



## IMPACT OF WEATHER CHANGES ON FISH CATCH AND SEASONAL DISTRIBUTION OF SPECIES IN DOWNSTREAM KAINJI LAKE, NIGER STATE, NIGERIA

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### Abstract

*The paper investigated the impact of weather changes on fish catch and seasonal distribution of species in downstream of Kainji Lake, Niger State. The study utilised structural questionnaire to elicit information from the people using systematic sampling procedure. Linear regression and simple descriptive statistic was used in the analysis of the data. Result showed that weather changes have impacted on fish catch and species distribution in the study area. The impact ranges from reduction in quality of fish catch, harvesting and post harvesting practices. Analysis of rainfall and temperature data shows an increased trend in the rainfall pattern with  $R^2$  value of 0.0424 while the pattern of temperature distribution showed a fluctuating trend with  $R^2$  value of 0.0654. Result further indicated that species catch varied with season as more fish are caught during wet season. The study discovered are that 80% of *Cichildeagalileus* are caught in dry season and 95% *Distichodusrostratus* caught in wet season. The use of obsolete fishing equipment and techniques, seasonal variation in species distribution and flooding were identified as the major challenges facing fishing communities in the study area. The study recommended that fish farmers need alternative ways of diversifying their socio-economic activities. Also, that government should empower the fish farmers with modern equipment and techniques that will reduce risk and improve their safety.*

**Keywords:** Weather Change, Fish Catch, Seasonal Distribution, Downstream, Kainji Lake.

### 1.1 Introduction

Weather is the state of the atmosphere describing the degree of hotness and coldness, wet or dry, calm and cloudy. While climate is the average weather experienced over a long period. This includes weather elements such as temperature, wind, humidity, and air pressure and rainfall patterns. Climate change is more than just a change in the weather it refers to seasonal changes over a long period of time (IPCC, 2007).

Change of weather will impact on fisheries through a diversity of direct and indirect pathways whose importance will vary depending on the type of ecosystem and fishery. Inland fisheries,

particularly important for small-scale fishers in developing countries and an integral part of many rural livelihood systems will be severely impacted by changing water levels and flooding events, while coastal marine fisheries dependent on sensitive ecosystems such as coral reefs will be impacted by rising water temperature that affects ecosystem functions. Some of the pathways identified are impacts of Precipitation and evapotranspiration change on hydrology of inland water flows and flood timing and extent change, affecting fish reproduction, growth and mortality, as well as other elements of wetland-based livelihoods (agriculture, pastoralist, forestry etc.). Changes in precipitation quantity, location and timing that alter water availability will collectively alter abundance and composition of wild stock, and impact on seed availability for recruitment. Changes in lake water level will alter spawning and recruitment of endemic fish species. Lower water level will lead to low water quality due to reduced productivity capacity of photosynthetic balance (Allison *et al.* 2005).

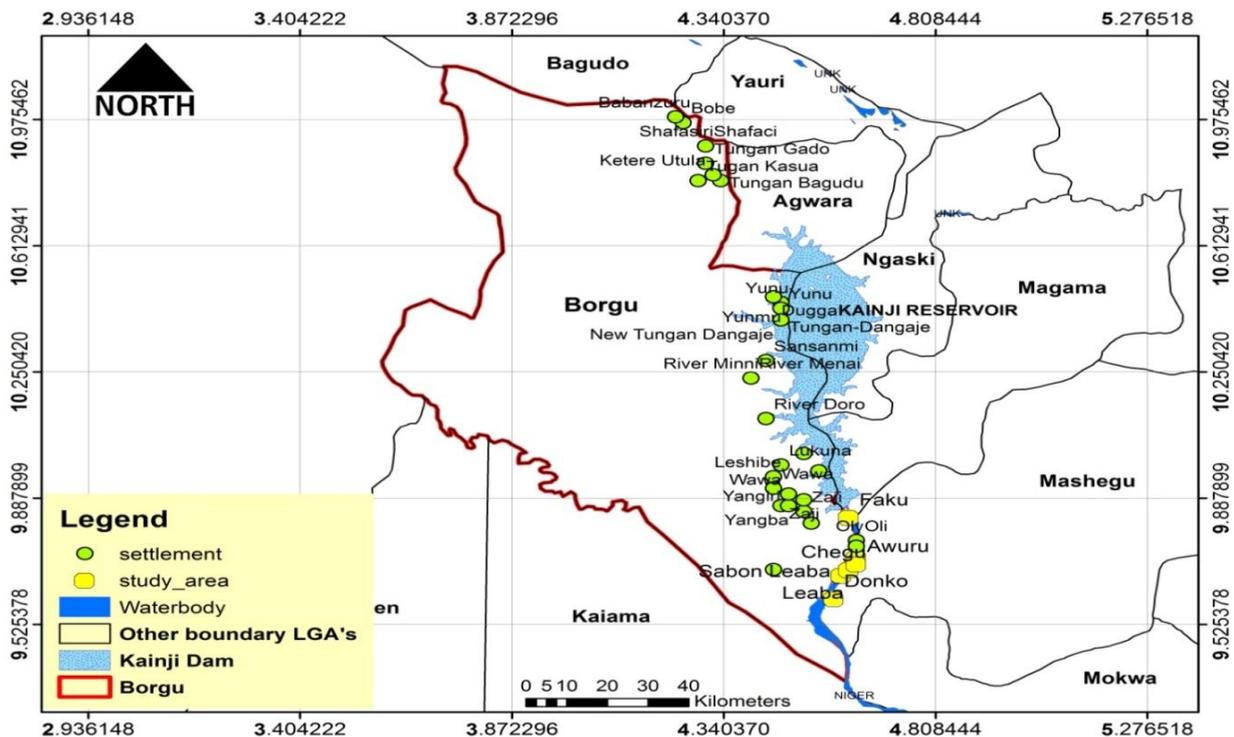
Fish Often seek optimal temperature or salinity regimes or avoid suboptimal conditions. Thus, ocean and freshwater changes as a result of projected climate changes can lead to distributional changes. In suboptimal conditions, performance is reduced, leading to starvation or increased predation. Damage to other livelihood and food production resources may also occur. A thorough knowledge of the optimum temperature for nearly all fish stock is necessary for the prediction of fish concentration (Klyastorin, 2001).

Changes in temperature and rainfall altered the catch of some fishes but other factors such as over-fishing, pollution and the reduction in freshwater flow may have influenced the fish and shrimp catch. Therefore, proper fisheries management and monitoring is required to meet the challenges of global climatic changes as well as other environmental issues (Ayub, 2010).

(Grace, 2011) stated that fish recovery becomes less available in inshore waters but more numerous in offshore waters when water temperatures are warmer than average. Sea temperature change on aquatic ecology is shifting range of fish species, change in ocean currents affecting upwelling zone fisheries, coral bleaching affecting reef fisheries, disruption to fish reproductive patterns and migratory routes. This present study examined the impact of weather changes on fish catch and seasonal distribution of species in downstream Kainji Lake, Niger State, Nigeria.

## 1. THE STUDY AREA

The Study Area which is the downstream communities of Kainji lake, located in Borgu Local Government Area of Niger State. The selected communities are; Fakun, Awuru, Emighi, Awuru, Sabon Leaba, Chegun and Doko located between Longitude 04°35' 00" – 04°38' 00" meridian and Latitude: 09° 45' 00" – 09°50' 00".



**Figure 1:** Study Area (Downstream of Kanji Lake)

**Source:** Authors work

## 2. Materials and Methods

The major data used for this study were collected from field observation using structural questionnaires and data on weather parameters (rainfall and temperature) from National Institute for Fresh Water Fisheries Research (NIFFR) from 1995 to 2016. Simple linear regression analysis was used and this involved the use of one independence variables to show the pattern of weather changes (rainfall and temperature). The equation is given as:

$$Y = a + bx$$

Where

Y= Rainfall and Temperature

a= constant

b= slope

x= A year index (decade)

While the Data collected from the field were subjected to descriptive analysis that is frequency, mean and percentage distribution using the equation below:

Average response= $\frac{Xn}{N}$

Xn=total response received per option

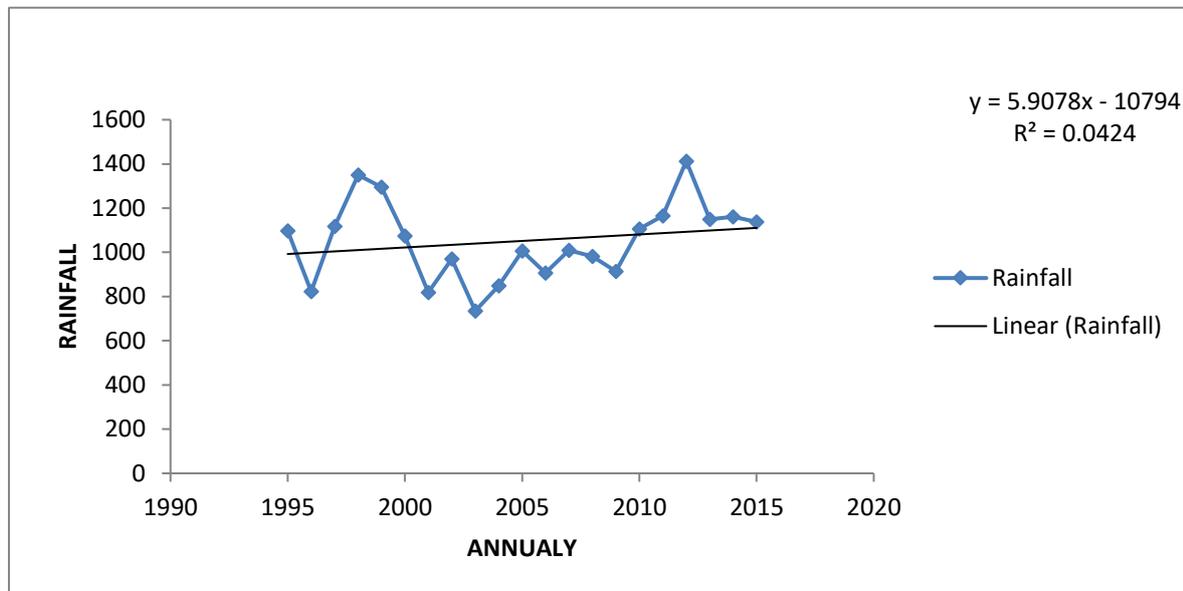
N=1, 2,3,4,5 i.e. response value per option

Mean( $\bar{X}$ ) response =  $\frac{\text{sum of average response per option}}{100}$

### **3. Results and Discussions**

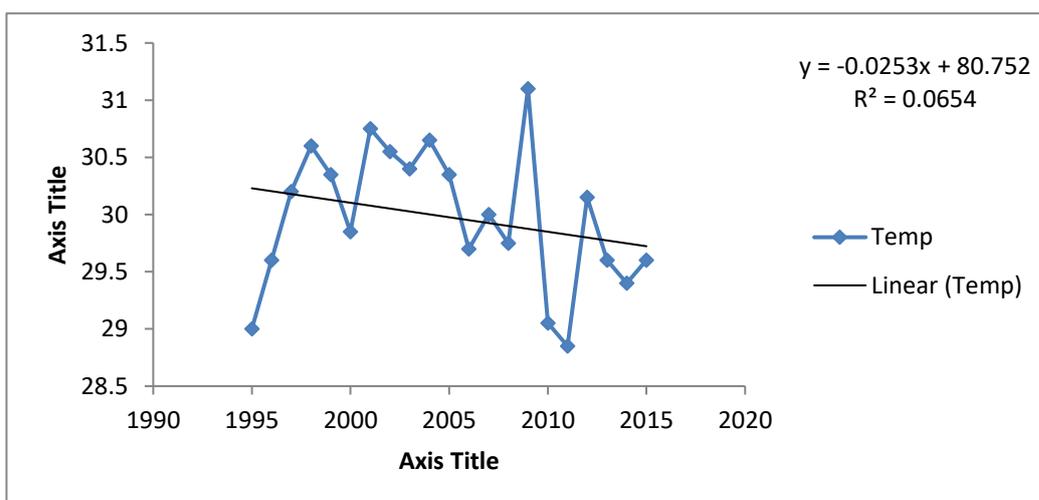
#### **Analysis of Rainfall and Temperature Patterns in the Study Area (1995-2016)**

Figure 2, shows rainfall patterns in the study area from 1995-2016. The result revealed an increased trend between 1997 to 2000, while between 2008 to 2009 and 2010 to 2016 a downward trend was observed. Result from figure 2 further shows that 2012 recorded the highest rainfall amount in the study area while the lowest rainfall amount was recorded in 2003. Generally, the study area experienced fluctuating rainfall pattern while the rainfall amount increased with  $R^2=0.0424$  which account for 4% increase in rainfall amount.



### Analysis of Temperature Patterns in the Study Area (1995-2016)

Figure 3 shows the analysis of temperature pattern in the study area from 1995 to 2016. The result shows that the study area experienced reduction in the mean annual temperature from 1995 to 2000. 2001 to 2003 recorded an increase in the mean annual temperature with 29<sup>0</sup>C while 2010 recorded the highest mean annual temperature with 31<sup>0</sup>C. Generally, the study area experienced fluctuating mean annual temperature with R<sup>2</sup>=0.0654. The fluctuation in temperature pattern implies that there is evident of weather variability in the study area which will have effect on fish catch and species distribution.



**Figure 3: Mean Annual Temperature Distribution over the Study Area (1995 -2015).**

### **Analysis of Impact of Weather Changes on Fish catch and Species Distribution**

Table 1 shows the impact of weather changes on fish catch and species distribution in the study area. Result revealed that 3.92% of the respondent agreed that the pattern of weather variable have influences on fish catch and species available. 2.8% of the respondent disagree that weather variables affects fish harvesting and postharvest activities. This study observed that 3.25% of the respondent disagree that weather variable affect fishing techniques and equipment. Result also shows that 3.62% of the respondent agreed that the quantity of fish catch maybe associated with pattern of weather variable.

The study revealed that there is a variation in quantity of fish catch depending and pattern of temperature and rainfall in the study area and this variation depend on season of the year. Investigation shows that large quantities of fish are caught in wet season than dry season. The study also shows that 80% of *Cichilideagalileus* species are caught in dry season while 95% of *Distichodusrostratus* species are caught in wet season. Finding from the study shows that 4.45% of the respondent agreed that species catch varied with pattern of weather variable and seasonality. The study discovered that species catch varied with the pattern of rainfall and temperature with respect to dry and wet seasons. Furthermore, the study revealed that more fish are caught in wet season with difference in species from one season to the other. This study also found out that temperature and rainfall altered the catch of some fish species.

**Table 1**Repondents Consensus Opinion Interpretation

S/N	Opinion of respondent	Sum	Mean (sum/100)	Interpretation (consensus opinion)
1.	The pattern of weather variable may have influences on fish catch and species available?	392	3.92	Agree
2.	Weather variables are believed to have effect on fish harvesting and post harvesting activities?	283	2.83	Disagree
3.	The effect of weather variable may likely affect fishing techniques and equipment?	325	3.25	Disagree
4.	The quantity of fish catches maybe associated with pattern of weather variable?	362	3.62	Agree
5.	Species catch varied with pattern of weather variable and seasonality?	445	4.45	Agree

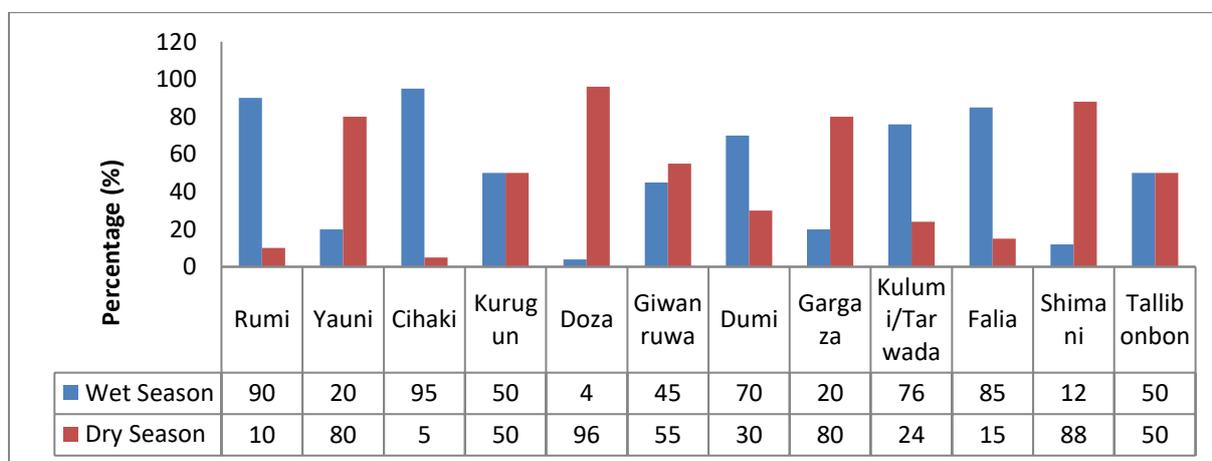
### Analysis of Species Distribution during Wet and Dry Season

Figure 4, shows the frequency of occurrence of some of the common species found in the lake in relation to dry and wet seasons, 90% of *Mormyridaemormyrus* (Rumi) species are caught in wet season while 10% are caught in dry season, 20% of *Gymnarchusniloticus* (Yauni) are found in dry season and 80% in wet season, 95% of *Distichodusrostratus* (cihaki) are caught in wet season, 5% in dry season, 50% of *Synodontismembrancea* (*kurugu*) are caught in both dry and wet season this implies that *Synodontismembrancea* are in abundances in both season, about 4% of *Bagridaebagursbajaad* (Doza) are found in wet season while 96% are

found in dryseason, 45% of *Latesniloticus* (Giwanruwa) are caught in wet season and 55% in dry season, more than 70% of *Labeosenegalensi* (Dumi) are caught in wet season, 30% in dry season, almost 80% of *Cichlidaegalilaeus* (Gargaza) are found in dry period and 20% in wet season, 76% of *Clariasgariiepinus* (kulumi) are caught in wet season and 24% in dry season, 75% of *Citharinuscitharus* (Falia) are caught in wet season and 15% in dry, 88% of *AlestidaeAlestesbaremoze* (shamani) are caught in dry season and 12% in wet season, 50% of *Tetraodon lineatus* (Tallibonbon) are found in dry season while in wet season 50% are also found.

Conclusively, the study discovered that weather variables have impact on species abundant, which is in agreement with Allison *et al.* (2005), who highlighted that temperature changes produce changes in the abundance of species, sometimes of many orders of magnitude because of its impacts on water masses and hydrodynamics, as well as adversely affecting fish physiology like growth, reproduction and general activity.

It is naturally to expect pole-ward range movement of species or migration to cool water environment with increasing temperature in the tropics or an area within the water body. Consequently, according to Ezenwaji (2006), many fish species make seasonal migrations towards the poles during the summer and towards the equator in winter. Thus, these migrations are likely to be temperature dependent and the seasonal pattern of rainfall is changing annually and inter-annually, due to the direct and indirect effect of climate change. Direct effects are reduced rainfall and greater evaporation act on physiology and behaviour and alter growth, development, reproductive capacity, mortality which in turn impact on distribution of species caught. And also the study discovered that some of the species found in the lake has gone on extinction.



#### **Figure 4: Frequency of Occurrence of Some Species during Dry and Wet Seasons.**

#### **Conclusion and Recommendations**

It is evident that fish farmers in the study area experienced fluctuation in weather pattern. Increase in rainfall will tend to increase the quantity of fish catch while changes in temperature alter the distribution of species. The impact of weather changes ranges from reduction in quantity of fish catch, harvesting and post harvesting activities, fishing techniques and seasonal variation in species distribution and flooding of fish. Therefore, there is an urgent need for the fish farmers to have alternative way of diversifying their socio-economic activities. The farmers should also adopt alternative method of culturing fish artificially so as to minimise the effect of changing weather pattern on their operations.

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