustainable governance requires the effective integration of social structures with ecological systems to achieve positive results (Folke et al. 2005).

Respondents also expressed concerns about the perceived lack of economic incentives to comply with conservation measures. This mirrors findings by Gutiérrez et al. (2011), who argue that co-management approaches, where communities receive tangible benefits from conservation efforts, tend to have higher compliance rates. Implementing alternative livelihood programs alongside conservation policies could help bridge this gap, ensuring that communities see direct economic benefits from sustainable resource use. Through its framework, the SES supports measures that demonstrate how social benefits from alternative livelihoods contribute to ecological sustainability. Communities will uphold and follow resource management policies if they experience economic growth through conservation activities. Long-term sustainability can be achieved through the essential feedback mechanism that connects social and ecological systems (Berkes & Folke 1998).

5 Conclusion and policy implications

This study examined the interconnections between marine resource management, governance structures, and local livelihoods at the Muni-Pomadze Ramsar Site in Ghana. Findings show that livelihoods depend on multiple forms of capital, with financial and natural capital emerging as the most significant predictors. However, institutional overlaps, weak enforcement, inadequate infrastructure, and the exclusion of women and youth constrain sustainable governance. These challenges underscore the need for co-governance frameworks that strike a balance between statutory authority and traditional legitimacy, thereby fostering inclusivity in decision-making.

Beyond these empirical insights, the study contributes to broader debates in marine governance by showing how adaptive governance principles (Folke et al. 2005) and co-governance arrangements (Berkes, 2009; Ostrom 2009) can be grounded in local socio-cultural realities. The Ghanaian case highlights that governance effectiveness is not solely about institutional presence, but rather about how legitimacy, enforcement, and inclusion are negotiated among diverse actors. In this way, the study extends the SES framework by demonstrating the importance of

cultural and political dynamics in shaping compliance and sustainability.

The policy implications also go beyond the local site. First, the proposed Multi-Stakeholder Lagoon Management Board and community resource guard initiatives offer a replicable model for other West African wetlands where statutory and customary institutions coexist. Second, livelihood interventions such as microcredit, aquaculture training, and cold storage investments are scalable in contexts where fishers face similar financial and infrastructural barriers. Third, embedding women and youth into governance structures not only improves equity but also strengthens the long-term sustainability of conservation policies by ensuring intergenerational stewardship.

The study demonstrates that achieving sustainable marine governance requires interventions that are context-specific yet adaptable across regions. By linking governance, livelihoods, and ecological resilience, the findings provide pathways for scaling inclusive co-governance models beyond Muni-Pomadze to other Ramsar sites in Ghana and the wider Global South.

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Authors' contributions

EYO: Conceptualization, Investigation, Methodology, Project administration, Writing – original draft, and Supervision. JAN: Data curation, Formal analysis, Software, Validation, Visualization, Writing – review and editing. EA: Resources, Validation, software, and visualization, Writing – review and editing.

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Data availability

The data collected during this study are available upon request to promote inclusion and further exploration of this topic.

Declarations

Ethics approval and consent to participate

The methods employed in this study adhered to relevant guidelines and regulations. The Ghana Health Service Ethics Review Committee exempted the study from ethical approval, considering it a general qualitative inquiry involving voluntary participation, in accordance with the 2015 Standard Operating Procedures. Before engaging in any research activities, all participants provided written informed consent. They were fully informed about the study's purpose and procedures. Additionally, participants consented to the publication of the study's findings. Ensuring the dignity, safety, and well-being of the interviewees was of paramount importance. Participation in the study was entirely voluntary, and no identifying or sensitive information was documented.

Competing interests

The authors have no competing interests to declare that are relevant to the content of this article.

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