

**Abstract**

Fishes have generally evolved physiologically to live within specific environmental variations, and existence outside these variations can be stressful or fatal. Extreme environmental factors such as, elevated water temperature can have deleterious effects on fishes. This research was carried out to assess the potential effects of climate change on fisheries of River Zunguru, Niger State, Nigeria. Data collection included cross-sectional survey with a number of qualitative methods; focus group discussion, in-depth interviews were administered. The secondary data on rainfall and temperature were gotten from Nigerian Meteorological Agency (NIMET), Niger State. The study revealed that, temperature increased, while the amount and number of fish species dropped. Increase in temperature caused fish mortality particularly during dry season when the temperature peaked coupled with shocks from the large number of electric fish which was one of the dominant fish species in the river. It also showed a decrease in number of catches and biodiversity of the River due to overfishing, as well as, the effect of damming downstream. Moreover, the study showed that, most of the fisher folks were locals with limited knowledge and understanding of climate change.

**Keywords:** Climate change, River Zunguru, temperature, rainfall.

**Introduction**

Natural climatic fluctuations, particularly those at medium (decadal) scale have always affected fisheries as well as management performance (Ipinjolu *et al.*, 2014). Global warming means an increase in global mean air temperature. Air temperature increases, a similar increase is expected in water temperature which has wide spread effects on the life history, physiology and behavior of most aquatic organisms including fishes. Moreover, climate associated changes affect the annual rainfall a particular region experiences, which significantly affects lake levels, fish catches, production and supply. The significance of fisheries is often understated, the implications of climate change for these sectors; and for coastal and inland communities in general are difficult to ignore (Barange *et al.*, 2010).

The potential effects of climate change on fisheries of River Zunguru, Niger State, Nigeria was assessed in this research.

**Materials and Methods**

**Data Collection**

Data for this study were generated through a survey on production function which controls the aquatic environment and physical, biological and socio-economic factors of the study area; and how climate change affect fisheries. Some of the documented in maps (Figures 1 and 2), graphs, and complemented with participatory questionnaire, focus group discussion in-depth interview to obtain salient but important human components of potential effect of climate change and to get into the specific actions of the people to avert climate change. The secondary data consisted of ready materials obtained in formats such as, meteorological data from NIMET (i.e. temperature and rainfall records from 1984-2010) and relevant digital formats while the topographic maps of Niger State and its environs were digitalized to act as a baseline map of the study area.



Plate1: Satellite image of River Zunguru

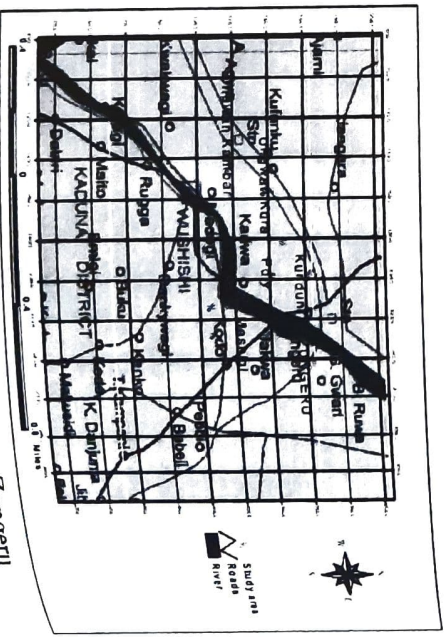


Figure1: Base Map of River Zunguru

**Data Analysis**

The data obtained on climate (i.e. temperature and rainfall records) were related statistically and presented in form of graphs while the primary data were analyzed and presented as tables and themes respectively.

**Results and Discussion**

Table 1 is a summary of the observable changes around the study area.

Observed Changes in the River from 1981-2011

	1981	2011	Reasons for the change
<b>Fish and Fishing</b>			
Species availability	Higher	Lower	Rapid increase in number of fisher folk in the community
Fish growth rate	Moderate	Higher	Increased availability of food and ability to escape catch
Mortality rate	Lower	Higher	High temperatures especially during dry season as well as, shock from electric fish which happen to be one of the dominant species in the river.
Number of fishermen	Lower	Higher	High cost of living and increase demand for fish
Volume of catch	Higher	Lower	Increase in number of fisher folk in the community
Fish population	Higher	Lower	Overfishing and mortality

(Source: Authors' compilation, 2010)

Interviews of fish growth, the fisher folk interviewed were of the view that, the fishes grew faster and bigger now than before. This was due to increase in natural food in the river as a result of high rate of fertilizer application on lands around the river, and that, most fishes have developed abilities of escaping catch. It also showed that, the mortality was lower before but higher now, due to high temperatures particularly during dry season as well as, shock from the large number of electric fish that dominated the river. The decrease in the biodiversity of the river is a factor of potential climate change and other factors like overfishing due to the rapid increase in number of fisher folk in the community. This was ascertained from the three decadal meteorological data obtained which reflected increase in temperature Figures 2 and 3.

Figure 2: Fisher Folks Experiences on Climate Change

Process	1981	2011	Reasons for the change
Rate of river flow	Lower	Higher	Construction of dam upstream which spill its bank into the river.
Frequency of flood	Higher	Lower	Damming upstream which regulates the volume of water coming into the river at any point in time
Amount rainfall	Higher	Lower	Drop in number of rain days
Rainfall intensity	Moderate	Higher	Natural
Length of dry season	Shorter	Longer	Drop in number of rain days
Intensity of the sun	Lower	Higher	Natural
Temperature	Lower	Higher	High intensity of the sun
Number of trees around the river	Higher	Lower	Frosion and deforestation
Turbidity level	Lower	Higher	Frosion

(Source: Authors' compilation, 2010)

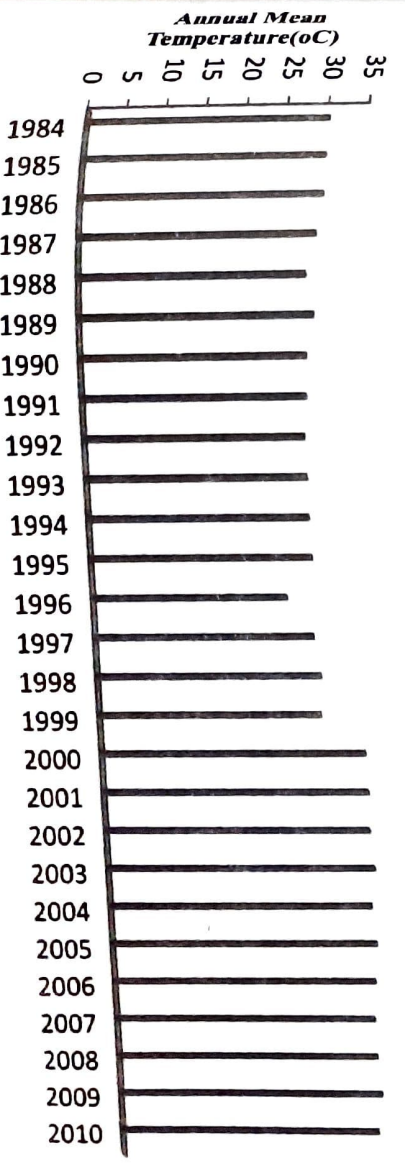


Figure 2: Annual Mean Temperature (°C) of the Study Area (1984-2010)

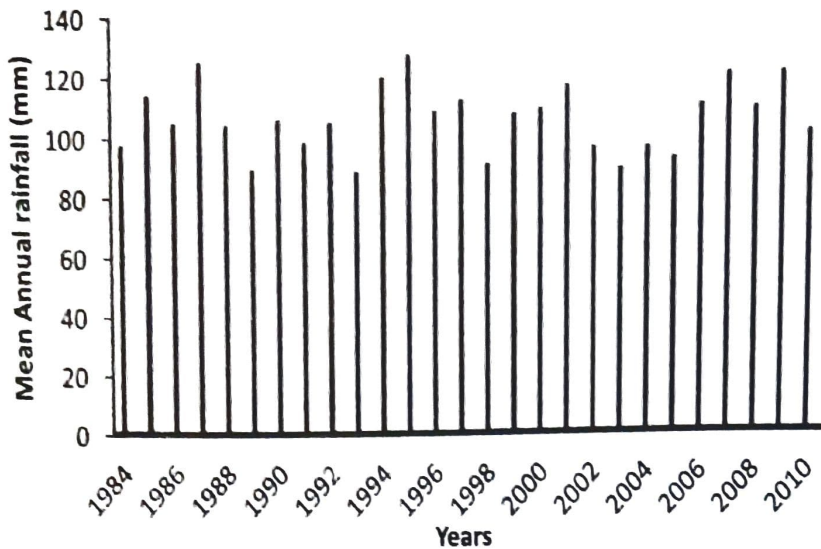


Figure 3: Annual Mean Rainfall (mm) of the Study Area (1984-2010)

The results of the interview (Table 2) showed that, the increase in the river flow and decrease in the frequency of flood are attributable to the damming at Shiroro which spill its bank into the river at a regulated volume and time. It also revealed that the amount of rainfall received was higher before (with moderate intensity) but lower now (with high intensity). Also the number of trees around the river were more before but fewer now due to erosion and clearing of land for farming activities which at the same time increased the turbidity of the river due to run-off. This was in agreement with the findings of Edegbene *et al.* (2012) that, decrease in the quality of water bodies was as a result of various anthropogenic activities within the riparian and surrounding communities.

**Conclusion**

The study shows that, the mean air temperature around Zungeru River increased with time of while the amount of rainfall and number of rain days reduced with a lot of variations. This increase in temperature has led to high fish mortality particularly during dry season when the temperature peaked. Fisher folks should therefore; be enlightened about climate change so as to create awareness and enhance their understanding of the causes and possible ways of averting some of the observed changes due to climate variability.

**References**

Barange, M., Merino, G., Blanchard, J. L., Scholtens, J., Harle, J., Allison, E. H., Allen, J. I., Holt, J. and S. Jennings (2014). Impacts of climate change on marine ecosystem production in societies dependent on fisheries. *Nature Climate Change* 4: 211–216 Available <https://www.nature.com/articles/nclimate2119> supplementary-information

Edegbene, A. O., Arimoro, F. O., Nwaka, K. H., Omovah, G. O., Ogidiaka, E and O. J. Abolagba (2012). The physical and chemical characteristics of Atapko River, Niger Delta, Nigeria. *Journal of Aquatic Sciences*, 27 (2):159 - 172

Ipinjolu, J. K., Magawata, I. and B. A. Shinkafi (2014). Potential Impact of Climate Change on Fisheries and Aquaculture in Nigeria. *Journal of Fisheries and Aquaculture Science*, 9(5): 338-344. Doi: 10.3923/jfas.2014.338.344.