FISHER'S PERCEPTION AND MITIGATING STRATEGIES ON CLIMATE CHANGE: BEFORE AND AFTER THE COMMENCEMENT IN KATSINA STATE, NIGERIA

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ABSTRACT

The study was carried out to ascertain the fishers' perception on the impacts (negative or positive) of climate change on fisheries activities in Katsina State. The fisheries sector is an important source of livelihood, food security, income and employment for millions of people around the world. The impacts of climate change have been experienced globally particularly in the tropical regions. These have caused various physical and biological changes across the world with negative impacts on agriculture, humans, and the environment. Total of one hundred and sixty (160) structured questionnaires were used. Data collected were analyzed using the mean and standard deviation. While t- test was used in order to compare the means of the variables before and after. Cronbach alpha reliability method was used to evaluate the internal consistency of the items in the questionnaire, where 0.82 reliability coefficients was considered. Results revealed that climate change had some level of negative impacts on the fishers' efforts consequently their income, food security and living standard. There is significant difference observed on the fisheries yields of fishermen efforts, income, food security as well as their level of living standardbefore and after the commencement of climate change observed. Climate change negatively impacted the fishing efforts in the study area. However, the fishers employed some strata of coping strategies to mitigate the negative impacts of climate change, this study, therefore recommended further analysis of the effectiveness of coping strategies adopted by fishers to combat effect of climate change in Nigeria.

KEYWORDS

Climate Change, Fishers, Katsina, Strategies, Perception

1. INTRODUCTION

For millions of people worldwide, the fishery is a vital source of employment, income, food security, and livelihood [1; 2]. Streams, rivers, lakes, artificial reservoirs, creeks, brackish waters, and coastal waters up to 12 nautical miles from shore are the main locations for these fisheries activities, with rural residents making up the majority of participants [3]. According to FAO [1], the number of Nigerian registered fishermen directly engaged in the capture fisheries industry is estimated to be between 12 and 13 million, but this figure may have been underestimated. The Intergovernmental Panel on Climate Change [5] defines climate change as a change in weather patterns that is attributed directly or indirectly to human activities that alter the composition of the global atmosphere and natural climate variability observed over a comparable time period. Climate change is defined as long-term shifts, alteration, or change in the type of climate prevailing over a particular location, region, or entire planet [4].

The impacts of climate change have been experienced globally [6], particularly in the tropical regions [7; 8]. These have caused various physical and biological changes across the world with negative impacts on agriculture, humans, and the environment [9].It is important to note that while the vulnerability to climate change impacts is higher in underdeveloped and developing countries, particularly Africa, the readiness to improve resilience positioned very low [10]. There are factors affecting the climate in relation to fisheries, and this comprises but not limited to global weather patterns.

Before and after model was propounded by [11] in 1974, the model was used in this study to technically compare the past and current situations of fishers before and after if any perceptions of climate change. Change in an environment is natural and variation due to natural effect may be greater, as the measurement of the effects may be hard [12]. Climate change is worldwide issue problem likewise its impact can affect all biotic and abiotic [10]. Being it one of the major challenges facing the fishers' activities as the host environs was affected. The main objectives of this work was to evaluate the fisher's knowledge on the climate change and its potential impacts to their income, livelihood, and food security.

2. MATERIALS AND METHODS

2.1 Study Area

Katsina as a state is 33 years old. The state lies between latitude 11° 7' and 13° 22' north and longitude 6° 52' and 9° 2' east. It has a total land area of about 23,930 km², with an estimated human population of 5.2 million of which majority live in the rural areas. The state extends to three major savannah vegetation zones: Drier Sahel zone in the north and Sudan and guinea savannas in the middle and the southern zones respectively. The mean annual rainfall in the three Agricultural zones (Katsina, Daura, and Funtua) is 300-400m, 600-800m and 900-1100m respectively. Rain fall lasts from April to September depending on the zone [13]

2.2 Design of the Study

Descriptive survey design was adopted for this research, where structured questionnaire was used to randomly collect data from active Artisanal fishers in the study area. The variables of interest are fishers' opinion on the impact of climate change on their fishing yield/catch, income and standards of their living.

2.3 Method of Data Collection

One well-trained enumerators/research assistants from each of the fivere search outlets (Katsina, Jibiya, Kusada, Funtua, and Dutsin-ma) was used to administer the research instrument to the fishers. The research assistants were briefed on the administration, interpretation (where necessary) and collection of questionnaire.

2.4 Population for the Study and Sampling Technique

The targeted population for this study was all active artisanal fishers found on various landing sites within the beset study area. The distribution of fishers by Major Fishing zones of three Agricultural Zones of Katsina State to represent the fishers' population of the Katsina. Total of one hundred and sixty (160) questionnaires were disseminated and the total of (105) forms/responses were retrieved. Multi-stage sampling technique was adopted for the study to select the respondents.

2.5 Data Analysis

Data collected were analyzed using the mean and standard deviation. While t- test was used in order to compare the means of the variables before and after. Cronbach alpha reliability method was employed to determine the internal consistency of the items in the questionnaire and 0.82 reliability coefficients was used.

3. RESULTS

3.1 Status of Fishermen yield before and after the commencement of the climate change

The data presented in (Table 1) below showed that all the 14 fish species had their first mean ($Mean_1$) values ranged from 3.500 and 3.950. All the items had their ($Mean_2$) values less than 3.00 which is an indication that level of fishing yield by the fishers low after the commencement

Table 1: Mean, Standard Deviation and t-test Analysis of the Responses on Level of Fishing Specie Based Yields Before and After Climate Change as Perceived by Fishers in Katsina, Nigeria.

			BEFORE			AFTER				
S/N	**Specie Based Yields, fishing Yields Before and After Commencement of Climate Change**	**$Mean_1$**	**SD_1**	**RMKS**	**$Mean_2$**	**$S.D_2$**	**RMKS**	**t-value**	**t-tab**	**Decision**
1	*Bagrus bayad*	3.950	0.810	H	1.840	0.720	L	0.660	1.960	S
2	*Bagrus docmac*	3.520	0.980	H	1.740	0.860	L	0.4070	1.960	S
3	*Clarias gariepinus*	3.610	0.870	H	1.790	0.800	L	0.850	1.960	S
4	*Clariasanguilaris*	3.560	0.780	H	2.000	0.720	L	0.480	1.960	S
5	*Oreochromisniloticus*	3.520	0.860	H	1.570	0.810	L	0.460	1.860	S
6	*Tilapia zilli*	3.730	0.710	H	1.820	0.750	L	0.190	1.96	S
7	*Sarotherodongalilaeus*	3.800	0.600	H	1.840	0.680	L	0.850	1960	S
8	*Tilapia mosambicus*	3.540	0.740	H	1.920	0.740	L	0.390	1.960	S
9	*Momyrusrume*	3.600	0.740	H	1.850	0.880	L	0.970	1.960	S
10	*Schilbe mystus,*	3.320	0.730	L	1.970	0.730	L	0.270	1.960	S
11	*Alestes nurse*	3.610	0.750	H	2.120	0.750	L	0.070	1.960	S
12	*Alestesdentex*	3.720	0.820	H	1.990	0.820	L	0.700	1.960	S
13	*Synodontismembranaceous*	3.000	0.720	L	2.210	0.720	L	0.490	1.960	S
14	Fish products	3.500	0.710	H	1.980	0.730	L	0.560	1.960	S

Key: SD, H, L, S and RMK stands for standard deviation, high, low, significant, and remark, respectively.

Level of Food Security before and after the commencement of Climate Change

Mean values ranged from 3.50 and 3.92 showed the responses of fishers prior the perception of climate change was presented in (Table 2). Standard deviations (SD) of the species accrue are within the range of 0.70 to 0.98.

Table 2: Mean, Standard Deviation and t-test Analysis of the Responses on Level of Food Security Before and After Climate Change as Perceived by Fishers in Katsina

S/N	Item statements	Before			After			t-value	t-tab	Decision
		Mean$_1$	S.D$_1$	RMKS	Mean$_2$	SD$_2$	RMKS			
A	**Level of Availability of Fish Species in Katsina**									
1	*Bagrus bayad*	3.62	0.82	H	2.39	0.94	L	0.06	1.96	S
2	*Bagrus docmac*	3.83	0.71	H	1.99	0.92	L	0.79	1.96	S
3	*Clarias gariepinus*	3.53	0.82	H	2.04	0.93	L	0.12	1.96	S
4	*Clariasanguilaris*	3.71	0.84	H	1.93	0.72	L	0.40	1.96	S
5	*Oreochromisniloticus*	3.54	0.93	H	1.94	0.70	L	0.50	1.96	S
6	*Tilapia zilli*	3.72	0.88	H	1.95	0.51	L	0.84	1.96	S
7	*Sarotherodongalilaeus*	3.62	0.98	H	2.04	0.99	L	0.86	1.96	S
8	*Tilapia mosambicus*	3.92	0.97	H	2.15	0.86	L	0.29	1.96	S
9	*Momyrus rume*	3.59	0.73	H	1.52	0.94	L	0.41	1.96	S
10	*Schilbe mystus,*	3.54	0.84	H	1.82	0.93	L	0.13	1.96	S
11	*Alestes nurse*	3.61	0.54	H	1.86	0.93	L	0.71	1.96	S
12	*Alestes dentex*	3.82	0.97	H	2.21	0.72	L	0.18	1.96	S
13	*Synodontismembranaceous*	3.53	0.92	H	1.81	0.70	L	0.09	1.96	S
14	Fish products	3.60	0.87	H	2.00	0.51	L	0.95	1.96	S

Key: Note: SD-standard deviation, H-high, L-low, S-significant, RMK-remark.

3.2 Fishers' Income Before and After Climate Change

Fisher's income in the study area was high before the commencement of the climate change as the means ranged from 3.50 to 3.97, contrarily there mean of the studied items ranged from 1.51 to 2.50 which indicated level of income generated from fishing activity by the respondents was low after the commencement of the climate change in the study area (Table 3).

Table 3: Mean, Standard Deviation and t-test Analysis of the Responses on Fishers' Income Before and After Climate Change as Perceived by Fishers in the study area

S/N	Item statements	Mean$_1$	S.D$_1$	RMKS	Mean$_2$	S.D$_2$	RMKS	t-value	t-tab	Decision
	Level of Income Generated from Fishing Before and After Climate Change in the study area									
1	*Bagrus bayad*	3.56	0.65	H	2.33	0.78	L	0.80	1.96	S
2	*Bagrus docmac*	3.59	0.98	H	1.89	0.90	L	0.16	1.96	S
3	*Clarias gariepinus*	3.81	0.87	H	1.72	0.81	L	0.30	1.96	S
4	*Clariasanguilaris*	3.60	0.89	H	2.00	0.77	L	0.19	1.96	S
5	*Oreochromis niloticus*	3.61	0.92	H	1.93	0.90	L	0.50	1.96	S

6	*Tilapia zilli*	3.70	0.70	H	2.13	0.77	L	0.21	1.96	S
7	*Sarotherodon galilaeus*	3.54	0.93	H	1.93	0.92	L	0.73	1.96	S
8	*Tilapia mosambicus*	3.60	0.75	H	2.28	0.77	L	0.91	1.96	S
9	*Momyrus rume*	2.86	0.83	L	1.82	0.73	L	0.38	1.96	S
10	*Schilbe mystus,*	3.51	0.93	H	1.88	0.84	L	0.52	1.96	S
11	*Alestes nurse*	2.67	0.94	L	1.67	0.94	L	0.24	1.96	S
12	*Alestes dentex*	3.76	0.84	H	2.31	0.84	L	0.87	1.96	S
13	*Synodontismembranaceous*	3.96	0.99	H	1.75	0.92	L	0.07	1.96	S
14	Fish products	3.78	0.67	H	2.40	0.77	L	0.61	1.96	S

Key: SD-standard deviation, H-high, L-low, S-significant, RMK-remark.

3.3 Fishers' Living Standard Before and After Climate Change

The results of standard of living were presented in (Table 4) below, the mean value on motor cycle, water system toilet and computer set was 1.55, 1.91 and 1.70. The mean values of fisher's living standard on motor car, computer set and water system toilet was low.

Table 4: Mean, Standard Deviation and t-test Analysis of Responses on Fishers' Living Standard Before and After Climate Change as Perceived in the study area.

		BEFORE			**AFTER**					
S/N	**Item statements**	**Mean$_1$**	**S.D$_1$**	**RMKS**	**Mean$_2$**	**S.D$_2$**	**RMKS**	**t-value**	**t-tab**	**Decision**
	Level of fishers living standard before and after climate change commencement in their respective communities									
	Household equipment acquisition									
1	Television set	2.33	0.78	L	3.64	0.78	H	0.75	1.96	S
2	Radio set	3.64	0.86	H	1.86	0.82	L	0.71	1.96	S
3	Refrigerator	3.88	0.65	H	1.72	0.84	L	0.20	1.96	S
4	Electric cooker	3.53	0.98	H	2.00	0.93	L	0.60	1.96	S
5	Electric fan	3.71	0.87	H	1.93	0.88	L	0.92	1.96	S
6	Kerosene stove	3.81	0.89	H	3.20	0.98	M	0.51	1.96	S
7	Water system toilet	1.70	0.92	L	2.15	0.97	L	0.27	1.96	S
8	Pit latrine	3.55	0.81	H	3.04	0.70	M	0.19	1.96	S
9	Motor cycle	3.64	0.93	H	2.16	0.84	M	0.25	1.96	S
10	Motor car	1.91	0.75	L	1.78	0.64	M	0.16	1.96	S
11	Bicycle	3.69	0.83	H	3.37	0.97	M	0.33	1.96	S
12	Computer set	1.55	0.93	L	2.32	0.92	L	0.35	1.96	S
13	Hand set	2.56.	0.87	M	3.91	0.94	H	0.63	1.96	S
14	Electric iron	3.61	0.84	H	2.34	0.65	L	0.28	1.96	S
	Self-status									
15	Cement block-zinc house	3.99	0.81	H	2.14	0.87	L	0.19	1.96	S
16	Feeding on balance diet	3.53	0.78	H	1.78	0.94	L	0.38	1.96	S
17	Purchase of good clothing	3.52	0.86	H	2.16	0.92	L	0.33	1.96	S

18	Affordability of health service	2.92	0.93	L	3.67	0.65	H	0.36	1.96	S
19	Sponsoring of children education/training	3.78	0.98	H	3.19	1.03	L	0.08	1.96	S

Key: Means $_{(1\ \&2)}$, SD: standard deviation, H: high, L: low, S: significant, RMK: remark and M: moderate.

3.4 Mitigating strategies by fishers in Katsina State

The result presented in Table 5 eight (8) out of 15 strategies had their mean values ranged from 3.51 to 3.92. The standard deviations (SD) ranged from of 0.70 to 0.97 (Table 5).

Table 5: Mean and Standard Deviation on the Coping Strategies Employed or not employed by fishers for Alleviating the Negative Impacts of Climate Change on fisheries activities and Income in Katsina state.

S/N	Adaptation strategies	Mean	S.D	Remarks
1	Diversifying of fishing gears	3.92	0.71	Employed
2	Diversifying of fishing locations	3.96	0.82	Employed
3	Aquaculture/Husbandry	2.98	0.84	Not Employed
4	Changing Fishing time	2.76	0.93	Not Employed
5	Increasing fishing frequency	3.91	0.88	Employed
6	Regular mesh size	3.72	0.98	Employed
7	Using different baits	3.70	0.97	Employed
8	Increasing depth in gear setting	3.82	0.70	Employed
9	Motorized votes	2.85	0.87	Not Employed
10	Reliance on local fishing gears	3.51	0.65	Employed
11	Income diversification	3.62	0.75	Employed

Key: SD-standard deviation

4. DISCUSSION

Based on Fishers' perceptions the means of fishermen catches before and after the commencement of climate change were found to be significantly different, with the fishery's yields lower after change. The study has therefore shown that climate change had a negative impact of reducing fishermen catches in Katsina state. Adaptation to climate change is linked to sustainable socioeconomic development in the belt because large proportions of the inhabitants rely on natural resources (land and water) for their livelihood. Fish is relatively cheaper than meat [14]. Almost every Nigerian has access to fish in a variety of forms, including fresh, smoked, dried, tinned, chilled, and frozen. As a result, there is rarely any mention of fish shortages in the marketplaces [15; 16]. Due to the fact that, unlike swine and cow meat, there are virtually no religious taboos around the consumption of fish, it has a significant impact on food security. This, together with its affordability, explains why fish is in such high demand. Based on the supply of animal protein and job creation, the development of rural areas, and the possibility of foreign exchange, fisheries have an extensive financial effect on Nigeria [17].

Based on Fishers' perceptions the means of food security before and after the commencement of climate change were found significantly different with the food security lower after change. The study has therefore shown that climate change had a negative impact of reducing Fishers' income in Katsina state. Findings of the study shows that the values of responses on living standard of the fishers revealed that fishers had good living standard before the climate change as result of high Catches/yield of the fishing activity. The responses on the coping strategies employed for mitigating the negative impact of climate change on fishing activity and income of artisanal fishermen in Katsina state revealed that the respondents employed the following strategies; Diversified fishing gears, Diversified fishing locations, Changed Fishing time, Increased fishing frequency, Regular mesh size, Using different baits, Increased depth in gear setting, Reliance on local fishing gears and Income diversification which is amicably a clear indication that the fishers perceive some level of climate change and are trying to mitigate by using natural strategies.

5. CONCLUSION

Based on the results of this study, the following inferences were outlined; fishers on average perceived some level of the impact of climate change. It can also be deduced that there was an adverse negative impact on fishers' income, food security and living standard in Katsina state. The climate change negatively impacted the fisher's living standard after the changes. Similarly, fishing yield was adversely affected due to the shocks of the climate change effects on the fishing activities over time. However, the fishers employed some strata of coping strategies to mitigate the negative impacts after the commencement of climate change in the study area.

6. RECOMMENDATIONS

1. Fishers should be enlightened and trained through seminars on appropriate ways for coping with the effect of climate change on fish and fisheries
2. Government should encourage fishers to employ the right adaptation and mitigating strategies for combating negative impact of climate change.
3. Analysis of the effectiveness of coping strategies adopted by fishers to convert the effect of climate change in Katsina state should be intensively conducted

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