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Social Resilience and the Blue Economy: A Study on Fishermen in Coastal Communities in Ghana[1]

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Abstract

Fishing is the most notable human activity in the ocean because many people, including the poor, vulnerable, and less advantaged, earn their living directly or indirectly. However, fishing practices have been recognized to have an effect on the sustainability of the ocean, which calls for concern (referred to as the blue economy). The social resilience of marine communities is key to achieving a blue economy and an essential aspect of sustainability in environmental management, particularly in resource-dependent communities. Previous studies on social resilience have neglected the social resilience state of marine communities, the determinants of such social resilience, and its relationship to the blue economy. We employed a convergent parallel mixed-methods research design to collect and analyze data on 491 coastal artisanal fishermen across nine semi-urban, two urban, and 16 villages in Ghana. Principal Component Analysis was employed to determine the factors contributing to the fishermen's social resilience. At the same time, a binary logistic model was employed to examine the relationship between social resilience and demographic characteristics. Using a five-point Likert scale (strongly agree, agree, don't know, disagree, and strongly disagree) on four major components, fishermen self-assess their expected well-being. Social resilience of fishermen in the study can be explained by four broad characteristics: the risk perception emanating from change, planning, learning, and reorganization ability; how people perceive their ability to cope with change; and the interest level of individuals in a prospective change. Also, demographic variables significantly determine the state of social resilience. Specific policy measures for strengthening social resilience at the local level could target building community social capital by helping fishermen form self-help associations and developing community economic and social infrastructures that could provide an alternative source of livelihood.

Keywords: Blue economy, social resilience, Demographic characteristics of coastal communities, Ghana.

JEL Codes: Q22, Q57, P48.

Introduction

The ocean's importance is so great that to say that human beings cannot do without it is almost stating the obvious. Aside from being a source of employment across the globe, with 97% of fisherfolk coming from developing countries (Food and Agriculture Organisation-FAO, 2020), it is also a source of food, fodder, hydrocarbons (for electricity), etc. Fishing is the most prominent human engagement with the ocean (Sakhuja, 2015); thus, there is a tendency for unsustainable practices posing a threat to the degradation of the marine ecosystem (World Bank & United Nations Department for Economic and Social Affairs-UNDESA, 2017). FAO (2016) estimated that the fish stock that is fully exploited is 57% of the fish stocks, and the stock that is over-exploited/depleted, or recovering, consists of 30%, and this has raised concerns about the sustainable management of water bodies as development spaces. The sustainable exploitation and use of ocean resources is known as the blue economy (United Nations Environmental Program-UNEP, 2013; 2015), whose components include fisheries, tourism, maritime transport, and renewable energy (Akinyemi *et al.,* 2019).

The blue economy entails reorienting marine rules, regulations, policies, practices, and guidelines on marine resource extraction and use. However, such changes could limit the ocean resource usage, and this will, in the short term, affect those who (fishermen) depend on the ocean directly for their livelihood (Beaumont, 1997). Thus, such changes should consider not only biophysical but also socioeconomic concerns (Karakara et al., 2023; Karakara, 2023). This is because marine resource regulations have direct implications on people's access to, use, and control. These implications could affect the marine communities' economic and social structures. Thus, enhancing the coping strategies of marine communities is vital in adapting to any possible effects that might emanate from the economic and social spheres of the community. The idea of social resilience in marine communities, as Adger (2000) puts it, is that an individual or group of individuals can cope with external pressures emanating from social, political, or environmental spheres.

In theory, social resilience and social capital are related (Norris *et al.,* 2008; Coleman, 1990), as literature on social capital recognizes and identifies social capital as a major influencer to the use of natural resources and environmental risk (Adger, 2002; Putnam, 1993). A well-established and socially resilient population increases the probability of achieving sustainable development in an environment where human life depends much on economic activities related to natural resource usage (Holling, 2001). Most studies examining the design and effect of

marine conservation policies (such as Marine Protected Areas-MPAs) are done from a biological point of view. However, studies (Karakara *et al.,* 2023; Karakara & Dasmani, 2022) have concluded that social factors are as important as biological or physical factors in determining marine conservation success or failure.

It is important to study the link between demographics and social resilience for some reasons. One such reason is that an understanding of how the demographic sphere of a group influences their resilience capacity is an indicator of how to carve out policy to help increase their social resilience. Policies on demographics (education, mobility, population, age structure, family size, and economic status) could easily be drawn to help boost the social resilience of communities. This current study contributes to the theoretical literature by arguing that the demographic characteristics of communities affect their social resilience state.

We used Principal Component Analysis-PCA and followed the conceptualization of Marshall and Marshall (2007) in studying the factors that contribute to the state of social resilience of commercial fisheries in Queensland, Australia. Marshall and Marshall's (2007) four key features of the social resilience of fishermen are summarized as; (1) fishermen's risk perception relating to any change; (2) fishermen's planning, learning, and reorganization ability; (3) fishermen's perception on their coping ability to change; and (4) fishermen's interest level in change that is coming. Marshall and Marshall (2007) therefore described a 12-item multidimensional scale that they used to operationalize the concept of social resilience. They found a positive relationship between social resilience and the way commercial fishers assess, appreciate, experience, and respond to prospective policy change within the Queensland commercial fishing community.

Our study takes Marshall and Marshall's (2007) study further by exploring how the demographic characteristics of fishermen are linked to their social resilience, besides our finding that fishermen's acceptance of change as part of human living also influences social resilience, which reiterates that social resilience could be at the individual or community level. We studied individual fishermen; hence, individual resilience is captured here. Individual resilience could be transferred to community resilience when aggregated. When the majority in a community is socially resilient, the community can be said to be socially resilient. Eachus (2014) indicated that community resilience is built upon the foundation of individual resilience, as the strength of a community is derived from the collective strength of its members. Our

conceptualization in Figure 1 reiterates this. Thus, our study addresses the issues of what necessary factors should be of concern in marine communities to enhance social resilience. How can the principle of social resilience be built into marine communities to achieve a blue economy? The rest of the paper is written as follows: the next section is on literature (both theoretical and empirical), as well as the conceptual framework. The third section touched on data and methods of analysis employed in the study, while section four presented results and discussions, and the last section concludes with policy implications.

Our study rests on the theoretical base of other scholars, such as Folke *et al.* (2002) hypothesize that four critical elements interact with each other, and these elements are required when dealing with social-ecological system dynamics in times of change. These factors are known as "*principles for building resilience,"* which interact with each other and are interdependent. The first principle is *learning to live with change and uncertainty (adaptability),* which underscores the need for individuals/communities to accept change and live with risk or uncertainty. The factor advocates that when there is a crisis, the social system should be able to withstand it and make an opportunity out of it for development; thus, adapting to change is key. The second principle is: *Nurturing diversity for reorganization and renewal (diversity),* which dwells on how to nurture diversity to be resilient. Being diverse safeguards one against uncertainty and surprises in life (Marschke & Berkes, 2006).

The third principle is to *combine different knowledge for learning (learning & knowledge),* which regards the knowledge and understanding of people about the ecosystem in the local communities and traditional societies as significant in building resilience (Berkes, 2004). This traditional system of knowledge is embedded in the local institutions and value systems and is effective in resource management (McClanahan *et al.,* 2006). The last principle is c*reating opportunity for self-organisation (self-organisation),* which advocates that social resilience could be built by increasing the likelihood of flexible and adaptive resources or behaviour among stakeholders during periods of crisis, reorganization, or uncertainty. For instance, multi-level governance and accountability harmonize governance controls in a decentralized-centralized system (Olsson, 2003), which helps build social resilience. However, resilience is seen as different from adaptive capacity and vulnerability, as Nath et al. (2020) indicated that resilience is concerned with the effect of socio-ecological, biophysical, geophysical, ecological, and engineering factors (and processes) on systemic change, while vulnerability is on the effect of socio-political and socio-economic factors (and processes) on systemic change.

Empirical studies, such as Amevenku, Asravor, and Kuwornu (2019), Marschke and Berkes (2006), and Finkbeiner (2015), all alluded to the fact that fishing households' livelihood strategies help to ascertain how they respond to the prevalent vulnerabilities they face, thereby building their resilience. Demographic factors are found to influence the alternative livelihood strategies of fishing households. Despite the contribution of these studies to our understanding of livelihood diversification, they overlook the sustainability of fishing activities, and in particular, ignore how livelihood diversification enhances or impinges on the sustainability of fishing should resource regulation issues curtail their fishing activities. We studied Ghana in this context for some unique reasons. First, Ghana has one of the historic fishing communities and is therefore home to many old and experienced fishermen. A study on their social resilience state could help in policymaking regarding the blue economy. Second, Ghana has yet to put together a document dedicated to the blue economy. Hence, an understanding of the factors that affect the nature and opposing issues to the blue economy will be a welcome study.

Conceptualization of the study

The conceptualization of the study is presented in Figure 1. In the figure, the study suggests that a fisherman who is socially resilient acts as a bridge to achieving sustainable development cum the blue economy principles. In the figure, we have two different fishermen (fisherman 'A' and fisherman 'B'), where fisherman 'A' is socially resilient, and fisherman 'B' is non-socially resilient. If the two individuals are confronted with shocks and other related issues from social, economic, political, and environmental changes, it affects their advancement. Given that individual 'A' is socially resilient, he/she would be able to bounce back from the shock, and this promotes sustainable development and subsequent achievement of the blue economy.

For instance, individual 'A' being socially resilient means it can withstand a shock caused by changes in fishing practices, rules, regulations, or a ban on fishing, which might limit their catch rate and thereby affect their income and livelihood. Being resilient means fishermen (community members) have alternative livelihood support to survive the storm of income limitations from fishing. In line with the individual-community resilience dichotomy, a resilient community can withstand climate change emanating from environmental changes. Thus, this social-climate resilience would help the community to attain SDG 11 (sustainable cities and communities), SDG 13 (climate change), and subsequently the blue economy (SDG 14). A

social resilience of fishermen could be inferred from their ability to build social capital by belonging to a fishermen's association. Such social capital strength will cushion a fisherman in times of unforeseen events, and thus, he can plan, learn, and reorganize.

Again, a socially resilient individual might be able to withstand disturbance emanating from economic changes like a booming harvest that drastically reduces the fish price and leads to low incomes or an environmental change that wipes away their fish species, leading to a very low catch. Being socially resilient in alternative livelihoods can help withstand such shocks and hence help achieve SDG 1 (end poverty), SDG 2 (zero hunger), and SDG 8 (decent work and economic growth). On the other hand, an individual 'B' that is not socially resilient is prone to disaster, as he might not be able to withstand shocks coming from social, political, economic, and environmental changes. This thus affects his effort to live a sustainable life and might lead to unsustainable exploitation of marine resources in the community.

The Marshall and Marshall (2007) conceptualization holds here. A socially resilient person can plan, learn, and reorganize. This ability will enable him to have a high level of interest in any forthcoming and foreseeable changes. Again, a socially resilient person would have a high perception that they can cope with change and the risk associated with any foreseen change (such as prospective policy in this study). For instance, an experienced fisherman (measured by number of years of fishing) may know the industry well and can predict the outcome of policies or events in the industry, hence, can be socially resilient compared to a less experienced fisherman.

Again, education is high in influencing the social resilience nature of fishermen. A highly educated fisherman can understand practices and policies documented and thus could be resilient to a forthcoming policy change. This is because he can read and understand. Such an educated person may also have some alternative source of livelihood to cushion them in times of low fish catch that affects their earnings. Other fishmen characteristics, such as migration for fishing, marital status, number of child dependents, and income share from fishing, are said to influence their social resilience state. Thus, we hypothesized that building the social resilience of fishermen could help achieve some of the targets of the UN Sustainable Development Goals, which emanates from the UN Agenda 2030, a global plan of action that outlines 17 Sustainable Development Goals (SDGs) and 169 targets to achieve a more just and sustainable world by 2030, encompassing economic, social, and environmental dimensions.

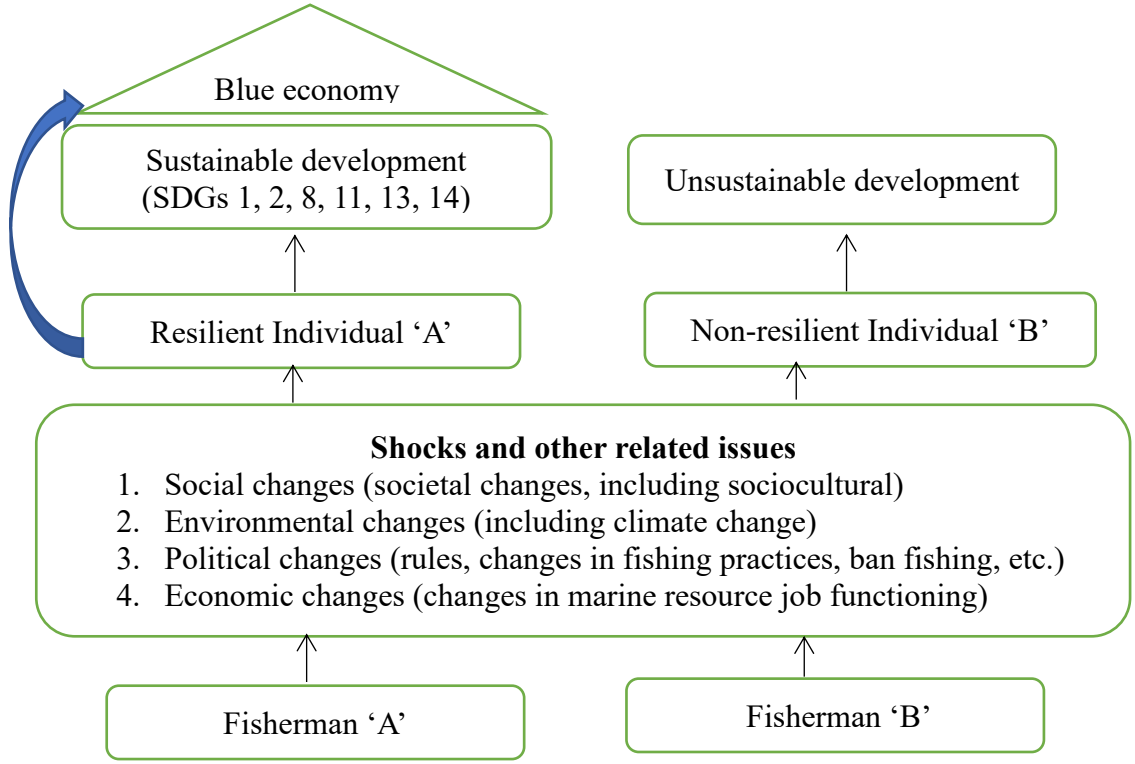

Figure 1: Conceptual framework of the study
Note: *SDGs means Sustainable Development Goals;* **Source:** Authors' conceptualization

Data and methods of analysis

Data

Sampling selection, instruments, and data collection procedure

This study uses the convergent parallel mixed-methods approach (qualitative and quantitative) to study marine/coastal communities in Ghana. This method allows us to concurrently conduct the quantitative and qualitative elements in the same phase of the research process. We weigh the methods equally, analyze the two components independently, and interpret the results together (Creswell & Pablo-Clark, 2011). For the sake of corroboration and validation, we aim to triangulate the methods by directly comparing the quantitative statistical results and qualitative findings. Following Denzin's (2009) multiple triangulation approach, which encourages different methods to collect data and multiple investigators with varied expertise, we achieve triangulation by employing different datasets, comprising interviews with key informants, fishermen, and focus group discussions to explore a range of experiences and perceptions. We collected data on chief fishermen in the communities, and individual fishermen also responded to questionnaires individually, and a focus group discussion, where some fishermen were gathered in one place. Again, we adopted different methods of analysis, qualitative (narrative) and quantitative (PCA and regression), which promote the use of several

data collection methods such as interviews and observations. The method we adopted enables us to provide a comprehensive analysis of the research problem by converging or merging quantitative and qualitative data to test for convergence, divergence, contradictions, or relationships between two sources of data (Morse, 1991), hence, achieving triangulation.

We collected data using interview-administered questionnaires on 491 artisanal fishermen across nine semi-urban, two urban, and 16 villages along the coast of Ghana (see Appendix Table A1). These study areas were chosen because they have the highest numbers of fishers in the country and have different ethnic groups. Diversity in customs and traditions on resource conservation could be learned in these diverse communities. A purposive sampling technique was used for respondents who are fishermen. Actual respondents were selected using a simple random sampling technique. The first stage is to identify fishers, and the second stage is to randomly interview them to get the required sample in each region/community. The sample of respondents was carved out of the total 107,518 fishermen who operate along the coast of Ghana (Dovlo et al., 2016). Following Yamane (1967), the sample is determined as follows;

The sample size is $n = \frac{N}{1+N(\propto)^2}$ Where N = sample frame (population); n = sample size and

α = margin of error = 0.05

Hence, the sample size for the study is $n = \frac{107,518}{1+107,518(0.05)^2}$ = 399.996 = 400

The 400 respondents were further distributed according to each region's total (weighted) number of fishers. That is, regional samples were done according to proportion to size as captured in Table 1 below;

Table 1: Sampling calculations according to regional proportions

Region	**Total number of fishers**	**Sampling calculation**	**Total sample size**
Volta	14,699	$\frac{14699}{107,518} = 13.67\%$ of 400	55
Greater Accra	25,844	$\frac{25844}{107,518} = 24.04\%$ of 400	96
Central	33,373	$\frac{33373}{107,518} = 31.04\%$ of 400	124
Western	33,603	$\frac{33603}{107,518} = 31.25\%$ of 400	125
Overall calculated sample size			**400**

Source: Authors' computation

We adjusted the sample size of 400 respondents to 530 to account for incomplete and non-responses. With the adjusted sample of 530, the actual number of respondents who responded to the questionnaires was 515. However, after data collection, data management, and cleaning, the actual number of respondents was 491. This gave a response rate of 92.6%.

We used an interview-administered questionnaire to collect quantitative data from 491 respondents. Additionally, we conducted key informant interviews with 20 chief fishermen and one focus group discussion with nine participants from five communities to obtain qualitative data. The interviewer-administered questionnaire was used because of high illiteracy among the respondents. The questionnaires were read out to the respondent in their local language, and their responses were recorded. Some of the questions on the questionnaires included respondents' socioeconomic and demographic characteristics, such as age, marital status, educational attainment, fishing activities, and income. Additionally, there were social resilience questions, such as "I can cope with small changes in the fishing industry". The questionnaire administration (field data collection) for this study was done from December 2021 to February 2022. The respondents were duly informed that their responses were solely for research purposes and assured of the confidentiality of their identities and responses. The data gathered is subjected to a validation check and cross-check to maintain the chronological responses.

The survey instruments were developed by first conducting a pilot study on 10 respondents in Adina, a fishing community in the Volta Region, to help pre-test the instruments. This pre-test shows that some questions are repeated, as the same responses to different questions were given by the respondents. Again, the question of whether all the respondents' children are in school was reworded, and keep in mind that some respondents' children might not be in school currently but have all completed schooling. This was revealed when a 76-year-old fisherman (a retired teacher) indicated that all his children had completed school. Also, at the pretest, some respondents indicated that they are not married but have been cohabiting/living together for ages. This was combined, and a revision of the questionnaire was done accordingly. There were other insights gained, and a revision of the questionnaires was done, and the finalized questionnaire for collection, where necessary, was finalized for the data collection.

The focus group discussions were done with approximately 9 respondents from different communities (Kedzikope, Tetevikope, Dzelukope, Hedzranawo, and Blekusu). The respondents for the focus group discussion (FGD) were gathered at one place, and the questions

were posed to them for their responses. The respondents were made to respond to questions one after another. Responses were audio-recorded with the permission of the respondents. The audio recording was transcribed to generate results for the study. The FGDs allowed the respondents to speak freely about other concerns about their fishing activities, welfare issues, knowledge of the environment, and the general fishing activities in the communities. Some questions in the FGD were: Do you consider yourself to be socially resilient? Such that when there are any changes in the fishing industry, you can survive without being much affected by those changes. If there are small changes in the industry (changes such as government regulation on fishing), can you cope and survive? Do you have alternative jobs available in your community that you can rely on when fishing activities are affected? Do you have any other skills outside the fishing industry that you rely on when something happens in the fishing industry to affect fishing activities?

We studied individuals who go fishing in the sea. Thus, in this study, we intended to collect data on both men and women who engage in actual fishing activities by going to the sea. However, our data collection revealed only male fishers for whom we collected data for the study. It is indicated that Ghana's fishing sector is male-dominated at sea, and women are mostly into postharvest processing, sale, and marketing of fish and other related products (Overå et al., 2022; Ameyaw et al., 2020; Dovlo et al., 2016). We observed from data collection that in all the communities visited, when a canoe arrived from the sea, the fishers onboard were all men, whilst the women waited at the shore to receive the harvest. We concentrated on fishermen and no other groups like young non-fishermen, women, etc., for some reasons; first, this group is the first to be affected directly by any blue economy effort that directly affects fish catch. Second, this group is mostly men who will keep the fortunes of their families and the communities where they live (de la Torre-Castro et al, 2017), as stated by Harper et al. (2024) that coastal anthropogenic activities are mainly engaged by men.

The data collected was subjected to validity checks. For external validity checks, a tabulation of basic variables from the data was done in comparison with similar variables from known and publicly available existing data (i.e., the Ghana Living Standards Survey-GLSS and the Canon Frame Survey) and is presented in Table 2. The table shows the basic statistics on these variables. In the table, the average age of fishermen is 45 years, while it is 44 for the canoe frame survey data conducted by the Ministry of Fisheries and Aquaculture Development.

Again, the majority of the fishermen are married, as shown in all the data collection sources. This trend shows that the primary data collected for this study is externally validated by other public data in existence. The internal validity checks were done when the study ran the PCA analysis and used Cronbach's α statistics. For reliability, the Cronbach's α analysis was done. A figure of 0.7 Cronbach's α value is accepted as a reliable scale (Chen & Popovich, 2002).

Table 2: Testing internal validity of the primary data collected

Variable	Primary data	Canoe Survey	GLSS – 7
The Average age of fishermen	45	44	46
The Average educational level of fishermen	Senior High School (Primary)	Senior High School (Primary)	Primary – BECE (Primary)
The Marital status of fishermen	(Married)	(Married)	(Married)
The Average number of children	3 (4 & above)	4 (above 4)	6 (above 6)
Fishermen has a secondary occupation	(Farming)	(Farming)	(Trading)
Fishing holidays or non-fishing days	(Tuesdays& Sundays)	(Tuesdays)	-

Note: responses for the GLSS-7 data are household head responses; responses in brackets indicate the majority response. **Source:** Author's compilation

Methods of analysis

This section discusses two methods employed in the analysis: PCA and logistic regression. The PCA helps to determine which factors contribute to social resilience, while the logic is used to examine the determinants of social resilience.

Principal Component Analysis (PCA)

We analyzed the state of social resilience of fishermen in coastal communities to prospective marine policy change in Ghana by adopting a Principal Components Analysis matrix. We followed Marshall and Marshall (2007), who also employed PCA in their analysis. The PCA analysis is a technique that helps to determine which statements are subsets and independent from other statements. Statements are combined into factors when they are independent from other statements but correlated among themselves (Tabachnick & Fidell, 1996). The PCA techniques assume that some underlying factors, which may be small in number compared to the initial number of statements, could cause co-variation among the responses. This study is on assessing and defining how individual fishermen respond to prospective policy change. This is because the scale (PCA) is hardly used for such analysis of individual responses; however,

responses from individuals could be vital in understanding resilience at a higher level (Adger et al. 2002; Manfredo & Dayer, 2004). Hence, individual data allows analysis of resilience at higher levels without undermining the essential factors that may determine responses to policy change (Freudenberg & Gramling, 2002; Mascia et al., 2003; Trosper, 2004) and increases the general applicability of results (Bradley & Grainger, 2004; Smith et al., 2003).

The first Principal Component (PC 1) dwells on fishermen's perception of risk relating to their ability to absorb and adapt to change. The second component (PC 2) tests how well the fishermen can learn and reorganize in the fishing industry. The third component (PC 3) dwelled on the fishermen's ability to cope with changes and at what threshold coping is reached. The fourth and final component (PC 4) is on the fishermen being able and interested in adapting to change by repositioning themselves in or outside the industry. Fishermen self-assessed their expected well-being concerning how they accept, are willing, and can adapt to prospective policy change. They self-rated their attitudes using a five-point Likert scale (strongly agree, agree, don't know, disagree, and strongly disagree) (Spector, 1992). The PCA analysis components' weights and values, as well as the questions to measure them, are shown in Tables A2 and A3.

Binary logistic regression

We measured social resilience with the four broad characteristics: the risk perception emanating from change; planning, learning, and reorganization ability; how people perceive their ability to cope with change; and the interest level of individuals in a prospective change. A fisherman is considered socially resilient if he scores a higher mark on at least three of the four characteristics. That is for the first component (how fishermen perceive risk and their absorptive and adaptive ability). If a respondent strongly agrees, or agrees to more than 50% of the questions, then he has scored a higher mark. This applies to all components of the PCA. The overall mark of being socially resilient is determined by when a respondent scores higher marks in more than two of the four components. Details of each question are captured in Tables A2 and A3 in the appendix. Hence, those who scored more than 50% in more than two components are considered socially resilient, and otherwise are not socially resilient. This similar approach was used by Karakara et al. (2021a) in their measure of individuals facing financial distress. Thus, we have a binary outcome (resilient and non-resilient) for the regression analysis; hence, the study adopts a binary logit regression to study the

socioeconomic and demographic determinants of fishers' social resilience. Karakara and Osabuohien (2020) have indicated that the logit is the preferred model for studying binary probabilities.

In a binary outcome, let P_i represent the probability that a fisher is socially resilient, and the probability that a fisher is not socially resilient is given as $1-P_i$. As Y is a latent variable, we do not observe P_i, However, the outcome $Y=1$ is observed if the fisherman is socially resilient and $Y=0$ if he is not. This is functionally represented as:

$$P_r\ (Y_i = 1) = P_i \qquad (1)$$

$$P_r\ (Y_i = 0) = 1 - P_i \qquad (2)$$

Reformulating these equations in terms of the odds ratio and taking the natural logarithms, we obtained the logit, and hence the name logit model for equations specified as.

$$Ln\left[\frac{Pi}{1-Pi}\right] = Li = \beta_0 + \beta' Xi \qquad (3)$$

The following socio-economic and demographic variables are used; the age of the respondent, educational level of respondent, whether migrant or citizen, the gender of respondent, marital status of the respondent, income level of the respondent, duration of being fisher (how long the respondent is a fisher), fish for self or other, household size where the respondent is from.

Results and discussions

Results

Descriptive statistics and distribution of data

Table 3 shows that the fishermen surveyed have a mean age of 41 years and an average of 23 years of fishing experience. These fishermen (at least 79%) have resided and fished in their communities for more than 20 years. A large percentage (50.51%) of the fishermen have never attended formal school. However, the remaining have ever attended school, though not to the tertiary level.

Married fishermen constitute the majority (73.5%), and on average, fishermen have on average five children; this could mean that such married fishermen could obtain support from their spouses to help their fishing business. Christian faith is dominant (70.47%) among the fishermen, and the majority being Christian could mean that certain beliefs about the sea God

might not be prevalent, as Adjei and Sika-Bright (2019) earlier made conclusions in this direction.

Fishing is the primary job of most (about 88%) of the respondents. Again, 75.36% indicated they have no secondary job, and a large proportion (85.75%) of fishermen's income is from fishing, which means income from fishing is the highest among fishermen's stream of income. As low as 23% of the fishermen belong to a fishing self-help association. It is revealed that the majority (80.65%) of the fishermen migrate for fishing either within or outside Ghana. The majority (about 69%) do not own a fishing canoe and have to work under a canoe owner either on a profit-sharing or a work-and-receive payment basis.

Table 3: Descriptive statistics and distribution of data

Variable	Measurement	Response	%	Obs.
Region	The region that the respondent is from	Greater Accra	16.9	83
		Central	34.4	169
		Western	32.8	161
		Volta	15.9	78
Community Membership	Whether the respondent is from the community or a migrant	Yes	79	403
		No	21	107
Marital status	The marital status of the respondent	Single	16.3	80
		Married	73.5	361
		Divorce	5.5	27
		Widowed	2.9	14
		Separated	2.4	12
Children	The number of children the respondent has	(Figure in mean value)	4.6*	491
Age	The age of a fisherman in completed years	(Figure in mean value)	41*	491
Education	Level of education of the respondent	None	50.5	248
		BECE	36.3	178
		MSLC	3.1	15
		SHS	7.7	38
		Voc/Tech/Teacher	1.8	9
		Tertiary	0.6	3
Religion	The religious faith the respondent belongs to or practices	Traditional	21.4	105
		Christianity	70.5	346
		Islam	5.1	25
		Others	3.1	15
Experience	Number of years the respondent has been a fisher	(Figure in mean value)	23.6*	491
Fishing as a primary job	Whether fishing is the primary job of the respondent	Yes	87.6	430
		No	12.4	61
Secondary job	Whether the respondent has a secondary job	Yes	24.6	121
		No	75.4	370

Income from fishing	The percentage share of fishing income from total income	(Figure in mean value)	85.8*	491
Fishermen Association	Whether the respondent belongs to any fishermen's association or group	Yes	23.2	114
		No	76.8	377
Migrate to fish	Fisherman migrates to other fishing grounds	Yes	80.7	396
		No	19.3	95
Ownership of canoe	Whether the respondent owns a fishing canoe	Yes	31.4	154
		No	68.6	337

Note: * figures in mean values; BECE = Basic Education Certificate Examination, MSLC = Middle School Living Certificate, SHS = Senior High School, Voc/Tech/Teacher = Vocational/Technical/Teacher education. **Source:** Authors' computation

The state of social resilience of fishermen

Table A2 in the appendix captures the reliability analysis for the 17 statements that measure social resilience (Marshall & Marshall, 2007). However, out of the 17 statements, only 13 statements have been seen to affect the scale (see Table A3). Thus, these 13 statements (as seen in Table A3) mirror the social resilience measure in this study. These 13 statements were analyzed using PCA, which showed that four factors best described them. These four factors together explain 64.8% of the variations in the analysis.

The first PCA captured statements that seek to understand how fishermen perceive risk and their absorptive and adaptive ability. This represents 24.3% of the variance. Thus, a statement such as "*I have many career options available if I decide to no longer be a fisherman*" was analyzed. These statements measure the fishermen being ability to lay hands on work somewhere should the need arise and coping with small changes. The second component represents 19.7% of the variance and looks at fishermen's planning, learning, and reorganization ability in the fishing industry. Statements such as the ability of the fisherman to plan his financial security, being able to plan well in times of change, and being more likely to adapt to change compared to other fishers.

The third component sums to 11.1% of the variance and captures statements on fishermen's coping threshold attainment. Statements that measure such coping threshold include: the fisherman being competitive enough to survive much longer; the fisherman being confident that things will turn out well for him; and the confidence that he will survive regardless of any change. The fourth component is 9.7% of the variance and dwells on fishermen's ability and interest in learning new skills outside the fishing industry and seeing change as a normal part

of human living. These two statements measure the fisherman's ability to adapt to change and acceptance of change. The other statements that didn't contribute much in determining social resilience in this study include: *I will find it very difficult working for someone else*; *I believe that the future will look after itself*; and I am always thinking of new and better ways to improve my fishing business.

With this state of social resilience of fishers, as revealed in Table A2, this study further explores the link between fishers' demographic characteristics and social resilience. This is estimated and reported in Table 3. Table 3 represents the econometric estimation of the demographic characteristics of the social resilience of fishermen. The table indicates that as a fisherman ages, he becomes less socially resilient to changes in the fishing industry. Though this finding is not significant, it makes sense, in that the older fishermen may not be able to have alternative jobs or migrate to fish.

The resilience of fishermen is associated with their level of education. A secondary-level educated fisherman has a 7% higher chance of being socially resilient than a co-fisherman who received no formal education. A tertiary-level educated fisherman has a 19% increase in the likelihood of being socially resilient than a non-educated fisher. This is so because an educated person might easily understand policy change and prepare for it, or might live an environmentally benign life than a non-educated person. Also, married fishermen are seen as being more resilient than their counterparts. Karakara et al. (2021a) concluded that married individuals are more likely to escape financial distress (i.e., being resilient) compared to their unmarried counterparts. However, fishermen who have ever married but are currently either divorced, widowed, or separated are less likely to be socially resilient than single-status fishers. Married fishers could pool resources with their spouse to enable them to stay resilient to changes that affect their fishing activities. An increase in the number of children fishermen has reduced the likelihood of the fisher being resilient by about 2% (however, it is not significant). This is similar to what Karakara and Ortin (2022) concluded on the Livelihood Empowerment Against Poverty program in their study.

Furthermore, in Table 4, the fishing experience of fishers is found to affect their social resilience. A one-year increase in the years of fishing boosts the resilience of fishers by about 6.6%. Also, having an alternative job increases the odds of being socially resilient by more than 10%. Perhaps fishermen with alternative sources of livelihood could fall on such alternatives

during times of close season or a ban on fishing. If a fisherman belongs to a fishermen's association or self-help group, it more than doubles the odds of being socially resilient than not being part of any fishermen's association. This could be so because a group can diversify risk, thereby building individual resilience. Also, a group could help its members by providing finance and having a unified voice to fight for their welfare and well-being. Again, as the income share of fishing increases for fishers, this increases their resilience. A one percent increase in income from fishing increases resilience by about 2%. Also, those migrant fishers are 2.4% more likely to be resilient than non-migratory fishermen.

The model we estimated is robust, showing from the probability chi-square (Prob>Chi2) value of 0.0000, indicating that the explanatory variables together significantly determined the dependent variable. Again, a probit model was used to reaffirm the logit model. The logit model has predicted probabilities in the range of 0.006 minimum and 0.67 maximum, while that of the probit model is 0.002 minimum and 0.64 maximum. An endogeneity test to ensure there is no correlation between an explanatory variable and regression error term(s) was done (Abdallah *et al.,* 2015). Again, omitted-variable bias was estimated to ensure that there is no correlation between the error term and the independent variables (Stock & Watson, 2003). A probability value of 0.3068 was obtained and is higher than the usual threshold of 0.05 (95% significance), indicating that we do not need more variables. The study further did a multicollinearity test to ensure no regressor would be a linear function of another (e.g., a fisherman may look resilient just because he has family support). A variance inflation factor (VIF) of 2.3 indicates there is no multicollinearity in the model, which means that endogeneity is not a serious problem.

Table 4: Econometric estimation results of demographic characteristics on social resilience

Explanatory variables	**Social Resilience (dependent variable)**	
	Logit	**Probit**
Age of the respondent	-0.054	-0.052
	(0.047)	(0.043)
The educational level of the respondent		
No formal education	Base category	
Primary (BECE)	0.067	0.06
	(0.05)	(0.04)
MSLC	0.062	
	(0.06)	
Senior High School	0.07*	0.09*
	(0.050)	(0.04)
Vocational/Technical/Teacher	0.08*	

		(0.05)	
Tertiary		0.19*	0.02
		(0.05)	(0.05)
Marital Status of the respondent			
Single		Base category	
Married/cohabiting or living together		0.03*	-0.03
		(0.02)	(0.022)
Others (widow, divorced, separated)		-0.01	-0.01
		(0.036)	(0.04)
The number of children the respondent has		-0.02	-0.03
		(0.02)	(0.02)
Years of being a fisherman (experience)		0.07*	0.06*
		(0.04)	(0.04)
Have an alternative job (yes)		0.10***	0.09***
		(0.04)	(0.03)
Employed by someone (yes)		-0.003	-0.003
		(0.003)	(0.003)
Belongs to a fishermen's association (yes)		2.88*	3.006
		(1.7)	(0.001)
Percentage of income from fishing		0.02*	0.02*
		(0.01)	(0.01)
Migrate to fish (yes)		0.02*	0.005
		(0.21)	(0.02)
		0.002	0.01
		(0.028)	(0.03)
Predicted probabilities	**Min**	0.01	0.002
	Max	0.67	0.64
Log-likelihood		-457.02402	-456.28781
Prob>Chi^2		0.0000	0.0000
Pseudo R^2		0.0622	0.0632
Observations		491	491

Note: The standard errors are within brackets; ***, **, * =significant at 1 percent, 5 percent, 10 percent levels. **Source:** Authors' estimation

Qualitative results analysis

A narrative analysis of the FGD showed mixed results. On whether the respondent fishers see themselves as being socially resilient, some indicated they are resilient, while others maintained that they are not. One participant who thinks he is resilient, though such resilience seems to be Godly, has this to say;

"*I know some would say if there are changes in fishing practice that limit our fishing business, they would not survive. But God being so wonderful, anytime there is a close season we survive because everyone is forced to do other things to get money*" (FGD participant from Dzelukope, Volta Region).

In another response, an old fisherman counters this by saying;

"*Those of us who are old and never learned any skill at our youthful age and have no strength currently, how do we survive? When the last tidal wave hit some communities, I remember I was thinking that if this wave were to hit my community badly as it did in Blekusu, by now I would have been gone by this incident*" (FGD participant from Kedzikope, Volta Region).

To add to this, another fisherman said;

"*To me we are resilient. Those who are not very educated are those found wanting when there is a change in the industry. Whenever there is going to be any change from the government, most of the fishermen do not understand the issue well, and how to deal with it. So, you would see them resisting*" (FGD participant from Hedzranawo, Volta Region).

Lack of education is seen as an issue that affects fishing and fishermen's resilience. One chief fisherman for Dzelukope, Volta Region, has this to say;

"*Most of the fishermen lack education concerning fishing as a business. Fishing is environmentally inclined, and so to survive in fishing, one needs much education. Maybe the government should provide us a continuous education, perhaps 3 to 4 times a year*" (KII of chief fisherman, Dzelukope, Volta Region)

When the participants were asked whether there were small changes in the industry that they could cope with. Most said that they could, with just a few maintaining that they couldn't. One participant said;

"*We can cope with government regulations with small changes, as we used to cope with others, like a close season. However, any change to come we should be pre-informed for us to prepare, as unforeseen changes affect almost all of us badly*" (FGD participant from Kedzikope, Volta Region).

The qualitative responses reiterate the findings from the quantitative analysis. It shows that most of the fishermen see themselves as being resilient. This is revealed from the FGD and the KII responses. However, for them to be socially resilient to changes coming from the government (e.g., policy changes that affect the industry), the fishermen should be reliably

informed and well-educated about the policy. In that way, they could respond to the policy change without much effect on their resilience state.

Discussion of results and their implications for the blue economy

In the literature, resilience studies are in two parts: community resilience and individual resilience. Studies on community resilience agreed that the sum of individual resilient people is not an indication that the community is resilient (Norris *et al.,* 2008). Put in another way, community members can be resilient together but not in a similar way (Brown & Kulig, 1997), which means that community resilience does not guarantee the same individual resilience. Also, Sultana et al. (2021) indicated that resilience is a multilevel feature that stressed the importance of combining persistence (i.e., fishing as their main source of livelihood) and the adaptation process (e.g., livelihood diversification).

We found in Table 3 that the majority of the fishermen have more than 20 years of fishing experience and an average age of 41 years. This was similarly found by Dovlo et al. (2016). This means that, as most of the fishermen have experience in fishing and are on average 41 years of age, they would be socially resilient. Experience goes with accumulated knowledge, and this could help an individual when there is going to be any change that he/she has experienced before. Again, we found that the majority (74%) of the fishermen are married. This could give them the advantage of pooling resources together as couples to help the family welfare. It means that, in times of any change in the fishing industry that affects a fisherman's earnings, his spouse could support the family. Thus, married fishermen would be socially resilient compared to their counterparts.

Also, the descriptive statistics show that fishing is the main/primary job of the majority. Dovlo et al. (2016) and Karakara et al. (2024) all found fishing as the main occupation of coastal Ghana. What it means is that the majority have their only source of livelihood to be fishing. The findings imply that, should anything happen to the fishing industry that limits their fishing activities and subsequently their earnings, this could reveal their non-resilient state, because they lack alternative sources of livelihood. With no alternative source of livelihood, fishermen would be non-resilient, and any effort that drives toward blue economy objectives (by limiting fishing activities) would face opposition from the fishermen. The lack of alternative sources of livelihood in coastal communities in Ghana was earlier found by Dovlo et al. (2016) in their survey.

A low percentage (23%) of the fishermen belong to a fishermen's self-help association. A self-help association is a means of building social capital, mostly in rural communities, and as the majority of the fishermen don't belong to one of such groups, they are denied the benefits of support and risk-sharing that such groups come with. This non-association member can expose the fishermen to vulnerability, all things being equal, to shocks, thereby making them non-resilient. Karakara et al. (2021b) indicated that rural social capital, such as self-help groups, has financially supported many rural dwellers, especially farmers in Ghana. Also, in theory, social resilience is found to be related to social capital (National Academies of Sciences, Engineering, and Medicine, 2019; Aldrich, 2012; Norris *et al.,* 2008). Again, Kim et al. (2022) suggest that social capital attributes and a variety of mitigation measures play a critical role in building resilience against flood risks when assessing county-level adaptive capacity and resilience to inland flood risks in the US Upper Midwest. Tian et al. (2024) also alluded that Miao (Hmong) villages in Hunan Province, China, seem vulnerable and yet still display resilience when they are exposed to tourism-induced structural changes.

Using a PCA analysis, this study found four components to determine the social resilience state of the fishermen surveyed. This study discussed the nature of the results as to what might be behind the four key social resilience components that are found. In the theoretical section, the study discussed these four social resilience components: the risk perception in approaching change; the ability to plan, learning, and reorganize; how fishermen perceive their ability to cope with change; and their interest level in adapting to change. Even though it is complex to measure social resilience because it is multidimensional, the results from the PCA analysis indicate that the source of social resilience of fishermen along the coast of Ghana can be described by four broad attributes.

General resilience theories (Choudhury et al, 2021; Holling, 1973) emphasized that, first, the ability of a system to absorb disturbance without losing its structure or function. Second, the extent to which a system is self-organizing. Third, the extent to which a system builds its learning and adaptation capacity (Biggs et al., 2015). The measure of fishermen's perception of their coping ability to change is seen in this study. This measure (perception of coping ability) has been used by other studies and found to be highly profound, as Smith *et al.* (2003) indicated that with the Florida Bet Ban policy change, local fishermen, who were resource

dependent, saw increases in their stress, depression, anxiety, and anger levels. Also, this study established that social capital enhances social resilience in resource-dependent communities such as the ones in this study. This finding is vital for social resilience theories as scholars (Wardekker et al., 2023; Adger et al., 2005; Moberg & Galaz, 2005) have alluded that social capital building plays a key role in building social resilience in natural resource management.

The fishermen's coping and adaptive ability to change regarding their perception of risk is seen as a fourth factor in this study. The PCA results suggest that fishermen's risk assessment informs their responses to the potential policy change. Thus, the perception of risk is a vital part because it examines social resilience to prospective policy change. For instance, Gramling and Freudenberg (1992) indicated that miners' perception of change significantly affected their coping and response to change. Drawing from the PCA analysis, the fishermen's social resilience is determined by the four components, and any blue economy effort should consider these components in its policy discourse. In a nutshell, it was established that, in general, the fishermen are resilient, and this implies that the blue economy could be successful when initiated well in the context of socioeconomic characteristics taken into consideration.

This study's findings on social resilience reiterate the fact that community resilience could be built based on achieving individual resilience. When individual fishermen in this study are socially resilient, it goes a long way to increasing the community's chances of being resilient. Scholars (Eachus, 2014; Koshy & Smith, 2022; Okwori, 2022; Livnat & Almog-Bar, 2023) have found this and stressed that even though individual resilience is distinct from community resilience to some extent, individual resilience generally affects resilience at a higher level, such as the community or societal level. This is because a community's ability to withstand adversity and be resilient is strengthened by the collective resilience of its members (Eachus, 2014). Resilient individuals are better equipped to cope with stress, trauma, and other challenges and could support other individuals within the community (Okwori, 2022; Livnat & Almog-Bar, 2023).

Conclusion and Policy Relevance

The study focused on establishing the state of social resilience of fishermen along the coast of Ghana. Two hypotheses were tested: (a) the state of social resilience in coastal communities and (b) the link between social resilience and demographic characteristics of coastal communities in Ghana. Using primary data, with a sample of 491 fishermen, the PCA and

binary logistic models were used to study social resilience. Results and discussion on social resilience and its interrelationship with the blue economy are carried out in this study. The study revealed that the social resilience of fishermen along the coast of Ghana can be explained by four broad characteristics: the risk perception emanating from change; planning, learning, and reorganization ability; how people perceive their ability to cope with change; and the interest level of individuals in a prospective change. Thus, how fishermen perceive risk and their absorptive and adaptive ability is the utmost thing to look at when one wants to build social resilience among the fishermen. This is followed by ensuring fishermen are well educated to plan their activities, learn the dynamics in the industry, and their ability to reorganize when there is a crisis in the industry.

Again, exploring the link between fishers' demographic characteristics and social resilience shows that demographic characteristics (such as age, marital status, religion, migration, fishing experience, alternative livelihood, income, etc.) greatly determine the social resilience of fishermen. A narrative analysis of the FGD, however, showed mixed results. In a nutshell, this study proved that building fishermen's social resilience is needed for achieving a blue economy. The necessary factors that should be looked at in marine communities to enhance social resilience include: building on alternative sources of livelihood for fishermen; building social capital in coastal communities (at least by encouraging self-help groups); and making an effort to increase educational access in coastal communities.

This study offers insights about Ghana and other similar coastal countries in two broad areas. First, the social resilience aspect of coastal communities has been broadly ignored in the marine resource conservation efforts of the Ghanaian government. This study brings our attention and understanding to how social resilience could affect efforts to achieve the blue economy in Ghana and beyond, and how this social resilience could be attained. Second, the study brings to light the neglected issues of fishermen's characteristics that would affect the entire community and hence render the community non-resilient. This aspect of the study awakened our thinking about the connection between individual resilience and community resilience.

Specific policy measures for strengthening social resilience at the local level should be on, building community social capital by helping fishermen form self-help associations, and developing community economic and social infrastructures to help provide alternative means of generating income for fishers during crisis periods. The Ministry of Fisheries and

Aquaculture Development and other marine agencies could ensure that self-help associations are formed in each fishing community. This would, aside from helping build the social resilience of fishermen, aid the agencies or the ministry to easily organize fishermen for training or education-related matters. Again, building community social and economic infrastructure could be achieved by ensuring that social cohesion exists among community members, and providing alternative livelihood sources that might be peculiar to the coastal environment, such as aquaculture, tourism, or other economic activities. Fishermen should also strive to build their alternative skills in non-fishing jobs to enable them to be resilient to shocks. This study's findings are intended to be used by the country ministries and agencies that work in the space of marine sustainability and fisheries management. Again, non-governmental organizations and policymakers within fisheries and the marine environment. Academics interested in research in coastal and fisheries management will also find the work useful.

The caveat in this study is that the analysis of the results was based on a cross-sectional analysis of data collected on small-scale fishermen. Using cross-sectional data for a study may miss an understanding of changes in the variables of interest over time. Again, the cross-sectional data were mainly dedicated to fishermen in the coastal communities alone, and hence, relevant issues relating to the community as a whole might not be covered. This is because the respondents were only fishermen and not other groups (like fishmongers, opinion leaders, and community members who are not fishermen) within those communities, which could be relevant to the study. Again, the respondents might not accurately respond to questions, thereby reducing the quality of the information gathered for the analysis. Hence, the findings of this study could best be attributed to the study area and might not be generalized to other fishermen elsewhere across the globe.

Further research is needed to examine coastal communities' resilience to climate change. Climate change has a devastating effect on coastal resources, as evidenced in the 21st century. A study on the effects of climate change on coastal communities and fishermen could be a turning point in offering suggestions. Again, there is virtually no marine protected area in Ghana as the World Bank (2012) reports that MPAs in Ghana (% of total surface area) were 0.01% in 2010, and currently, Our World in Data team (2023) noted that 0.10% of all of Ghana's territorial waters are protected. Thus, this is a threat to preserving biodiversity in Ghana. Thus, future studies could explore the readiness of coastal communities in Ghana to adjust to a policy emanation from an MPA objective. This will help to understand the likelihood

of the blue economy policy succeeding, as the blue economy principles include MPA practices to conserve marine resources. Thus, future researchers should consider these two scenarios (climate change issues, and marine protected areas) and how they affect social resilience cum blue economy.

Although the study can't be generalized to some other areas across the globe, it has some regional and international implications for policy. This study's outcome introduces new insights into existing knowledge in the current literature by arguing that the social resilience state of fishermen matters in achieving the blue economy. Again, the demographic determinants of this social resilience are key to the phenomenon of the blue economy. Hence, other coastal jurisdictions should study the social resilience of fishermen and incorporate it into their blue economy roadmap.

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APPENDIX

Table A1: Regional, District, and Community distributions of respondents

Region	Districts	Communities
Volta (79)	Ketu South Municipal (Total respondents –53)	Denu (12) Hedzranawo (17) Tettevikope (12) Viepe (12)
	Keta Municipal (Total respondents – 26)	Dzelukope (11) Tettikope (6) Kedzikope (9)
Greater Accra (83)	Ada East District (Total respondents – 22)	Azizanya (22)
	Ada West District (Total respondents – 24)	Aklabanya (24)
	Ningo Prampram District (Total respondents – 37)	Old Ningo (21) Ahwiam (16)
Central (168)	Mfantseman Municipal (Total respondents – 73)	Abandze (24) Anomabo (16) Biriwa (14) Kormantse (19)
	Cape Coast Metropolis (Total respondents – 23)	Ola (4) Abrofo-Mpoano (19)
	Abura-Asebu-Kwamankese District (Total respondents – 12)	Moree (12)
	Komenda-Edina-Eguafo-Abrem Municipal (Total respondents – 60)	Elmina (60)
Western (161)	Shama District (Total respondents – 75)	Aboadze (59) Abuesi (16)
	Sekondi Takoradi Metropolitan (Total respondents – 37)	Sekondi (18) Ngyiresia (19)
	Ahanta West District (Total respondents – 49)	Upper Dixcove (13) Busua (14) Lower Dixcove (22)

Source: Authors' **Note:** The number of respondents is within brackets

Table A2: Descriptive statistics and reliability analysis

	Survey items (questionnaires)	Mean	Standard deviation	Item-total correlation	α if the item is deleted
1	I have many career options available if I decide to no longer be a fisher	1.98	1.06	0.46	0.653
2	I am confident that I could get work elsewhere if I needed to	1.89	0.97	0.45	0.656

3	I am too young to retire and too old to find work elsewhere	2.68	0.90	0.47	0.656
4	I would be nervous trying something else	2.09	1.08	0.43	0.656
5	I can cope with small changes in the industry	1.66	0.91	0.41	0.662
6	I have planned for my financial security	2.86	0.94	0.68	0.666
7	Every time there is a change, I plan a way to make it work for me	2.18	1.00	0.32	0.670
8	I am more likely to adapt to change compared to other fishers	3.01	0.85	-0.05	0.676
9	I think I am competitive enough to survive much longer	1.66	0.88	0.23	0.680
10	I am confident things will turn out well for me, regardless of changes in fishing	3.06	0.98	0.20	0.684
11	If there are any more changes, I will not survive much longer	2.86	1.15	0.13	0.684
12	I am interested in learning new skills outside of the industry	2.32	1.10	0.17	0.685
13	I would find it very difficult working for someone else	1.89	1.02	0.56	0.685
14	Change is a normal part of our everyday life	2.85	0.84	0.28	0.686
15	I would like to start up a business one day, doing something other than fishing	1.97	0.95	0.30	0.693
16	I believe that the future will look after itself	1.64	0.85	0.02	0.700
17	I am always thinking of new and better ways to improve my fishing business	2.97	0.94	0.27	0.706

Note: α is Cronbach's α; statements were measured on a 5-point scale: 1=strongly disagree, 2=disagree, 3=don't know, 4=agree, 5=strongly agree.
Source: Authors' estimations

Table A3: Principal Components Analysis (matrix of the fishermen's response to policy change)

S/N	Survey items (questionnaires)	PCA 1 (24.3%)	PCA 2 (19.7%)	PCA 3 (11.1%)	PCA 4 (9.7%)
1	I have many career options available if I decide to no longer be a fisher	0.808			
2	I am confident that I could get work elsewhere if the need arises	0.787			

3	I am too young to retire and too old to find work elsewhere	0.625			
4	I would be nervous trying something else	0.603			
5	I can cope with small changes in the industry	0.462			
6	I've planned for my financial security		0.858		
7	Any time there is a change, I plan a way to make it work for me		0.746		
8	Am more likely to adapt to change compared to other fishers		0.628		
9	I am competitive enough to survive much longer			0.682	
10	I am confident things will turn out well for me			0.637	
11	If there are any changes, I will not survive much longer			0.547	
12	I am interested in learning new skills outside of the fishing industry				0.936
13	I see change as a normal part of our everyday life				0.671

Source: Authors' construct

Table A4: Summary of findings on key demographic and resilience factors

S/N	***Key demographic factors***	**Finding**
1	Educational level	The resilience of fishermen is associated with their level of education. Education is positively related to social resilience, with a pronounced effect at higher education levels

2	The fisherman's household size	An increase in the number of children fishermen has reduced the likelihood of the fisher being resilient. Fishermen with a large household size have reduced social resilience
3	Fishing experience	The number of years of fishing that fishermen have (fishing experience) affects their resilience status. Experience goes with accumulated knowledge, and this could help an individual when there is going to be any change that he/she has experienced before.
4	Social capital (belongs to the fishermen group)	A self-help association is a means of building social capital, mostly in rural communities. This self-help association helps build social capital that heightens chances of being socially resilient.
5	Age of the fisherman	As a fisherman ages, he becomes less socially resilient to changes in the fishing industry.
	Key Resilience Factors	
6	Fishermen's risk perception emanating from change	The fishermen's coping and adaptive ability to change regarding their perception of risk is seen in this study. The results suggest that fishermen's risk assessment informs their responses to the potential policy change. Thus, the perception of risk is a vital part of their social resilience to prospective policy change.
7	Fishermen's ability to plan, learn, and reorganize	Fishermen's ability to plan their fishing activities, learn from past experiences, and reorganize in times of great change affects their social resilience.
8	Fishermen's perception of their ability to cope with change	Fishermen's perception of their ability to cope with change affects their social resilience. Those who think they can cope with a particular change are well prepared for such a change, hence, boosting their social resilience.
9	Fishermen's interest level in a prospective change	Fishermen's interest level in an oncoming change also affects their social resilience state. Those without interest in a coming change will not even attempt to prepare against its effects.

Source: Authors' construct