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Adaptation to climate change among artisanal fishers around Lekki Lagoon, Nigeria: A gender analysis

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ABSTRACT

This study assessed fishers' adaptation to climate change in fishing communities around Lekki Lagoon from a gender perspective. A multistage sampling procedure was used to select 112 (77 males and 35 females) fishers from nine fishing communities. Primary data were collected with the interview guide and analyzed using descriptive and inferential statistics. Results revealed that 67.5% of males and 60.0% of females were into fishing for business and consumption. The mean adaptation scores indicated that more male fishers changed from fishing to crop farming and non-agricultural activities than their female counterparts. The mean score of severity of constraints indicated that low fish catch, lack of information from weather stations, and the influence of middlemen were more severe constraints for male fishers than female fishers. A significant association was established between fishers' use of insurance schemes as an adaptation strategy and their gender. The study concluded that female fishers demonstrated a lower extent of adaptation and were more constrained in their use of adaptation strategies than their male counterparts. Fisheries extension services should be strengthened to build the capacity of female fishers to access different adaptation strategies.

Keywords: Adaptation strategies; artisanal fishing; climate change; gender analysis; Lekki Lagoon

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Introduction

Climate change, food security, sustainable development, and gender equality are issues of great concern to all nations (Agarwal, 2018). These issues are foremost on the development agenda of developed and developing nations like Nigeria. The relevance of these issues has received the global attention of almost all nations, as these and other developmental issues are explicitly stated in the Sustainable Development Goals (SDGs), following the shortcomings of the Millennium Development Goals (MDGs) to develop our nations sustainably. Dealing with climate change has been identified as one of the most serious challenges of the twenty-first century (Ozor *et al*., 2012).

In 2020, agriculture contributed about 24.14 percent of Nigeria's Gross Domestic Product (GDP) (O'Neil, 2021). Agriculture is crucial to economic growth, poverty reduction, supply of food, and employment

creation (Bello, 2020). Agriculture also serves as a means of foreign exchange earnings and supplies raw materials to agro-allied industries. Fisheries is one of the recognized subsectors of agriculture that contributed significantly to the nation's GDP (FAO, 2000). The fisheries subsector grew 3.24% in Q1 2021 from -3.60% in Q4 2020 and 1.49% in Q1 2020 (NBS, 2021). This implies an increase in fish production due to several conscious efforts of the successive Nigerian governments to ensure that the gaps between the demand and supply of fish and the protein needs of Nigerians are bridged.

Among those efforts is the National Fadama Development Programme implemented in phases across the states of the nation (Bature *et al*., 2013; Umar *et al*., 2012), the West African Agricultural Productivity Programme (WAAPP), and the River Basin and Rural Development Authorities – 1976 (Iwuchukwu & Igbokwe, 2012; Vincent-Akpu, 2013). Despite not being tailored specifically to the fishing industry, these projects had elements that aimed to improve the lives of rural fishermen by boosting output, income, and the efficiency of value chains in the fishing industry. The Nigerian government's Agriculture Promotion Policy is geared toward enterprise development and includes the fishery and livestock sub-sectors with input supply, production, storage, processing/utilization, marketing, and consumption (Abasilim *et al*., 2020). The sustainable development of artisanal fisheries is also consistent with these policy objectives.

Despite these efforts, Nigeria has yet to bridge the gap between the fish demand and supply (Olaoye & Ojebiyi, 2018). Reasons for this include the increasing human population and artisanal fishery being Nigeria's major means of domestic fish production. The artisanal fishery is characterized by the use of crude fishing gears and equipment, low adoption of improved fisheries technologies, lack of credit for expansion, and inadequate infrastructural facilities for storage and processing, among others (Odebiyi *et al*., 2013; Bolarinwa, 2014; Abasilim *et al*., 2020). It covers the activities of small-scale canoe fisheries engaged in the coastal, inshore, creek, lagoon, and inland river systems (Abasilim *et al.,* 2020). Changing climatic conditions have also been reported to negatively affect fishery and other subsectors of agriculture because agriculture is a very climate-sensitive sector (Issa *et al*., 2015). Salau *et al.* (2012) regarded agriculture as a victim of climate change.

The effect of climate change can be directly or indirectly felt on water bodies, the fishing communities, and the people whose livelihood depends on fishing and related activities. Climate change is visible in Lekki Lagoon through rising temperatures, sea level rise, and shifting rainfall patterns, resulting in poor fish growth, floods, and shifting species diversity, abundance, and distribution. Increasing temperature, for example, impacts aquatic organisms' reproductive success and may result in the extinction of some fish species and biodiversity loss (Eti-Ukwu *et al*., 2020). Changes in the price of catch values, fishing costs, fisher's income, and profits have all been impacted by climate change. Fishers may lose their principal source of income in some circumstances.

Lekki Lagoon is a major source of food and income for the locals who live nearby. Omitoyin & Fregene (2012) categorize fish and the value chains surrounding it as family businesses. Although men make up the bulk of fishermen, women control fish catch's sales, processing, and marketing. Fathers are usually assisted by their sons, whereas mothers are usually helped by girls who pick up the skill through observation, involvement, and imitation. Additionally, men work on

boats, repair equipment, and other projects. According to Olaoye *et al.* (2012), the female gender is constrained to the less competitive form utility component, which impacts access and control over fishery resources. Alhaji *et al.* (2015) discovered gender imbalance in the fishing industry. They claimed that while some women fish, a substantial number engage in fish processing and marketing. Almost all men in fishing communities fished part-time or full-time (Alhaji *et al*., 2015; Omitoyin & Fregene, 2012; Olaoye, 2010). Even though most fishing households still use their catch to feed their immediate family, it has largely evolved into a business (Ikenweinwe *et al*., 2011; Mafimisebi *et al.,* 2016).

Climate change also alters the demographic distribution of the fisher folks, especially concerning gender, age and level of education, as some women, youths and educated persons are now engaged in artisanal fishing and other associated operations, unlike in the past two–three decades when artisanal fishing was the exclusive domain of aged men with a low level of educational attainment. Furthermore, climate change negatively impacts human and livestock nutrition and food security, especially from a gender perspective. Furthermore, climate change affects people differentially depending on their age, position, economic level, occupation, and gender (Amobi & Onyishi, 2015).

Following attempts to expand fisheries, including methods of disaster and climate change mitigation, have focused on men because artisanal fishing was believed to be the primary activity of men. Due to the possibility that women who were not involved in creating these policies and programmes may not be able to adapt to climatic shocks as well as males, those strategies might not be appropriate in today's environment. Compared to men, women have a lower potential for adaptation, claims Haider (2019). They are, therefore, more vulnerable to the negative consequences of climate change (FAO, 2016). The Nigerian Environmental Study/Action Team (NEST), claims that women are more susceptible since they depend on natural resources more (NEST, 2011). Similarly, studies (Tawari & Davies, 2009; Shaffril *et al*., 2015; Abu Samah *et al*., 2019) have deduced that applying climate change adaptation strategies could be influenced by demographic variables, including age groups, social class, income, experience and educational attainment.

Due to the dynamic nature of society, fishers and other fisheries resources users need to be knowledgeable about different adaptation strategies such as access to climate information, relocating to other communities either temporarily or permanently, and livelihood diversification (Badjeck *et al*., 2010; Asayehegn, 2012; Oduniyi & Tekana, 2019). Such strategies are expected to meet the specific needs of each group of people within the community. Due to differences in rights, wealth, and decision-making, Bernier *et al*. (2013) observed that men and women had distinct capacities to adjust to climate shocks and longer-term climate change.

Earlier submissions (Ayinde *et al*., 2011; Amusa *et al*., 2015) on the impact of climate had, however, concentrated on other subsectors of agriculture, such as livestock and crop production. Others that researched on the effects of climate change on fisheries were also limited to how climate change affected fish production, leaving out the adaptation strategies employed by the fishers (Aphunu & Nwabeze, 2012; Ipinjolu *et al*., 2014; Ikehi & Zimoghen, 2015). Gender concerns about the impact and adaptation to climate change were also not treated by most of the previous studies (Aphunu & Nwabeze, 2012; Ikehi & Zimoghen, 2015; Amusa *et al*., 2015).

This study provided gender analysis data on fishers' adaptation strategies to climate change. The outcome of this research also provided empirical data on fishing practices, the extent of use of adaptation strategies, and the constraints faced by male and female fishers around Lekki Lagoon in the face of climate change. Finally, the study documented the association between the adaptation strategies employed by the fishers in relation to gender at a 0.05 level of significance.

Materials and Methods

The study was conducted in nine fishing communities around Lekki Lagoon, southwest Nigeria (Figure 1). With a surface area of around 247 km^2, Lekki Lagoon is a freshwater ecosystem that receives water from the River Oni in the northeast and the Rivers Oshun and Saga in the northwest (Emmanuel, 2010). According to Opadokun *et al*., (2015), it enters the Lagos Lagoon and Lagos Harbour. In Epe and Ibeju-Lekki local government areas of Lagos State and Ogun Waterside local government regions of Ogun State, Lekki Lagoon is the most significant source of readily accessible animal protein in the form of fish (Emmanuel, 2009). Fishing is the primary occupation for the residents of the lagoon's neighbouring towns.

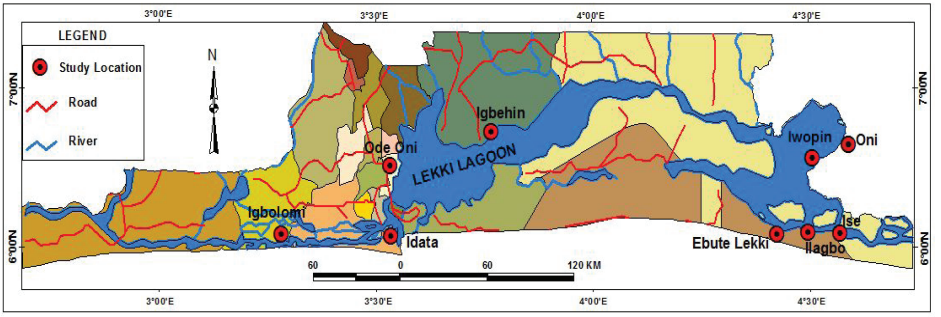

Fig. 1: Map of Lekki Lagoon showing the selected fishing communities

The study adopted the use of a multistage sampling procedure. Stage 1 involved the purposive sampling of Lekki Lagoon in southwest Nigeria. The lagoon was selected based on its transitional nature, linking Ogun, Lagos and Ondo States. Stage 2 entails the purposive selection of nine fishing communities around Lekki Lagoon based on the guidance of agricultural extension officers, high intensity of artisanal fishing activities, and access to fishing communities. Stage three involved the convenient sampling of artisanal fishers who were available and ready to participate in the survey. This was achieved by visiting the landing sites to administer the interview guide at a previously scheduled meeting with some key informants who invited other fishers. A total of 112 fishers provided useful responses, which were used in data analysis. The summary of the sample size by fishing communities is detailed in Table 1. Data on the fishing characteristics, adaptation strategies, and constraints to using adaptation strategies were collected from the fishers with an interview guide. Collected data were analyzed with mean, standard deviation, and Chi-square analytical technique.

The extent of use of adaptation strategies was measured with a 10-item scale

on 5-point responses: Very Great Extent, Great Extent, Little Extent, Very Little Extent, and Not at all, with scores of 4, 3, 2, 1, and 0, respectively. Items with the mean scores of ≥2.00 were considered to be commonly used by the fisher folks, and otherwise, if the mean scores were <2.00. Constraint militating against the use of adaptation strategies was measured by using a 10-item scale on 4-point response options of Very Great Extent, Great Extent, Little Extent and Very Little Extent, with assigned scores of 4, 3, 2 and 1, respectively, as used in the study of Isife & Ekeremor (2015). The cut-off mean of ≥2.5 was used to ascertain factors militating against the adaptation measures.

TABLE 1
Sampling frames and sample sizes of fishers

Selected fishing communities	Sample size (based on respondents' availability and consent)
Ise	14
Ilagbo	12
Ebute Lekki	14
Idata	9
Igbolomi	10
Iwopin	15
Oni	13
Ode Omi	12
Igbehin	13
Total	**112**

Results and Discussion

Fishing practices of the artisanal fishers

Results on the fishing practices (mode of fishing, goals of fishing, fishing frequency per week, duration of fishing per day, and sources of financing fishing enterprise) are presented in Table 2.

TABLE 2
Fishing characteristics of male and female artisanal fishers in Lekki Lagoon

Fishing characteristics	Male (*n* = 77)		Female (*n* = 35)	
	Frequency	%	Frequency	%
Mode of fishing				
Full time	44	57.1	19	54.3
Part-time	23	29.9	14	40.0
Occasionally	10	13.0	2	5.7
Goal of fishing				
Business only	15	19.5	10	28.6
Business and	52	67.5	21	60.0
Consumption	10	13.0	4	11.4
Business, consumption and hobby				
Fishing days per week	28	36.4	13	37.1
1–3 (Occasionally)	41	53.2	21	60.0
4–6 (Often)	8	10.4	1	2.9
7 (Daily)				
mean±SD	4.21±1.65 days		4.31±1.43 days	
Number of fishing hours per day	27	35.1	23	65.7
2–5	43	55.8	11	31.4
6–9	7	9.1	1	2.9
>9				
Mean ±SD	7.62±2.23 hours		4.97±1.85 hours	
Sources of finance				
Loan from friends/	22	28.6	5	14.3
relatives only	13	16.9	7	20.0
Loan from	4	5.2	4	11.4
cooperative societies	33	42.9	15	42.9
only	5	6.5	3	8.6
Loan from banks				
only	0	0.0	1	2.9
Personal savings only				
Loans from banks and cooperative societies				
Personal savings and loans from banks and friends/relatives				

Findings revealed that 57.1% and 54.3% of male and female fishers were into fishing full-time. This implies that more fishers, irrespective of gender, were into fishing full-time. Fishing was considered a primary means of survival by the dwellers of communities around Lekki Lagoon. This study contradicts the findings of Olaoye (2010), who reported that there were more part-time fishers than full-time fishers in Lagos and Ogun States and that fishing was not the major source of livelihood of the people in

the two States. However, Omitoyin & Fregene (2012) reported that fishing was the permanent occupation of most artisanal fishers in Lagos State.

Regarding fishing goals, Table 2 reveals that 67.5% of males and 60.0% of females were into fishing for business and consumption purposes. In comparison, 19.5% of males and 28.6% of females only ventured into fishing for commercial purposes. This implies that fishing serves two primary goals: earning income and as food to the primary producers of fish (artisanal fishers), irrespective of gender differences. This agrees with the findings of Ikenweinwe *et al.* (2011), who reported that most fishers were into fishing for commercial purposes to make a profit. Mafimisebi *et al.* (2016) also found that fishing was for both sales and consumption. However, Olaoye *et al.* (2012) observed that fishing was a family business that served the family's consumption purpose.

Results in Table 2 reveal that 53.2% of the male and 60.0% of the female fishers go fishing for 4–6 days per week with mean fishing frequency of 4.21±1.65 days and 4.31±1.43 days per week, respectively. This implies that there was no marked difference in the number of days spent on fishing by fishers per week, irrespective of gender. On average, 55.8% of the male fishers spent 6–9 hours per fishing trip and about two-thirds (65.7%) of the female fishers spent 2–5 hours per fishing trip. The mean fishing hours indicated that the male fishers spent more time per fishing trip ($\bar{x}$ = 7.62±2.23 hours) than their female counterparts ($\bar{x}$ = 4.97±1.85 hours). The difference in time spent fishing could mean that men's intensity of sourcing for fish per trip was higher than that of the women. This could result from women's involvement in other productive and reproductive activities and household chores, which require more women's time.

Again, the study reveals that personal savings were the fishers' only source of business finance to the highest proportions (male = 42.9%, and female = 42.9%). Also, 28.6% of male and 14.3% of female fishers sourced finance from friends/relatives, while cooperative societies were the only source of finance for 16.9% of male and 20.0% of female fishers. It could be inferred from the study that male and female fishers highly relied on informal sources of finance rather than formal sources through bank loans. This assertion corroborates the findings of earlier researchers (Olaoye, 2010; Ikenweinwe *et al*., 2011; Olaoye *et al*., 2012) that informal sources such as personal savings and loans from friends and family were the major sources of finance to artisanal fisher folks.

Adaptation strategies employed by fishers in the face of climate change

Adequate and appropriate use of suitable adaptation strategies is essential in ensuring the sustainability of any business. Results on the adaptation strategies employed by male and female fishers in the face of climate change are presented in Table 3. It reveals that more male fishers adopted changing from fishing to crop farming ($\bar{x}$ = 3.36±0.92), and non-agricultural activities ($\bar{x}$ = 3.34±0.93); fishing along the shore ($\bar{x}$ = 3.04±1.01), temporary relocation ($\bar{x}$ = 2.51±1.06), and performing ancestral ceremony/spiritual invocations ($\bar{x}$ = 2.14±1.27), than the female fishers with mean adaptation scores of 3.17±1.31, 3.10±1.18, 2.69±1.23, 2.48±1.15 and 1.86±1.19, respectively. The mean adaptation scores also indicate that using weather forecast information was an adaptation strategy reported by females but not commonly used by male fishers. Access to climate information can serve as an early warning system that has the potential to minimize capture fishers' vulnerability to climate change

(Badjeck *et al*., 2010). Many studies also established a strong and positive effect between climate information and adaptation strategies (Asayehegn, 2012; Oduniyi & Tekana, 2019).

These findings further indicated that changing from fishing to farming, and non-agricultural activities, fishing along the shore, and temporary relocation were the commonly used adaptation measures among male and female fishers. The grand mean values indicated that the male fishers' extent of use of adaptation strategies ($\bar{x}$ = 2.30±1.02) was higher than their female counterparts ($\bar{x}$ = 2.22±1.15). The study deduced that male and female fishers were trying to reduce the impact of climate change on their fishing activities and livelihood diversification. However, male fishers had a higher level of adaptation than their female counterparts.

TABLE 3
Mean scores of male and female fishers' adaptation strategies

Adaptation strategies	Mean±SD	
	Male	Female
Changing from fishing to farming	3.36±0.92*	3.17±1.31*
Changing from fishing to non-agricultural activities	3.34±0.93*	3.10±1.18*
Fishing along the shore	3.04±1.01*	2.69±1.23*
Temporarily relocating to a new or different fishing community	2.51±1.06*	2.48±1.15*
Permanent migration to another fishing community	1.80±1.22	1.90±1.26
Performing ancestral ceremony/spiritual invocation	2.14±1.27*	1.86±1.19
Use of weather forecast information	1.96±1.22	2.10±1.11*
Changing from capture to aquaculture fisheries	1.43±1.15	1.34±1.01
Use of agricultural insurance schemes	1.11±1.25	1.38±1.27
Grand mean	**2.30±1.02**	**2.22±1.15**

SD means standard deviation; * means that the mean values were greater than 2.00 and implies that the adaptation was highly used

It was therefore posited that female fishers were likely to be more vulnerable to climate change impact than their male counterparts because women have lower adaptive capacities than men. Haider (2019) also posited that women have lower adaptive capacity than men and that this position is in line with FAO (2016), who opined that women are more vulnerable to the impacts of climate change than men due to asymmetries in social structure.

Constraints to fishers' use of adaptation strategies

Some factors constrain the use of adaptation strategies and vary by gender. The mean scores of the severity of constraints presented in Table 4 reveal that low fish catch ($\bar{x}$ = 3.29±1.01), lack of information from weather stations ($\bar{x}$ = 3.33±0.84), and influence of middlemen ($\bar{x}$ = 2.60±1.08) were more severe constraints to male fishers' use of adaptation strategies than the female fishers with mean severity scores of 3.17±0.89, 3.31±0.71, and 2.59±0.91 respectively while poor technological advancement ($\bar{x}$ = 3.21±0.86), poor fishery extension services ($\bar{x}$ = 3.21±0.77), lack of appropriate insurance cover ($\bar{x}$ = 3.14±0.88), and poor transportation ($\bar{x}$ = 2.79±0.94) were more severely constraining the female fishers' use of adaptation strategies than male fishers. This result is in tandem with the findings of Amobi and Onyishi (2015), who stated that climate change will affect income groups, age and gender in varying ways.

Also, low fish catch, poor technological advancement, lack of information from weather stations, poor fishery extension services, and lack of appropriate insurance cover were common constraints facing male and female fishers in their adaptation strategies. At the same time, insufficient support from the government was an additional constraint common to the female fishers. The grand mean

values indicated that female fishers were more severely constrained ($\bar{x}$ =2.95±0.72) than their male counterparts ($\bar{x}$ = 2.87±0.76).

Lack of information from weather stations constrained more male than female fishers, probably due to the lower level of educational attainment of the male fishers than the female fishers. As a result, male fishers are less likely to access and utilize information from weather stations as a strategy that could reduce the impact of climate change. Generally, the results indicated that female fishers were slightly more constrained in their attempts to employ different adaptation strategies in the face of climate change than male fishers. A probable reason for this is the gender inequality in relation to fishers' access to productive resources, which places women in a disadvantaged position compared to men.

TABLE 4
Mean score of severity of constraints by male and female fishers

Constraints to the use of adaptation strategies	Male fishers	Female fishers
Low fish catch	3.29±1.01*	3.17±0.89*
Poor technological advancement	3.09±0.83*	3.21±0.86*
Lack of information from weather stations	3.33±0.84*	3.31±0.71*
Poor fishery extension services	3.14±0.94*	3.21±0.77*
Lack of appropriate insurance cover	2.94±0.90*	3.14±0.88*
Insufficient support from the government	2.76±0.89*	3.03±0.98*
Poor transportation	2.60±1.01*	2.79±0.94*
Poor access to the market	2.34±1.02	2.52±0.91*
Inadequate storage measures	2.57±1.00*	2.48±0.91
Influence of middlemen activities	2.60±1.08*	2.59±0.91*
Grand mean	**2.87±0.76***	**2.95±0.72***

SD means standard deviation; * means that the mean values were greater than 2.50 and implies that the fish handlers were severely constrained

Association between gender and adaptation strategies employed by the fishers

The use of a particular strategy is influenced primarily by demographic variables like gender. Results on the association between gender and adaptation strategies employed by fishers are presented in Table 5. Findings revealed a significant association between fishers' use of agricultural insurance schemes as an adaptation strategy and their gender (χ^2 = 10.796, $p \leq$ 0.05). Though using agricultural insurance schemes was not considered a common adaptation strategy, the result indicated that the female fishers are more likely to utilize it than their female counterpart. This could be linked to two important socio-economic variables – age and education which translate positively to exposure to information. This is in line with the position of Tawari & Davies (2009), who concluded that fishers' level of education affected their innovation adoption rates; and Abu Samah *et al*. (2019), who reported that climate change adaptation was significantly affected by the fishing experience, age, and income of the fishers.

TABLE 5
Association between gender of fishers and employed adaptation strategies

Adaptation strategies	χ^2	df	p-value
Changing from fishing to farming	7.346	4	0.119
Changing from fishing to non-agricultural activities	4.257	4	0.235
Fishing along the shore	4.493	4	0.343
Temporarily relocating to a new or different fishing community	2.335	4	0.674
Permanent migration to another fishing community	0.869	4	0.929
Performing ancestral ceremony/spiritual invocation	3.875	4	0.423
Use of weather forecast information	1.029	4	0.905
Changing from capture to aquaculture fisheries	1.863	4	0.761
Use of agricultural insurance schemes	10.796	4	0.029*

χ^2 means Chi-square value, df = degree of freedom, * means significant association exists

Conclusion and Recommendation

The study concluded that the use of adaptation strategies such as agricultural insurance was influenced by gender, as female fishers were more constrained than the male fishers in their adaptation strategies. Based on the findings from this study, the study recommends that policies, programmes and other intervention efforts on artisanal fisheries development should be gender-sensitive. Fisheries extension services should be strengthened to build the capacity of female fishers to access different adaptation strategies.

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