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Adaptation strategies to reduce the effect of climate change (utilization of indigenous systems by the fisher folks) in the coastal region of Nigeria

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Abstract

Climate change is now very much with us, so all countries must work to reduce their greenhouse gas emissions and learn how to cope with the impacts of climatic change. Developing countries, however, have relatively small greenhouse gas emissions, so mitigation is less important for them. Adaptation is more relevant for poorer nations because of their relative vulnerability to the impacts of climate change. The present study examined the utilization of the Indigenous Systems as a means of reducing the effect of climate change in the coastal region of Nigeria using Ilaje Local Government Area (LGA) of Ondo state as a case study. The objectives of the study includes: determination of the socio-economic characteristics of the respondents in the study area, identification of the indigenous system (IS) peculiar to the study area, determination of the relationship between the most utilized IS and the demographic characteristics of the respondents, identification of the problems inherent in fishing and identification of the problems caused by IS in fishing. Eighty-four (84) respondents were purposively selected from two communities in Ilaje LGA. The results of the study revealed some of the indigenous system which the respondents were familiar with and their effects. It was also revealed from this study that most of the respondents were male and a large percentage of the fishing population in Ilaje LGA believed that ISs are better than modern systems, they also believed that fishing is not profitable without the use of IS. Chi-square analysis was used to determine the relationship between the six most utilized IS and the demographic characteristics of the respondents. A 5- Likert scale was used to answer some perception questions while Chronbach alpha was used to test the reliability of the survey instrument used in the study.

Keywords: Climate change, Vulnerability, Adaptation strategies, Indigenous system, and Modern system

1. Introduction

Africa is one of the continents with the highest vulnerability to climate change, it was predicted that about 6% of the population in sub-Saharan Africa will suffer from chronic hunger or undernourishment by 2050 [9]. Climatic change on fisheries productivity would be negatively affected in many West African countries [16]. Climatic change would largely reduce the potential fisheries catch in the Exclusive Economic Zones (EEZs) of West African nations [4-6]. Fisheries in low latitudinal regions such as West Africa may be affected most [6].

The impact of climate variability are disastrous and extremes in the last thirty years. West Africa has been identified as one of the most vulnerable regions to climate change [4, 11], but the level of awareness of the magnitude of the phenomenon is not commensurate with the risks to which the region is exposed [10]. The fisheries sector, particularly the artisanal, is a major source of employment and income for both skilled and unskilled young men and women of coastal communities through direct and ancillary activities [8, 16].

Despite this fact, fish stocks in West African waters are already overexploited, driven to a large extent by the dominance of foreign distant water fleets in the Exclusive Economic Zones (EEZs) of the West African countries. The predicted decrease in the productivity of marine and coastal resources under climate change may have large impacts on the livelihoods of West African communities [11].

Nigeria is a country of marked ecological diversity and climatic contrasts. The country is vulnerable to the impacts of climatic change as a result of desertification process advancing southward. As predicted, Nigeria expected to suffer the greatest loss in the economic output of fisheries in terms of direct, indirect or induced impacts from fisheries, in the 2050s under Climatic change [11].

Fishing as an occupation carries its own risks, however, people involved in fisheries and fishery-related livelihoods are vulnerable to a variety of external factors. Hence, there is need to understand the effects of climate change on fish production and food supply in Nigeria. Small-scale fishing communities are also vulnerable to climatic and other natural events, such as yearly and seasonal fluctuations in stock, poor catches, bad weather and natural disasters such as floods and storms at sea, high cost of fishing inputs, market price fluctuations and variable access to markets.

Indigenous system (IS) is used to describe the differences between the knowledge systems developed by a community and the international knowledge systems; which are generated through Universities, Government research agencies and private industries. Indigenous system was defined as the native or local knowledge that is unique to a given culture or society [13]. Indigenous system (IS) is define as a systematic body of knowledge acquired by the local people through the accumulation of experiences, informal experiments and intimate understanding of the environment in a given culture. Indigenous system forms part of the global knowledge, it can be preserved, transferred, or adopted and adapted elsewhere. It encompasses the skills, experiences and insights of people, applied to maintain or improve their livelihood. Indigenous knowledge is developed and adapted continuously to gradually changing environments and passed down from generation to generation and closely interwoven with people's cultural values. Indigenous knowledge is also the social capital of the poor; their main asset to invest in the struggle for survival, to produce food, shelter or to achieve control of their own lives. This paper therefore, examines the Adaptation strategies to reducing the effect of climate (utilization of indigenous systems by the fisher folks) change in the coastal region of Nigeria. Specifically, the socio-economic characteristics of the respondents in the study area, identification of the indigenous system (IS) peculiar to the study area, relationship between the most utilized IS and the demographic characteristics of the respondents and identification of the problems inherent in fishing as a result of IS were determined.

2. Materials and Methods

The study was carried out in Ondo state, Nigeria, Ilaje Local Government Area was purposively selected because it is in the coastal area of the state. According to regional classifications, the LGA lies between 6°N and 6.3°N and longitude 4.5°E. It lies along the coast and it is deeply covered by a large number of lagoon and creeks. Its Headquarter is in Igbokoda. It has an area of 1,318 km² and a population of 290,615 (NPC, 2006). The shorelines are about 180 Km long. Primary and secondary data was collected for the purpose of this Research work The Primary data was obtained through the use of well-structured questionnaires that was administered. Multi stage sampling technique was used in selecting the fisher folks. Artisanal fisher folks were purposively selected from Igbokoda town based on their level of Fishing and Coastal fisher folks were also purposively selected from Araromi town. Forty seven Respondents were selected from Araromi town and thirty seven respondents were selected from Igbokoda. This gave a total number of Eighty-four Respondents from Ilaje LGA.

A cross sectional data was collected on indigenous system in the fisheries sector. The data collected was subjected to both descriptive statistics and Chi-square analysis. The descriptive statistics that was used include; frequency distribution, percentages and means (in determining the number of

Fishermen who are familiar with the indigenous knowledge system in Fishing. Chi-square analysis was used to determine the relationship between IS Utilization and socio-economic characteristics of the respondents. The relationship between the IS utilization and the socio-economic characteristics of the respondents can be expressed in a linear functional equation as follows:

$$Y = b_0 + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6 + b_7X_7 + b_8X_8 + e_i$$

Where;

Y:	IS Utilization
b ₀ :	Constant
X ₁ :	Gender of respondents
X ₂ :	Marital status
X ₃ :	Religion of respondents
X ₄ :	Academic qualification
X ₅ :	Family size and composition
X ₆ :	Age of respondents
X ₇ :	Level of fishing of respondents
X ₈ :	Years of fishing experience of the Respondents
e _i :	Error term.

Kruskal Wallis Test and Likert scale was used to answer some perception questions. Reliability analysis was computed using Cronbach's alpha (α). The items selected were gender of respondents, marital status, and religion of respondents, academic qualification, family size and composition, age of respondents, level of fishing of respondents, years of fishing experience of the respondents.

Where:

N = No of items (8);

\bar{C} = average inter – item covariance among the items; and

\bar{V} = average variance.

Cronbach alpha (α) was used to analyse the sufficiency of the survey instrument.

3. Results and Discussions

Table 1: shows the results of the socio-economic characteristics of the respondents in the study area. From the Table, (85%) of the respondents were male while only (15%) were female. This might be due to the fact that fishing operations requires more energy. The modal age range was 36-45 (38%), followed by 46-55 (23%) this implies that most of the fishermen were still in their active age and are physically strong, mentally alert to participate fully in fishing activities. The result also revealed that 76% of the respondents were married while only 1% were divorced. This might be due to the strict custom of the people in the study area, prohibiting divorce of any kind. 82% of the respondents were Christians, 14% were Muslims while 4% were Traditionalists. This implies that Christianity was the most prominent religion in the study area and it might be traced back to the early missionary that migrated via the coast to propagate their gospels in the early 1940s before the independence in 1960 [2]. 39% of the respondents had primary education, 33.3% had secondary education. This shows that most of the respondents in the study areas had primary education. All the respondents were engaged in fishing as their primary occupation. This shows that the major occupation of the respondents is fishing this might be due to the geographical location they find themselves that along the coast [2].

Table 1: Socioeconomic Characteristics of the Respondents

Gender	Frequency	Percentage
Male	71	84.5
Female	13	15.5
Total	84	100
Age group/range (years)	Frequency	Percentage
10-25	5	6.0
26-35	18	21.4
36-45	32	38.1
46-55	19	22.6
>55	10	11.9
Total	84	100
Marital status	Frequency	Percentage
Single	9	10.7
Married	64	76.2
Widowed	10	11.9
Divorced	1	1.2
Total	84	100
Religion	Frequency	Percentage
Christianity	69	82.1
Islam	12	14.3
Traditional	3	3.6
Total	84	100
Level of Education	Frequency	Percentage
Primary education	33	39.3
Secondary education	28	33.3
Tertiary education	6	7.1
None	17	20.2
Total	84	100
Primary occupation	Frequency	Percentage
Fishing	84	100
Total	84	100

Source: Field survey 2012

Table 2: shows the responses of the respondents on some fishing variables. It was revealed that (40%) of fishermen in Ilaje LGA had been fishing for about 21-30 years. 46% of the respondents were using the traditional method of fishing, 54% of the respondents were using a combination of traditional and modern method. This implies that most of the respondents relied on the use of both traditional and modern fishing methods. Net, hook and trap which is (42%), were used by most of the respondents, followed by the use of Net and Hook (33%). 19% of the respondents used Net and trap, 5% use nets and other traditional equipment. (54%) of the respondents were using modern equipment (Mechanized boat) while the remaining 46.4% were not using modern equipment. 1% of the respondents sell their captured fish, while 13% capture for consumption and 86% capture for selling and consumption. It can be deduced that a large percentage of the respondents captured fish for their household consumption and for sale to earn some cash which they can use to purchase other items needed for their livelihood. This implies that the volume of fish catch per unit effort will still be at subsistence level because of the type of fishing gears the fisher folks used in fishing activities.

Table 2: Distribution of Respondents according to some variables on Fish.

Years of fishing experience	Frequency	Percentage
1-10	11	13.1
11-20	30	35.7
21-30	32	38.1
31-40	5	6.0
41-50	6	7.1
Total	84	100
Method of fishing	Frequency	Percentage
Traditional	39	46.4
Modern	0	0
Traditional and modern	45	53.6
Total	84	100
Traditional Equipment used	Frequency	Percentage
Net	1	1.2
Net and hook	28	33.3
Net and trap	16	19.0
Net, hook and trap	35	41.7
Net and others	4	4.8
Total	84	100
Modern Equipment used	Frequency	Percentage
None	39	46.4
Speed boat	45	53.6
Total	84	100
Uses of captured fish	Frequency	Percentage
Selling	1	1.2
Consumption	11	13.1
Selling and consumption	72	85.7
Total	84	100

Source: Field survey, 2012

Table 3: Shows that 71% of the respondents believed that fishing is not profitable without IS while 29% believed that fishing is profitable without IS. 87% of the respondents believed that IS is better than Modern knowledge, while 11.9% is of the opinion that IS is not better than Modern knowledge. 81% of the respondents believed that IS save labour in Fishing, while 18% believed that it does not save labour and 1.2% was indifferent. 71% of the respondents believed that IS reduces production cost, while 25% believed that it does not reduce production cost and 4% were indifferent. 56% of the respondents believed that IS increase their income, while 16% believed that it does not have any impact on their income and 29% were indifferent. 70% of the respondents believed that IS increases output while 21% believed it does not increase the output.

It can be deduced from the table that fishing is not profitable without IS in the study area, IS is perceived to be better than modern knowledge, because it saves labor and helps to reduce production cost, which in return increases output and income of the respondents. Despite the adverse effect of climate change which makes the fish and the fishing environment prone or vulnerable to the adverse effects of climate variables and change.

Table 3: Perception of the Relevance of IS to Fishing.

Statement	Agree		Disagree		Undecided	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Fishing is profitable without IS	24	28.6	60	71.4	0	0
IS is better than modern Knowledge	73	86.9	10	11.9	1	1.2
IS saves labor	68	81.0	15	17.9	1	1.2
IKS reduces production cost	60	71.4	21	25.0	3	3.6
IS increases income	47	56.0	13	15.5	24	28.6
IS increases outputs	59	70.2	18	21.4	7	8.3

Source: Field survey, 2012.

Table 4: Identified Indigenous System and effects in the Study Area

S/n	Identified Is	What It Is Used For	Effects/Impacts
1	Capturing and eating of <i>Ekiki</i> fish	Fish capture and Consumption	Partial or total Deafness
2	Rising of the water level of the Sea	Fish capture	This implies that a sacrifice is to be made and failure to do this can lead to death
3	Use of <i>Agugu</i> wood	Boat construction	<i>Agugu</i> wood is light and moves fast on water. It also enhances Fish capture
4	Use of <i>Aghen</i>	Net mending	It is used to mend Fishing nets during Fishing
5	Use of Plank	Boat construction	It is believed to enhance Fish capture
6	Prohibited use of Charm	Fish capture	Untimely death, poverty, etc.
7	A menstruating woman is forbidden from Fishing	Fish capture	Untimely death
8	Throwing of dirty things into the sea is forbidden	Fish capture	This will lead to rising of the water level and untimely death
9	Bubbling of the sea	Fish capture	This means there is a dead body in the sea and if it is not removed, there can be no fishing
10	Any visitor going to the sea must dance	Fish capture	This is believed to be a sign of respect to <i>Malokun</i> (the river goddess) and this will enhance Fish capture
11	A nursing mother is forbidden to Fish	Fish capture	Untimely death of the mother
12	Reduction in the size of the full Moon	Fish capture	Enhanced Fish capture
13	Appearance of the new moon	Fish capture	Enhanced fish capture
14	Use of <i>Arere</i> wood	Boat construction	Enhanced Fish capture
15	Appearance of <i>Eko</i>	Fish capture	Reduced fish capture
16	Appearance of <i>Aromi</i>	Fish capture	Enhanced fish capture
17	Prohibited fishing for any man above 50 years of age	Fish capture	It incurs the wrath of <i>Malokun</i> .
18	Appearance of <i>Fakadosi</i>	Fish capture	Enhanced fish capture
19	A woman is forbidden from eating the head of a big fish	Fish consumption	Untimely death
20	Use of <i>Iyama</i>	Fish capture	Enhanced fish capture
21	Eating coconut before Fishing is forbidden	Fish capture	Dysentery and untimely death
22	The time to capture <i>Abo</i> Fish (Cat fish) is around the hours of 4 pm- 8 am	Fish capture	Enhanced fish capture
23	Floating Fishes	Fish capture	Enhanced fish capture
24	Use of lead and floater	Fish capture	Enhanced fish capture
25	Standing up when fishing	Fish capture	Enhanced fish capture
26	Capturing and eating of <i>Mabumabu</i> without the consent of the Elders if forbidden	Fish capture Fish consumption	Untimely death
27	Use of <i>Ighere</i>	Fish capture	Enhanced Fish capture
28	Use of <i>Doje/Palamu</i>	Fish capture	Enhanced Fish capture
29	Use of <i>Egungun</i> wood	Boat construction	Enhanced fish capture and durability
30	Appearance of Two layers of water	Fish capture	Reduced fish capture

Source: Field survey, 2012

Table 5: shows the level of awareness (or utilization) of the identified IS in the study area. Eating of coconut before fishing and standing up when fishing were the IS with the highest level of awareness/utilization (100%). The reasons for this might be because all fishermen (whether residence or migration) must be aware of the IS before fishing commenced.

Next to this were those that forbids a menstruating woman and a mother who is nursing a baby that is less than three months from fishing and also that which forbids a woman from eating the head of a big fish. The reason for this might be the fact that women are weaker vessels and are tender in nature compare to men.

Table 5: Distribution of respondents by IS awareness/ Utilization. (N=84)

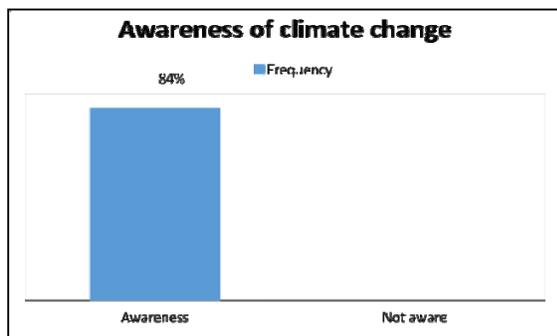
S/n	IS	Frequency	Percentage
1	Capturing and eating of <i>Ekiki</i> fish	28	33.3
2	Rising of the water level of the Sea	39	46.4
3	Use of <i>Agugu</i> wood	39	46.4
4	Use of <i>Aghen</i>	38	45.2
5	Use of Plank	10	11.9
6	Prohibited use of Charm	52	61.9
7	A menstruating woman is forbidden from Fishing	65	77.4
8	Throwing of dirty things into the sea is forbidden	37	44.0
9	Bubbling of the sea	55	60.7
10	Any visitor going to the sea must dance	8	9.5
11	A nursing mother is forbidden to Fish	65	77.4
12	Reduction in the size of the full Moon	55	65.5
13	Appearance of the new moon	55	65.5
14	Use of <i>Arere</i> wood	39	46.4

15	Appearance of <i>Eko</i>	47	56.0
16	Appearance of <i>Aromi</i>	47	56.0
17	Use of two fishing boats	23	27.4
18	Appearance of <i>Fakadosi</i>	47	56.0
19	A woman is forbidden from eating the head of a big fish	65	77.4
20	Use of <i>Iyama</i>	46	54.8
21	Eating coconut before Fishing is forbidden	84	100
22	The time to capture <i>Abo</i> Fish (Cat fish) is around the hours of 4 pm- 8 am	47	56.0
23	Floating Fishes	40	47.6
24	Use of lead and floater	58	69.0
25	Standing up when fishing	84	21.4
26	Capturing and eating of <i>Mabumabu</i> without the consent of the Elders if forbidden	48	57.1
27	Use of <i>Ighere</i>	46	54.8
28	Use of <i>Doje/Palamu</i>	6	7.1
29	Use of <i>Egungun</i> wood	39	46.4
30	Appearance of Two layers of water	47	56.0

Source: Field survey, 2012.

3.1 Awareness of respondents to climate change

All the respondents (84%) were aware of climate change. This implies that fishermen in the study area were familiar with the effects of climate change in fish production and might be familiar with the adaptative strategy to combat the adverse effects of climate change [14]. Have stated that educated and experienced farmers have more knowledge and information about climatic change and adaptation practices.



Source: Field Survey Data, 2012.

Fig 1: Shows Respondents Awareness of Climatic Change in the study area.

3.2 Perception of Fishermen on the effect of Climate change on fishing

Likert scale result on Table 6 revealed that the respondents

Table 6: Distribution of Respondents According to Perception on the Effect of Climate Change on Fish

Perceptual statements	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree	Mean	Summary
Increase in rainfall have a positive impact on fishing	19(47.5)	14(35.0)	2(5.0)	5(12.5)	-	4.20	Agree
Increase in rainfall have a negative impact on fishing	5(12.5)	10(25.0)	6(15.0)	15(37.5)	4(10.0)	2.93	Undecided
Occurrence of flood increases fish production	2(5.0)	1(2.5)	2(5.0)	12(30.0)	23(57.5)	1.68	Disagree
Occurrence of flood decreases fish production	28(70.0)	7(17.5)	3(7.5)	1(2.5)	1(2.5)	4.50	Agree
Increase in temperature have a positive impact on fish production	5(12.5)	6(15.0)	4(10.0)	17(42.5)	8(20.0)	2.58	Undecided
Increase in temperature have a negative impact on fish production	15(37.5)	11(27.5)	5(12.5)	5(12.5)	4(10.0)	3.72	Agree

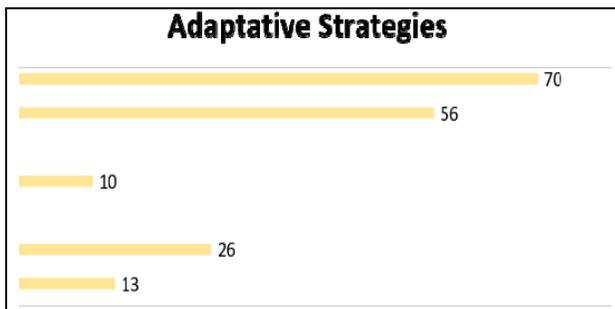
Source: Computed field data, 2012

3.3 Adaptive strategies employed by fish farmers in the study area.

Figure 2 shows that the respondents were carry out mitigation measures that were premeditated based on the indigenous system practiced in the area this include: proscribed fishing for a menstruating woman, proscribed fishing for a woman

agreed that increase in rainfall has a positive impact on fish farming and this agrees with the findings of [1] on climate change perception and adaptation strategies in Oyo State, Nigeria. Results from the Table shows that, 48% of the respondents strongly agreed that increase in rainfall had a positive impact on fishing, 35% agreed on the notion, 5% were undecided while 13% disagreed. On the other hand, 13% strongly agreed on the notion that increase in rainfall have a negative impact on fishing, 25% agreed, 15% disagreed, 37% disagreed while 10% strongly disagreed. The implication of this is that increase in rainfall has a positive impact on fish production. 55% of the respondents strongly agreed that when raining season starts earlier it will increase fish production while 3% strongly disagreed. Also, 70% of the respondents strongly agreed that the occurrence of flood in the area will decrease fish production while 30% disagreed. From the study, 53% of the respondents strongly agreed that long period of hot/dry season decreases fish production while 42% strongly disagree. 38% of the respondents strongly agree that increase in temperature will have a negative impact on fish production, 27% agreed, 13% undecided, 12% disagreed, and 10% strongly disagreed. The responses as indicated by Likert scale showed that most of the fishermen agreed that increase in temperature have a negative impact on fish production. It implies that increase in temperature will affect the fish activeness in feeding, reproduction and other metabolic processes.

nursing a baby less than three months, prohibited eating of the head of fish for a woman, reduction in the size of the full moon and appearance of the new moon.



* Multiple responses recorded
 Source: Field Survey Data, 2012.

Fig 2: Adaptative Strategies in the study area.

Table 7: shows the result of the Chi Square Analysis, the relationship between the most utilized IS practices (Dependent variable) and the socioeconomic characteristics of the respondents influencing the use of the IS (Independent variables).

Demographic characteristics influencing the use of IS are:

- Gender: X₁
- Marital status: X₂
- Religion: X₃
- Academic qualification: X₄
- Family size and composition: X₅
- Age: X₆
- Level of fishing: X₇
- Years of fishing experience: X₈

The most utilized IS are:

- prohibited fishing for a menstruating woman,
- prohibited fishing for a woman nursing a baby less than three months,
- prohibited eating of the head of fish for a woman,
- reduction in the size of the full moon,
- Appearance of the new moon.

The result on Table 6: shows that there is no significant relationship between the marital status, religion, academic qualification, age, level of fishing, years of fishing experience (Independent variables) and the awareness of this IS but there is a significant relationship between gender, family size and composition (Independent variables) and the awareness of most of the utilized IS. The implication of this result is that the awareness of these IS is very much around in the study area and that will help them to reduce the adverse effect of climate change hence they continue their way of life which is fishing.

Table 7: The Result of Chi Square

Demographic characteristics	Calculated X ²	Tabulated X ²	D.F	Decision
Gender	4.49	3.84	1	S
Marital status	4.01	7.82	3	N.S
Religion	1.69	5.99	2	N.S
Academic qualification	5.62	7.82	3	N.S
Family size and composition	11.74	5.99	2	S
Age	4.38	9.49	4	N.S
Level of fishing	0.38	3.84	1	N.S
Years of fishing experience	5.85	9.49	4	N.S

N.S = Not significant at P = 0.05 Significant level S = Significant.

4. Conclusion and Recommendations

The study identified the IS peculiar to the fishermen in Ilaje LGA, Ondo state, Nigeria. With a view to, examine the utilization of the Indigenous systems of reducing the effect of climatic change and vulnerability of the fisher folks in the coastal region of Nigeria. A well-structured questionnaire was used to obtain information on the IS peculiar to the study area, the information was collected from 84 respondents who were purposively and systematically selected. Most of the respondents were males (85%) while the rest were female. The study revealed that most of the fishing population were able bodies and had the capacity to engage in fishing (38%). Also, (76%) of the fishing population were married. A large proportion of the fishing population was Christians (82%) and about 39% of the entire population had primary education. All the respondents (84%) were aware of climate change and had various premeditated and inadvertent strategies to mitigate the adverse effects of climate change on fish production in the area. The most utilized indigenous system used in the study area was proscribed fishing for a menstruating woman (70%) followed by proscribed fishing for a woman nursing a baby less than three months (56%). The result of the Chi-square analyses revealed that most of the IS had significant relationships with gender, age, level of fishing and fishing experience. 70% of the respondents strongly agree that the occurrence of flood in the area will decrease fish production. The Likert scale results showed that most of the fishermen agreed that increase in temperature has a negative impact on fish production. Based on the result of the fisher folks had different perception and attitude towards increase or decreases the climatic variables. Hence, indigenous system can proffer little or no solution to the effect of climate change in the study area. It is therefore recommended that, Government should bring up policy that would help provide credit to small scale fisher folks in order to enhance their production and diversify their livelihood as a result of unpredicted weather and climate change which might have adverse effect on fish production. Also, extension services should be made available to fish folks in order to encourage them on how to keep climate variables records for future prediction.

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