www.jard.edu.pl http://dx.doi.org/10.17306/J.JARD.2017.00353

Journal of Agribusiness and Rural Development

pISSN 1899-5241
eISSN 1899-5772

4(46) 2017, 825–833
Accepted for print: 15.11.2017

ARTISANAL FISHER FOLK'S PERCEPTION OF THE EFFECTS OF VARIABILITY IN CLIMATIC FACTORS ON FISH YIELD IN KAINJI LAKE BASIN, NIGERIA

Mustapha Sa'adu[1]✉, Ahmadu Abubakar Tafida[2]

[1]Federal University Wukari, Taraba State, Nigeria
[2]Modibbo Adama University of Technology Yola, Adamawa State, Nigeria

Abstract. This study assessed the artisanal fisher folk's perception of the effects of variability in climatic factors on fish yield in Kainji Lake basin. The specific objectives were to: describe the socio-economic characteristics of the respondents; assess the artisanal fisher folk's perception of the effects of variability in climatic factors on fish yield; and assess the influence of variability in climatic factors on fish yield. Both primary and secondary data was used for the study. Primary data was collected from 173 respondents using structured questionnaires while secondary data was obtained from the Power Holding Company of Nigeria and the National Institute of Freshwater Fisheries Research (NIFFR), all of them located in New Bussa, Niger State. Once collected, the data was analyzed based on descriptive and inferential statistics involving the use of multiple regression models. As shown by the results, 91.32% of respondents were male; many (75.14%) of them aged between 41 and 60. Most of them (90.18%) were married and had Quranic education (96.62%). 48.74% had a household composed of 6 to 10 members. The respondents perceived all the factors of climate variability (draught, change in the lake's water levels, variations in the seasonal calendar, change in seasonal rainfall, Harmattan intensity and change in temperatures) as unfavorable developments (with small variations in the mean scores). As an exception, humidity and change in sunlight conditions were believed to be favorable aspects by the respondents. The implication is that all the variables except humidity and change in sunlight conditions will adversely affect the fish yield, as claimed by the respondents. As shown by the results of a multiple regression study of the influence of variability in climatic factors on fish yield, the temperature had a negative influence on fish yield, whereas water inflow had a positive effect. The study recommends that the local population should attend adult literacy classes and improve their formal education levels. The management of NIFFR and other higher authorities, such as the Ministry of Water Resources and the Ministry of Environment, that are vested with the responsibility of managing the water bodies, should be advised to stock the water bodies with fish species that are resistant to temperature. In turn, the artisanal fisher folk should be encouraged to improve on their management practices, especially as regards overfishing and the use of obnoxious fishing methods. Also, they should extend their livelihood to such areas as crop production, animal breeding, trading/commerce and services as alternative income diversification strategies to cushion the effect of declining fish yields as a result of climate change.

Keywords: artisanal fisher folk, variability, perception, fish yield, Kainji Lake

INTRODUCTION

IPCC (2007) stated that climate variability refers to variations in the mean state and other statistics (such as standard deviations, occurrence of extremes etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. The climate may vary on a large range of spatial and temporal scales. Spatial scales may vary from local and regional areas to a whole

✉Msc Mustapha Sa'adu, Department of Agricultural Economics and Extension, Federal University Wukari, P.M.B 102 Katsina-Ala road, Wukari-Nigeria Taraba State, Nigeria, e-mail: saadu@fuwukari.edu,ng

continent. In turn, temporal scales may range from seasonal to geological (up to hundreds of millions of years). The variability may be due to natural internal processes within the climate system (internal variability) or to variations in natural or anthropogenic external pressures (external variability). Climate variability is an environmental factor strongly associated to aquaculture productivity. Environmental and social aspects are important keys in ensuring sustainable and safe aquaculture production (Anon, 2003; FAO, 2008).

Climate variability is likely to lead to some irreversible impacts. Approximately 20 to 30 percent of fish species may be at increased risk of extinction if increases in average global warming exceed 1.5–2.5°C (Brander, 2010; IPCC, 2007). Climate variability is projected to have a broad impact across ecosystems, societies and economies, increasing pressure on all livelihoods and fish supplies. Capture fisheries have some unique features of the natural resource harvesting sector linked with global ecosystem processes, and thus are more prone to such problems. Aquaculture complements and increasingly adds to the supply chain, has important links with capture fisheries and is likely to be affected by problems faced by the capture fisheries sector. The ecological systems which support fisheries are already known to be sensitive to climate variability (IPCC, 2007). Orr et al. (2005) highlighted various risks to aquatic systems from climate change, including loss of coastal wetlands, coral bleaching and changes in the distribution and timing of fresh water flows, and acknowledged the uncertain effect of acidification of oceanic water which is predicted to have profound impacts on marine ecosystems.

Similarly, fishing communities and related industries are concentrated in coastal or low-lying zones which are increasingly at risk from sea level rise, extreme weather events and wide range of human pressures (Nicholls et al., 2007). At the same time, poverty in fishing communities or other forms of marginalization reduces their ability to adapt and respond to change. Increasingly globalized fish markets cause more vulnerabilities to market disruptions which may result from climate change. The fisheries sector and fisher folk may be impacted by climate variability in a wide range of ways. The distribution or productivity of marine and fresh water fish stocks might be affected owing to the processes such as ocean acidification, habitat damage, changes in oceanography, disruption to precipitation and fresh water availability (Daw et al., 2009).

All marine and aquatic invertebrates (molluscs, crustaceans and worms) and fish are poikilotherms; their body temperature varies directly with that of their environment. This makes them very sensitive to changes in the temperature of their surrounding environment. When changes do occur, they move to areas where the external temperature allows them to regain their preferred internal temperature (Barange and Perry, 2009). This "behavioral thermoregulation" is resulting in rapid migrations towards the poles or cooler bodies of water corresponding to the pole-ward shift of climatic zones. As a result, benefits are likely to accrue at higher latitudes and losses will be experienced in the tropics. Some species will also shift from shallow coastal waters and semi-enclosed areas, where temperatures will increase faster, into deeper cooler waters (Cheung et al., 2009; Roessig et al., 2004). Also, some stocks may become vulnerable to overfishing at levels of fishing efforts that had previously been sustainable (Bates et al., 2008; Easterling et al., 2007; Fagade, 2010).

The environmental changes as a result of variability in precipitation and of water inflow and outflow in Lake Kainji, and the consequential depletion in fish yield over the years, forced the fishers to adjust their activity to a certain ecological, social and economic system. This could allow them to alleviate the adverse impacts of changes and seize some opportunities based on the availability of assets around them in order to develop other livelihood activities (Mustapha, 2013; Tafida and Galtima, 2016).

Apart from the various international projects conducted by the German Technical Cooperation Agency (GTZ), the Japan International Cooperation Agency (JICA) etc. in collaboration with the Nigerian government to address the challenging environmental and ecological problems of the lake (NIFFR, 2012), several other studies were conducted. Their objective was to address the current challenges of poverty, vulnerability and fisheries production in order to enhance the livelihood of fisher folk and to sustain the natural resource base (Bene et al., 2009; Olowosegun et al., 2014; Tafida et al., 2011). However, none of these studies attempts to consolidate the views of artisanal fisher folk on the effects of variability in climatic factors on fish yield in Kainji Lake basin. Such a consolidated approach would provide some imperative guidelines for the primary beneficiaries while ensuring the policy is communicated downstream. This paper intends to describe the socio-economic characteristics of the artisanal fisher folk in the region of Kainji Lake, assess the artisanal fisher folk's perception of the effects of variability in climatic factors on fish yield in Kainji Lake, assess the influence of variability in climatic factors on fish yield in Kainji Lake, and finally to suggest solutions that mitigate the effects of the declining fish yield on the livelihood of the fisher folks.

METHODOLOGY

The study area

Kainji Lake is located between longitudes 4°21' and 4°45' East and latitudes 9°5' and 10°55' North. It cuts across the Niger and Kebbi states, and is mostly located in Niger state. Kainji is the second largest lake and the largest man-made lake in Nigeria (Ayanda and Alamu, 1991). It was created in 1968 following the impoundment of the Niger River by the construction of the Kainji Dam at New Bussa, in Borgu Local Government Area of Niger State. It has a maximum length of 134 km, a maximum width of 24.1 km, a mean and maximum depth of 11 m and 60 m, respectively, a surface area of 1,270 sq. km, a volume of 13×10^9 m^3, and a catchment area of 1.6×10^6 sq. km (Obot, 1989). The climate of the Kainji Lake usually alternates between dry and rainy conditions. The total annual rainfall for the Lake ranges between 1,100 mm and 1,250 mm, spreading from April to October (Salami et al., 2011). The highest amount of rainfall is observed in August. The highest (about 30°C) and the lowest (about 25°C) monthly temperatures are recorded in March and August, respectively (Ajibade, 1982; Richard et al., 2010). As shown by the studies conducted on the Lake basin, the socio-economic characteristics of the people are as follows: the majority of the fishermen are *Sarkawa* sub-tribe of Kebbi Hausa, while other belong to such tribes as *Laru, Gungawa*, *Lopawa* and *Nupes* (Ayanda and Alamu, 1991). Fishing is the major traditional occupation of these people whereas other occupations include: farming, livestock breeding and local entrepreneurship such as pottery, mat weaving, gear/craft making and servicing (Alamu and Mdaihli, 1995).

Sources and types of data

Data for this research was collected from both primary and secondary sources. The source of primary data was demographic information on the fisher folk, and the fisher folk's perception of effects of variability in climatic factors on fish yield. A structured questionnaire was administered to the respondents, based on an interview schedule, to collect this information. Secondary data includes the following: annual fish yield; temperature; rainfall; water inflow and outflow to/from the Lake within a twenty-year period (1994 to 2014). The source of secondary data were the archives of the National Institute for Freshwater Fisheries Research and of the Power Holding Company of Nigeria, both located in New Bussa, Niger State.

Sampling technique

For ease of sampling, Kainji Lake is divided into three main strata (A, B, C) and further subdivided into eight sub-strata (01–08) by the National Institute for Freshwater Fisheries Research (NIFFR) in New Bussa. There are 296 permanent fishing villages and camps with a fishing population of 3,823. This figure (3,823) represents the sampling frame out of which the sample of the study was drawn. The stratified random sampling technique was used to select the communities and respondents. As the communities and respondents are homogenous in nature, they stand equal chance of selection.

Two steps were involved in drawing the sample population as presented in Table 1.

Step one

- The eight sub-strata of the Lake, cutting across Niger and Kebbi states, were used for the study.
- 5% of the villages (30) were considered to represent the total village population in the sampling frame (296).
- In order to obtain a proportionate number of villages per sub-stratum, the village sample size (30 villages) was distributed amongst the eight sub-strata, namely:

$$nh_1 = Nh_1/N_1 \times n_1 \quad (1)$$

With:

nh_1 = number of villages in the sample stratum
Nh_1 = number of villages per sub-stratum
N_1 = total number of villages on the lake
n_1 = village sample size (30)

After establishing the village sample size per substratum, the random sampling technique was used to select the required number of villages per stratum, so that every village has an equal chance of selection.

Table 1. Selection of villages and respondents for the study

Substratum	Number of villages	Number of sampled villages	Villages	Fishing population	Sampled population
1	46	5	Garafini	5	2
			Kwanga	9	4
			T. Alh. Saliu	33	16
			T. Libata	12	5
			T. Mongoro	7	3
2	52	5	G. Auna	16	5
			T. Dan Hugal	22	8
			T. Kindawa	6	3
			T. Mongoro	4	1
			T. Samiya Dala	5	2
3	62	6	Amboshidi	23	9
			Kukubawa	10	4
			Shagunu	26	10
			T. Alh. Manu	12	5
			T. Dendi	9	4
			T. Maisaje	12	5
4	7	1	Audu gungu	7	3
5	11	1	T. Magariya	10	4
6	28	3	Libata	15	6
			T. Alh Idi	4	1
			Wara	66	27
7	22	2	Agwata Samaila	9	4
			T. Wata	7	3
8	68	7	Barashi	21	8
			Dadabo	15	7
			G. Ikum	23	7
			Magobite	21	6
			T. Alh. Sharu	9	4
			Uchinanu	10	4
			Yabo rofia	5	2
Total	296	30	30	433	173

Source: own elaboration based on field survey, 2015.

Step two

- The lists of fishing population in all of the selected fishing villages were identified.
- To identify the actual sample, 40% (173) of the total fishing population in the selected villages were assumed to be the study population.
- The population was stratified to obtain a proportionate number of respondents per selected village covered by the study population.

$$nh_2 = Nh_2/N_2 \times n_2 \quad (2)$$

With:

nh_2 = number of respondents (Fisher folks) in a sample village

Nh_2 = population of fisher folks in a specific village

N_2 = total fishing population in the sampled villages (433)

n_2 = sample population (173)

Finally, the study population from the selected villages was selected using random sampling technique.

Analytical technique

Descriptive and inferential statistics were used for this study. Descriptive statistics were used to describe the socio-economic characteristics of the respondents and to assess the artisanal fisher folk's perception of the effects of variability in climatic factors on fish yield. Multiple regression analysis was used to assess the influence of variability in climatic factors on fish yield in Kainji Lake.

Descriptive statistics

Descriptive statistics such as frequency distribution, means and percentages were used.

The mean is expressed as:

$$\bar{X} = \Sigma fx / n \quad (3)$$

With

$\bar{X}$ = mean

Σfx = sum of individual observations

n = sample size

Likert scale

The Likert scale was used to assess the respondents' perception of the effects of variability in climatic factors on fish yield in Kainji Lake.

$$X = \Sigma X_i/N \quad (4)$$

with:

i = 1, 2, 3, 4, 5; X is the assigned perception score (i.e. critical problem = 5, major problem = 4, problem = 3, minor problem = 2, not a problem = 1)

N = number of occurrences

Σ = summation sign

To determine the fisher folk's perception of effects of climate variability on fish yield, a list of known variables of possible effects of climate change on fish yield was provided. The fishing population were asked to rank specific problems on a 5-point Likert scale, with: critical problem = 5, major problem = 4, problem = 3, minor problem = 2, not a problem = 1. The values on the scale were added together and divided by 5 to obtain the mean value of 3. Variables with a mean score value ≥ 3 are considered to be perceived as potential problems posed by climate change, while variables with a mean score below 3 were not regarded as such. Lastly, priority ranking was used to arrange the respondents' perception of the effects of climate variability on fish yield.

Model specification

$$Y = b_0 + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + u \quad (5)$$

Y = Fish yield

x_1 = Rainfall (mm)

x_2 = Temperature (°C)

Water outflow (m^3)

u = Error term

RESULTS AND DISCUSSION

According to the findings of this study (Table 2), the majority of respondents (91.32%) were males while the share of females was 8.68%. This is because fishing is believed to be a male occupation due to religious and cultural background. Another reason is that fishing requires physical energy, strength and agility which are male characteristics. The findings revealed that the majority (75.14%) of respondents were aged between 41 and 60. Those aged between 21 and 40 and the group above 60 accounted for 23.69% and 1.15%, respectively. The mean age of the fishing population was 43 years. This implies that most of the respondents are members of the middle-aged group. The majority of respondents were married (90.18%) while 4.04% were single, 3.46% were divorced and 4% were widowed. This shows that married people dominated the artisanal fishing sector

Table 2. Socio-economic characteristics of the respondents

Characteristics	Frequency (%)
Gender	
Male	158 (91.32)
Female	15 (8.68)
Age	
21–40	41 (23.68)
41–60	130 (75.14)
> 61	2 (1.15)
Marital status	
Single	7 (4.04)
Married	156 (90.18)
Widow/widower	4 (2.32)
Divorced	6 (3.45)
Educational status	
Quranic education	150 (86.70)
Primary education	10 (5.78)
Secondary education	13 (7.51)
Years of fishing experience	
11–20	16 (9.24)
21–30	68 (39.30)
31–40	76 (43.93)
> 40	13 (7.51)

Source: own elaboration based on field survey, 2015.

in the study area because they have more responsibilities and therefore require a better livelihood than single, divorced or widowed persons with fewer responsibilities. The respondents' distribution by educational level revealed that most of them (86.70%) had attended a Quranic school. Only 5.78% and 7.51% had attended primary and secondary schools. None of the respondents had a tertiary education. The respondents' distribution by fishing experience is as follows: 9.24% of them had 11 to 20 years of fishing experience, 39.30% had 21 to 30 years of experience, 43.93% had 31 to 40 years of experience and 7.51% had more than 40 years of experience. This means that the respondents were highly experienced fishermen, able to become conversant with the system, improve their productivity and adequately manage their time and resources.

The respondents' perception of climate factors variability on fish yield

Perception often refers to conscious understanding of a certain situation or thing, usually based on one's experience. Different individuals have different ways of understanding issues, depending on numerous aspects, such as age, knowledge, experience etc. Table 3 shows that drought is perceived by the respondents as the top critical problem with a mean score of 4.71. Other issues perceived as critical problems were as follows: change in water levels of the lake (mean score of 4.69); variation in seasonal calendar (mean score of 4.62); change in seasonal rainfall and Harmattan intensity (mean score

Table 3. Respondents' distribution by perception of effects of climate factors variability on fish yield

Perception	Mean score	Rank	Remark
Harmattan intensity	4.61	4	Critical problem
Change in temperature	4.55	6	Critical problem
Change in seasonal rainfall	4.61	4	Critical problem
Change in sunlight conditions	1.39	7	Not a problem
Humidity	1.25	8	Not a problem
Variation in seasonal calendar	4.62	3	Critical problem
Change in water levels of the lake	4.69	2	Critical problem
Drought	4.71	1	Critical problem

≥ 4.0 – critical problem, 3.5–3.99 – major problem, 3.0–3.49 – problem, 2.5–2.99 – minor problem, ≤ 2.5 – not a problem.
Source: own elaboration based on field survey, 2015.

Table 4. Multiple regression analysis of influence of variability in climatic factors on fish yield (exponential)

Variables	Parameters	Coefficient	Standard error	*T*-value
Constant		–14.972**	6.414	–2.334
Rainfall	X_1	.000	.001	–1.253
Temperature	X_2	–.692***	.168	–4.113
Water inflow	X_3	5.017*	.000	1.896
Water outflow	X_4	2.445	.000	.955

***, **, * represent values significant at 1%, 5% and 10%, respectively.
Source: Computer output (SPSS) analysis, 2015.

of 4.61 each); and change in temperature (mean score of 4.55). Change in sunlight and humidity conditions were not perceived to be a problem, with mean scores of 1.39 and 1.25, respectively. The respondents perceived the variability of all climate factors as an unfavorable development. There was little variation in the mean scores, except for humidity and change in sunlight conditions which were perceived as a favorable development by the respondents. The implication is that, in the respondent's opinion, all the variables except humidity and change in sunlight will adversely affect fish yield.

Results of multiple regression analysis of the influence of variability in climatic factors on fish yield

The analysis determined the relationship between the dependent variable and independent variables. Y, the dependent variable, is the fish yield over the years while X_1–X_4 are the independent climate variables: temperature, rainfall, and water inflow/outflow.

Four functional forms were tested. Based on the econometric and statistical criterion, an exponential equation was chosen as the lead equation. The results are presented in Table 4. As shown by the adjusted R square, 46.90% of variation in Y (fish yield) was explained by the explanatory variables (rainfall, temperature, water inflow and outflow). However, this is because several other variables that affect fish yields such as pollution, overfishing, management etc. were not covered by the present study but could be responsible for the remaining percentage of the R^2. F-ratio is significant at 1%, suggesting that the model is adequate in explaining the probable effect of explanatory variables on fish yield (Y). Temperature is significant at 1% and has an adverse effect on fish yield. In other words, the temperature has an inverse relationship with fish yield. Therefore, the higher is the temperature, the higher is the probability of the fish yields to decline. Water inflow is significant at 10% and has a positive effect on fish yield. Thus, the higher the increase in water inflow, the more probable is the increase in fish yield; and the higher the decrease in the inflow (outflow), the more probable is the decrease in fish yield.

CONCLUSION

The fishing activity in the lake basin is dominated by males, while women are mostly engaged in processing and marketing. Most of the fishing population do not have any formal educational background. Because of their multi-year experience, the fishing population perceive some changes in the climatic factors such as drought, rainfall and temperature variation. The fisheries of the lake have declined over the years. The artisanal fisher folk should be encouraged to improve on their literacy skills so as to enhance their human capacity. There is need for adult literacy classes and formal education. The water temperature is exogenous to the fisher folk and in most cases they are unable to address the effect. However, the management of NIFFR and other higher authorities, such as the Ministry of Water Resources and the Ministry of Environment, that are vested with the responsibility of managing the water bodies, should be advised to stock the water bodies with fish species that are resistant to temperature. That would improve the fecundity and abundance of fish in the lake. The artisanal fisher folk should also be encouraged to improve on their management practices, especially as regards overfishing and the use of obnoxious fishing methods. Also, they should extend their livelihood to such areas as crop production, animal breeding, trading/commerce and services as alternative income diversification strategies to cushion the effect of declining fish yields as a result of climate change.

REFERENCES

Ajibade, A. C. (1982). The origin of the Older Granites of Nigeria: some evidence from the Zungeru region. Nig. J. Mining Geol., 1, 223–230.

Alamu, S. O., Mdaihli, M. (1995). Evaluation of Formal and Informal Loan Scheme Existing in Kaimji Lake (p. 188–193). National Institute for Fresh Water Fisheries Research Annual Report.

Anon, C. (2003). Annual Fisheries Statistics (vol. 1). Department of Fisheries.

Ayanda, J. O., Alamu, S. O. (1991). Preliminary investigation into the development and impact of fishermen's organization in the Kainji Lake basin (p. 195–204). National Institute for Freshwater Fisheries Research annual report.

Brander, K. M. (2010). Impacts of Climate change on fisheries. J. Marine Syst., 3, 389–402.

Bates, D. (2008). Environmental refugees? Classifying human migration caused by Environment change. J. Popul. Env., 5, 465–478.

Barange, M., Perry, R. I. (2009). Physical and ecological impacts of climate change relevant to marine and inland capture fisheries and aquaculture. In: K. Cochrane, C. Young, D. De Soto, T. Bahri (Eds). Climate change implications for fisheries and aquaculture overview of current scientific Knowledge (p. 7–43). FAO Fisheries and Aquaculture Technical paper: No. 530. Rome: FAO. Retrieved from: http://www.fao.org/docrep/012/i0994e/i0994e02a.pdf

Bene, C., Kodio, A., Lemoalle, J., Mills, D., Morand, P., Ovie, S., Sinaba, F., Tafida, A. A (2009). Participatory diagnosis and adaptive management of small-scale fisheries in the Niger River Basin. CPWF Project Number 72: CGIAR Challenge Program on Water and Food Project Report series.

Cheung, W. W. L., Lam, V. W. Y., Sarmiento, J. L., Kearney, K., Watson, R., Pauly, D. (2009). Projecting global marine biodiversity impacts under climate change scenarios. Fish Fisher., 10, 235–251.

Daw, T., Adger, W. N., Brown, K., Badjeck, M. C. (2009). Climate change and capture fisheries: potential impacts, adaptation and mitigation. In: K. Cochrane, C. Young, D. De Soto, T. Bahri (Eds). Climate change implications for fisheries and aquaculture overview of current scientific Knowledge (p. 107–150). FAO Fisheries and Aquaculture Technical paper: No. 530. Rome: FAO. Retrieved form: http://www.fao.org/docrep/012/i0994e/i0994e03.pdf

Easterling, W. E., Aggarwal, P. K., Batima, P. (2007). Food, fibre and forest products. In: M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. van der Linden, C. E. Hanson (Eds.). Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (p. 273–313). Cambridge, UK: Cambridge University Press.

Fagade, S. O. (2010). Climate Change: Implications for fisheries and coastal aquaculture Keynote Address delivered on 25th annual conference, fisheries society of Nigeria, held at Administrative Staff College of Nigeria, Badagry, Lagos State, Nigeria.

FAO (2008). A review of scientific knowledge on climate change impacts and implications for fisheries and aquaculture. Rome: FAO.

IPCC (2007). IPCC adapts major assessment of climate science. Retrieved from: http://www.ipcc.cn/press/prwg-2feb07.htm

IPCC (2001). Climate Change 2001. IPCC Third Assessment Report.

Nicholls, R. J., Wong, P. P., Burkett, V. R. (2007). Coastal systems and low-lying areas. In: Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on te Change.

NIFFR (2012). Statistical Bulleting. An Annual Publication of National Institute for Freshwater Fisheries Research.

Mustapha, M. K. (2013). Potential Impacts of Climate Change on Artisanal Fisheries of Nigeria. J. Earth Sci. Clim. Change, 4, 126–130.

Obot, E. A. (1989). The macrophytic flora of the draw down area of Lake Kainji. Nig. Jo. Ecol., 27, 173–177.

Olowosegun, A. O., Odunuga, E. J., Landu, O., Olowosegun, O. M. (2014). Fisher Folk's Response to Climate Change in New Bussa and its Environs of Kainji Lake Basin Nigeria. Int. J. Agric. Res., 9, 312–318.

Orr, J. C., Fabry, V. J., Aumont, O., Bopp, L., Doney, S. C., Feely, R. A., Gnanadesikan, A. (2005). Anthropogenic ocean acidification over the twenty-first century and its impact on calcifying organisms. Nature, 437, 681–686.

Richard, L. B., Attahiru, M. S., Innocent, Y. Y., Simon, N., Rafiu, A. (2010). Indigenous Fish Identification Methods In Lakes Kainji and Jebba, Nigeria. Report Opin., 2(6), 16–22.

Roessig, J. M., Woodley, C. M., Cech, J. J., Hansen, L. J. (2004). Effects of global climate change on marine and estuarine fishes and fisheries. Rev. Fish Biol. Fisher., 14, 251–275.

Salami, A. W., Sule, B. F., Okeola, O. G. (2011). Assessment of Climate Variability on Kainj Hydropower reservoir. Paper presented at the annual conference of the National Association of Hydrological Science, "Hydrology for Sustainable Development and Management of Water Resources in the Tropic" (18^{th} – 21^{st} Oct. 2011).

Tafida, A. A., Adebayo, A. A., Galtiajima, M., Raji, A., Jimme, M., John, C. T. (2011). Livelihood Strategies and Rural Income: The case of fishing communities in Kainji Lake Basin, Nigeria. Agric. J., 6(5), 259–263. DOI: 10.3923/aj.2011.259.263

Tafida, A. A., Galtima, M. (2016). Environmentally Induced Alternative livelihood. Strategies Among the Artisanal Fisher Folk of Kainji Lake Basin, Nigeria. Int. J. Env. Sci. Dev., 7, 1, 36–40. Retrieved from: http://www.ijesd.org/vol7/737-D667.pdf