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Perceived Effects of Climate Change on Fish Production among Artisanal Fishermen in Badagry, Lagos State

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ABSTRACT

Climate change has been reported to have direct and indirect impacts on fisheries and aquaculture globally. It is in this light that the study was carried out to assess the perceived effects of climate change on fish production among artisanal fishermen in Badagry, Lagos state. One hundred and twenty (120) respondents were selected through multi-stage sampling procedure. The findings were analyzed using descriptive statistics such as frequencies, percentages and pie chart while Chi-square and PPMC were used to test the hypotheses of the study. The result of the study shows that many of the respondents (40.8%) are between the ages 31-40, mostly male (89.2%); majority have primary school education (33.3%), married (57.5%), Christian (65.8%) and do not belong to any membership association (41.7%). The result shows that there is no significant relationship between the respondents sex (p=0.169) and occupation (p=0.729) and their perceived effects of climate change. There is a significant relationship between marital status (p=0.000), level of education (p=0.000), religion (p=0.013) and membership association (p=0.000). The result also shows that their awareness of climate change (r=0.006, p=0.944) do not significantly affect their perception to the effect of climate change. Also, the coping strategies of the fishermen in mitigating the effects of climate change (r= -0.076, p=0.407) negatively affects their perception to the effect of climate change. The sources of information on climate change available to artisanal fishermen (r=0.665, p=0.000) significantly affects their perception to the effect of climate change. It is concluded that despite their knowledge on climate change, if given the resources and empowerment needed in their fishing operations, they will be able to increase fish production without feeling the effects of climate change.

Keywords: Fishermen, Climate change, Fish production, Perception.

Introduction

Climate change according to the Intergovernmental Panel on Climate Change (IPCC, 2013) usage refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. It refers to any change in climate over time, whether due to natural variability or as a result of human activity (UNFCC, 2011). Climate change operates over decades or longer. Changes in climate occur as a result of both internal variability within the climate system and external factors. Climate change is also described as a long-term shift in the statistics of the weather, including its averages. We know that the global climate is currently changing. The last decade of the 20th Century and the beginning of the 21st have been the warmest period in the entire global instrumental temperature record, starting in the mid-19th century.

(NOAA, 2007). Climate change may affect food systems in several ways ranging from direct effects on crop production, changes in rainfall leading to drought or flooding, warmer or cooler temperature which leads to changes in the length of season, changes in food prices and food supply in the market (Ovansa and Onimisi, 2015). The actual and potential impacts of climate change in Nigeria are considerable and have far reaching effects. All sectors of the socioeconomic development, including agriculture are vulnerable to climate change. It presents significant threats to the achievement of the Millennium Development Goals especially those related to eliminating poverty and hunger and promoting environmental sustainability (Enete and Gbigbi, 2014).

Several empirical studies have been conducted to investigate the different impacts of climate change on Nigeria fisheries and aquaculture which includes the work of Idowu *et al*. (2011) on the Impact of climate change in Nigeria; Ipinjolu *et al*. (2014), the potential impacts of climate change on fisheries and aquaculture in Nigeria; Anyanwu *et al*. (2015), climate change, effects and mitigation strategies on aquaculture: a review; Essam and Zenebe (2013); Impacts of climate change on fisheries: implications for food security in Sub-Saharan Africa; Aphunu and Nwabeze (2012). According to these authors, climate change scenario especially through temperature and carbon dioxide increase will continuously warm the earth with resultant effects on fisheries and aquaculture, and that Nigeria vulnerability is high. Leon and Antonio (2015) asserted that warming has increased thermal stratification, reduction in surface water cold and warm mix thereby preventing upwelling effects of nutrients, and consequently affect primary productivity, the distribution and fecundity of marine fishes. Surprisingly, it was also observed that changing climate through temperature will temporarily increase dissolved oxygen in water which will deplete afterwards due to increase in biochemical Oxygen demand; a natural phenomenon in water noted to regulate water quality. This have been observed to increase nutrient content of water bodies causing algal bloom, thus eutrophication of waters in Netherlands (Verweij *et al*., 2010).

Changes in weather patterns, namely rainfall, relative humidity, winds, temperature and light intensity and period have undoubtedly affected agricultural production systems including fisheries and aquaculture. Climate change has both direct and indirect influence on fisheries and aquaculture. The direct implications of climate change are on physiology and behaviour of the fish that affect growth, reproduction, mortality and distribution (Allison *et al*., 2009; IFAD, 2014; Yazdi and Shakouri, 2010). The indirect impact affects the productivity, structure and composition of the ecosystem in which the fish depend on for food (Yazdi and Shakouri, 2010). Changes in biophysical characteristics of the aquatic environment and frequent occurrence of extreme events will have significant effects on the ecosystems that support fish (Essam and Uraguch, 2013).

Globally, development in fisheries has been viewed as a measure of increasing and improving food security and as a means of supplementing income to families (Ibrahim *et al.*, 2014). Fisheries and aquaculture are

rarely included in national development policy and donor priorities primarily due to problems with valuation of small-scale fisheries, as policy makers often do not have access to data which reflect the importance of fisheries and aquaculture to development. Fishery is a vibrant and dynamic commercial sector in Nigeria ripped with investment and employment opportunities. Although aquaculture activities in Nigeria started about 50 years ago (Olagunju *et al.*, 2007), Nigeria has not been able to meet domestic production demand for the populace. According to Ekunwe and Emokaro (2009), statistics indicate that Nigeria is the largest African aquaculture producer, with production output of over 15,489 tonnes per annum. This is closely followed by Egypt with output of about 5,645 tonnes. Only five other countries: Zambia, Madagascar, Togo, Kenya and Sudan produce more than 1,000 tonnes each (FAO, 2005). Even with the huge contribution of aquaculture to poverty reduction and food security, the perception of climate change impacts on aquaculture has not received much attention of researchers among African countries. Largely, artisanal fishermen hear of climate change impacting the natural environment but little about how it may impact the livelihoods associated with small-scale fisheries. These include the actual fishing activity, fish processing, trade, and fisheries technical support services. While several studies have implicated climate change on rapidly changing physical, chemical and biological properties of known water bodies to sea level, with significantly impacts on fisheries; a subsector known to contribute about 4% Nigeria annual domestic fish production, are made up of significant few large-scale investors. The climatic and geomorphic characteristics of Nigeria has placed the country among vulnerable and one of the most threatened countries globally. Although, these impacts are widely reported as direct and indirect or positive and negative consequences, including in aquaculture; their impacts are becoming more evident. However, the country's highest contributions to global fisheries estimated in 2014 was from inland aquaculture, in line with the 2008 Central Bank of Nigeria Statistics office (FAO, 2014), and believed to be most threatened by changing climate. Thus, there is a knowledge gap regarding the impacts of climate change, especially among artisanal fishermen.

Nigeria's climate is likely to see growing shifts in temperature, rainfall, storms and sea levels throughout the twenty-first century. These climatic challenges, if unaddressed, could throw already stressed resources such as land and water into even shorter supply. Moreover, poor responses to resource shortages could have serious negative secondary effects, including more sickness and hunger, fewer jobs and poor economic growth. The productivity of fisheries is tied to the health and functioning of the ecosystems on which it depends for food, habitat and even seed dispersal (Multi-Agency Brief, 2009). With climate change, primary productivity is predicted to decline at lower latitudes (FAO, 2008). Many fisheries-dependent communities already live a precarious and vulnerable existence because of poverty, lack of social services and essential infrastructure. The vulnerability of

aquaculture-based communities is primarily a function of their exposure to extreme weather events, as well as the impact of climate change on the natural resources required to undertake aquaculture, such as quality water, land, seed, feed and energy (Easterling *et al.*, 2001).

Methodology

The study was conducted in Badagry, a coastal town and local government area (LGA) headquarters in Lagos State, Nigeria. Badagry is located between Lagos and Seme Border, Benin Republic. The town has a personality of its own. Its proximity to Lagos has always made it more significant than some small towns in Nigeria. Although, Lagos has a hassled and rugged atmosphere, Badagry has a quiet vibe with laid-back locals. It has a tropical wet and dry climate with two distinct rainy seasons; the more intense season occurs between April and July, with a milder one from October to November. At the peak of the rainy season, the weather in Lagos is wet about half the time. Lagos experiences a dry season (when it rains less than two days per month) during August and September, as well as between December and March, accompanied by harmattan winds from the Sahara Desert, which are at their strongest from December to early February. The temperature range in Lagos is fairly small, generally staying between a high of 91°F (33°C) and low of 70°F (21°C). The hottest month is March, when average daytime temperatures reach 84°F (29°C), while July is the coldest month with an average temperature of 77°F (25°C). Badagry residents derive their livelihoods predominantly from fishing and agriculture, also maintaining a small museum on slavery. The town is a few kilometers from Seme, a border town to Republic of Benin — and generates the highest Nigeria customs duties income till date. The study was carried out using multi-stage sampling technique as shown in Table 1. Badagry local government is divided to eleven wards. At first, there was a purposive selection of four wards based on the ease of accessibility to coastal water bodies and level of fishing activities. Afterwards, three communities were randomly selected from these four wards where 10 fishermen were each selected. (Wikipedia.)

Table 1: Sampling procedure and sampling size

S/N	Wards	Selected Communities	Number of fishermen in the communities	10% fishermen selected
1	Ajido	Povita	80	8
		Akarakunmo	110	11
		Ebute-Olofin	100	10
2	Keta-East	Wasere	90	9
		Kwame	120	12
		Yekeme	110	11
3	Ajara	Ajara Topa	120	12
		Ajara Vetho	90	9
		Ajara Agamethen	90	9
4	Apa	Gbaji	110	11
		Agorin	80	8
		Joforo	100	10

Data for this study was collected using a well-structured questionnaire and interview schedule. Field survey was used to gather primary data for this study. A structured interview schedule was used to obtain information from sampled forest officers and the rural dwellers who are not well educated. The questions was drawn in English and translated into local dialect during administration. Data was analysed using both descriptive and inferential statistics. Descriptive statistics such as frequencies, percentage distribution and mean were used to achieve the highlighted objectives while inferential statistics, such as Chi-Square PPMC were used to test the hypotheses.

Results and Discussion

Table 2: Distribution of respondents based on age

Age	Frequency	Percentage
Less than 30	46	38.3
31-40	49	40.8
41-50	13	10.8
51-60	4	3.3
61 and above	8	6.7

The result of the analysis in Table 2 shows that 40.8% of the fishermen are within the age range of 31-40 years, 38.3% are < 31 years, 10.8% are within the age range of 41-50, 6.7% are above 60 years while 3.3% are within the age range of 51-60, with a mean age of 35.76 years. This implies that young people dominate the fishing occupation. While younger fishermen believe that fish stocks remain unchanging (National Geographic, 2017), older fishermen however, perceive that their fish catch has been strongly decreased since the time they started fishing, thus reducing their engagement in fishing operations as they seek alternatives for better livelihoods.

Sex is an important factor in determining the perception of the respondents. The result of the study in Fig.1 shows that 89.2% of the respondents are male while 10.8% are female. This implies that fishing is an occupation dominated by men possibly because of the image that only men go to sea in fishing boats. In most cases, women in fishing communities are not allowed to go with the fishing vessels, but this prohibition is tied mostly to the need for them to remain within the premises of the household so that they can attend to their designated responsibilities in the home. Tamale (2004) reported that the non-recognition of women contribution in production process is enhanced by uneven allocation of resources. Therefore, lack of access and control over productive process is one of the major factors limiting women participation in economic activities.

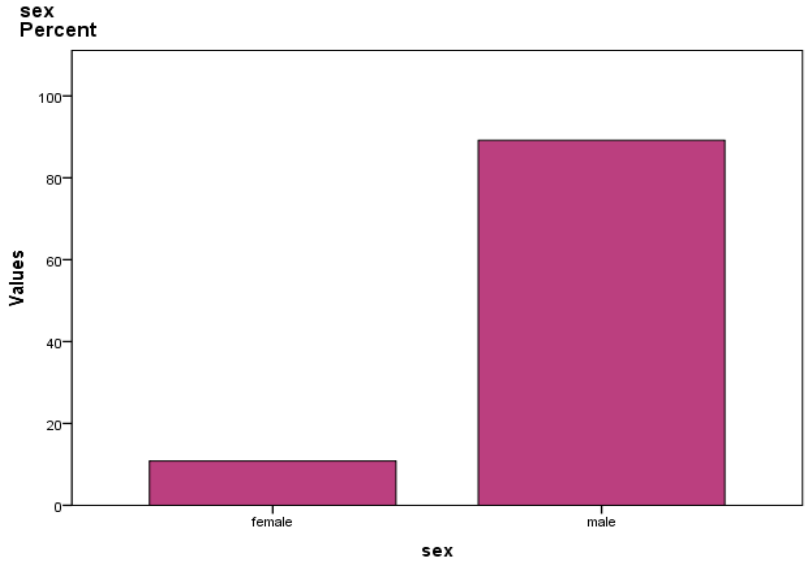

Figure 1: Distribution of respondents based on sex

Marital status is an important factor to be considered in fish production. From Fig.2, 57.5% are married, 41.7% are single, while 0.8% is separated. According to Nwabeze *et al.*(2013), the dominance of married fishers is attributed to an act of proactivity in ensuring food security, generating income and reducing vulnerability within the family.

The level of education is also an important factor to be considered. The results showsinFig.3 indicates that 33.3% of the respondents had just primary education, 30.8% of the respondents had a tertiary education, 29.2% indicated that they had a secondary school education while 6.7% had no formal education. This implies that the majority of the fishermen had access to education. This is an indication that print media can be used to disseminate information to the fishermen in the study area.

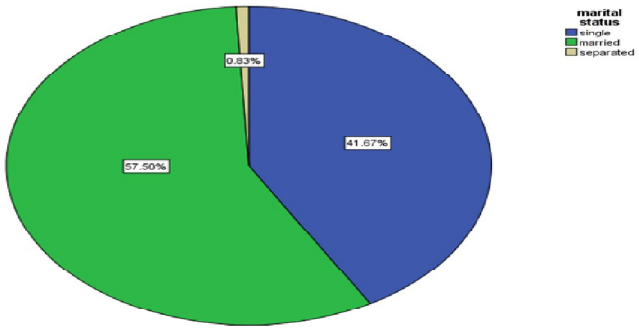

Figure 2: Distribution of respondents based on marital status

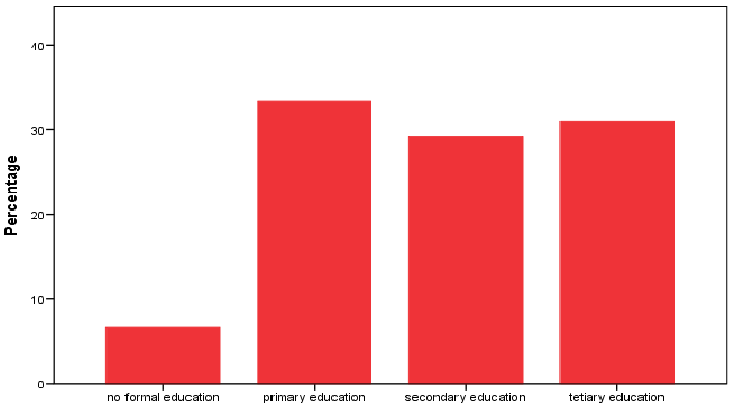

Figure 3: Distribution of respondents based on level of education

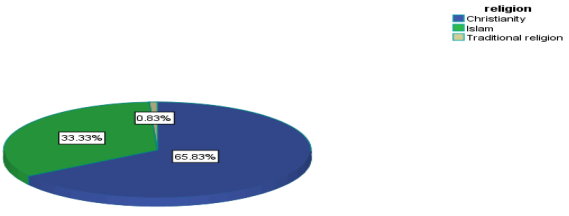

Figure 4: Distribution of respondents based on religion

The results in Fig.4 shows that 65.8% of the respondents are Christians, 33.3% are Muslims while 0.8% practice traditional religion. This implies that majority of the respondents practice the contemporary religions that are practiced in Nigeria and in coastal communities.

The results of this study on Table 3 shows that the respondents indicated a family size of 6-10 are 62.5%, family size of 1-5 are 34.2% while a family size of 11-15 are 3.3% with a mean household size of 6.75. The result on Fig.5 also shows that 41.7% do not belong to any membership association, 27.5% belong to a cooperative society and 24.2% belong to other associations while 6.7% engage in monthly contribution.

Table 3: Distribution of respondents based on household size

Household size	Frequency	Percentage
1-5	41	34.2
6-10	75	62.5
11-15	4	3.3

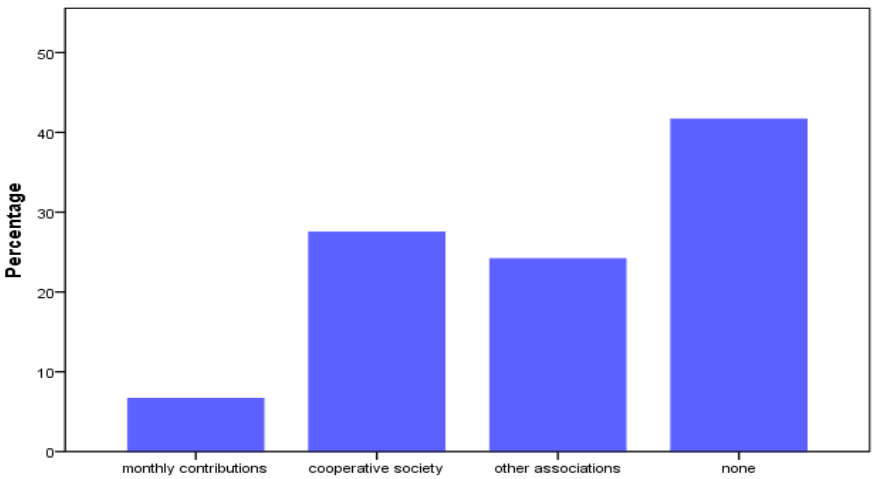

Figure 5: Distribution of respondents based on membership association

The total monthly income is an important factor in fish production. However, as shown in Table 4, 43.3% of the respondents earn between ₦26,000-₦50,000, 32.5% earn between ₦51,000-₦100,000, 21.7% earn between ₦10,000-₦25,000 while 2.5% earn over ₦100,000. This implies that fishermen engage in diversified profitable activities either as primary or secondary jobs. The income from fish is a strong determinant of fish production. The results on Table 5 reveals that 50% earn between ₦10,000-₦25,000, 40.8% earn between ₦26,000-₦50,000 while 9.2% earn between ₦51,000-₦100,000.

Table 4: Distribution of respondents based on total monthly income

Total monthly income	Frequency	Percentage
10,000-25,000	26	21.7
26,000-50,000	52	43.3
51,000-100,000	39	32.5
Over 100,000	3	2.5

Table 5: Distribution of respondents based on income from fish alone.

Income from Fish	Frequency	Percentage
10,000-25,000	60	50.0
26,000-50,000	49	40.8
51,000-100,000	11	9.2

Table 6 shows the distribution of respondents based on occupation. This is divided into primary and secondary. It is observed that majority 75% of the fishermen took fishing as their primary occupation while 25% of the respondents took it as their secondary occupation. However, 12.5% of the respondents indicated business as their primary occupation while 20% of the respondents indicated business as their secondary occupation. However, 4.2% indicated civil service as their primary occupation while none indicated civil service as a secondary occupation. 0.8% indicated livestock as their primary occupation while 7.5% indicated livestock as their secondary occupation. Moreover, 9.1% indicated farming as their primary occupation while 46.7% indicated farming as their secondary occupation. The implication of this finding is that the artisanal fishermen are more likely to engage in agricultural activities, especially farming as alternatives to fishing activities. Fishermen that rely on a single source of income for their livelihood such as fishery are more vulnerable to climate impacts than those who have diversified source of income, especially if they are highly dependent on sensitive resources.

Table 6: Distribution of respondents based on occupation

Occupation	Primary F (%)	Secondary F (%)
Fishing	90 (75)	30 (25)
Business	15 (12.5)	24 (20)
Civil servant	5 (4.2)	-
Livestock	1 (0.8)	9 (7.5)
Farming	11 (9.2)	56 (46.7)
Security	1 (0.8)	-

The daily quantity of fish capture is a measure of the volume of fish production. The result on Table 7 shows that 39.2% of the respondents had a daily fish capture of 1-5kg, 34.2 had a daily fish capture greater than 10kg while 26.7% had daily fish capture of 6-10kg. The mean fish capture is 7.44kg. This implies that despite the unfavourable fluctuations in volume of fish capture, there is still a moderate quantity captured on a daily basis.

Table 7: Distribution of respondents based on daily fish capture

Fish capture	Frequency	Percentage
1-5kg	47	39.2
6-10kg	32	26.7
> 10kg	41	34.2

Fishermen awareness of climate change

The results from Table 8reveals the awareness of fishermen to climate change. It shows that 89.2% of the fishermen are aware of heavy flood, 86.7% are aware about the heavy rainfall, 78.3% are aware about the rise in water temperature, 72.5% are aware about the increased sediments of load, 70% are aware about the severity of droughts. Also, 65.8% of the artisanal fishermen are aware about irregular rainfall, 64.2% are aware about the longer period of droughts, 59.2% are aware of intense heat waves. However, majority 58.3% of the fishermen are not aware of increased variability of inter-annual water flow for rivers while 52.5% are not aware of the change in wind direction. This implies that heavy flooding and heavy rainfall, which are linked to each other are the major indicators of climate change to the fishermen. Along with the increased water temperature and droughts, this climatic indicators have affected the fishing communities such as its impacts on agriculture, increased coastal erosion and catastrophic weather events.

Table 8: Distribution of respondents based on awareness of climate change

Indicators	Aware F (%)	Not Aware F (%)
Rise in water temperature	94 (78.3)	26 (21.7)
Heavy rainfall	104 (86.7)	16 (13.3)
Irregular rainfall	79 (65.8)	41 (34.2)
Heavy flood	107 (89.2)	13 (10.8)
Intense heat waves	71 (59.2)	49 (40.8)
Longer periods of droughts	77 (64.2)	43 (35.8)
Increased variability of inter-annual water flow for rivers	50 (41.7)	70 (58.3)
Disruption of shapes of river channels	61 (50.8)	59 (49.2)
Increased sediments of load	87 (72.5)	32 (26.7)
Increased severity of droughts	84 (70.0)	36 (30.0)
Change in wind direction	57 (47.5)	63 (52.5)

Sources of information on climate change

Table 9 shows that 62.5% of the fishermen said that they got their information from personal experience, 21.7% got their information from newspapers, 15.8% got their information from radio while 7.5% got their information from other sources such as friends and neighbours. It is also worth to note that only 5% of the fishermen said that

they do have extension worker available to them to presents the sources of information on climate change. In addition, no respondent had television as their source of information.

Table 9: Distribution of respondents based on sources of information

Sources of information	Yes F (%)	No F (%)
Neighbor	9 (7.5)	111 (92.5)
Friends	9 (7.5)	111 (92.5)
Personal experience	75 (62.5)	45 (37.5)
Extension workers	6 (5.0)	114 (95.0)
Newspaper	26 (21.7)	94 (78.3)
Radio	101 (15.8)	19 (84.2)
Television	-	120 (100)

Artisanal Fishermen Perceived Effects of Climate Change on Fish Production

Table 10 reveals that 80.8% of the respondents said that there is always reduction in the volume of fish caught as a result of climate change. Majority of the respondents said that there is never high rate of fish mortality as a result of rise in temperature (80.0%), increased fishing distance due to climate change (79.2%), conflict with other fishermen due to longer periods of droughts (76.7%), alteration in the seasonality of fishing as a result of irregular rainfall (72.5%), increase in fishing effort due to increased severity of drought (67.5%). The respondents also said that there is never increased migration by fishermen due to increased severity of droughts (65.8%), %), increase in fish disease as a result of climate variation (65.0), loss of other income earning source as a result of climate change (64.2%), change in distribution of fishes as a result of climate change (61.7%), increased shoreline erosion due to heavy flood (60.8%) and lower efficiency of labour use as a result of increased severity of droughts (60.0%).This implies that over the years, there been decline in the volume of fish catch. While climate change appears to be mainly responsible, pollution and overfishing are also possible contributing factors. With the decreased good-weather days for fishing and unpredictable seasons, artisanal fishermen have recorded lower yield from coastal and freshwater fisheries.

Table 10: Distribution of respondents based on perceived effects of climate change on fish production

Perceived Statements	Always F (%)	Occasionally F (%)	Never F (%)	Mean	Standard deviation
There is reduction in the volume of fish caught as a result of climate change	97 (80.8)	23 (19.2)	-	1.81	0.395
There is increase in fish disease as a result of climate variation	3 (2.5)	39 (32.5)	78 (65.0)	0.38	0.536
There is reduction in water quality due to climate change	30 (25.0)	43 (35.8)	47 (39.2)	0.86	0.792
There is increase in fishing effort due to increased severity of drought	15 (12.5)	24 (20.0)	81 (67.5)	0.45	0.708
There is poor harvest of fish as a result of longer period of drought	24 (20.0)	56 (46.7)	40 (33.3)	0.87	0.721
There is an increase in health hazards due to climate variation	21 (17.5)	46 (38.3)	53 (44.2)	0.73	0.742

There is loss of other income earning source as a result of climate change	-	43 (35.8)	77 (64.2)	0.36	0.482
There is increase fish susceptibility to toxicants due to increased sediments of load	32 (26.7)	36 (30.0)	52 (43.3)	0.83	0.823
There is high rate of fish mortality as a result of rise in temperature	15 (12.5)	9 (7.5)	96 (80.0)	0.33	0.688
There is an increased damage to fishing gear as a result of increased sediments of load	24 (20.0)	41 (34.2)	51 (45.8)	0.74	0.772
There is an increased damage to fishing site due to heavy flood	9 (7.5)	32 (26.7)	9 (65.8)	0.42	0.630
There is reduction in the mean size of fishes as a result of climate variation	9 (7.5)	-	101 (92.5)	0.15	0.529
There is alteration is the seasonality of fishing as a result of irregular rainfall	8 (4.2)	28 (23.3)	27 (72.5)	0.32	0.550
There is lower efficiency of labour use as a result of increased severity of droughts	37 (30.8)	11 (9.2)	72 (60.0)	0.71	0.911
There is implementation of unfavourable fishing laws and regulations due to longer period of droughts	14 (11.7)	46 (38.3)	60 (50.0)	0.62	0.688
There is increased incidence of rough sea due to change in wind direction	11 (9.2)	40 (33.3)	69 (57.5)	0.52	0.661
There is lower profitability in fishing activities as a result of irregular rainfall	43 (35.8)	71 (59.2)	6 (5.0)	1.31	0.562
There is increased shoreline erosion due to heavy flood	6 (5.0)	41 (34.2)	73 (60.8)	0.44	0.591
There is reduction in fish varieties as a result of rise in water temperature	27 (22.5)	21 (17.5)	72 (60.0)	0.63	0.831
There is more frequent change of fishing points due to severity of droughts	33 (27.5)	57 (47.5)	30 (25.0)	1.03	0.727
There is change in distribution of fishes as a result of climate change	74 (8.3)	36 (30.0)	10 (61.7)	0.47	0.647
There is damage to infrastructure due to heavy flood	43 (35.8)	47 (39.2)	30 (25.0)	1.11	0.776
There is conflict with other fishermen due to longer periods of droughts	8 (6.7)	20 (16.7)	92 (76.7)	0.30	0.588
There is more migration by fishermen due to increased severity of droughts	25 (20.8)	16 (13.3)	79 (65.8)	0.55	0.818
There is intensified competition for fishing areas as a result of irregular rainfall	7 (5.8)	35 (29.2)	78 (65.0)	0.41	0.601
There is increased fishing distance due to climate change	25 (20.8)	-	95 (79.2)	0.42	0.816
There is increased fishing depth as a result of intense heat waves	9 (7.5)	-	92.5 (111)	0.15	0.529
There is increased fish catch of juveniles as a result of irregular rainfall	-	23 (19.2)	97 (80.8)	0.19	0.395

Table 11: Categorisation of respondents based on perceived effects of climate change on fish production

Perceived effects	Frequency	Percentage
High (below mean)	11	39.3
Low (mean and above)	17	60.7

Fishermen' Coping Strategies to Effects of Climate Change

Table 12 shows that 93.3% never considered demonstration and training as a coping strategy in reducing the effect of climate change, 91.7% never considered government initiatives as a coping strategy, 86.7% of the respondents never considered the role of credit institutions as a coping strategy while 70.0% never considered diversion to non-fishing activities as a coping strategy. However, on occasional basis, 68.3% of the respondents considered information awareness on better practices as a coping strategy while 62.5% considered increased time on fishing grounds as a coping strategy. Also, 62.5% of the respondents always considered community-based fishery as a coping strategy. This lack of demonstration

and training implies that the extension education outreach for the fishermen is very weak. Extension has a crucial role in enhancing the productivity of the resource poor artisan fishermen for effective transfer of innovations to them. According to an earlier study by Idrisa and Ogunbameru (2008), the most effective ways of influencing the fishermen to adopt the technologies in their fishing routine is by establishing a demonstration centre. Extension programs aimed at increasing knowledge have potential to increase adoption of technology in mitigating the impacts of climate change (Sule *et al.*, 2009). In addition, education and extension training are essential for artisanal fishermen to adopt new technologies (Oladimeji *et al.*, 2013). However, the adoption of community-based fishery as a coping strategy by majority of the fishermen infers collective effort to produce significant transformative development in their livelihood.

Table 12: Distribution of respondents based on coping strategies

Coping Strategies	Always F (%)	Occasionally F (%)	Never F (%)	Mean	Standard deviation
Adjustment in time of fishing	10 (8.3)	63 (52.5)	47 (39.2)	0.69	0.619
Information awareness on better practices	28 (23.3)	82 (68.3)	10 (8.3)	1.15	0.545
Increased time on fishing grounds	21 (17.5)	75 (62.5)	24 (20.0)	0.97	0.614
Diversion to non-fishing activities	18 (15.0)	18 (15.0)	84 (70.0)	0.45	0.743
Migration		48 (40.0)	72 (60.0)	0.40	0.492
Changing fishing gear	12 (10.0)	47 (39.2)	12 (50.8)	0.59	0.667
Demonstrations and trainings	1 (0.8)	7 (5.8)	112 (93.3)	0.07	0.295
Community-based fishery	75 (62.5)	18 (15.0)	27 (22.5)	1.40	0.834
Government initiatives		10 (8.3)	110 (91.7)	0.08	0.278
Role of credit institutions/financial assistance	7 (5.8)	9 (7.5)	104 (86.7)	0.19	0.523
Change target species	5 (4.2)	37 (30.8)	78 (65.0)	0.39	0.569
Do nothing	35 (29.2)	17 (14.2)	68 (56.7)	0.73	0.888

Conclusion

The study determined the perception of climate change effects among artisanal fishermen. The study showed that majority of them were young adults, male and practice Christianity religion. Majority of them have low education attainment i.e. primary education, most of them are married and do not belong to a membership association. The study also established the perceived effects of climate change on fish production, with

reduction in the volume of fish catch appear to be the most perceived effect while high rate of fish mortality, increased fishing distance, conflict with other fishermen, alteration in the seasonality of fishing and increase in fishing effort are the least perceived effects. The study thus shows that artisanal fishermen have low perception on the effects of climate change.However, irrespective of their low perceptions on the effects of climate change, they are well aware of climate change. Thus, there is need to provide the resources and empowerment needed in their fishing operations, to increase fish production.

Recommendations

Based on the findings in this study, the following recommendations were made:

- Artisanal fishermen should properly organize themselves into cooperatives so that government can channel various aids, loans and other fishing facilities through cooperative bodies.
- Extension services should be intensified with adequate programmes that will not encourage improved fishing practices in order to boom fish production and limit the present losses experienced by the fishermen.
- Adequate credit facilities should be made available to fishermen for the expansion of their fishing activities. There is need to design special programmes to improve access of artisanal fishermen to credit facilities. The fishermen should be linked up with Nigerian Agricultural Cooperative and Rural Development Bank (NACRDB) for timely credit facility.
- Adequate infrastructure such as motorable roads, electricity and resources for preservation of equipment should be provided in the rural fishing villages.

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