Title: Knowledge, Attitudes, and Practices of Fisherfolk in Ghana Toward Climate Change: A Cross-Sectional Study

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Lay Summary

Climate change threatens the livelihoods of millions of fisherfolk globally, yet limited information exists on how Ghanaian coastal communities understand and respond to these changes. This study surveyed 800 fisherfolk across three coastal regions to assess their knowledge, attitudes, and adaptation practices related to climate change. While 62% demonstrated adequate knowledge, fewer than half exhibited positive attitudes toward adaptation. Education and years of experience were significant predictors of knowledge and attitudes. Although many respondents reported observing environmental changes, their adaptation practices remained limited. These findings highlight the need for tailored climate education and community-based adaptation interventions.

Abstract

Background: Climate change poses serious risks to coastal livelihoods and marine ecosystems. Ghana's artisanal fisheries sector is vital for food security and employment, yet fisherfolk's climate adaptation awareness remains understudied.

Methods: A descriptive cross-sectional survey was conducted among 800 fisherfolk across three coastal regions. Structured questionnaires assessed knowledge, attitudes, and adaptation practices. Descriptive statistics, chi-square tests, and multivariate logistic regression were used to identify predictors of knowledge and attitudes.

Results: Among respondents, 82.7% had heard of climate change, and 62.7% demonstrated adequate knowledge. Only 42.7% exhibited positive attitudes toward climate mitigation and adaptation. Education level and years of experience were significant predictors in both models. Adaptation practices included mangrove conservation (56%), reforestation (48%), and proper waste disposal (46%). Media sources and community leaders were the primary channels of climate information.

Conclusion: Although climate awareness is relatively high, limited adaptive attitudes and practices persist. Strengthened education, local engagement, and community-based interventions are essential to enhance resilience within fisheries-dependent communities.

Keywords: Climate change, Ghana, fisherfolk, knowledge, attitudes, adaptation practices.

Introduction

Climate change is a key environmental, economic, and social concern facing mankind in the twenty-first century. The Intergovernmental Panel on Climate Change (IPCC) asserts that there is irrefutable evidence of global warming in the Earth's climate system, with extensive effects noted on both natural and human systems worldwide. Global surface temperatures have risen by around 1.1°C since pre-industrial times, and if present trends continue, warming is anticipated to surpass 1.5°C over the next twenty years [1]. The ramifications for poor nations are especially grave, since populations with restricted adaptive ability face disproportionate threats to food security, livelihoods, and health.

Coastal areas are particularly susceptible to climate change, facing threats from rising sea levels, elevated sea surface temperatures, coastal erosion, and the escalation of severe weather phenomena, including storms and floods. Small-scale fisheries, supporting approximately 40 million people globally with sustenance and revenue, are significantly impacted by these alterations [1]. Fisheries in Sub-Saharan Africa play a crucial role in employment, commerce, and nutrition. Ghana, with a coastline of around 550 kilometers, has a robust artisanal fishing industry that contributes approximately 70% of the nation's fish output and directly employs over 200,000 people. The industry further facilitates several auxiliary businesses, such as fish processing, marketing, and transportation, mostly conducted by women [2].

Although fisheries are important to Ghana's economic and social structure, the industry has several issues exacerbated by climate change effects. These include overfishing, habitat deterioration, pollution, and inadequate governance. Notable environmental alterations in Ghana's coastal areas include coastline erosion, diminishing fish yields, heightened unpredictability in precipitation patterns, and an increase in flooding incidents that compromise fishing infrastructure and disrupt lives [1]. Climate change exacerbates these pre-existing stresses, creating an intricate network of susceptibility that hinders poverty alleviation and sustainable development objectives.

Successful adaptation in the fisheries sector requires both technical and infrastructurale advancements, as well as behavioral and social transformations influenced by the knowledge,

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attitudes, and practices (KAP) of local populations. The KAP framework offers a valuable perspective for evaluating people's perceptions of climate hazards, the significance they assign to adaptive behaviors, and the activities they are prepared or capable of executing. Prior research in Ghana has mostly focused on farmers' views of climate change and agricultural adaptation measures. Research in the Northern and Upper East areas indicates that smallholder farmers are becoming more cognizant of climatic unpredictability and have implemented strategies such as altering planting schedules, diversifying crops, and using enhanced seed types [4]. Nonetheless, very little is known about fisherfolk's comprehension of climate change and their preparedness to adapt.

International study has shown that the views and attitudes of fishing communities toward climate change are influenced by several variables, including socioeconomic position, cultural beliefs, access to knowledge, and institutional support [11]. In some circumstances, fisherfolk see climate change as an external occurrence beyond their influence, resulting in fatalistic attitudes and little proactive adaptation. In different contexts, robust community cohesiveness and the exchange of information have promoted resilience and creativity. Research in the Philippines and Indonesia indicates that the amalgamation of indigenous ecological knowledge with scientific data might improve adaptive capability and foster sustainable fisheries management [8].

Anecdotal data in Ghana indicates that fisherfolk have seen changes in fish quantity, marine conditions, and meteorological patterns in recent decades. The relationship between these observations and a knowledge of climate change, as well as their translation into favorable attitudes and adaptive actions, is inadequately documented. This information deficiency has considerable ramifications for policy and practice. In the absence of a comprehensive understanding of fisherfolk's beliefs and actions, the design and implementation of adaptation programs may not align with local objectives and may be ineffectively implemented.

The Government of Ghana has created many policies and frameworks to tackle climate change, including the National Climate Change Policy and the National Adaptation Strategy. These materials underscore the need of fostering awareness, augmenting capacity, and advocating for community-based adaptation in at-risk sectors such as fisheries. Development

partners and civil society groups have launched initiatives to assist coastal communities via education, livelihood diversification, and environmental restoration. Nonetheless, amplifying these initiatives needs an evidentiary foundation that delineates the distinct needs, difficulties, and capabilities of fisherfolk across various areas.

This research seeks to address this deficiency by methodically evaluating the knowledge, attitudes, and behaviors of fisherfolk in designated coastal villages in Ghana. The research aims to find leverage areas for targeted interventions by analyzing socio-demographic aspects related to knowledge and attitudes. The study examines the primary sources of climate change knowledge and the adaptation strategies being used by fisherfolk. These findings may guide the development of culturally relevant communication techniques, capacity-building initiatives, and policy measures to enhance adaptive capacity in the fisheries industry.

Specifically, the objectives of the study are:

1. To assess the level of knowledge of climate change among fisherfolk in the Volta, Western, and Central regions of Ghana.
2. To examine attitudes toward climate change mitigation and adaptation.
3. To identify adaptation practices currently adopted by fisherfolk.
4. To analyze socio-demographic factors associated with knowledge and attitudes.
5. To recommend strategies to enhance awareness, promote positive attitudes, and strengthen adaptive practices.

By addressing these objectives, the study contributes to the broader discourse on climate change adaptation in small-scale fisheries and highlights the importance of integrating local knowledge and perspectives into policy and program design. The findings are expected to be relevant not only for Ghana but also for other countries in West Africa facing similar challenges in their fisheries-dependent communities.

Methods

Study Design and Setting

This research used a descriptive cross-sectional survey approach to gather quantitative data on the knowledge, attitudes, and behaviors of fisherfolk about climate change. A cross-sectional technique was used since it facilitates the evaluation of perceptions and actions at a particular moment and permits the discovery of relationships between variables in a cost-efficient way.

The study was carried out in three coastal areas of Ghana: Volta, Western, and Central. These locations were intentionally chosen because of their significant reliance on artisanal fisheries, their recorded vulnerability to coastal disasters, and the varied socio-economic conditions among fishing communities. The Volta Region, located in eastern Ghana, is distinguished by large lagoon systems and sandy beaches that facilitate both marine and inland fishing endeavors. Keta Municipal, a prominent fishing center in the Volta Region, has had considerable coastline erosion and intermittent floods. The Western Region, situated in the southwestern sector of the nation, has an extensive coastline with several landing beaches and seafood processing facilities. Half Assini, a designated research site, is recognized for its robust fishing sector and susceptibility to coastal storms. The Central Region, located in the south-central region, is equally dependent on fisheries and has seen significant environmental alterations in recent decades. The Gomoa West District was chosen as the research site in this area because of its vibrant fishing community and the noticeable effects of climate change.

Study Population

The target demographic consisted of adult fisherfolk, including fishermen, fish processors, and merchants, who were actively involved in fisheries-related livelihoods within the designated localities. Participants must have been at least 18 years old, had a minimum of one year of experience in fishing activities, and offered informed permission to participate in the research. Both males and females were involved to get gendered viewpoints and experiences.

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Sample Size Determination

Using Cochran's formula, the minimum required sample size was calculated as 288. To enhance statistical power and regional representation, the final sample size increased to 800 respondents.

Sampling Procedure

A multistage sampling methodology was used. In each chosen region, one district or municipal area was deliberately designated as the major sample unit, determined by fishing activity and accessibility. In each district, certain settlements and landing beaches were chosen at random. The last phase included systematic sampling of qualified fisherfolk. Due to the absence of complete listings of fisherfolk, a modified random walk approach was used. Research assistants began at a central reference point (e.g., fish landing site) and contacted every third home or workstation engaged in fishing or fish processing. In households with numerous eligible respondents, one was chosen using simple random selection. One hundred respondents were selected in each location to guarantee proportionate representation and facilitate site comparisons.

Data Collection Instruments

Data were collected using a structured questionnaire developed by the research team based on a review of relevant literature and validated KAP instruments used in similar studies. The instrument was pre-tested with 100 fisherfolk in a non-study community (Ada East) to assess clarity, cultural relevance, and internal consistency. Minor revisions were made to improve comprehension and flow. Reliability analysis yielded a Cronbach's alpha of 0.80, indicating acceptable internal consistency.

The questionnaire was designed in English and translated into Ewe, Fante, and Nzema to accommodate local languages and translated back into English by different people to determine whether the translations were consistent and to ensure that the meaning of all survey items have been preserved. This approach was to remove bias or minimize it because it ensures that the research assistants did not give different interpretations of the questions

as well as the answers. The translated questionnaires were pilot tested on 15 individuals by four interviewers in areas where the survey instruments were not going to be administered. One month after the translation these individuals were contacted and had one-on-one interviews to determine whether significant differences would be found between the English version and the ones in local dialect. No major differences were observed between responses given by the fisherfolks on key variables such as knowledge, attitude and adaptation practices as they all yielded reliability coefficients of 0.85 or higher between the two versions. The survey consisted of five sections and organized to elicit information on the following issues:

1. **Socio-demographic characteristics:** age, sex, marital status, education level, years of experience, occupation.
2. **Knowledge of climate change:** fourteen items assessing awareness, understanding of causes and effects, and familiarity with adaptation concepts. Items were scored 1 (correct) or 0 (incorrect), with total scores categorized as adequate or inadequate knowledge.
3. **Attitudes toward climate change:** ten statements rated on a 5-point Likert scale (strongly agree to strongly disagree), exploring perceptions of severity, responsibility, and willingness to adapt.
4. **Adaptation practices:** questions on actions taken in response to climate impacts, including livelihood adjustments, environmental conservation, and participation in community initiatives.
5. **Sources of information:** multiple-choice items on where respondents obtained climate-related information.

Data Collection Procedure

Data collection occurred during a six-week period, spanning from March to April 2023. Four research assistants proficient in local languages received training in research ethics, interviewing procedures, and questionnaire administration. Prior to each interview, the study's goal was explained to participants, and signed informed permission was secured. The questionnaire was delivered orally to individuals with limited literacy, and the interviewer recorded their replies. Each interview lasted for around 30 to 45 minutes.

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To maintain quality control, supervisors performed spot checks, examined completed questionnaires regularly, and offered comments to interviewees. Submitted forms were verified for thoroughness and uniformity prior to data input.

Data Management and Analysis

The questionnaire answers were encoded and inputted into Microsoft Excel 2019. Data cleansing included the identification of duplicates, outliers, and missing values. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were computed to encapsulate the characteristics, knowledge, attitudes, and habits of the respondents.

Chi-square tests were used for inferential analysis to evaluate relationships between socio-demographic characteristics (e.g., education, years of experience) and levels of knowledge and attitudes. Variables with significant relationships ($p < 0.05$) were included into multivariate logistic regression models to calculate adjusted odds ratios (AOR) and 95% confidence intervals. All statistical analyses were conducted using Stata version 16.0.

Ethical Considerations

Human participants were prospectively recruited for this study between March and April 2023. Ethical approval was obtained from the Ethical Committee of the School of Public Service and Governance (SPSG), GIMPA (Approval Reference: GM/IRB/2024/65 with ID GM/IRB/125/23, dated 19 February 2023). All participants provided written informed consent prior to participation. There were no minors included in the study. The questionnaire was administered to ensure confidentiality, anonymity and privacy. Each participant was assured of confidentiality and anonymity. They were informed that participation was entirely voluntary, they were at liberty to out of the study at any time, they could refuse to answer some questions if they did not want to, and refusal to take part in the study or complete the questionnaire would not jeopardize the participants' stand in the neighbourhood, continued stay in the fisherfolks community or employment..

Results

A total of 800 fisherfolk participated in the survey, achieving a 100% response rate. Among the respondents, 342 (42.7%) were male and 458 (57.3%) were female, underscoring the significant contribution of women to fish processing and trade in Ghana's coastal communities. The average age of respondents was 45.3 years (SD = 12.4). The predominant age group was 41–54 years, comprising 333 (41.6%) participants. Fisherfolk aged 18–40 years accounted for 294 (36.7%), while those aged 55 years and above represented 173 (21.7%). Regarding educational attainment, 314 (39.3%) respondents had no formal education, 272 (34.0%) had completed primary education, and 214 (26.7%) had attained secondary education or higher. Most respondents were married (512; 64.0%), followed by those who were single (174; 21.7%), with the remainder widowed or divorced. In terms of occupation, 272 (34.0%) respondents were fishermen, 386 (48.3%) were fish processors, and 142 (17.7%) were engaged in ancillary activities such as canoe ownership, fish trading, or net repair. With respect to years of experience in fisheries, 290 (36.3%) had worked for more than 20 years, 238 (29.7%) for 11–20 years, and 272 (34.0%) for 1–10 years (Table 1).

Knowledge of Climate Change

A total of 662 respondents (82.7%) indicated familiarity with the phrase "climate change." Of the full sample, 502 respondents (62.7%) demonstrated adequate knowledge based on their scores on the 14 knowledge items (Table 2).

A significant majority correctly recognized deforestation as a contributor to climate change, reported by 624 respondents (78.0%). Similarly, 528 respondents (66.0%) identified the burning of fossil fuels as a major cause. Approximately 448 respondents (56.0%) acknowledged that climate change is partially driven by human activities, while 230 respondents (28.7%) attributed it primarily to natural cycles or divine intervention.

Regarding observable consequences of climate change, 568 respondents (70.3%) reported noticeable increases in temperature, 520 (65.0%) indicated declining fish catches, and 486 (60.7%) cited heightened coastal erosion within their communities (Table 3).

When knowledge levels were categorized as adequate or inadequate based on aggregate scores, significant disparities emerged across demographic groups. Respondents with primary education had a higher likelihood of demonstrating adequate knowledge (81.4%) compared to those without formal education (52.5%) ($p < 0.001$). In addition, those with more than 10 years of occupational experience showed greater knowledge (70.3%) than respondents with 1–10 years of experience (53.2%) ($p = 0.019$) (Table 4).

Attitudes Toward Climate Change

The analysis of respondents' attitudes toward climate change revealed varied perceptions regarding the severity of the issue, personal responsibility, and willingness to engage in adaptation actions. Overall, 342 respondents (42.7%) demonstrated positive attitudes toward climate change mitigation and adaptation efforts.

Most of respondents—464 (58.0%)—agreed that climate change is a serious problem requiring urgent action. However, fewer respondents (344; 43.0%) believed that individual actions can meaningfully contribute to addressing climate change. Governmental involvement was widely supported, with 520 respondents (65.0%) indicating that the government should enforce stronger environmental protection laws. Additionally, 392 respondents (49.0%) agreed that community meetings were important platforms for identifying local solutions.

Less encouraging findings included the perception that climate change is too costly to address, with 374 respondents (46.7%) expressing concern over adaptation expenses. Furthermore, 230 respondents (28.7%) believed that climate change is mainly driven by natural cycles, and 202 (25.3%) felt it was too late to take meaningful action.

Gender differences in attitudes were minimal: 160 males (46.9%) and 181 females (39.5%) exhibited positive attitudes, though this difference was not statistically significant ($p = 0.214$). Education level demonstrated a strong association with attitudes. Respondents with

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secondary education or higher were nearly twice as likely to demonstrate positive attitudes (68.4%) compared to those without formal education (34.7%) (p < 0.001). Years of occupational experience also influenced attitudes, with 410 respondents (51.2%) who had worked in fisheries for more than 10 years exhibiting positive attitudes, compared to 310 respondents (38.7%) among those with 1–10 years of experience (p = 0.030) (Table 6).

Adaptation Practices

The study further assessed the adaptation strategies employed by fisherfolk in response to perceived climate-related impacts. Overall, 448 respondents (56.0%) reported participating in mangrove conservation activities, while 384 respondents (48.0%) engaged in reforestation initiatives. Proper waste disposal practices aimed at reducing pollution and mitigating coastal degradation were reported by 368 respondents (46.0%) (Figure 2).

Regional variations were observed in the adoption of adaptation measures. In the Volta Region, 65.0% of respondents—equivalent to 173 participants—reported involvement in mangrove conservation. In comparison, the Western Region recorded 52.0% (138 participants), and the Central Region 51.0% (136 participants) for the same activity. Participation in formal training programs was highest in the Western Region, where 32.0% (85 participants) indicated having taken part, compared with lower proportions in both the Volta and Central Regions (Table 7). These findings highlight substantial engagement in environmental restoration across communities while also illustrating disparities in access to or uptake of formal climate training programs.

Association Between Socio-demographic Factors and Knowledge and Attitudes

Chi-square tests were performed to examine the relationships between key demographic characteristics and respondents' knowledge and attitudes toward climate change. Education level demonstrated a strong positive association with both outcomes. Among respondents with secondary education or higher, 81.5% (approximately 174 individuals) demonstrated adequate knowledge, compared to 52.5% (165 individuals) of those without formal education (p < 0.001). Similarly, 68.4% (146 individuals) of those with higher education exhibited

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positive attitudes, whereas only 34.7% (109 individuals) of respondents with no formal education reported positive attitudes (p < 0.001).

Years of experience in fisheries were also significantly associated with both knowledge and attitudes. Respondents with more than 10 years of experience demonstrated greater knowledge (70.3%) compared to those with 1–10 years of experience (53.2%) (p = 0.019). Similarly, positive attitudes were more common among respondents with over 10 years of experience (51.2%) than those with fewer years in the occupation (38.7%) (p = 0.030). Age was significantly associated with knowledge (p = 0.018) but not with attitudes (p = 0.072). While gender differences in knowledge levels were not statistically significant (p = 0.142), males reported slightly higher adequate knowledge (63.2%) compared to females (61.6%).

Multivariate logistic regression analyses were conducted to identify independent predictors of adequate climate change knowledge and positive attitudes toward climate adaptation among fisherfolk. After adjusting for age, gender, and region, both education level and years of occupational experience emerged as significant determinants of knowledge and attitudes.

Knowledge Model

Respondents with primary education were significantly more likely to demonstrate adequate knowledge of climate change compared to those without formal education:

- Primary education: AOR = 2.50 (95% CI: 1.74–5.78), p < 0.001.

Years of experience also independently predicted knowledge:

- More than 10 years of experience: AOR = 1.56 (95% CI: 1.01–2.78), p = 0.042.

These findings suggest that both formal schooling and prolonged exposure to fisheries-related environmental changes enhance understanding of climate-related issues.

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Attitude Model

Education remained a strong predictor of positive attitudes toward climate mitigation and adaptation:

- Secondary education or higher: AOR = 2.89 (95% CI: 1.65–4.92), p < 0.001.

Similarly, years of experience significantly influenced attitudes:

- More than 10 years of experience: AOR = 1.74 (95% CI: 1.12–3.12), p = 0.031.

These results reinforce the central role of educational attainment and occupational tenure in shaping fisherfolk's perceptions, sense of agency, and readiness to engage in adaptive behaviors

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Discussion

This study examined the knowledge, attitudes, and adaptation behaviors related to climate change among fisherfolk in three coastal districts of Ghana. The findings provide critical insights into awareness levels, behavioral responses, and the socio-demographic factors shaping climate-related perceptions in this economically significant population. Overall, the results highlight important strengths while also revealing notable gaps that must be addressed through targeted policy and programmatic interventions.

More than 80% of respondents reported being aware of climate change, and nearly two-thirds demonstrated adequate understanding of the concept when assessed using structured items. This level of awareness exceeds that reported in earlier Ghanaian and regional studies. For instance, Fosu-Mensah et al. (2012) found that only 59% of smallholder farmers in northern Ghana recognized the impacts of climate change, while Esan (2018) reported broad but shallow knowledge among fisherfolk in Nigeria. The relatively higher awareness identified in the current study may reflect increasing media exposure, more visible environmental changes, and expanded community engagement in recent years.

Despite this encouraging awareness, knowledge of the underlying scientific drivers remained uneven. While respondents frequently identified deforestation and pollution as contributing factors, fewer recognized the roles of greenhouse gas emissions or fossil fuel combustion. Similar gaps have been documented in other low- and middle-income countries, where scientific terminology is often less familiar to resource-dependent populations. Moreover, a subset of participants attributed climate change to divine causes—a perspective consistent with studies in West Africa that show coexistence of spiritual and scientific explanations. These mixed beliefs may influence perceptions of personal agency and the extent to which communities feel responsible for adopting mitigation behaviors.

Attitudes toward climate change and adaptation were more variable. Fewer than half of respondents expressed positive attitudes characterized by a sense of urgency, responsibility, or confidence in adaptation strategies. This is concerning, as positive attitudes are strongly linked to behavioral change. Comparable attitude–behavior gaps have been reported among

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farmers in Uganda and Nigeria, where awareness does not always translate into motivation to adopt adaptive practices.

Education level and years of fisheries experience emerged as the strongest predictors of both knowledge and attitudes. This aligns with existing literature suggesting that education enhances the ability to interpret environmental information, while occupational experience promotes direct exposure to climate impacts and adaptive strategies. These findings underscore the importance of incorporating education and training components into climate resilience initiatives. Interventions should be adapted to varying literacy levels and grounded in culturally relevant communication approaches.

The study also identified the adaptation strategies currently being implemented by fisherfolk. Mangrove conservation and reforestation were the most frequently reported actions, suggesting increasing community involvement in environmental restoration. These practices are particularly beneficial, as mangroves support coastal protection, biodiversity, and fisheries productivity. However, less than one-third of respondents reported participating in training programs or adjusting fishing practices, and engagement in livelihood diversification was limited. This is notable because diversification is widely recognized as a key strategy for reducing vulnerability to climate shocks.

Challenges to adaptation are likely multifaceted. Financial constraints, competing livelihood pressures, limited extension services, and uncertainty about the effectiveness of adaptation actions may all contribute to low adoption rates. The expressed desire for government and external support further suggests perceived limitations in local capacity and agency. These patterns have been observed in previous studies where top-down initiatives fail to align with local priorities or resource availability.

Information channels played a central role in shaping climate change perceptions. Respondents relied predominantly on television, radio, and community leaders, underscoring the importance of these conventional communication pathways. Limited access to internet-based communication highlights the digital divide facing many coastal communities. Thus, effective communication strategies must integrate both traditional and modern systems.

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Evidence from participatory approaches such as Action Media suggests that engagement-oriented communication can strengthen understanding and foster community ownership.

Gender also played an important role in shaping climate-related insights and actions. Although no significant gender differences in knowledge or attitudes were identified statistically, women constituted most respondents due to their major involvement in fish processing and marketing. Previous studies have shown that women often face greater adaptation barriers, including restricted access to financial resources, limited decision-making power, and fewer extension services. Future adaptation strategies must therefore be explicitly gender-responsive to ensure inclusivity and equity.

Regional differences in adaptation practices were also evident. Participation in mangrove restoration was highest in the Volta Region, likely reflecting active donor-supported restoration projects. In contrast, formal training participation was more common in the Western Region, where NGOs have played a major role in climate advocacy and education. These findings suggest that localized, context-specific approaches are necessary to strengthen adaptation outcomes.

The policy implications of this study are substantial. First, awareness campaigns must go beyond basic messaging to address gaps in understanding the scientific causes of climate change and the practical relevance of adaptation strategies. Approaches that incorporate storytelling, demonstrations, and peer learning may help bridge these gaps. Second, fostering positive attitudes requires interventions that build self-efficacy and highlight the benefits of adaptation. Community leadership, participatory planning, and visible success stories can play key roles in strengthening these attitudes. Third, structural barriers—including financial limitations, insufficient extension services, and limited access to training—must be addressed to enable sustained adaptive behaviors. Fourth, gender-sensitive and inclusive approaches must be central to program design to ensure that women's perspectives and needs are adequately reflected.

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Integrating local knowledge with scientific expertise is critical for designing relevant and sustainable adaptation solutions. Participatory risk assessments, community-driven adaptation planning, and multi-stakeholder engagement platforms can align interventions with local priorities and enhance ownership. Treating fisherfolk as partners rather than beneficiaries enhances both the legitimacy and long-term effectiveness of adaptation initiatives.

Overall, this study contributes to the body of literature on climate change adaptation in small-scale fisheries and affirms the utility of the Knowledge–Attitudes–Practices (KAP) framework for diagnostic assessment. Through a nuanced understanding of the drivers and barriers of climate-responsive behavior, policy actors can design interventions that are both evidence-based and contextually appropriate.

Strengths and Limitations

This study has several strengths, including a relatively large sample size, representation across three regions, and the use of a validated and pre-tested instrument and translation and back translation to reduce bias. The inclusion of both fishers and fish processors allowed for a more comprehensive understanding of perceptions and behaviors across the value chain.

However, some limitations must be acknowledged. The cross-sectional design precludes causal inferences about the relationships between knowledge, attitudes, and practices. Self-reported data may be subject to social desirability bias, particularly regarding adaptation practices and volunteer bias. While efforts were made to ensure random sampling, the use of a modified random walk approach may have introduced selection bias. Finally, the study focused primarily on quantitative measures; qualitative insights could have enriched understanding of motivations, barriers, and contextual factors shaping adaptation.

Future research should consider longitudinal designs to assess changes in KAP over time and mixed methods approaches to capture the depth and nuance of fisherfolk's experiences. In addition, impact evaluations of specific adaptation interventions can provide evidence on what works in promoting resilience in fisheries-dependent communities.

Conclusion

This study provides important insights into the knowledge, attitudes, and adaptive behaviors of fisherfolk in Ghana regarding climate change, revealing both notable strengths and areas requiring urgent attention. While awareness levels are relatively high, translating this awareness into positive attitudes and sustained adaptation behaviors remains a significant challenge.

Education and years of professional experience were the most important determinants of both knowledge and attitudes, highlighting the need to invest in accessible and culturally relevant learning opportunities. Although some adaptation measures—particularly mangrove conservation and reforestation—are being implemented, other crucial strategies such as livelihood diversification and modification of fishing practices remain underutilized due to structural and resource constraints.

The reliance on traditional information channels underscores the need for communication strategies that integrate trusted community platforms with modern participatory learning approaches. Gender-responsive and locally contextualized interventions are essential, given the central role of women in fisheries value chains and the region-specific differences in adaptation practices and support systems.

As Ghana continues to implement climate adaptation policies, it is crucial to incorporate fisherfolk's experiences, knowledge, and priorities. Participatory, inclusive, and empowerment-oriented approaches will be key to strengthening resilience and ensuring sustainable fisheries livelihoods. By addressing educational, social, and economic barriers, stakeholders can support fisherfolk in becoming active agents of climate resilience, contributing meaningfully to national and global sustainability goals.

Data Availability Statement

The data underlying this article are available at reasonable request to the corresponding author.

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Conflict of Interest

The author declares no conflicts of interest.

Acknowledgments

References

1. Intergovernmental Panel on Climate Change. Climate Change 2021: The Physical Science Basis. Cambridge: Cambridge University Press; 2021. doi:10.1017/9781009157896

2. Intergovernmental Panel on Climate Change. Climate Change 2013: The Physical Science Basis. Cambridge: Cambridge University Press; 2013. doi:10.1017/CBO9781107415324

3. Food and Agriculture Organization of the United Nations. The State of World Fisheries and Aquaculture 2014. Rome: FAO; 2014. Available from: https://www.fao.org/publications/sofia/2014

4. Fosu-Mensah BY, Vlek PLG, MacCarthy DS. Farmers' perception and adaptation to climate change: A case study of Sekyedumase district in Ghana. Environ Dev Sustain. 2012;14(4):495–505. doi:10.1007/s10668-012-9339-7

5. Esan O. Knowledge and perception of climate change among fishermen in Nigeria. J Climate Change Res. 2018;5(2):45–52. doi:10.18488/journal.107.2018.52.45.52

6. Savage M. Public perceptions of climate change in Sub-Saharan Africa: A systematic review. Environ Stud Q. 2019;12(1):15–28. Available from: https://www.jstor.org/stable/environmentalstudiesq2019

7. Nzeadibe TC, Egbule CL, Chukwuone NA, Agu VC. Climate change awareness and adaptation in the Niger Delta Region of Nigeria. Afr Technol Policy Stud Netw Working Paper Ser. 2011;57:1–33. Available from: https://www.atpsnet.org

8. Badjeck MC, Allison EH, Halls AS, Dulvy NK. Impacts of climate variability and change on fishery-based livelihoods. Mar Policy. 2010;34(3):375–83. doi:10.1016/j.marpol.2009.08.007

9. Alongi DM. Mangrove forests: Resilience, protection from tsunamis, and responses to global climate change. Estuar Coast Shelf Sci. 2008;76(1):1–13. doi:10.1016/j.ecss.2007.08.024

10. Allison EH, Ellis F. The livelihoods approach and management of small-scale fisheries. Mar Policy. 2001;25(5):377–88. doi:10.1016/S0308-597X(01)00023-9

11. Marshall NA, Marshall PA, Tamelander J, Obura D, Malleret-King D, Cinner JE. A framework for social adaptation to climate change: Sustaining tropical coastal

communities and industries. Gland: IUCN; 2010. Available from: https://portals.iucn.org/library/node/9393

12. Marshall NA, Smajgl A. Understanding variability in adaptive capacity on rangelands. Rangeland Ecol Manag. 2013;66(1):88–94. doi:10.2111/REM-D-11-00157.1

13. Petersen B, Sackey F, Agyeman Y. Participatory approaches to climate adaptation: Lessons from Ghana's coastal communities. Clim Dev. 2019;11(7):561–72. doi:10.1080/17565529.2018.1519708

14. Terry G. No climate justice without gender justice: An overview of the issues. Gend Dev. 2009;17(1):5–18. doi:10.1080/13552070802696839

15. Below T, Mutabazi KD, Kirschke D, Franke C, Sieber S, Siebert R, Tscherning K. Can farmers' adaptation to climate change be explained by socio-economic household-level variables? Glob Environ Change. 2012;22(1):223–35. doi:10.1016/j.gloenvcha.2011.11.012.

Tables

Table 1. Socio-demographic characteristics of respondents (N=300).

Variable	Frequency	%
Age (Yrs.)		
18-24	61	7.7
25-40	174	21.7
41-54	333	41.6
55-70	232	29.0
Gender		
Male	342	42.7
Female	458	57.3
Occupation		
Fisherman	314	39.3
Fish processor	386	48.3
Canoe Owner	100	12.4
Number of years in the occupation		
<1	29	3.7
1-5	75	9.3
6-10	179	22.3
11-20	238	29.7
>20	280	35.0
Number of years lived in community (Yrs)		
<1	27	3.3
1-5	66	8.3
6-10	200	25.0
11-20	208	26.0
>20	299	37.4
Educational level		
No formal education	314	39.3
Primary	226	28.3
Secondary	144	18.0
"O"/ A level	59	7.3
Technical or vocational	57	7.1
Household size		
1	15	5.7
1-4	195	24.3
5-10	360	45.0
>10	230	25.0

Table 2. Awareness and Knowledge of Climate Change among Respondents.

Indicator	Frequency (n)	Percentage (%)
Heard of climate change	662	82.7
Adequate knowledge (among total sample)	502	62.7
Familiar with adaptation measures	248	31.0

Table 3. Observed Effects of Climate Change Reported by Respondents Aware of Climate Change.

Observed Effect	Frequency (n)	Percentage (%)
Increased temperature	465	70.3
Declining fish catches	430	65.0
Increased coastal erosion	402	60.7

Table 4. Knowledge Level by Education and Years in Occupation.

Variable	Adequate Knowledge (%)	p-value
No formal education	52.5	<0.001*
Primary education	81.4	
Secondary and above	86.3	
1–10 years' experience	53.2	0.019*
>10 years' experience	70.3	

*Significant at p < 0.05

Table 5. Responses to Key Attitude Statements about Climate Change

Attitude Statement	Agree (%)
Climate change is a serious problem requiring urgent action	58.0
Individual actions can help mitigate climate change	43.0
Government should enforce environmental protection laws	65.0
Community meetings are important for finding solutions	49.0
Climate change mainly results from natural cycles	28.7
It is too late to do anything about climate change	25.3
Climate change will affect my livelihood	62.0
I feel prepared to respond to climate impacts	39.3
Adapting to climate change costs too much	46.7
Responsibility mainly lies with government and NGOs	27.3

Table 6. Positive Attitudes toward Climate Change by Demographic Characteristics

Variable	Positive Attitude (%)	p-value
Sex		
Male	46.9	0.214
Female	39.5	
Education Level		
No formal education	34.7	<0.001*
Secondary education+	68.4	
Years in Occupation		
1–10 years	38.7	0.030*
>10 years	51.2	

*Significant at $p < 0.05$

Table 7. Adaptation Practices Reported by Respondents

Adaptation Practice	Overall (%)	Volta (%)	Western (%)	Central (%)
Mangrove conservation	56.0	65.0	52.0	51.0
Reforestation	48.0	49.0	47.0	48.0
Proper waste disposal	46.0	48.0	44.0	46.0
Advocacy with local authorities	29.3	28.0	30.0	30.0
Participation in training workshops	24.7	20.0	32.0	22.0
Modified fishing schedules or gear	15.0	14.0	16.0	15.0

Table 8. Associations Between Socio-demographic Variables and Knowledge and Attitudes.

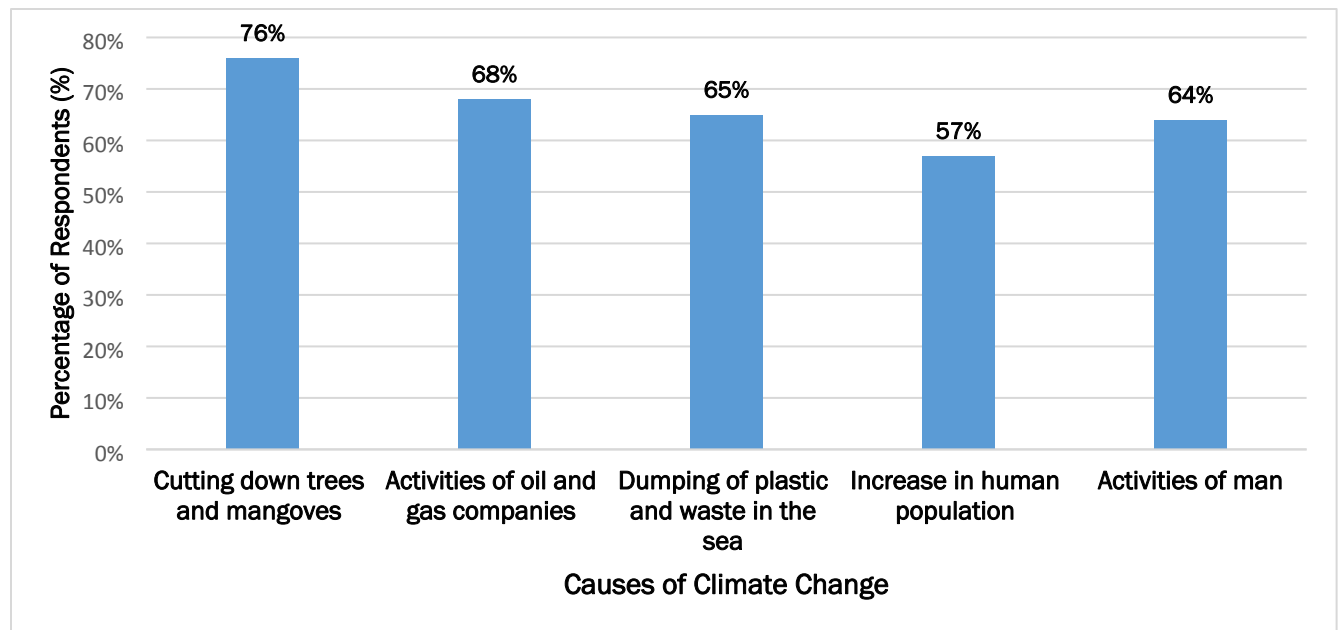| Variable	Adequate Knowledge (%)	p-value (Knowledge)	Positive Attitude (%)	p-value (Attitude)
Education Level				
No formal education	52.5	<0.001*	34.7	<0.001*
Secondary education+	81.5		68.4	
Years in Occupation				
1–10 years	53.2	0.019*	38.7	0.030*
>10 years	70.3		51.2	
Age Group				
<41 years	58.0	0.018*	40.3	0.072
≥41 years	67.8		45.1	
Gender				
Male	63.2	0.142	46.9	0.214
Female	61.6		39.5	

*Significant at $p < 0.05$

Figure 1. Fisherfolks responses on the causes of climate change.
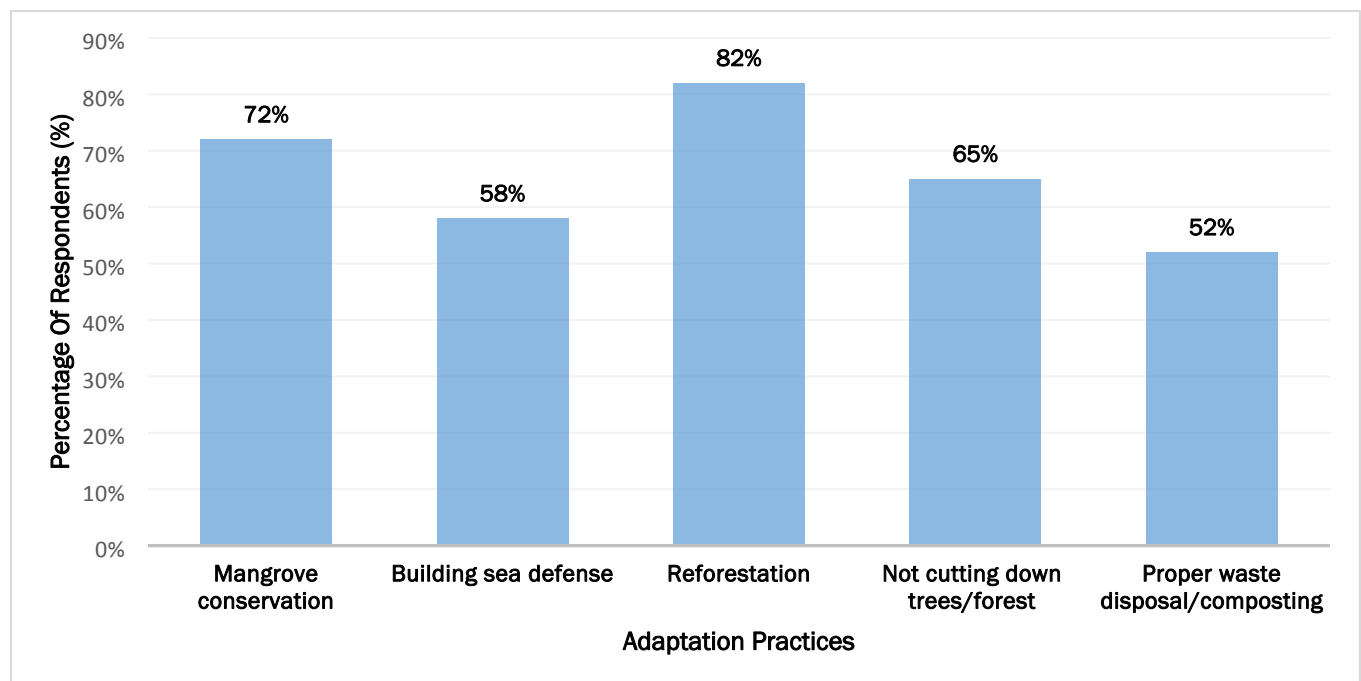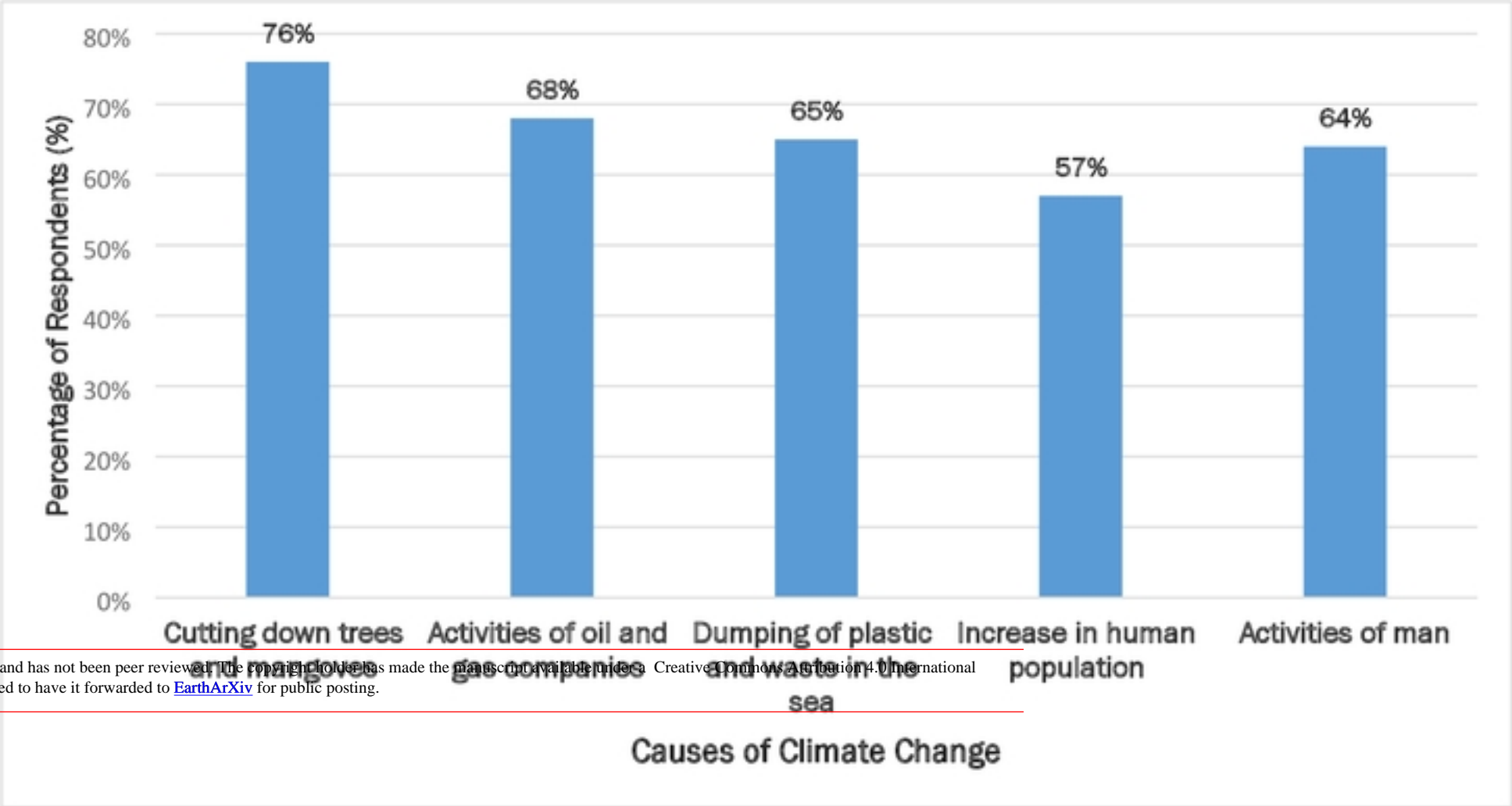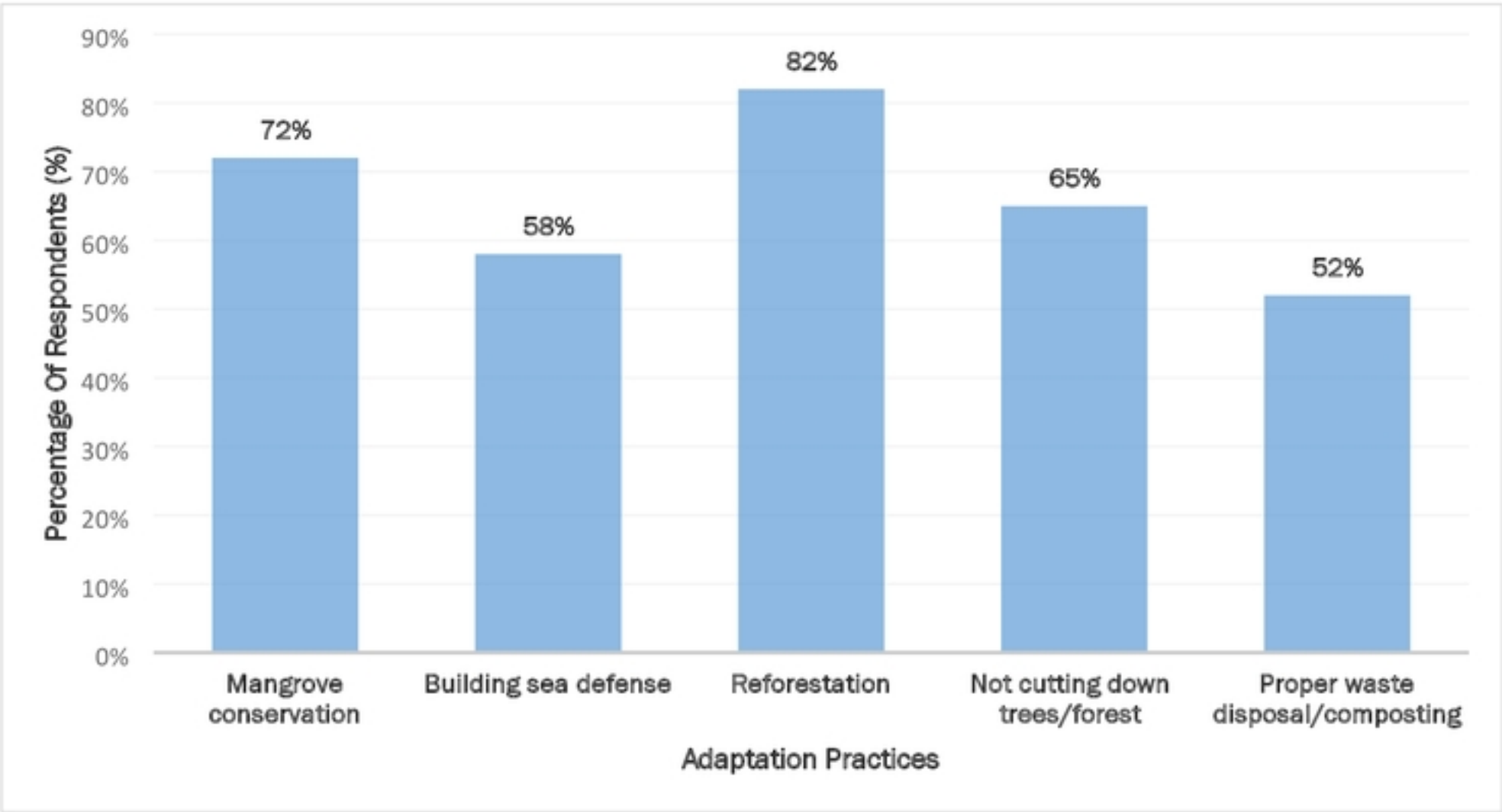

Figure 2. Adaptation Practices Adopted by Respondents.

Figure 1. Fisherfolks responses on the causes of climate change.

Figure 2. Adaptation Practices Adopted by Respondents.

Figure