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CLIMATE CHANGE IMPACT, ITS ADAPTATION MEASURES ON FISHERMEN LIVELIHOOD STATUS IN COASTAL AREA OF SOUTHWEST NIGERIA

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Abstract
Climate change effect and adaptation measure on the livelihood deeds of artisanal Fishermen was carried out within the coastal areas of Southwest Nigeria. Multi-stage sampling technique was used to select 263 fishermen from Lagos, Ogun and Ondo States. Information obtained was with the use of structured interviewed schedule and subjected to descriptive and inferential statistics at 0.05 level of significance. Findings shows that majority (65.4%) of the Fishermen were between 45-64 years of age, 77.9% married, 67.7% had above 11 years of fishing experience across the Coastal area of Southwest, Nigeria. Also, 22.4% of Fishermen in the coastal area have access to extension services while 22.4% of them only had access to extension services. Major livelihood activities were fishing gathering (95.1%), fish processing (91.6%) and fish marketing (81.7%) in the selected area. the main effect of climate change on the fishermen activities were flooding ($\bar{x}$= 2.43), while increased waves were ($\bar{x}$ = 2.24), ocean surge ($\bar{x}$ =2.23), rainfall intensity ($\bar{x}$ = 2.07) and high temperature ($\bar{x}$ = 2.06) respectively across the selected states respectively. Majority of the artisanal Fisherfolk utilized different adaptation measures/practices towards climate change. There were significant relationship ($p < 0.05$) between the respondent sex (χ^2 = 19.342, df = 1), educational level (χ^2 = 11.242, df = 4), ethnicity (χ^2 = 10.523) and climate change effect on livelihood deeds of artisanal Fishermen across selected states. Correlation result also reveals significant relationship ($p < 0.05$) between age (r = 0.872), household size (r = 0.653), years of fishing experience (r = 0.815) and the climate change effect on livelihood activities of artisanal Fishermen across selected States, Results also showed that there is significant difference in the effect of climate change on livelihood of artisanal Fishermen (F = 16.325; P = 0.001) across the selected states. The study realized that Artisanal Fishermen sampled experienced high effect of climate change in term of flooding, increased waves, ocean surges, rainfall intensity and high temperature across the selected States sampled. The study recommended that Artisanal Fishermen should be participating in policy and strategy formulation in mitigate climate change impacts on their fishing and livelihood activities so as to reduce the vulnerability of the effects caused by climate change in the coastal areas.

Keywords: Artisanal, Climate change, Coastal communities, Fishermen, Livelihood activities, Southwest.

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1.0 Introduction

Small-scale fishing farming populations in developing countries are most times relegated at the bottom of the socio-economic hierarchy. This occurs in many countries where the overall pointers of human development are relatively good (Jentoft and Midré, 2011). Presently, with inadequate sector-disaggregated data to calculate the precise share of fishery-dependent people within the above total populations in poverty in many setting of developed country. Nevertheless, more than 90% of people employed in the sector are engaged in small-scale fisheries activities, including processing and marketing, and this is where poverty is most prevalent (Béné, *et al*,, 2007). There has been improvement through the combination of state support, public welfare programmes, engagement of civil society organizations, and collective action by the fishing population themselves (FAO, 2016a). Also, the acknowledgement of the significance of small-scale fisheries in food security and poverty reduction has led to the development and authorization of the SSF Guidelines (FAO, 2015). The livelihood position of many coastal peoples in the emerging world especially in Nigeria can be labelled as friable and call

for concern from different tiers of Government. Fishing as an occupation frequently provides those in deficiency with an additional source of revenue for their household. As documented in the SSF Guidelines, small-scale fisheries are classically relatively a relaxed sector, which provides workers with the elasticity needed to make harvesting a food security safety regulator (FAO, 2017a). For it to serve as a purpose, in the context of climate change adaptation, elasticity must not be challenged as an imperative adaptive device (Cinner *et al.,* 2018). Adaptive ability is knowns to consolidation resilience, limiting vulnerability and attaining strength i.e. the capacity of the system to endure opposing conditions (IPCC, 2014a; Miller *et al.*, 2010). More precisely, climate resilience denotes the ability of social, ecological, technical, or infrastructural schemes to discourse problems while upholding the same purpose, structure and overall identity; and to respond to opportunities (IPCC, 2007).

Livelihood Framework (SLF) which has been extensively used as an investigative tool (Carney, 2003; Su *et al.,* 2019; Conroy and Litvino, 2013). A livelihood status of the fishermen includes not only activities that produce income but many other varieties of choices for analysis, including both cultural and social choices, that come together to form primary occupation of a household. Climate change intensifies non-climatic burden on fisheries such as over-exploitation, habitat degradation, fragmentation and loss (Brander 2010). As noted by McIlgorm *et. al.,* (2010) and Auerbach, *et. al.,* (2014) that synergistic effects of climatic factors, overfishing, water pollution and alien invasive species restraint inland fisheries with resultant effects on fisheries-dependent livelihoods. Fishing activities support the livelihoods of half a billion people worldwide through safeguarding food security, stable employment and earning foreign currency for nations (Allison 2011; FAO 2012). It is imperious to recognize the climate change impacts on fisheries and fisheries-dependent livelihood status. As noted by Allison *et al.,* (2009) and FAO (2016) that numerous studies have paid attention on susceptibility of fisheries on a national scale. Some studies have focused on fisheries vulnerability on the coastal regions (see Kebe *et. al.,* 2009; Cinner, *et. al*. 2012; Islam *et. al.,* 2014; Adelekan and Fregene, 2015) and riverine systems (Das *et. al.* 2013). Though, there is an organized neglect of assessment of the fishermen livelihood status on the climate change impact and its variation in the coastal area of Southwest Nigeria. Climate changes have adverse consequences on aquatic creatures, people who hinged on fish for food, and the proceeds of the universal economy. For illustration, as revealed by Belhabib *et al.,* (2016) that the worldwide fisheries incomes are likely to drop by 35% which is more than the predictable decrease in catches by 2050s under CO2 emissions. Millions of people residence in coastal communities around the world now exist the margins, and are often competing with converging pressures that place them in a vulnerable position to make a decent living Bennett, *et al.,* (2015). The process of providing right and inclusive knowledge on climate change is the need of time and this can be accomplished through a bottom-up approach including the primary stakeholders along with the community which will eventually position them to adequate climate change adaptation and mitigation by enhancing their traditional knowledge (Shyam *et al,* 2014). A livelihood is said to be sustainable when is able to cope with and recover from stresses and shocks; and uphold or improve its capabilities and assets both now and in the future, but not undermining the natural resource base; which is refers to as the ability of a system to maintain productivity when subject to disturbing forces, whether a 'stress' (a small, regular, predictable disturbance with a cumulative effect) or a 'shock' (a large infrequent, unpredictable disturbance with immediate impact). This suggests avoiding depleting stocks of natural resources to a level which results in an effectively permanent decline in the rate at which the natural resource base yields useful products or services for livelihoods of people. Coping with climatic inconsistency is definitely not new to many Nigerian farmers most especially the fishermen in coastal area of Southwest Nigeria, Bashaasha *et al.,* (2010) noted that the problem is that present coping devices may not match with the level of predominant challenges that are likely to be encounter in the future. Weather changes and inconsistency has had adverse influences on environment, food security, economic activity, human health, natural resources and physical infrastructures of the fishermen in the major coastal area of Southwest Nigeria. Although many sectors of the district like social, economic and political also faced climate change impact at varying degrees, the worst hit sector is the rain fed agriculture due to its high compassion to climate stimuli. The analysis of the study will be guided by the following research objectives:

1. describe the socio-economic characteristics of fishermen in the study area.
2. determine the livelihood status of the fishermen in the study area.
3. determine the climate change impact on the fishermen activities in the study area.
4. identify the adaptation practices being used by fishermen towards climate change in the study area.

1.1 Hypotheses of the study

Ho_1: There is no significant relationship between the socio-economic characteristics of the fishermen and the adaptation practices being used by fishermen towards climate change impact in the study area.

Ho_2: There is no significant association between livelihood status of the fishermen selected and the adaptation measures/practices being used by fishermen towards climate change in the study area.

2.0 METHODOLOGY

The southwest lies in the humid tropical zone surrounded by a mangrove swamp forest in the South. Major parts of the study area lie in the fresh water swamp forest and rain forest to the South, which turns to moist and dry woodland savannah towards the North. It has a land expanse of about 114,271square kilometers (about12% of total land mass of Nigeria, lying between latitude 4^0,21^1 and 9^0,23^1 North of the equator and longitude 2^0,25^1 and 6^0,31^1 East. The three (3) main agro-ecological regions in the area are the swamp on the Atlantic coast, tropical rainforest in the middle and guinea savannah in the North. The part experiences both the dry and wet seasons, the rainy season start from March and continues till October while the dry season commences in November and lasts till February. This study was carried out in Southwest Nigeria, which covers Lagos, Ekiti, Ogun, Ondo, Osun and Oyo States mainly dominated by the Yoruba ethnic group. This group is the largest ethnic group in the West African coast and one of the largest and longest established ethnic groups on the African region. The study is viewed from the geo-political zones. The study was carried out in coastal Southwest of Nigeria which encompasses of Lagos Ogun and Ondo States respectively. Southwest coastal area has a marine shoreline of about 330 km and rich water resource for fishing and other aquatic activities. Farming forms the base of the overall development thrusts of the zone, with crop farming as the main occupation beside with livestock farming for the people in the area.

2.1 Population of the study: The population of the study comprises of fishermen in the coastal area of Southwest Nigeria.

2.2 Sampling procedure and sample size: A multi-stage sampling method was used in the selection of respondent in the study areas. The stages include: Out of the six (6) States, based on geo-political classifications, three (3) states were selected. In the first stage, purposive sampling techniques was used in choosing all the three (3) coastal states and one (1) Local Government Areas (LGAs) namely; Epe, Ogun waterside and Ilaje LGAs in Lagos, Ogun and Ondo State respectively and this was based on the fact that these LGAs were the prominent ones where intensive fishing activities occurred mostly and well known. The second stage involved selection of fishing communities, 10% of the fishing community was selected in Epe LGA due to larger number villages in the area while 15% of the fishing communities were selected in Ogun and Ondo states respectively due to the small number of communities, which gave nine (9) fishing communities from Epe, four (4) in Ogun waterside and two (2) in Ilaje LGAs. A total of fifteen (15) fishing communities were selected for the study. The third stage involved (10%) of the total fisher folks in each of the total 15 fishing communities selected for the study. Therefore, a total of 263 fisher folks were selected for the study as shown in Table 1.

Table 1: Sampling Procedure and Sample Size for artisanal fishermen

States	Fishing LGAs	Fishing villages	10% of fishing villages	Selecting villages	Registered fisher folks	10% of registered fisher folks
Lagos State	Epe	90	9	Epe, Eyin Osa, Ehin Osa, Odo Egiri, Odo Ayandolu, Ole Odo, Odo Gbawojo, Odomola, Odo Ajogun	954	95
			15%			
Ogun State	Ogun Water-side	23	4	Ilete Olosumeta, Igbeki and Igbosere	840	84
Ondo State	Ilaje	13	2	Araromi and Enu Amo	835	84
Total					**2154**	**263**

Source: Fishermen co-operative society

2.3 Method of Data Collection Analysis: Data for this study were collected through the use of structured interview scheduled that was administered to the respondents by the research and the trained enumerators. Data obtained was analyzed using both descriptive statistics such as frequency counts, mean, percentage, standard deviation and inferential statistics (chi-square and PPMC).

3.0 RESULTS AND DISCUSSION

3.1 Socio-economic characteristics of the Artisanal Fishermen.

Results in Table 2 revealed that majority (63.1%, 71.4% and 61.9%) of the respondents in Lagos, Ogun and Ondo State were between the age range of 45 – 64 years respectively. This implies that majority of them were in

their prudently active age bracket and therefore create a good labour force that can cope with the severities of fishing operations and this in contract to Olusegun and Mathew (2016) submission that this age bracket composed of the inventive, motivated and adoptable individuals in the coastal area. Majority (78.9%, 71.4% and 83.3%) of them were males. This suggest that males were more involved in the act of fishing in coastal area than female because of the strenuous nature of the occupation but female majorly involved in marketing, processing and sorting activities in the coastal area as their own contribution to the livelihood activities. Also, majority (73.7%, 71.4% and 66.7%)of the respondents across the study area were married and had one form of education or the others (i.e from primary to tertiary education) and thus implies that they are able to read and write so easy for extension agents to communicate and broadcast message about their fishing activities to them without complained. The result in Table 2 also revealed that majority (73.7%, 65.5% and 59.5%) of the artisanal fishermen were of Yoruba ethnic group. This is primarily due to the detail that the Ijebu ethnic outweigh Epe and Ogun waterside LGAs areas while Ilajes people are main ethnic group in the coastal areas of Ondo State while other ethnic group were minimal in the study location. Finding in Table 4 shows that majority (73.7%, 71.4% and 88.1%) of the respondent across the three selected States (i.e. Lagos, Ogun and Ondo State) indicates that they did not have access to extension services while little (26.3%, 28.6% and 11.9%) of them indicated they had access to extension services in the selected state respectively. This indicates that majority of the artisanal fishermen sampled in the selected States did not have access to extension services for additional information that could aid their productivity and livelihood activities. This discovery was in line with the submission of Oose *et al.* (2015) who stated that there is lack and deprived extension services to artisanal fishermen in coastal communities in Southwest, Nigeria.

Table 2: Distribution based on respondents on socio-economic characteristics.

Variables	Lagos State (n = 95)	Ogun State (n = 84)	Ondo State (n = 84)	Southwest (n = 263)
Age (years)				
Less than 35	15(15.8)	10(11.9)	14(16.7)	39(14.8)
35 – 44	20(21.1)	14(16.7)	18(21.4)	52(19.8)
45 – 54	35(36.8)	36(42.9)	40(47.6)	111(42.2)
55 – 64	25(26.3)	24(28.5)	12(14.3)	61(23.2)
Sex				
Male	75(78.9)	60(71.4)	70(83.3)	205(77.9)
Female	20(21.1)	24(28.6)	14(16.7)	58(22.1)
Marital status				
Single	10(10.5)	8(9.5)	16(19.0)	34(12.9)
Married	70(73.7)	60(71.4)	56(66.7)	186(71.9)
Widow	10(10.5)	6(7.1)	4(4.8)	20(7.6)
Separated	5(5.3)	10(11.9)	8(9.5)	23(8.7)
Marriage type				
Monogamy	80(84.2)	74(88.1)	60(71.4)	214(81.4)
Polygamy	15(15.8)	10(11.9)	24(28.6)	49(18.6)
Ethnicity				
Yoruba	70(73.7)	55(65.5)	20(23.8)	145(55.1)
Ilaje	15(15.8)	15(17.9)	50(59.5)	80(30.4)
Others	10(10.5)	14(16.7)	14(16.7)	38(14.5)
Educational level				
No formal education	15(15.8)	5(5.9)	0(0.0)	20(7.6)
Primary education	20(21.1)	25(29.8)	9(10.7)	54(20.5)
Secondary education	30(31.6)	20(23.8)	40(47.6)	90(34.2)
Tertiary education	20(21.1)	30(35.7)	25(29.8)	75(28.5)
Vocational education	10(10.5)	4(4.8)	10(11.9)	24(9.1)
Household size				
1 – 4	15(15.8)	10(11.9)	14(16.7)	39(14.8)
5 – 8	50(52.6)	34(40.5)	40(47.6)	124(47.2)
9 – 12	30(31.6)	40(47.6)	30(35.7)	100(38.0)

Years of fishing experience				
1 – 5	10(10.5)	6(7.1)	6(7.1)	22(8.4)
6 – 10	24(25.3)	19(22.6)	20(23.8)	63(23.9)
11 – 15	35(36.8)	15(17.9)	18(21.4)	68(25.9)
Above 15	26(27.4)	44(52.4)	40(47.6)	110(41,8)
Contact with extension agent				
Yes	25(26.3)	24(28.6)	10(11.9)	59(22.4)
No	70(73.7)	60(71.4)	74(88.1)	204(77.6)

Source: Field Survey (2023)

3.2 Livelihood Activities of Artisanal Fisher folks

Findings in Table 3 showed that majority (95.1%) of the respondents involved in fish gathering (i.e. catching of fish), while majority (91.6%) of them involves in fishing processing, 81.7% engaged in fish marketing and 76.8% of them also in coconut trading. This implies that male fishermen betrothed in fish catching activities since they have the aptitude to withstand the tedious and strenuous nature of canoe paddling to gather enough fishes than female counterpart. The result validated that of Olaoye *et al.* (2012) who perceived that women are more involved in fish processing and marketing than other fishery activities in the coastal area of Southwest, Nigeria. Other notable livelihood activities of the Artisanal Fishermen were net fabricator and mending, petty trading (70.3%), poultry rearing (57.0%) and oil palm processing (51.3%) among the Artisanal Fishefolks sampled for this study.

Table 3: Livelihood activities of Artisanal Fisher folks

Livelihood activities*	Frequency	Percentage (%)
Fishing gathering	250	95.1
Fish marketing	215	81.7
Fish processing	241	91.6
Crop farming	120	45.6
Oil palm processing	135	51.3
Coconut trading	202	76.8
Boat making	58	22.1
Net fabricator and mending	200	76.0
Poultry rearing	150	57.0
Cassava processing	128	48.7
Petty trading	185	70.3
Fuelwood procurement	105	39.9
Fishing equipment selling	60	23.6
Artisan	75	28.5
Outboard engine repairer	35	13.3

***Multiple responses exist.** Source: Field Survey, (2023).

3.3 Climate change impact on the fishermen activities

Result in Table 4 indicate that climate change has various socio-economic impacts that are proficient at diverse levels, to individual, households and whole community. The mean value ($\bar{x}$) of effect of climate change on the fishermen activities in the coastal area in the selected states. Findings reveals that flooding was with the mean value of ($\bar{x}$ =2.43), while increased waves were ($\bar{x}$ = 2.24), ocean surge ($\bar{x}$ =2.23), rainfall intensity ($\bar{x}$ = 2.07) and high temperature ($\bar{x}$ = 2.06) respectively across the selected states. The flooding occurrences with sea lapses and heavy rainfall that could lead to road tracks blizzard, house losses, health hazards and losses of potable water owing to saltwater intrusions into wells, farming area destruction and population displacement. Climate change impact on aquaculture sustainability have gained significant interest owing to the agricultural sector's significant contribution to global food security, nutrition, and livelihoods (Dabbadie, *et al.*, 2018; FAO, 2020). Temperature plays an important role in the growth and development of aquatic animals (Ngoan, 2018). Fish, being poikilothermic, are more sensitive to temperature variations resulting from climate change occurrences (Sae-Lim, *et al.,* 2017). Hence, lengthy temperature stress may affect aquaculture productivity through various ways that is centered on lowered output. The oceans are assessed to store about 50times more CO_2 than the atmosphere (Seggel, *et al.*, 2016). Increased levels of rainfall, mainly if it occurs as heavier events, will increase

the production risks in lowland areas (Bell, *et al.,* 2010). These risks include losing fish from river base, invasion of rivers by unwanted species, death, etc.

Table 4: Effect of climate change on the fishermen activities in the study area.

Effect of climate change	Mean effects	Decision effect
Flooding	2.43	High effect
Increased waves	2.24	High effect
Ocean surges	2.23	High effect
Rainfall intensity	2.07	High effect
Disease outbreak	1.98	Low effect
Wind storms	1.81	Low effect
Erosion	1.75	Low effect
Sea level rises	1.71	Low effect
Increased water salinity	1.70	Low effect
Changes in fish distribution	1.66	Low effect
High temperature	2.06	High effect
Reduction in quantity of fish cropping	1.53	Low effect

Source: Field Survey, (2023).

3.4 Adaptation practices being used by fishermen towards climate change in the study area.

Different adaptive practices have been embraced by Artisanal fishermen in many state selected towards climate change impact. Result in Table 5 express the percentage of respondents that embraced different adaptive measures for climate change adaptation in the selected states. Majority (95.1%) of the respondents agreed to strengthening of support for service providers at the community level through improved transport systems, fish farming equipment's and processing centers; 94.3% agreed that to increase support to stakeholders through empowerment, provision of equipment's and credit assistance; 90.9% adapt by agreed to provision of rain-water collection systems, including public boreholes. Others include the restive and aggrieved communities should engage issues constructively to attract development rather than hostility and destruction of facilities (87.5%); participatory community projects' implementation through relevant policies and regulations towards sustainable livelihoods to mitigate climate change impacts (85.6%) and enforcement of laws targeted at reducing anthropogenic pollution of water bodies and activities by all level of government (80.9%) in the selected states. Most of these adaptations are an integral part of coastal zone management and sustainable fisheries management (FAO, 2003, 2015). Adaptations to fill the gap will need to focus largely on making it easier for small-scale fishers to access the region's rich tuna resources, developing fisheries for small pelagic fish, expanding pond aquaculture, and improving supply chains to avoid waste (Bell *et al.,* 2015, 2018; Johnson *et al.*, 2017).

Table 5: Adaptation measures/practices being used by fishermen towards climate change in the study area.

Adaptation measures/practices	Frequency	Percentages (%)
Establish community and stakeholders on the impacts of climate change	154	58.6
Strengthen government institutions in mitigating the effects of changing climate	165	62.7
Enforcement of laws targeted at reducing anthropogenic pollution of water bodies and activities by all level of government.	213	80.9
Adequate training on modern fishing techniques (including Mari culture) and provision of incentives to fish farmers.	120	45.6
Access roads network should be provided and maintained by riverine communities	200	76.1
Provision of rain-water collection systems should be provided including public boreholes.	239	90.9
Increase support to stakeholders through empowerment, provision of equipment's and credit assistance.	248	94.3
Strengthening of support for service providers at the community level through improved transport systems, fish farming equipment's and processing centers.	250	95.1
Participatory community projects' implementation through relevant policies and regulations towards sustainable livelihoods to mitigate climate change impacts.	225	85.6
Proper regulation and monitoring of industrial activities should be of international acceptable standards.	185	70.3
The restive and aggrieved communities should engage issues constructively to attract development rather than hostility and destruction of facilities.	230	87.5

Source: Field Survey, (2023).

3.5 Hypotheses of the study

Ho1: There is no significant relationship between the socio-economic characteristics of the respondents and the climate change impact on the livelihood activities of the Artisanal Fishermen across the selected States.

Relationship Between Selected Socio-economic Characteristics of Fishermen and Climate Change Impact on Livelihood Activities of Artisanal Fishermen Across all Selected States. Result of Chi-square analysis in Table 6 shows that there is significant relationship ($p < 0.05$) between the respondent sex ($\chi^2 = 19.342$, df = 1), educational level ($\chi^2 = 11.242$, df = 4), ethnicity ($\chi^2 = 10.523$) and the climate change impact on livelihood activities of artisanal Fishermen across sampled states. However, the Table 6 results revealed that no significant relationship ($p > 0.05$) existed between marital status, religion, marriage type, contact with extension agent and climate change impact on livelihood of artisanal Fishermen across the sampled States. While correlation result in Table 7 reveals that there is significant relationship ($p < 0.05$) between age ($r = 0.872$), household size ($r = 0.653$), years of fishing experience ($r = 0.815$) and the climate change impact on livelihood activities of artisanal Fishermen across sampled States, but no significant relationship between the monthly income ($r = 0.231$) and the climate change impact on livelihood activities of artisanal Fishermen across sampled States.

Table 6: Chi-square result on relationship between the socio-economic characteristics of the respondents and the climate change impact on the livelihood activities of the Artisanal Fishermen across the selected States

Variables	χ^2 –value	df	p-value	Decision
Sex	19.342	1	0.032	Sig.
Marital status	3.421	3	0.065	Not sig.
Religion	2.319	2	0.124	Not sig.
Educational level	11.242	4	0.001	Sig.
Marriage type	3.741	1	0.234	Not sig.
Ethnicity	10.523	2	0.042	Sig.
Contact with extension agent	1.638	1	0.071	Not sig.

Source: Field Survey, (2023).

Table 7: Correlation result on relationship between the socio-economic characteristics of the respondents and the climate change impact on the livelihood activities of the Artisanal Fishermen across the selected States

Variables	r-value	p-value	Decision
Age	0.872	0.043	Sig.
Household size	0.653	0.001	Sig.
Years of fishing experience	0.815	0.032	Sig.
Monthly income	0.231	0.056	Not sig.

Source: Field Survey, (2023).

Ho2: There is no Significant Difference Between Climate Change impact on Livelihood Status of Artisanal Fishermen Across the Selected States sampled.

Results of ANOVA (Table 8) showed that there is significant difference in the climate change impact on livelihood activities of artisanal Fishermen ($F = 18.434$; $p = 0.001$) across the selected States in South West Nigeria at $p < 0.05$ level of significance. Similarly, results of scheffe's post hoc test showed that climate change impact on livelihood status of artisanal Fishermen were significantly different in Lagos State compared to that of Ogun State and Ondo State respectively. However, Ogun and Ondo States share the same homogenous subsections. The results revealed that there is tendency for Lagos State Fishermen to recorded the highest climate change impact followed by Ogun State and then Ondo State. The implication is that climate change impact on livelihood activities of artisanal Fishermen varies slightly across the sampled states but confirms that there is evidence of significant differences.

Table 8: Test of difference between the climate change impact on livelihood of artisanal fishermen across the selected States in South West Nigeria using ANOVA

Effect of climate change on the livelihood activities	Sum of square	df	Mean square	F-value	Sig.	Scheffe' Post Hoc Tests
Between groups	1854.032	2	626.012	16.325	0.001	Lagos 44.45[b]
Within groups	32546.126	260	43.221			Ogun 42.32[a]
Total	34300.158	262				Ondo 40.65[b]

Note: Sig. = Significant at p < 0.05 level of significance, df = degree of freedom; the Means for Ogun and Ondo are in homogenous subset. Source: Field Survey, 2023

4.0 Conclusion and Recommendations

Consequence on the result from this study, artisanal Fishermen were in active and productive age, married and majority were educated for their fishing work using gill nets, siene nets, surrounding nets, cast net for their fishing activities in the selected States. Some of the livelihood activities of the Fishermen are fishing gathering, fishing marketing and processing, with farming, oil palm processing, petty trading, coconut trading and so on. The Fishermen experienced climate change impact in the area of flooding, ocean surges, high temperature, increased waves intensity rainfall among other effect in the study area. The study concludes Artisanal Fishermen sampled experienced high effect of climate change in term of flooding, increased waves, ocean surges, rainfall intensity and high temperature across the selected States sampled. The adaptive measure has been embraced by Artisanal Fishermen in the state selected towards climate change impact and livelihood activities. It was therefore, recommended that in order to appease the climate change impact in coastal areas of Southwest, Nigeria, extension agents knowledgeable in fisheries and climate change should be positioned to the study area by the government as well as adequate backing (i.e funds) as a strategy of solidifying awareness campaign/sensitization exercise on climate change. Incentive on fishing inputs at subsidized rate should be made available to all stakeholders in the fishing communities. There is need for natural and social science research collaboration on the oil-fisheries-livelihoods interface and subsequent interdisciplinary policy innovation from such research. Government needs to come early to assists fishermen when cases of flood are reported; detailed investigation should be carried out after which such artisanal fishermen should be bailed out of the problem. Artisanal fishermen and their organisations should be involved in policy and strategy formulation in mitigation of climate change impacts on their fishing and livelihood activities because these are among the groups most vulnerable to the effects caused by climate change. In that same vein, the climate change agenda needs to be mainstreamed to all government levels otherwise human, economic and physical negative impacts will be observed. More effort is needed to enhance mind set change on causes of climate change to all stakeholders including rural communities close to coastal area, because they are the most vulnerable groups to the climatic change risks.

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