Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Rethinking Fisheries Governance in West Africa: Facilitating Socio-economic Resilience Alongside Ecological Priorities for Conservation

Josephine Laryea Asare

jla20@st-andrews.ac.uk

University of St Andrews

Kenneth Arthur

Canoe and Fishing Gear Owners Association of Ghana (CaFGOAG)

Randolph Kwesi Benyi Johnson

Sustainable Coastal and Fisheries Development Advocacy Expert

Isaac Nana Kweigyah

Canoe and Fishing Gear Owners Association of Ghana (CaFGOAG)

Gabriel Mevuta

Friends of the Nation (FoN)

Timothy Stojanovic

University of St Andrews

Emmanuel Tenkorang

Fisheries Committee for the West Central Gulf of Guinea (FCWC)

Ifesinachi Okafor-Yarwood

University of St Andrews

Article

Keywords: Small-scale fisheries, livelihood diversification, equitable conservation, vulnerability

Posted Date: November 20th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11285035/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License.
Read Full License

Additional Declarations: No competing interests reported.

Rethinking Fisheries Governance in West Africa: Facilitating Socio-economic Resilience Alongside Ecological Priorities for Conservation

Josephine Laryea Asare[a,*], Kenneth Arthur[b], Randolph Kwesi Benyi Johnson[c], Isaac Nana Kweigyah[b], Gabriel Mevuta[d], Timothy Stojanovic[a], Emmanuel Tenkorang[e], Ifesinachi Okafor-Yarwood[a,h].

[a] *School of Geography and Sustainable Development - University of St Andrews, UK*
[b] *Canoe and Fishing Gear Owners' Association of Ghana (CaFGOAG), Ghana*
[c] *Westcoast Women Ambassadors (WWA), Ghana*
[d] *Friends of the Nation (FoN), Ghana*
[e] *Fisheries Committee for the West Central Gulf of Guinea (FCWC), Ghana*
[h] *Member of the Governing Board, International Maritime Institute of Nigeria (IMION), Nigeria*

Abstract

Conservation frameworks have predominantly focused on ecological dimensions, while the socio-economic dimension, essential to fisherfolk's livelihood security and resilience, is insufficiently integrated. Consequently, this narrow focus deepens inequality among already vulnerable communities and compromises the ecological effectiveness of such models. This study investigated how small-scale fisherfolk adapt to livelihood changes using empirical data from surveys, focus group discussions, key informant interviews and validation workshops involving 1,353 fisherfolk across Ghana's four coastal regions. Adopting the sustainable livelihoods approach framework, it characterises how fisherfolk deploy economic, social, physical and natural coping strategies in response to vulnerabilities exacerbated by the impacts of the closed season. It shows how limited economic options for small-scale fisherfolk contribute to resource depletion and to their adoption of both positive and negative coping strategies. To facilitate fisherfolk's socio-economic resilience, it recommends measuring socio-economic indicators alongside ecological metrics in existing national and regional surveys, both of which are essential for achieving equitable conservation outcomes and operationalising the blue economy objectives under Africa's Agenda 2063.

Keywords: Small-scale fisheries, livelihood diversification, equitable conservation, vulnerability

* Corresponding author: Josephine Laryea Asare; jla20@st-andrews.ac.uk

Introduction

As ocean and coastal ecosystems face growing human and climate-related pressures, the magnitude of these changes, their effects on ecosystem services, and strategies for sustainable management remain a priority for global scientists (United Nations, 2026). Coastal communities are at the frontline of these changes (Blanchard and Novaglio, 2024; Ghomsi et al., 2024), and bear the immediate impacts of ocean pressures which threaten their socio-economic wellbeing and security (Okafor-Yarwood et al., 2022). Fisheries production, being a major lifeline for coastal states, is reported to be significantly impacted by both climatic and human impacts such as storm surges, coastal erosion, biodiversity loss, depleted fish stocks, and sea surface temperature anomalies (Blanchard and Novaglio, 2024; Ghomsi et al., 2024). Governance interventions such as blue economy expansion, fishery regulations, and conservation policies intended to support livelihood security while promoting ocean sustainability objectives are often designed without consideration of the precarious conditions within these coastal communities and can unintentionally deepen existing social inequalities (Charles, 2021; Das, 2023; Okafor-Yarwood and Eastwood, 2025).

Small-scale fisheries constitute approximately ninety per cent of the global fishing workforce, contribute an estimated forty per cent of global catch, and support the livelihoods, food and nutritional security of nearly five hundred million people worldwide (FAO, 2015, 2024). For many coastal communities in West Africa, small-scale fisheries remain the sole source of income (Belhabib et al., 2015), as such events that restrict access to the resources adversely impact fisherfolk, especially those without alternative income or socio-economic support (Mensah et al., 2025). These impacts manifest economically as loss of income, borrowing, and depletion of savings reserves (Khanh Ngoc et al., 2026; Teh et al., 2024) and socially as withdrawal of children from school, migration (Bocoum et al., 2023), reduced food consumption, poor health and wellbeing (Ofori-Danson et al., 2019), theft, among other social vices (Gough et al., 2026; Okafor-Yarwood, 2020a). In the fishing industry, various pressures lead to unsustainable practices, such as fishers working longer hours or using finer-mesh gear to catch juvenile species that accelerates the depletion of overfished stocks (Knudsen, 2016; Setianti et al., 2024). In some cases, these pressures fuel illegal activities such as oil bunkering, IUU fishing and piracy (DIIS, 2023; Okafor-Yarwood, 2020a; Okafor-Yarwood and Eastwood, 2025; Phayal et al., 2024). The cyclical dynamic, in which economic vulnerability drives ecological degradation, and that degradation further entrenches vulnerability, has been described as a social-ecological trap (Sarker et al., 2026) or the poverty-overfishing loop (Chen and Liu, 2021).

As ocean sustainability and conservation efforts continue to expand, the focus remains largely on meeting ecological objectives and sustaining ecosystem services. Research into how such measures interact with the vulnerabilities of coastal communities, and how these communities draw on their capacities in response, is nascent and uneven in scope. Small-scale fisheries hold nutritional, cultural and livelihood relevance for millions of Africans, thus continued advancement of conservation efforts in the region without socio-economic considerations risks

significant disruptions. Research on coastal community resilience (see Marschke and Berkes, 2006 and Shah et al., 2025) has mainly emphasised accounts of positive adaptation and implicitly treated coping strategies as a means of improving fisherfolk's circumstances. Critiquing the tension fisherfolk may face between adapting to change and pursuing well-being, Coulthard (2012) argues for policies that support fisheries resilience by understanding the full range of consequences that adaptation carries for fisherfolk's well-being. Gough et al. (2026) report theft as a coping strategy adopted by fisherfolk during the closed season but stop short of assessing the broader range of strategies they use that could undermine well-being. Advancing this limited scope, this study investigates how small-scale fisherfolk adapt to livelihood changes. It draws empirical evidence from Ghana's fishing closed season, implemented to rebuild depleting fish stocks. Vulnerability, resilience, and the Sustainable Livelihoods Approach, which together frame this study, are reviewed in the next section before presenting the study's methodology, results and discussion.

Literature review

Vulnerability describes the likelihood that a system will be adversely affected by pressure(s). It is understood by conditions such as the extent to which the system is exposed, the system's sensitivity and its adaptive capacity to a pressure (Adger, 2006; Turner et al., 2003). In this light, Ribot (2014) helps us understand that vulnerability precedes the event that reveals it and often stems from conditions that the event subsequently triggers. The precarious conditions of fisherfolk communities dependent on small-scale fisheries are well documented, explained by their high dependence on one resource, income that fluctuates with seasonal changes, and limited access to social protection (Allison et al., 2009; Dercon, 2002). Adaptive capacity within such a community is also uneven, as it is dependent on assets, social organisation, knowledge and choices available to each household (Cinner et al., 2018); this closely matches with the capitals of the sustainable livelihoods approach which will be discussed later in this section. Following from this, a single event impacting a fishing community could be experienced on various levels depending on the community's shared experience of the event, and on the differing experiences of households and individuals based on their circumstances.

According to Simard et al. (2022), policy and regulations that restrict access to resources act as systemic disruptors triggering vulnerabilities within small-scale fishing communities. Examples of these include gear restrictions, temporary closures, fishing exclusion zones, and marine protected areas. However, measures of this kind are often communicated in advance and, in the case of closed seasons, repeated annually, so the extent of disruptions and triggers of any vulnerability will be shaped by what fisherfolk households do during the period when fishing is restricted. In households where that capacity is limited, measures introduced for ecological sustainability risk deepening inequalities already existing in coastal communities (Bennett et al., 2021; Okafor-Yarwood and Eastwood, 2025) and the work of absorbing the impact often falls on households rather than on the institutions that impose them (Okafor-Yarwood et al., 2022).

Resilience to pressures or triggered vulnerabilities therefore pertains to what fisherfolk do in these circumstances, and at what cost to themselves.

Resilience has been widely used across various disciplines and contexts (Alexander, 2013). For example, in ecology, Holling (1973) defined it as a system's ability to absorb change and return to equilibrium after disturbance. In engineering, resilience describes the capacity of a material to absorb stress and recover its original form, signifying a bounce-back framing that Holling (1996) later cautioned overlooks the possibility that systems settle into multiple stable states. In development studies, definitions of resilience recur around components of withstanding, recovering and adapting (Sturgess and Sparrey, 2015) and are often discussed alongside vulnerability, adaptability, resistance and recovery (Béné, 2009; Charles, 2021; Okafor-Yarwood et al., 2022). Resilience is featured in related ways across psychological, economic, institutional, socio-ecological, and political domains (Runde and Savoy, 2014), where its original meaning, "to rebound" from the Latin word *resilire* (Oxford English Dictionary, 2025), remains. Nonetheless, despite the role of resilience in addressing crisis situations and anticipating problems before they emerge, a common definition remains elusive, and development studies have critiqued who bears responsibility for building resilience.

In this study, we define resilience as the ability to draw on relevant, accessible capitals to sustain a livelihood and withstand or adapt to conditions that make one vulnerable. We draw this definition from our review of scholarship on the topic (Armitage et al., 2017; Okafor-Yarwood et al., 2022; Runde and Savoy, 2014; Sturgess and Sparrey, 2015) and depart from considerations that implicitly assume adaptive strategies are positive. In our context, relevant capitals refer to tangible and intangible assets accessible to fisherfolk at the personal, household, community, and national scales through governments or relevant development organisations. To understand how fisherfolk handle vulnerabilities and build resilience to adverse proximate impacts from the closed season, we adopt the Sustainable Livelihoods Approach (SLA) as our theoretical framework. SLA was developed by Scoones (1998) for development contexts and adopted for small-scale fisheries by Allison and Ellis (2001). The SLA framework was chosen for its conceptualisation of household resilience through financial, human, social, natural, and physical capitals and is illustrated in the infographic in Fig. 1 below (Allison and Ellis, 2001:378- 380).



***Fig. 1**: An illustration of the five capitals deployed by households under the Sustainable Livelihoods Approach (**Note**: Illustration adopted from* Scoones (1998) and Allison and Ellis (2001) *and generated with Google Gemini 3.6 flash)*

Scoones (1998) and Allison and Ellis (2001) converge on the argument that resilience emerges from the combination and deployment of these five capitals rather than from any single capital in isolation. They further argue that, in the context of the fisheries, a household's capacity to withstand an adverse impact will typically depend on how financial, human, social and physical capital are deployed to substitute for the natural capital they depend on that has become prone to depletion or has been restricted in access (Allison and Ellis, 2001). Another utility of the SLA is its expansive view of poverty and hardship beyond households' efforts alone, situating vulnerability within an institutional context and considering the wider dimensions of impact. With our adoption of the framework, we also acknowledge its criticisms. Among other scholars, Roscher et al. (2022) criticised the SLA's inconsistent use across studies, making it unclear what diversification requires to succeed. They also noted that interventions targeting a single capital fall short due to structural barriers, as low levels of education mean not all households can easily access alternative livelihoods. More fundamentally, Allisson and Ellis (2001) themselves note that the SLA's capital structure was developed for asset-based rural poverty, rather than the access-contingent shocks characteristic of shared resources such as the fisheries where livelihoods can be undermined by restricted access rather than asset loss, which is the particular type of impact examined in this study. Despite these critiques, the SLA remains a useful framework for the small-scale fisheries context of this study. Its five-capital structure readily serves as the analytical lens for examining and categorising fisherfolk's adaptations to build resilience to vulnerabilities exacerbated by impacts of the closed season later in this study. Additionally, it enables micro- and macro-linkages to review resilience from household-level

decisions to national-level interventions. Having clarified the key terms, the methodology deployed for this study is presented in the next section.

Study Area & Methodology

Ghana, a West African coastal country, is one of the major fishing nations along the Western Gulf of Guinea. Its fishery sector, made up of marine fisheries, inland fisheries and aquaculture, generates over US$ 1 billion in revenue, which accounts for at least 0.9% of Ghana's Gross Domestic Product (MoFAD, 2022). Fish constitutes about 60% of animal protein intake of Ghanaians, and the average per capita consumption of fish in Ghana is estimated to be 28 kg - higher than the world average of 16 kg (Asiedu et al., 2023). Ghana's fishery sector provides gendered employment for about 10% of its population (over 3.3 million people) (MoFAD, 2022), of which about half are women (Chambon et al., 2024; Harper et al., 2020). Its marine fisheries sector comprises the artisanal (or small-scale), semi-industrial (or inshore) and industrial (made up of the trawl and tuna fisheries) (MOFAD, 2022).

Ghana's small-scale fisheries sector employs about 80% of Ghana's fisherfolk, and the species of economic importance, such as round and flat sardinellas, anchovies, and mackerels, account for about 70% of the country's total marine capture fish production. Assessments from the last decade indicate a decline in fish production from the artisanal sector. Notably, sardinella, the primary species in Ghanaian fisheries, reached an all-time low, diminishing its potential contribution to the national economy and fisherfolk livelihoods (Lazar et al., 2020). Whilst recent research by Owusu (2024) shows a slight increase in historical fish production, Ghana's fishing industry faces multiple challenges, including illegal, unreported, and unregulated (IUU) fishing, as well as pressures from industrial fishing and coastal development. Ameyaw et al. (2021) draw particular attention to struggles with livelihood resilience among artisanal fishers and to growing concerns over the sustainability of coastal communities. These conditions prompted the Government to introduce a fishing closed season to rebuild collapsing fish stocks (MOFAD, 2022).

For this study, eight major research communities, two in each of the four coastal regions across Ghana were targeted with input from local research collaborators, and were: Abeliakope and Abutiakope in the Volta Region, Akplabanya and Tema in the Greater Accra Region, Apam and Cape Coast in the Central Region and Abuesi and Sekondi in the Western Region. During fieldwork, however, interactions extended to fisherfolk in some adjoining communities, for a total of 15 fishing communities engaged across the four coastal regions of Ghana (Fig. 2; also see Table A1 in the Appendix for details). The communities were selected based on the prominence of fishing in their livelihoods, their observance of fishing holidays (a weekly no-fishing day) as a traditional management approach, and their compliance (or otherwise) with the fishing closed-season policy. A summary of these factors is included in the appendix for reference (see Table A2).

A mixed-methods approach, incorporating qualitative and quantitative methods, was used to investigate fisherfolk's lived experiences and to triangulate findings to assess the perceived

impact of the FCS based on their situated knowledges (Haraway, 1988). The study adopted a collaborative approach by engaging local stakeholders as co-researchers[1] and locally validating research findings with fisherfolk, thereby developing a distinctive methodology for knowledge co-production and the correction of epistemic harm (Cooke et al., 2021; Farwig et al., 2017).



Fig. 2. *Map of major research communities engaged in the fieldwork across the four coastal regions of Ghana*

In the respective major research communities, five in-person data collection methods were deployed to align with local realities and the availability of voluntary participants: surveys (questionnaires), focus group discussions (FGDs), key informant interviews (KII), ethnographic observations, and validation workshops. All engagements were conducted in the language most comfortable for participants. The survey (questionnaires) followed a random stratified sampling strategy targeting between 50 and 60 fisherfolk per fishing village with a sampling quota of 1 female: 2 males. The survey design was informed by related studies (Ofori-Danson et al., 2019) and fisherfolk data from the Fisheries Commission (Dovlo et al., 2016). Data were collected on tablets using the ArcGIS Survey 123 application and quantitatively analysed with the same software. Mixed-gender FGDs engaged four livelihood categories of fisherfolk who had been randomly selected and participated voluntarily: 1. Fish Processors and Traders (FPT); 2. Canoe and Gear Owners (CGO) 3. Crew Fishermen (CRF) 4. Other fisheries livelihoods (OTH), which included food vendors, input dealers, and service providers. A semi-structured interview guide was used to moderate FGD discussions in each of the eight major fishing villages, with a target

[1] This study contributes to the Sankofa (aka Creating Synergies between Indigenous Practices and Scientific Knowledge (ISIPSK)) research project, as part of the PI's Pew fellowship in Marine Conservation. The research project in collaboration with key local stakeholders, including the Canoe and Fishing Gear Owners Association of Ghana (CaFGOAG), the FCWC and the Fisheries Commission of Ghana.

of 12 participants per session. While mixed-gender FGD was intended, due to the gendered nature of SSF livelihoods (Ameyaw et al., 2020; Okafor-Yarwood et al., 2022), engagements involving crew fishers were predominantly male, and with fish processors and traders were predominantly female. For the KII in each fishing village, a purposive sampling strategy was adopted, targeting at least five fisherfolk of either gender in leadership positions for conversations prompted by a semi-structured interview guide (Porcuna-Ferrer et al., 2023). The FGD and KII were audio-recorded with the consent of participating fisherfolk.

Ethnographic observations in each fishing village were documented in a field notebook, with photographs where applicable, to support data obtained from other methods (Luintel, 2020). The data for this study were collected by the Sankofa team of RAs during the annual closed season in July 2024. Ethics clearance for the research was obtained from the University of St Andrews after completing the risk assessment requirements. All engagements were pseudonymised i.e. participants' original names were replaced with unique alphanumeric codes to de-identify them and enable them to share their thoughts freely. The audio recordings of FGD and KII engagements that were conducted in the local dialect were translated and transcribed into English by the Sankofa RAs. Each transcript underwent two reviews by a facilitating RA and the field supervisor to clarify and fill any gaps. The reviewed FGD and KII transcripts were analysed with NVivo (2020, R1) for Windows.

An inductive coding approach was used to identify codes that emerged from the data, and similar codes from participants' responses that addressed the research question were grouped for subsequent thematic analysis (Braun and Clarke, 2022; Naeem et al., 2023). Findings were subsequently validated by fisherfolk, key stakeholders, and decision-makers through regional engagements held from September 2025 to February 2026, with 520 participants from 15 research communities engaged during the data collection and an additional 33 fishing communities across Ghana's four coastal regions (Fig 3; see Table A3 in Appendix for details). Our objective for using validation as a method was to create space for marginalised voices and indigenous knowledge to inform both the generation and interpretation of data and move beyond extractive research to integrate locally grounded knowledge systems to tackle epistemic injustice (Ndlovu-Gatsheni, 2021).

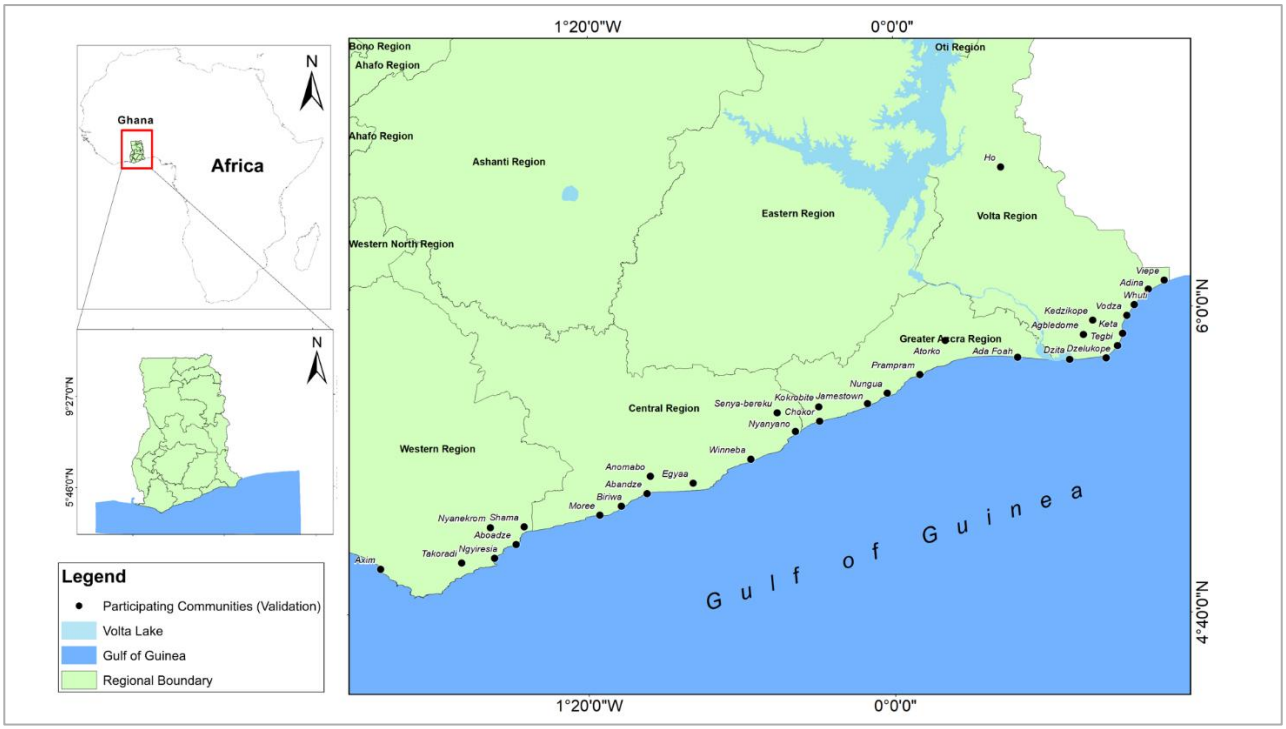


Fig. 3. *Map showing the additional communities engaged across the four coastal regions of Ghana to validate the research findings*

Results

Overall, 1,353 fisherfolk were engaged in the five methods across 48 fishing communities: survey (questionnaires), focus group discussions, key informant interviews, ethnographic observations and validation. Data on fisherfolk with and without supplementary livelihoods were primarily obtained through surveys (questionnaires). The survey findings were triangulated with qualitative insights from the other four methods to strengthen their credibility and validity among fisherfolk across Ghana's four coastal regions. Of the 427 surveyed fisherfolk, 65% were males and 35% were females. Among these, the greater proportion of participants fall within the demographic with familial responsibilities: 69% are aged between 35 and 64 years (Fig. 4), 72% are married (Fig. A2) and have large household sizes (Fig. A2); 85% of respondents have a household size ranging from 4 to 16 persons/household, with the largest household having 37 persons. 73% of surveyed fisherfolk had received some formal education from at least primary school through to tertiary levels.

The primary livelihood of respondents was fishing, engaged in solely by males, and fish processing and/or trading, predominantly engaged in by females. The other livelihood activities involved providing fisheries-related services, such as ice making, security personnel for fishing inputs, head portering, input dealership, fuel handling, food vending, carpentry, and teaching, which were mixed-gender. One-third (n = 129) of fisherfolk surveyed reported they earned income from a supplementary livelihood besides the fishery, while the remaining two-thirds (n = 298) relied solely on income from their fishery livelihood. Of those who engaged in activities that earned them supplementary income, 47% were female, and 52% were male. Females were mostly engaged in supplementary livelihoods like food vending and petty trading, whereas males

were involved in fishing input dealership, carpentry, masonry, and other labour-intensive jobs. Education was not observed to be a distinguishing factor between fisherfolk with supplementary income versus those without, as both groups included fisherfolk with no formal education and those educated up to tertiary levels.

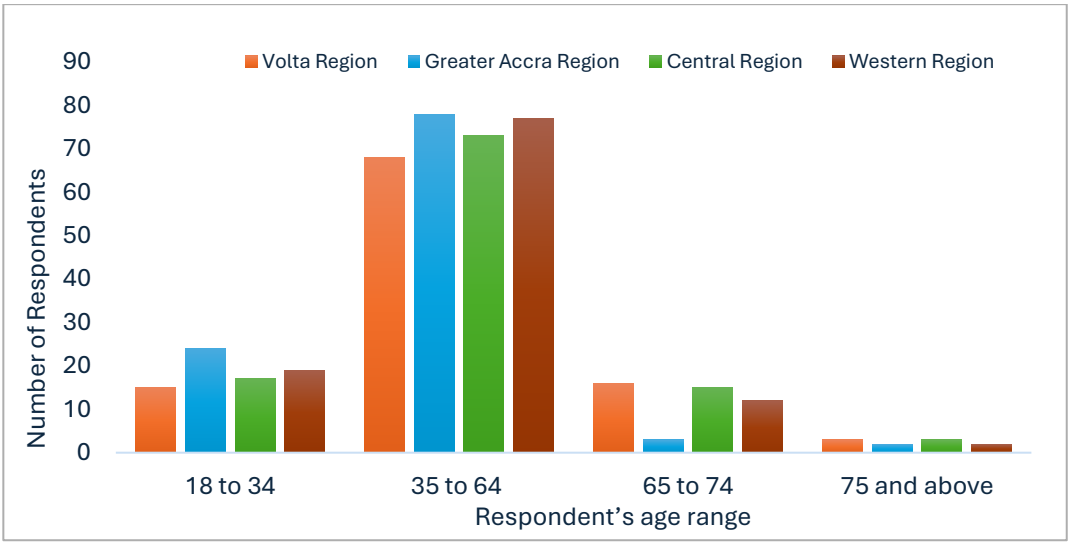


Fig. 4. *Age distribution of surveyed fisherfolk across the four coastal regions of Ghana*

Impacts of the fishing closed season were felt by all fisherfolk, given their shared use of resources, with variations in experience depending on each household's specific circumstances. Among fisherfolk's coping strategies in response to socio-economic impacts, they reported adopting at least one, up to four strategies, including relying on savings, borrowing money, travelling elsewhere, sharing their situation for emotional release, doing nothing, or adopting other strategies. The scope and frequency of these strategies have been visualised in Fig. 5 and disaggregated by gender. A variety of strategies were reported under "other" coping strategies, including preparing for the closed season, among others, which are detailed later in this section. As grouped in Fig A4 (see in the appendix), 30 % of fisherfolk reported adopting one strategy, more than half adopted two main strategies, 16% adopted three strategies, and 2% adopted four strategies. Since most fisherfolk reported using multiple coping strategies, the types of adaptation were not mutually exclusive; however, their adaptation could indicate the kind of capital accessible to them. To aid subsequent discussions, the coping strategies fisherfolk reported adopting are categorised into economic, social, natural, and physical adaptations, aligning with capitals under the Sustainable Livelihood Approach.

Economic adaptations employed by fisherfolk were the strategies most adopted by fisherfolk. In Fig 5, 65% of male and 75% of female fisherfolk surveyed relied on savings accrued from their fishery-related and/or supplementary livelihoods. 58% of male and 47% of female fisherfolk borrowed money from either friends, co-workers, family, or financial institutions, while only 16% of male and 29% of female fisherfolk switched to their supplementary livelihood, which they run alongside their fishery occupation for income. Fisherfolk reported adopting "other" economic adaptations, which included relying on financial gifts from family, friends, and canoe owners,

selling some of their personal belongings, or buying items on credit to repay later. Others sought temporary jobs to earn income, including labourer positions at construction sites, illegal small-scale gold mining locally referred to as 'galamsey', farm work, petty trading, and some even engaged in social vices such as theft, prostitution, gambling and fraud. Although no participant reported engaging in these social vices themselves, they were widely reported to be prevalent in the community, particularly among some youth fisherfolk during the closed season. One unconventional economic adaptation reported by some male crew fishermen and canoe owners in all four coastal regions was taking money in advance from the women fish processors to whom they supplied fish under an informal arrangement to repay with an equivalent supply of fish when the fishing season resumed. Some fisherfolk stored food at home to ensure food security during the closed season. Fish processors and traders preserved landed fish through smoking or freezing to sell for income, while others purchased frozen fish from cold stores for resale in frozen or processed forms. The Government distributed rice and oil as relief items to fisherfolk during the closed season; however, this was limited to canoe fishers and some fish processors who were members of the National Fish Processors and Traders Association (NAFPTA). The diversity of coping strategies quantified in the survey (questionnaires) was consistently reported across FGDs and KII engagements with fisherfolk. This was corroborated by the research team through ethnographic observations and further confirmed during the stakeholder validation exercises.

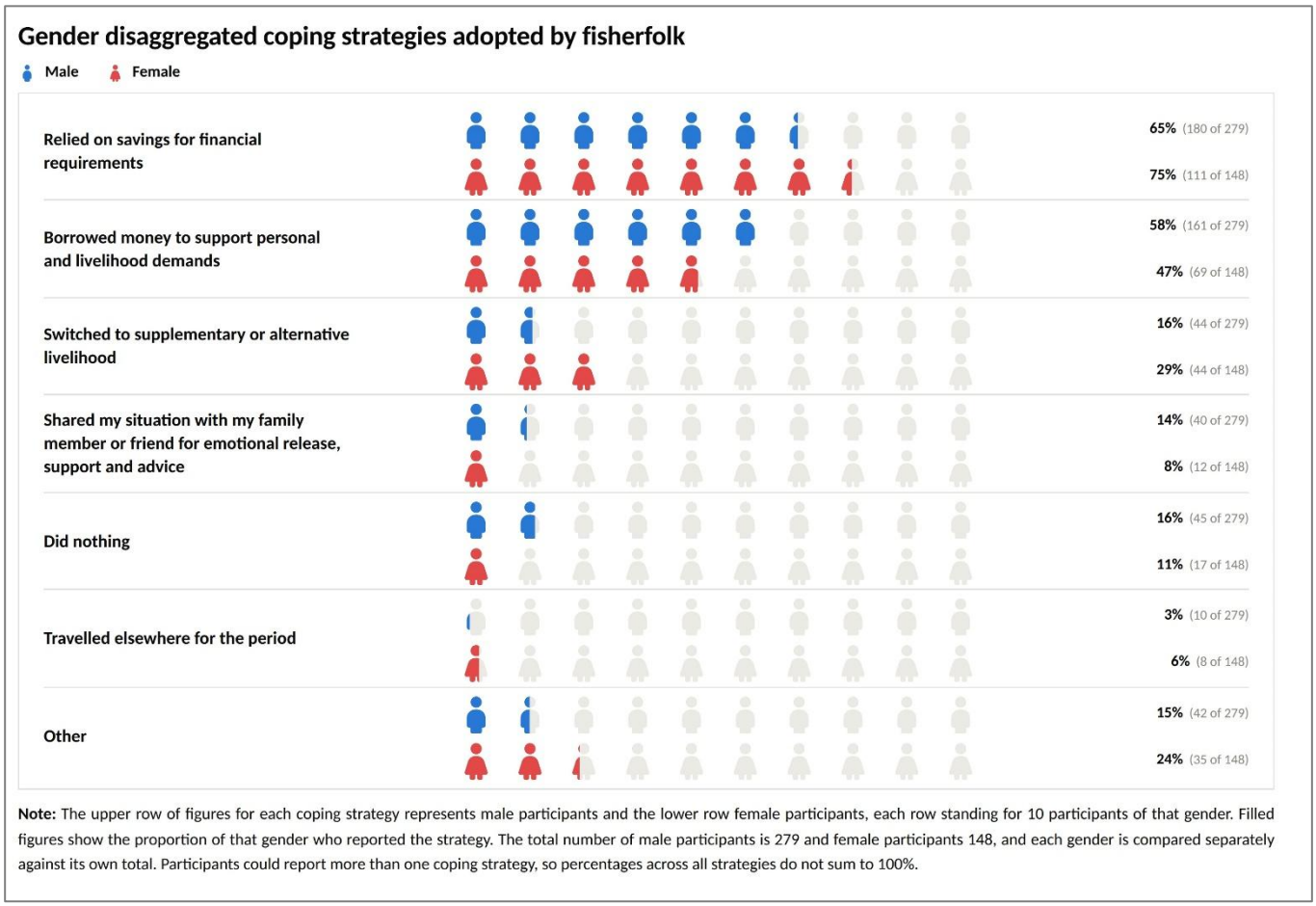


Fig. 5. *Coping strategies adopted by fisherfolk in response to proximate impacts of the fishing closed season.*

Social adaptations employed by fisherfolk included sharing their situation with family members or friends for emotional support, travelling to live with relatives elsewhere, or doing nothing. The fish processor and trader in Apam, who shared that: "*My son is abroad and he occasionally sends me some money to take care of the family*", a male canoe owner in Cape Coast: "*My wife (who is a fish processor and trader) supports me and our household with income from her business*", and the male crew member in Tema: "*I depend solely on the food and money given to me by my canoe owner's wife while we mend the fishing net to take care of myself during the closed season*", like many others, rely heavily on family and social networks to cope with the economic vulnerabilities they faced. Despite the social support available to the 58% of males and 47% of females who borrowed money and the 14% of males and 8% of females who shared their situation with family and friends for psychosocial support, the majority of fisherfolk (more than 90%) across the FGDs reported that they did not have any relatives or dependents they could rely on for such support. Rather, they themselves are relied on by their dependents.

Fishers who had certification or skills in trades such as tailoring, carpentry, catering and hospitality, and marketing, among others, used them to earn supplementary income, while those who did not felt limited by the temporary job options they could consider. A migrant male fisher engaged in Tema shared, "*I have received training in technical skills and that enabled me to get a job at the Volta Aluminium Company (VALCO) during the closed season*" and drew a contrast to the words of a resident male fisher in Tema who explained why he did not engage in a supplementary livelihood as, "*I do not have the skill or qualification to seek employment in any other job*". For fisherfolk who "did nothing", the data-related inference for this coping strategy was mixed: only a small proportion also reported having an alternative livelihood, thus suggesting their circumstances were unaffected because they had a steady income. However, based on reports from the FGD, KII, and ethnographic observations, fisherfolk "did nothing" because they either received support within their households, had to absorb and bear the situation, or chose not to disclose their coping strategy for discretionary reasons, possibly related to illegal activities.

In a spontaneous conversation with a crew fisher that aligns with social adaptations, he shared that in the olden days, an aspiring fisher became a crew member only after a reputable relative served as their referee and an apprenticeship fee was paid (in cash or goods). Following this, the canoe owner received the young fisher into what they called the canoe's 'fishing company'. He explained that this fishing company operated like an informal co-operative, where crew members were treated like extended family: it bore the social and welfare responsibilities for all its members, including elderly fishermen who had previously worked for the company and were no longer active. The fishing company routinely shared fish among its members and, at the end of a set period, distributed the profits, including to the aged who could no longer work. The elderly fishermen, in turn, contributed to the fishing company by sharing their traditional knowledge and technical skills in net mending and fishing with younger generations of crew fishers. This social structure among fisherfolk is no longer practised because fishing has become

highly competitive, and as crew members have become more transient, their loyalty is no longer tied to one canoe owner or their fishing company.

Physical adaptations employed by fisherfolk included investing in assets such as freezers or fish storage units, which enabled them to store and resell fish for sustained income. It also involved purchasing equipment that enabled the deployment of skills to earn income through supplementary livelihoods, e.g., cars for transport businesses, sewing machines for tailoring businesses, ovens and kitchen appliances for catering businesses, among other assets. During the closed season, fishers also repaired their fishing gear and vessels to improve efficiency for when the fishing season resumes. Other fishers adopted fishing with lights, chemicals, and/or fine-mesh nets to make up for lost income. A fresh fish trader in Tema shared that, "*During the closed season, we bring out and resell the same fresh fish that was landed, which we have stored in our freezers*". This investment in freezers, particularly among the fish traders in Tema, ensured they kept their businesses active throughout the month-long fishing closed season, during which they reported they were least affected by economic shocks. In some instances, fisherfolk sold their valuables, including wax-print cloths and television sets, to raise money. Fisherfolk's physical adaptations were often observed to be linked with their economic and human capital.

Fisherfolk reported natural adaptations such as travelling within the country and to other West African nations to access other natural resources like lagoons or rivers, enabling them to sustain their subsistence fishing for food and income. In the Volta Region, fisherfolk particularly switched to fishing in inland water bodies (i.e. the Volta Lake and the Keta lagoon), livestock rearing, and crop farming (onions, peppers), while 'galamsey' i.e. illegal small-scale gold mining, was widely reported among fisherfolk in the Central and Western regions. Both male and female fisherfolk similarly recommended the following institutional measures to help bolster their resilience to future regulatory policies: access to alternative livelihoods, technical and vocational training, the establishment of Village Savings and Loans Associations (VSLAs), low-interest bank loans, and cash transfers or economic relief schemes tailored to their needs.

Discussion

In examining our findings, we draw on the five capitals of the SLA framework as assessed by Allison and Ellis (2001) to develop an analytical framework (see the review of the five SLA capitals under the literature review section). In our analytical framework (see Fig. 6.), four categories of coping strategies are featured instead of the five originally presented based on the observation the social coping strategies leveraged both human and social capitals and included some examples from our findings. Fisherfolk employed mostly adaptive and some passive strategies (Korda et al., 2021) to impacts that were both widespread i.e. experienced by all fisherfolk given their shared dependence on the fisheries, and specific to households whose circumstances shaped their responses. Although alternative livelihoods are widely promoted to support subsistence, only 16% of male and 29% of female participants moved into supplementary work. This corroborates Roscher et al. (2022) finding that diversification improved livelihoods in fewer than half of the studies they reviewed and points to structural barriers that warrant closer

attention to facilitating uptake of supplementary livelihoods than is currently available. Roscher et al. (2022) also argued that the ecological justification of livelihood diversification remains largely untested; however, their call for clarity about what diversification is expected to achieve, and for whom, was addressed in our findings. A gendered pathway was clear among fisherfolk we engaged, as both male and female fisherfolk reported respective livelihood preferences and their recourse to any temporary work available. Such gendered intersectionality was emphasised as a key step by Okeke-Ogbuafor et al. (2024) for considering resilience frameworks in Africa.

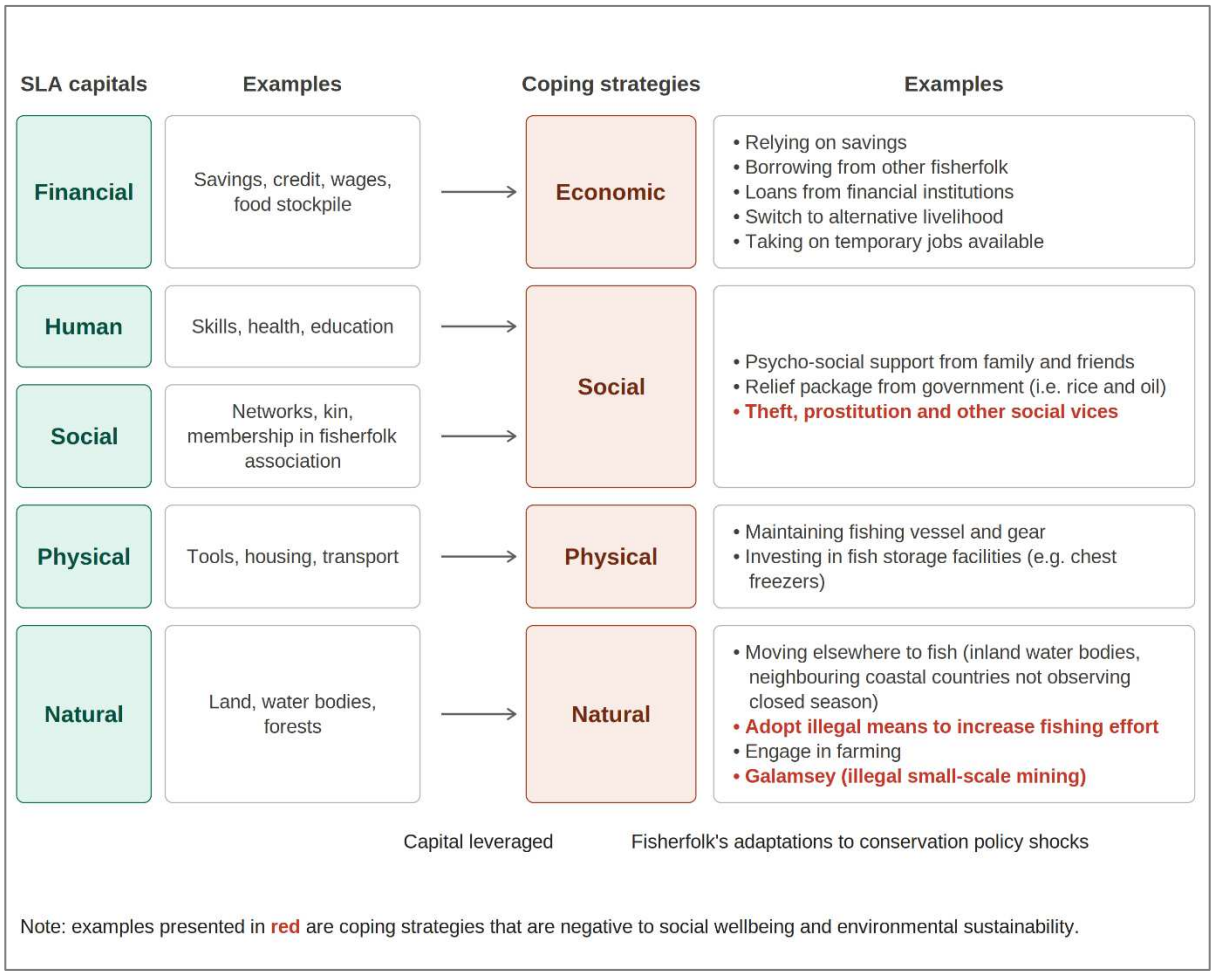


Fig.6. *Analytical framework summarising fisherfolk's leveraging of SLA capitals (Allison and Ellis, 2001) in the various strategies deployed to cope with proximate impacts of the fishing closed season. (Note: Examples of coping strategies presented are drawn by authors from findings in this study and are not exhaustive)*

The findings also point to something the SLA and wider resilience literature do not clearly address. They treat resilience as a function of the capitals or assets a household can mobilise in responding to vulnerability; thus, the more capitals a household can draw on, the more resilient it is judged to be. While our findings also show that capitals determine whether a household can respond to a shock, they take it further by capturing positive as well as negative responses, with the negative adaptations discussed by other scholars as maladaptation (Barnett and O'Neill, 2010; Schipper, 2020). This way, a fisherfolk who engaged in 'galamsey' or prostitution may be

counted as resilient to the vulnerabilities exacerbated during the closed season if they are able to provide for their and their household's needs, however they accomplished this through means that yield harmful long-term effects to their well-being and environment. In this light, this study extends the conversation about resilience in African small-scale fisheries beyond whether fisherfolk have the capital(s) to cope, to encompass the 'cost' of their coping strategies, echoing the question Dudouet et al. (2026) pose for equity in fisheries management.

Another gendered pattern is evident in fisherfolk responses. Among the 279 males and the 148 female fisherfolk surveyed, women were more likely than men to draw on savings (75% against 65%), and to move into supplementary or alternative livelihoods (29% against 16%). Men were more likely to borrow (58% males vs 47% females), share their situation with family or friends (14% males vs 8% females), and take no action at all (16% males vs 11% females), as shown in Fig. 5. The qualitative data from FGDs and KII help explain that male fishers and canoe owners borrowed from the women who patronised their catch, with an informal agreement to repay with fish once fishing resumed, whereas women borrowed from financial institutions and credit schemes. While the figure for the males who borrowed was higher, it understates at face value the financial role women play by extending credit to males in the value chain. Considering this alongside women's reliance on their savings, it underscores the disproportionate burden women bear during the closed season: they finance their own businesses, support their households, and lend money to the men they trade with, thereby compounding their economic strain. This pattern is consistent with wider literature that, women are largely responsible for maintaining fisherfolk households and influencing the fishing business, however remain less visible in governance (Ameyaw et al., 2020; Harper et al., 2020; Kleiber et al., 2015; Okafor-Yarwood et al., 2022).

The dominance of economic strategies such as drawing on savings, borrowing, buying items on credit, and stockpiling food outlined in the results showed that fisherfolk largely addressed the vulnerabilities they experienced through their own financial structures. Households with greater access to economic resources were better positioned to convert it into physical capital, better able to replace lost assets, relocate temporarily, or diversify their livelihoods during periods of socio-economic pressures (Amadu et al., 2021; Khanh Ngoc et al., 2026). These findings support Allison and Ellis' (2001) arguments that social and economic capitals are foundations on which other adaptations are built. This also shows that, even in the absence of economic capital, prior endowments of social and physical capital can facilitate better coping outcomes and resilience than circumstances without such capitals; borrowing money and relying on familial support may temporarily ease socio-economic pressures, however may not be an available option for everyone, since 42% of males and 53% of females did not report borrowing.

The decline of 'fishing companies' suggest the loss of an important system of collective resilience and warrants exploration. Although no longer prominent among small-scale fisherfolk, the arrangement served as a form of social welfare and pension scheme, in which older fisherfolk received support from younger fisherfolk, while the older fisherfolk retained their importance by sharing fishing traditions and local ecological knowledge with younger generations. Its re-adoption could not only serve the psychosocial well-being of ageing fisherfolk and reduce

isolation in later life (Matsuzaki, 2023; Saini et al., 2025) but also ensure inter-generational transmission of fishing traditions and knowledge. Throughout the field engagement from July 2024 to February 2026, no participant reported benefiting from any Government or institutional scheme supporting their welfare in old age. Ghana's National Pensions Act, 2008 (Act 766), sets the mandatory retirement age at 60 years, yet, 13% of surveyed fisherfolk were aged 65 or above, and the oldest fisherfolk actively fishing was 75 years (see Fig 4). The FAO Voluntary Guidelines identify social protection as integral to securing small-scale fisheries livelihoods, however, conversations for fisherfolk's pension scheme in Ghana have only recently commenced[2].

A key contribution of our findings to the literature on fisherfolk coping strategies is the adoption of illegal and socially damaging strategies. Where households could not sufficiently address their vulnerabilities with their existing capitals, they were driven towards 'galamsey' i.e. illegal small-scale gold mining, social vices including theft, prostitution, gambling, fraud and illegal and unsustainable fishing practices. This echoes regional evidence that the socio-ecological trap is not limited to fisheries alone and regulatory interventions could risk pushing some fisherfolk onto other natural resources and into criminal activities if socio-economic wellbeing were poorly considered (Merem et al., 2019; Okafor-Yarwood, 2020b; Phayal et al., 2024). Fisherfolk migration operates in a similar way as rural-to-urban and cross-border migration, as far as Mauritania, Sierra Leone, Cameroon, and Ivory Coast in search of more viable catches signals both diminished natural resources and limited economic resilience (Bocoum et al., 2023). For younger fisherfolk, migration could mean abandoning fishing altogether, but because small pelagic stocks in the Gulf of Guinea are shared, movement in search of viable catches shifts effort to stocks elsewhere in the region, with associated costs. From our findings and in the literature, diversification of income sources and improved access to credit remain among the few empirically supported ways to interrupt this cycle, since they reduce household dependence on extractive pressures for their socio-economic welfare (Khanh Ngoc et al., 2026).

Reviewing our findings of fisherfolk's coping strategies, almost all of them were initiated by fisherfolk themselves, as similarly recorded by Ayisi et al. (2024), Gough et al. (2026) and Shah et al. (2025). They accessed credit through traders, their relatives, and credit schemes, since there was no formal welfare scheme available to them. Although some had built capacity to cope with the impacts of the closed season, owing to its annual recurrence, the buffers used to absorb them required rebuilding before the subsequent cycle. In the common scenario where fisherfolk relied on their savings, the debt is carried forward and since they start the fishing cycle from a compromised position, thus chances of them resorting to unsustainable fishing practices become greater. The Government's distribution of rice and oil, which fisherfolk reported as insufficient and inequitably distributed, also revealed that relief items reached politically connected fisherfolk more than others within the same community. As similarly argued by Nyavor et al. (2023) and seen in a global parallel in Bangladesh closed season (Sarker et al., 2026), this intervention reinforces intra-community inequality rather than addressing it (Nyavor

[2] See: https://maritimafrica.com/en/ghana-ministry-of-fisheries-and-aquaculture-advances-pension-and-insurance-initiative-for-fisherfolk/

et al., 2023; Sarker et al., 2026). The disproportionate burden fisherfolk carry versus the role of the state in a policy necessitates interrogation of the justice dimensions of the conservation policy and speaks to ongoing debates over who bears responsibility for building resilience (Coulthard, 2012; Okafor-Yarwood et al., 2022).

The Government of Ghana has constitutional and statutory authority to enact and enforce fisheries legislation, together with its sovereign rights over the management of living resources within its Exclusive Economic Zone (UNCLOS Articles 56 and 61 – 62; Article 257(6) of Ghana's 1992 Constitution). As such, it bears a corresponding duty to protect and preserve the marine environment across the maritime zones under its jurisdiction (UNCLOS Article 192 – 193). Despite this, its responsibility for the social consequences of conservation measures it enacts is not commensurate with the legal foundations. The FAO Voluntary Guidelines for Securing Sustainable Small-scale Fisheries adopt a human rights-based approach that situates social protection alongside resource management, but they carry no binding force. The Kunming-Montreal Global Biodiversity Framework requires that conservation be delivered through equitably governed systems that respect the rights of local communities, but it does not provide the legal infrastructure to enforce compliance. The very limited policy and legal provisions in this area underscore the need for governments to treat social participation and resilience as priorities alongside environmental conservation (López-Bao et al., 2017).

Related research on closed seasons in Ghana indicates that the closed season has not significantly increased fish production since its introduction (Owusu, 2024) and has instead impoverished fisherfolk by reducing their income without clear ecological benefits. If so, the conservation instrument may not be serving the ecological objective for which it was designed, while imposing socio-economic shocks and costs documented in our findings. This strengthens our argument for evaluating conservation measures beyond ecological grounds. Nonetheless, Senegal's octopus closed season demonstrates that closed seasons can yield economic gains and improve livelihoods where institutions facilitate these conditions (Diedhiou et al., 2019). This also suggests a different design and governance approach is required beyond the instrument itself as Mensah et al. (2025), among others, have relatedly argued that integrating indigenous knowledge into scientific policy design produces more effective and equitable closed seasons.

In essence, for fisherfolk's coping strategies to inform fisheries policy, the social impacts of conservation must be assessed alongside its ecological gains, and we suggest three composite socio-economic indicators to do so. First, measuring household financial stability could establish whether households can meet their needs if fishing income stops. This could be done to complement the catch-per-unit-effort through income surveys conducted before, during, and after the closure, and by assessing how many months of essential spending a household's savings would cover, as demonstrated for reef closures in Kenya (McClanahan, 2010). Second, measuring fisherfolk's livelihood capital base could establish whether households accumulate or deplete their resources between successive closure cycles. This indicator will combine income from fishing and supplementary livelihood (if any) with an asset score covering physical assets and household goods, following the material style-of-life approach applied in East African

fisheries by Cinner et al. (2009). This fisherfolk's livelihood capital base will also distinguish households that rely on supplementary livelihoods from those that sell their personal property and assets to cope with the closure. Third, an impact-of-compensation indicator would simply assess if fisherfolk received the relief packages (or not) and how the packages contributed to their well-being during the period of vulnerability, exemplified in Kenya by Harker et al. (2022). Measurement of these three indicators could be incorporated into existing socio-economic surveys (questionnaires), national population censuses, or similar periodic surveys, such as the Canoe Frame Survey conducted by Ghana's Fisheries Commission to assess fishing effort and the economic contributions of its small-scale sector.

Recommendation and Conclusion

This research investigated how small-scale fisherfolk adapt to livelihood changes during the closed season and showed that individual households within the broader fisherfolk community were affected differently, depending on their specific circumstances and vulnerability. Fisherfolk employed economic, social, physical, and natural adaptations, often combining multiple strategies to build resilience through both positive and negative means. Fisherfolk's recommendations (male and female) for institutional support directly align with their economic and social adaptations and indicate that the areas they identified as critical for improving their livelihoods were those that increase their socio-economic resilience to proximate impacts of this conservation policy. Existing fishing closed seasons, such as those in Senegal's case, demonstrate that prioritising socio-economic resilience alongside ecological conservation can successfully meet ecological goals without risking the vulnerability of the communities they aim to support.

Fisherfolk's responses were based on their lived experiences during a major period of livelihood disruption. While this study provides expansive insights into fisherfolk experiences from 48 communities across four coastal regions of Ghana, they may not be representative of all fisherfolk and their circumstances outside of the closed season. To advance knowledge of fisherfolk's resilience, further studies could comparatively investigate adaptations (if any) between the years they observed the closed season and the years when the closed season was not implemented (2025 & 2026) to assess the extent to which these capitals and related adaptations were used. Furthermore, for aged fisherfolk who are being compelled to continue working for subsistence, governments could introduce a bespoke pension scheme or strengthen existing structures (where available) to specifically target those above the statutory retirement age.

It recommends incorporating three composite socio-economic indicators into existing periodic surveys to complement ecological indicators, to understand how conservation interventions interact with existing livelihood vulnerabilities and how these vulnerabilities shape fisherfolk's capacity to adapt. As conservation measures expand across the West African region, ensuring that such measures are appropriately designed, implemented and supported at national and regional levels will be critical to advancing conservation without reproducing or deepening

existing socioeconomic inequalities, which is essential to achieving equitable conservation and operationalising the blue economy objectives under Africa's Agenda 2063.

Acknowledgements

This article is based on the PhD thesis of the first author, conducted at the School of Geography and Sustainable Development, University of St Andrews - UK. The authors wish to express profound thanks to the fisherfolk and local leadership of the following study sites whose experiences provided the empirical data for the research project and this paper: Abeliakope (including Denu and Davidkope) and Abutiakope in the Volta Region; Akplabanya and Tema in the Greater Accra Region; Apam (including Mumford) and Cape Coast (comprising Ekon, Abrofo Mpoano, Duakor, Ola) in the Central Region; Sekondi and Abuesi (including Kesewokan) in the Western Region.

We also thank the local collaborators of the Creating Synergies Between Indigenous Practices and Scientific Knowledge (ISIPSK) research project in Ghana for their commitment and support with facilitating engagements with fisherfolk for data collection: the Fisheries Commission, the Fisheries Committee of the West Central Gulf of Guinea (FCWC) and the Canoe and Fishing Gear Owners Association of Ghana (CaFGOAG). Appreciation to the local agencies and other fisheries stakeholders who participated in the project launch, regional data validation events with fisherfolk and other research related activities of the ISIPSK project.

Funding declaration

This research was funded through the ISIPSK project by Ifesinachi Okafor-Yarwood's 2023 fellowship under the Pew Fellows Program in Marine Conservation at the Pew Charitable Trusts [grant code 10004370]. Funding for fieldwork lodging was supported by the University of St Andrews' Postgraduate Research Fieldwork Bursary.

Authors contribution

JLA, IOY and TAS wrote the main manuscript text and were responsible for methodology.
JLA and IOY were responsible for conceptualisation
JLA was responsible for formal analysis
JLA, KA, RKBJ, INK, GM, ET and IOY were responsible for investigation, data curation, and validation
IOY and TAS were responsible for supervision
IOY was responsible for funding acquisition, project administration and resources
All authors reviewed and edited the manuscript

Ethics

Ethical approval for the research was obtained from the University of St Andrews and complies with UK General Data Protection Regulation (GDPR); approval code GG17417.

Data availability

The raw data underpinning this study cannot be made publicly available due to data access conditions. However, relevant excerpts from the data transcripts drawn for this study have been included in the Supplementary data file with permissions obtained, see S1. Supplementary text (raw data).

References

Adger, W.N., 2006. Vulnerability. Glob. Environ. Change, Resilience, Vulnerability, and Adaptation: A Cross-Cutting Theme of the International Human Dimensions Programme on Global Environmental Change 16, 268–281. https://doi.org/10.1016/j.gloenvcha.2006.02.006

Alexander, D.E., 2013. Resilience and disaster risk reduction: an etymological journey. Nat. Hazards Earth Syst. Sci. 13, 2707–2716. https://doi.org/10.5194/nhess-13-2707-2013

Allison, E.H., Ellis, F., 2001. The livelihoods approach and management of small-scale fisheries. Mar. Policy 25, 377–388. https://doi.org/10.1016/S0308-597X(01)00023-9

Allison, E.H., Perry, A.L., Badjeck, M.-C., Neil Adger, W., Brown, K., Conway, D., Halls, A.S., Pilling, G.M., Reynolds, J.D., Andrew, N.L., Dulvy, N.K., 2009. Vulnerability of national economies to the impacts of climate change on fisheries. Fish Fish. 10, 173–196. https://doi.org/10.1111/j.1467-2979.2008.00310.x

Amadu, I., Armah, F.A., Aheto, D.W., Adongo, C.A., 2021. A study on livelihood resilience in the small-scale fisheries of Ghana using a structural equation modelling approach. Ocean Coast. Manag. 215, 105952. https://doi.org/10.1016/j.ocecoaman.2021.105952

Ameyaw, Breckwoldt, A., Reuter, H., Aheto, D.W., 2020. From fish to cash: Analyzing the role of women in fisheries in the western region of Ghana. Mar. Policy 113, 103790. https://doi.org/10.1016/j.marpol.2019.103790

Armitage, D., Charles, A., Berkes, F. (Eds.), 2017. Governing the Coastal Commons: Communities, Resilience and Transformation. Routledge, London. https://doi.org/10.4324/9781315688480

Asiedu, B., Iddrisu, S., Failler, P., 2023. Yesterday, today, and tomorrow's fish consumption: analysis of present and prospective fish consumption in Ghana by 2030. Cogent Food Agric. 9. https://doi.org/10.1080/23311932.2023.2224603

Ayisi, C.L., Sienso, G., Mensah, G.D., Baidoo, K., Alhassan, E.H., Duker, R.Q., Boamah, G.A., Amenyogbe, E., Droepenu, E.K., 2024. Impacts of Closed Season on Operations, Livelihood and Coping Strategies of Fishers. Hum. Ecol. 52, 923–933. https://doi.org/10.1007/s10745-024-00546-w

Barnett, J., O'Neill, S., 2010. Maladaptation. Glob. Environ. Change 20, 211–213. https://doi.org/10.1016/j.gloenvcha.2009.11.004

Belhabib, D., Sumaila, U.R., Pauly, D., 2015. Feeding the poor: Contribution of West African fisheries to employment and food security. Ocean Coast. Manag. 111, 72–81. https://doi.org/10.1016/j.ocecoaman.2015.04.010

Béné, C., 2009. Are Fishers Poor or Vulnerable? Assessing Economic Vulnerability in Small-Scale Fishing Communities. J. Dev. Stud. 45, 911–933. https://doi.org/10.1080/00220380902807395

Bennett, N.J., Blythe, J., White, C.S., Campero, C., 2021. Blue growth and blue justice: Ten risks and solutions for the ocean economy. Mar. Policy 125, 104387. https://doi.org/10.1016/j.marpol.2020.104387

Blanchard, J.L., Novaglio, C. (Eds.), 2024. Climate change risks to marine ecosystems and fisheries. Projections to 2100 from the Fisheries and Marine Ecosystem Model Intercomparison Project, FAO Fisheries and Aquaculture Technical Papers. FAO, Rome, Italy. https://doi.org/10.4060/cd1379en

Bocoum, W., Failler, P., Deme, M., Deme, E. hadj B., 2023. Migration of artisanal fishers in West Africa: 50 years of observation. J. Fish. Res. 7, 1–6. https://doi.org/10.35841/aajfr.7.3.141

Braun, V., Clarke, V. (Eds.), 2022. Thematic Analysis: a Practical Guide. SAGE Publications, London (United Kingdom).

Chambon, M., Miñarro, S., Alvarez Fernandez, S., Porcher, V., Reyes-Garcia, V., Tonalli Drouet, H., Ziveri, P., 2024. A synthesis of women's participation in small-scale fisheries management: why women's voices matter. Rev. Fish Biol. Fish. 34, 43–63. https://doi.org/10.1007/s11160-023-09806-2

678 Charles, A. (Ed.), 2021. Communities, conservation and livelihoods. IUCN, International Union
679 for Conservation of Nature. https://doi.org/10.2305/IUCN.CH.2021.01.en
680 Chen, G., Liu, W.D. and J., 2021. How Overfishing Aggravates Marginal Fishers Poverty:
681 Southeast Asia. Presented at the 2021 International Conference on Economic Management
682 and Corporate Governance, Clausius Scientific Press.
683 https://doi.org/10.23977/emcg2021.036
684 Cinner, J.E., Adger, W.N., Allison, E.H., Barnes, M.L., Brown, K., Cohen, P.J., Gelcich, S., Hicks,
685 C.C., Hughes, T.P., Lau, J., Marshall, N.A., Morrison, T.H., 2018. Building adaptive capacity to
686 climate change in tropical coastal communities. Nat. Clim. Change 8, 117–123.
687 https://doi.org/10.1038/s41558-017-0065-x
688 Cinner, J.E., Daw, T., McClanahan, T.R., 2009. Socioeconomic factors that affect artisanal
689 fishers' readiness to exit a declining fishery. Conserv. Biol. J. Soc. Conserv. Biol. 23, 124–130.
690 https://doi.org/10.1111/j.1523-1739.2008.01041.x
691 Cooke, S.J., Nguyen, V.M., Chapman, J.M., Reid, A.J., Landsman, S.J., Young, N., Hinch, S.G.,
692 Schott, S., Mandrak, N.E., Semeniuk, C.A.D., 2021. Knowledge co-production: A pathway to
693 effective fisheries management, conservation, and governance. Fisheries 46, 89–97.
694 https://doi.org/10.1002/fsh.10512
695 Coulthard, S., 2012. Can We Be Both Resilient and Well, and What Choices Do People Have?
696 Incorporating Agency into the Resilience Debate from a Fisheries Perspective. Ecol. Soc. 17.
697 https://doi.org/10.5751/ES-04483-170104
698 Das, J., 2023. Blue Economy, Blue Growth, Social Equity and Small-scale Fisheries: A Global
699 and National Level Review. Stud. Soc. Sci. Res. 4, 38. https://doi.org/10.22158/sssr.v4n1p38
700 Dercon, S., 2002. Income Risk, Coping Strategies, and Safety Nets 17, 141 to 166.
701 https://doi.org/https://doi.org/10.1093/wbro/17.2.141
702 Diedhiou, I., Yang, Z., Ndour, M., Dème, M., Fall, M., Thiaw, M., Thiam, N., Li, S., 2019.
703 Socioeconomic dimension of the octopus "Octopus vulgaris" in the context of fisheries
704 management of both small-scale and industrial fisheries in Senegal. Mar. Policy 106,
705 103517. https://doi.org/10.1016/j.marpol.2019.103517
706 DIIS, 2023. Counter-piracy in the Gulf of Guinea must not overlook local struggle and suffering
707 [WWW Document]. URL https://www.diis.dk/en/research/counter-piracy-in-the-gulf-of-
708 guinea-must-not-overlook-local-struggle-and-suffering (accessed 7.19.26).
709 Dovlo, E., Amador, K., Nkrumah, B., 2016. 2016 Canoe Frame Survey Report Ghana (No. 36).
710 Dudouet, B., Thébaud, O., Kinds, A., Villasante, S., 2026. A practical approach to assess equity
711 in fisheries management. Npj Ocean Sustain. https://doi.org/10.1038/s44183-026-00210-4
712 FAO, 2024. The State of World Fisheries and Aquaculture 2024 - Blue Transformation in action |
713 Knowledge for policy [WWW Document]. URL
714 https://knowledge4policy.ec.europa.eu/publication/state-world-fisheries-aquaculture-2024-
715 blue-transformation-action_en (accessed 6.24.25).
716 FAO, 2015. Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context
717 of Food Security and Poverty Eradication. FAO, Rome, Italy.
718 Farwig, N., Ammer, C., Annighöfer, P., Baur, B., Behringer, D., Diekötter, T., Hotes, S., Leyer, I.,
719 Müller, J., Peter, F., Riecken, U., Bessel, A., Thorn, S., Werk, K., Ziegenhagen, B., 2017.
720 Bridging science and practice in conservation: Deficits and challenges from a research
721 perspective. Basic Appl. Ecol. 24, 1–8. https://doi.org/10.1016/j.baae.2017.08.007
722 Ghomsi, F.E.K., Raj, R.P., Bonaduce, A., Halo, I., Nyberg, B., Cazenave, A., Rouault, M.,
723 Johannessen, O.M., 2024. Sea level variability in Gulf of Guinea from satellite altimetry. Sci.
724 Rep. 14, 4759. https://doi.org/10.1038/s41598-024-55170-x
725 Gough, K.V., Langevang, T., Agblorti, S.K.M., 2026. 'The sea is the only means of feeding': Coping
726 strategies in Ghanaian fishing communities during the closed season. J. Rural Stud. 122,
727 103954. https://doi.org/10.1016/j.jrurstud.2025.103954

Haraway, D., 1988. Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective. Fem. Stud. 14, 575–599. https://doi.org/10.2307/3178066
Harker, A.L., Stojanovic, T.A., Majalia, A.M., Jackson, C., Baya, S., Tsiganyiu, K.D., 2022. Relationships between Livelihoods, Well-Being, and Marine Protected Areas: Evidence from a Community Survey, Watamu Marine National Park and Reserve, Kenya. Coast. Manag. 50, 490–513. https://doi.org/10.1080/08920753.2022.2126266
Harper, S., Adshade, M., Lam, V.W.Y., Pauly, D., Sumaila, U.R., 2020. Valuing invisible catches: Estimating the global contribution by women to small-scale marine capture fisheries production. PLOS ONE 15, e0228912. https://doi.org/10.1371/journal.pone.0228912
Holling, C.S., 1996. Engineering resilience versus ecological resilience, in: Engineering Within Ecological Constraints. National Academies Press.
Holling, C.S., 1973. Resilience and Stability of Ecological Systems. Annu. Rev. Ecol. Syst. 4, 1–23.
Khanh Ngoc, Q.T., Xuan, B.B., Nam, P.K., 2026. The dual role of small-scale fisheries on food security and poverty eradication in Vietnam: A latent profile analysis. World Dev. 200, 107300. https://doi.org/10.1016/j.worlddev.2025.107300
Kleiber, D., Harris, L.M., Vincent, A.C.J., 2015. Gender and small-scale fisheries: a case for counting women and beyond. Fish Fish. 16, 547–562. https://doi.org/10.1111/faf.12075
Knudsen, M., 2016. Poverty and Beyond: Small-Scale Fishing in Overexploited Marine Environments. Hum. Ecol. 44, 341–352. https://doi.org/10.1007/s10745-016-9824-y
Korda, R., Gray, T., Stead, S.M., 2021. Resilience in the English Small-Scale Fishery: Small Fry but Big Issue. Springer International Publishing, Cham. https://doi.org/10.1007/978-3-030-54245-0
Lazar, N., Yankson, K., Blay, J., Ofori-Danson, P., Markwei, P., Agbogah, K., Bannerman, P., Sotor, M., Yamoah, K., Bilisini, W., 2020. Status of the small pelagic stocks in Ghana in 2019 (Scientific and Technical Working Group No. GH2014_SC1083_CRC.), USAID/Ghana Sustainable Fisheries Management Project (SFMP). Narragansett, RI: Coastal Resources Centet, Graduate School of Oceanography, University of Rhode Island.
López-Bao, J.V., Chapron, G., Treves, A., 2017. The Achilles heel of participatory conservation. Biol. Conserv. 212, 139–143. https://doi.org/10.1016/j.biocon.2017.06.007
Luintel, Y.R., 2020. Epistemological Values and Limitations of Ethnography as an Interpretive Research Approach. Sch. J. Arts Humanit. 2, 83–90. https://doi.org/10.3126/sjah.v2i0.35016
Marschke, M., Berkes, F., 2006. Exploring Strategies that Build Livelihood Resilience: a Case from Cambodia. Ecol. Soc. 11. https://doi.org/10.5751/ES-01730-110142
McClanahan, T.R., 2010. Effects of Fisheries Closures and Gear Restrictions on Fishing Income in a Kenyan Coral Reef. Conserv. Biol. 24, 1519–1528. https://doi.org/10.1111/j.1523-1739.2010.01530.x
Mensah, J., Amoah, J.O., Amenumey, E.B., Mattah, P.A.D., Mattah, M.M., 2025. The closed fishing season policy in Ghana: Lessons from the coastal fisherfolk. Mar. Policy 171, 106472. https://doi.org/10.1016/j.marpol.2024.106472
Merem, E.C., Twumasi, Y., Wesley, J., Alsarari, M., Fageir, S., Crisler, M., Romorno, C., Olagbegi, D., Hines, A., Ochai, G.S., Nwagboso, E., Leggett, S., Foster, D., Purry, V., Washington, J., 2019. Analyzing the Tragedy of Illegal Fishing on the West African Coastal Region. Food Public Health 9, 1–15. https://doi.org/10.5923/j.food.20190901.01
MoFAD, 2022. Fisheries Management Plan of Ghana: A National Policy for the Management of the Marine Fisheries Sector 2022-2026.
Naeem, M., Ozuem, W., Howell, K., Ranfagni, S., 2023. A Step-by-Step Process of Thematic Analysis to Develop a Conceptual Model in Qualitative Research. Int. J. Qual. Methods 22, 16094069231205789. https://doi.org/10.1177/16094069231205789
Ndlovu-Gatsheni, S.J., 2021. Epistemic injustice, in: Knowledge For The Anthropocene. Edward Elgar Publishing, pp. 167–177.

Nyavor, S., Amposah, S., Owusu, V., Boateng, K.J., 2023. Compensation payment for fisherfolk during closed-season fishing: Lessons from small-scale fisherfolk in Ghana. Cogent Soc. Sci. 9, 2282502. https://doi.org/10.1080/23311886.2023.2282502

Ofori-Danson, P., Asiedu, B., Amponsah, S.K.K., Crawford, B., 2019. Assessment of the Socio-Economic, Food Security and Nutrition Impacts of the 2019 Canoe Fishery Closed Fishing Season in Ghana.

Okafor-Yarwood, I., 2020a. The Cyclical Nature of Maritime Security Threats: Illegal, Unreported, and Unregulated Fishing as a Threat to Human and National Security in the Gulf of Guinea. Afr. Secur. 13, 116–146. https://doi.org/10.1080/19392206.2020.1724432

Okafor-Yarwood, I., 2020b. The Cyclical Nature of Maritime Security Threats: Illegal, Unreported, and Unregulated Fishing as a Threat to Human and National Security in the Gulf of Guinea. Afr. Secur. 13, 116–146. https://doi.org/10.1080/19392206.2020.1724432

Okafor-Yarwood, I., Eastwood, O., 2025. From deprivation to criminality: Reversing the trend by harnessing the Blue Economy to address criminality at sea (CAS). Criminol. Crim. Justice 17488958251385477. https://doi.org/10.1177/17488958251385477

Okafor-Yarwood, I.M., van den Berg, S., Collins, Y.A., Sefa-Nyarko, C., 2022. "Ocean Optimism" and Resilience: Learning From Women's Responses to Disruptions Caused by COVID-19 to Small-Scale Fisheries in the Gulf of Guinea. Front. Mar. Sci. 9.

Okeke-Ogbuafor, N., Atela, J., Nantongo, M.G., Aoko, L., Tonui, C., Rajah, E., Osamba, J., Odongo, J.O., Atchade, A.J., Gray, T., 2024. Locally led adaptation metrics for Africa: a framework for building resilience in smallholder farming sectors. Front. Clim. 6. https://doi.org/10.3389/fclim.2024.1429462

Owusu, V., 2024. Effects of the closed fishing season on small-scale fisheries and coastal livelihoods in Ghana. Fish. Aquat. Sci. 27, 753–768. https://doi.org/10.47853/FAS.2024.e70

Oxford English Dictionary, 2025. resilience, n. meanings, etymology and more | Oxford English Dictionary [WWW Document]. https://doi.org/https://doi.org/10.1093/OED/3371756822

Phayal, A., Gold, A., Maharani, C., Palomares, M.L.D., Pauly, D., Prins, B., Riyadi, S., 2024. All maritime crimes are local: Understanding the causal link between illegal fishing and maritime piracy. Polit. Geogr. 109, 103069. https://doi.org/10.1016/j.polgeo.2024.103069

Porcuna-Ferrer, A., Calvet-Mir, L., Guillerminet, T., Alvarez-Fernandez, S., Labeyrie, V., Porcuna-Ferrer, E., Reyes-García, V., 2023. "So many things have changed": Situated understandings of climate change impacts among the Bassari, south-eastern Senegal. Environ. Sci. Policy 148, 103552. https://doi.org/10.1016/j.envsci.2023.103552

Roscher, M.B., Allison, E.H., Mills, D.J., Eriksson, H., Hellebrandt, D., Andrew, N.L., 2022. Sustainable development outcomes of livelihood diversification in small-scale fisheries. Fish Fish. 23, 910–925. https://doi.org/10.1111/faf.12662

Runde, D.F., Savoy, C.M., 2014. Resilience: A Critical Framework for Development.

Sarker, M., Shamsuzzaman, M.M., Akter, K., Talukdar, A., Asadujjaman, M., Mozumder, M.M.H., 2026. Unexplored Social–Ecological Trap Lens of Hilsa Fishery in Bangladesh. Sustainability 18, 295. https://doi.org/10.3390/su18010295

Schipper, E.L.F., 2020. Maladaptation: When Adaptation to Climate Change Goes Very Wrong. One Earth 3, 409–414. https://doi.org/10.1016/j.oneear.2020.09.014

Scoones, I., 1998. Sustainable Rural Livelihoods: A Framework for Analysis (IDS Working Papers No. 72).

Setianti, Y., Muh, A., Hatmar, M., Monica, W., Aiman, U., Asri, H., 2024. Overfishing and Marine Ecosystem Collapse: A Global Perspective. https://doi.org/10.59613/fswc2m24

Shah, B.V., O'Leary, B.C., Rejula, K., Kemp, P., Sandhya, K.M., Madhu, V.R., Gopal, N., 2025. Adaptation Strategies of Small-Scale Marine Fisheries in Response to Climate Change, Resource Changes, and Sudden Systemic Shocks. WIREs Clim. Change 16, e70019. https://doi.org/10.1002/wcc.70019

Simard, N.S.M., Militz, T.A., Kinch, J., Southgate, P.C., 2022. Shocks within a Pacific island fishery: A historic study of events impacting the mother-of-pearl fishery in Papua New Guinea. Mar. Policy 143, 105173. https://doi.org/10.1016/j.marpol.2022.105173

Sturgess, P., Sparrey, R., 2015. What is Resilience? Evidence on Demand. DFID. https://doi.org/10.12774/eod_tg.may2016.sturgessandsparrey

Teh, L.S.L., Teh, L.C.L., Giron-Nava, A., Sumaila, U.R., 2024. Poverty line income and fisheries subsidies in developing country fishing communities. Npj Ocean Sustain. 3, 14. https://doi.org/10.1038/s44183-024-00049-7

Turner, B.L., Kasperson, R.E., Matson, P.A., McCarthy, J.J., Corell, R.W., Christensen, L., Eckley, N., Kasperson, J.X., Luers, A., Martello, M.L., Polsky, C., Pulsipher, A., Schiller, A., 2003. A framework for vulnerability analysis in sustainability science. Proc. Natl. Acad. Sci. 100, 8074–8079. https://doi.org/10.1073/pnas.1231335100

United Nations, 2026. The Third World Ocean Assessment [WWW Document]. URL https://woa.un.org/ (accessed 8.4.26).

845 **Appendix A**

846 **Table A1:** Breakdown of fisherfolk engaged from the eight major study sites and adjoining
847 communities during fieldwork

Fishing Village (Coastal Region)	Type of Engagement[3]	Males	Females	Total count
		Participant count (percentages)		
Abeliakope[4] (Volta Region)	FGD with FPT	0 (0%)	12 (100%)	12
	FGD with CGO	5 (42%)	7 (58%)	12
	FGD with CRF	12 (100%)	0 (0%)	12
	FGD with OTH	3 (27%)	8 (73%)	11
	KII	4 (80%)	1 (20%)	5
	Surveys	29 (58%)	21 (42%)	50
Total (Abeliakope)		**53**	**49**	**102**
Abutiakope (Volta Region)	FGD with FPT	1 (8%)	11 (92%)	12
	FGD with CGO	11 (92%)	1 (8%)	12
	FGD with CRF	12 (100%)	0 (0%)	12
	FGD with OTH	0 (0%)	12 (100%)	12
	KII	4 (80%)	1 (20%)	5
	Survey	31 (60%)	21 (40%)	52
Total (Abutiakope)		**59**	**46**	**105**
Akplabanya (Greater Accra Region)	FGD with FPT	0 (0%)	10 (100%)	10
	FGD with CGO	9 (75%)	3 (25%)	12
	FGD with CRF	10 (100%)	0 (0%)	10
	FGD with OTH	7 (58%)	5 (42%)	12
	KII	5 (71%)	2 (29%)	7
	Survey	38 (69%)	17 (31%)	55
Total (Akplabanya)		**69**	**37**	**106**
Tema (Greater Accra Region)	FGD with FPT	0 (0%)	12 (100%)	12
	FGD with CGO	10 (100%)	0 (0%)	10
	FGD with CRF	11 (100%)	0 (0%)	11
	FGD with OTH	5 (71%)	2 (29%)	7
	KII	3 (60%)	2 (40%)	5
	Survey	31 (60%)	21 (40%)	52
Total (Tema)		**60**	**37**	**97**
	FGD with FPT	0 (0%)	10 (100%)	10

[3] Codes used: FGD - Focus Group Discussion; FPT - Fish Processors and Traders; CGO – Canoe and Gear Owners; CRF – Crew Fishermen; OTH – Other fisheries livelihoods; KII – Key Informant Interviews

[4] engagements included some fisherfolk from adjoining communities of Denu and Davidkope

Fishing Village (Coastal Region)	Type of Engagement[3]	Males	Females	Total count
		Participant count (percentages)		
Apam[5] (Central Region)	FGD with CGO	11 (92%)	1 (8%)	12
	FGD with CRF	10 (100%)	0 (0%)	10
	FGD with OTH	1 (11%)	8 (89%)	9
	KII	4 (80%)	1 (20%)	5
	Survey	32 (62%)	20 (38%)	52
Total (Apam)		**58**	**40**	**98**
Cape Coast[6] (Central Region)	FGD with FPT	0 (0%)	12 (100%)	12
	FGD with CGO	9 (90%)	1 (10%)	10
	FGD with CRF	12 (100%)	0 (0%)	12
	FGD with OTH	7 (58%)	5 (42%)	12
	KII	4 (80%)	1 (20%)	5
	Survey	44 (79%)	12 (21%)	56
Total (Cape Coast)		**76**	**31**	**107**
Abuesi[7] (Western Region)	FGD with FPT	0 (0%)	12 (100%)	12
	FGD with CGO	12 (100%)	0 (0%)	12
	FGD with CRF	12 (100%)	0 (0%)	12
	FGD with OTH	8 (67%)	4 (33%)	12
	KII	4 (80%)	1 (20%)	5
	Survey	39 (67%)	19 (33%)	58
Total (Abuesi)		**75**	**36**	**111**
Sekondi (Western Region)	FGD with FPT	0 (0%)	12 (100%)	12
	FGD with CGO	12 (100%)	0 (0%)	12
	FGD with CRF	12 (100%)	0 (0%)	12
	FGD with OTH	7 (58%)	5 (42%)	12
	KII	6 (86%)	1 (14%)	7
	Survey	35 (67%)	17 (33%)	52
Total (Sekondi)		**72**	**35**	**107**
OVERALL TOTAL		**522 (63%)**	**311 (37%)**	**833**

[5] Few fisherfolk from adjoining community Mumford joined engagements

[6] Engagements were spread across the constituent landing beaches of the Cape Coast fishing village – Ekon, Abrofo Mpoano, Duakor and Ola

[7] Some fisherfolk in adjoining landing beach, Kesewokan, which is a constituent of the Abuesi fishing village were engaged

850 **Table A2**: Summary of factors that informed the selection of the eight research sites.

Coastal Region	Fishing Community	Impressions about closed fishing season	Traditional fishing holiday	Number of canoes[8]	Estimated number of fishers	
					Men	Women
Volta	Abutiakope	Largely adherent	Wednesdays	110	610	
	Abeliakope	Low adherence; migrate to Togo and fish in Ghana	Sundays	57	248	
Greater Accra	Akplabanya	Adherent, but have expressed objection to the period	Tuesdays, Sundays	146	2,548	
	Tema	Largely adherent	Tuesday	643	7,047	
Central	Ekon	Largely adherent, but have opposing views	Tuesday	48	267	
	Apam	Largely adherent	Tuesday	216	2,694	
Western	Sekondi	Largely adherent but have expressed opposition to the policy	N/A	372	2,934	
	Abuesi	Largely adherent but have expressed opposition to the policy	Tuesdays	196	2,500	

851

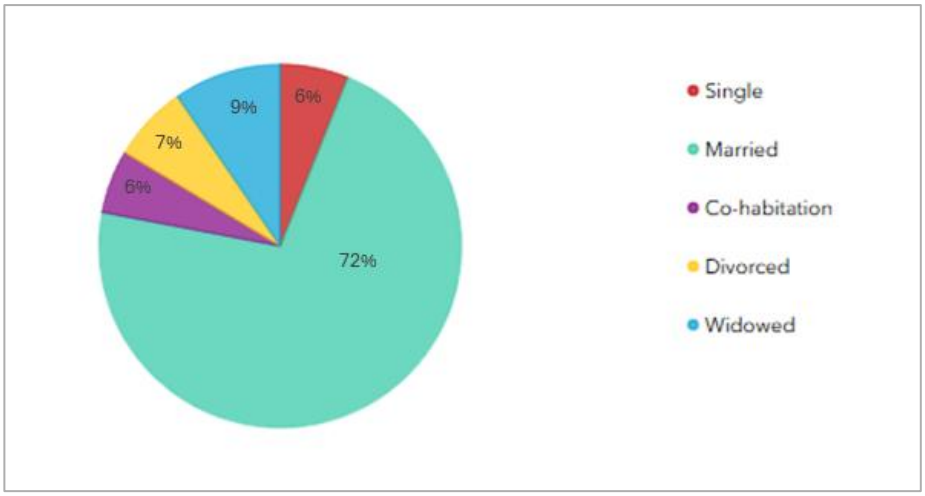
852 **Note:** Figures for women were not available in the 2022 Canoe and inshore frame survey from which
853 the data for male fisherfolk and number of canoes were obtained**.**

[8] Figures from 2022 Canoe and inshore frame survey (Fisheries Scientific Survey Division, Fisheries Commission)

[9] *ibid*

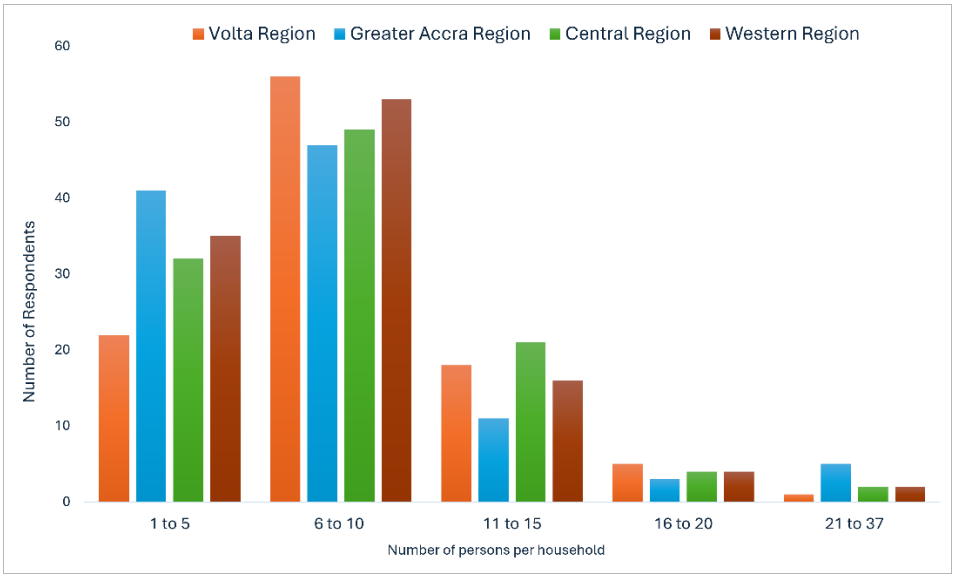
Table A3: Summary of Participants Engaged by the Sankofa Research Team for the validation of the research findings

Region	Date & Venue	Participating research communities	Other participating communities	Total number of communities	Attendance		
					M	F	Total
Western Region	1 September 2025 Albert Bosomtwi Sam Fishing harbour, Sekondi	Sekondi Abuesi Kesewokan	Nyanekrom Ngyiresia Axim Aboadze Takoradi Shama	9	48	22	70
Central Region	27 January 2026 Cape Coast Metropolitan Assembly Hall, Cape Coast	Apam Mumford Cape Coast Ekon Abrofo Mpoano Ola Duakor	Egyaa Anomabo Senya-Bereku Nyanyano Moree Biriwa Abandze Winneba	15	13	53	164
Volta Region	28 January 2026 Ketu South Municipal Assembly Hall, Denu	Abeliakope Davidkope Denu Abutiakope	Viepe Keta Vodza Kedzikope Tegbi Abledomi Adina Atorko Dzelukope Whuti Dzita Ho	16	13	38	151
Greater Accra Region	3 February 2026 CLOGSAG Hall, Accra	Akplabanya Tema	Jamestown Chokor Kokrobite Prampram Ada Foah Nungua	8	94	41	135
	SUMMARY			**48**	68	154	**520**



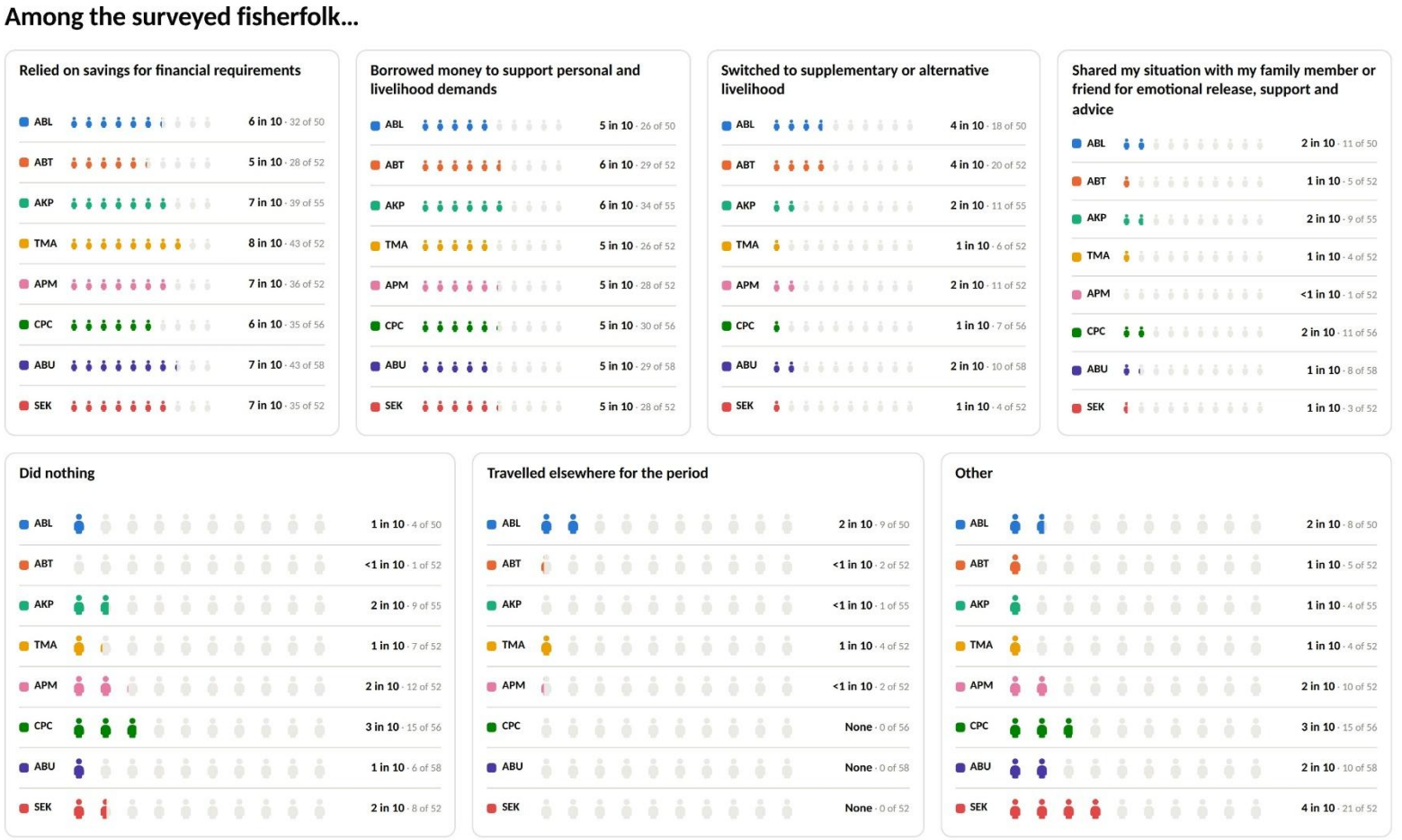
857

858 ***Fig. A1.*** *Marital status of surveyed fisherfolk (combined for all four coastal regions)*



859

860 ***Fig. A2.*** *Household size of surveyed respondents across the four coastal regions of Ghana*



Note: One figure = one-tenth of a community's surveyed fisherfolk, and filled figures show the share who reported each coping strategy. "X in 10" is that share rounded to the nearest tenth of the community's participants; the icons themselves are filled to the exact share, and the exact count out of each community's participants is shown beside each row. Participants could report more than one coping strategy, so shares within a community can sum to more than 10 in 10. For example, in TMA, about 8 in 10 participants (43 of 52) relied on savings for financial requirements, while in ABL about 2 in 10 (9 of 50) travelled elsewhere for the period. Community codes: ABL = Abeliakope, ABT = Abutiakope, AKP = Akplabanya, TMA = Tema, APM = Apam, CPC = Cape Coast, ABU = Abuesi, SEK = Sekondi.

Fig. A3. *Breakdown of coping strategies adopted by surveyed respondents for the eight major research communities*

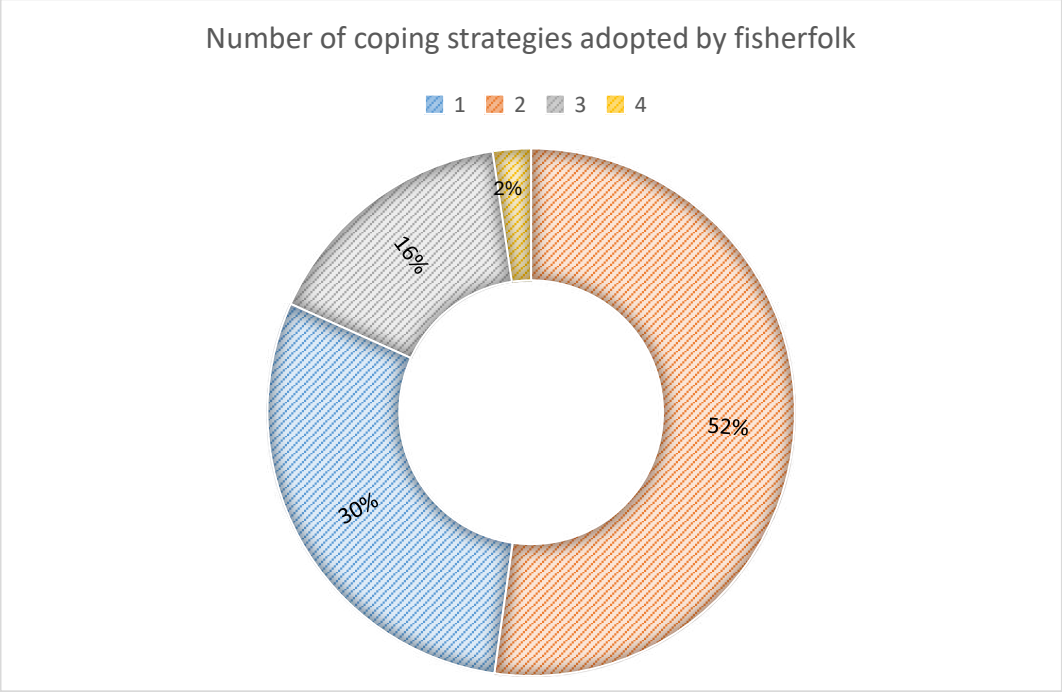


Fig. A4. *Number of coping strategies surveyed fisherfolk across the four coastal regions of Ghana reported to have adopted during the fishing closed season*

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- SupplementarydatanpjOceansustainability.docx