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EFFECTS OF MICROCLIMATE ON FISH PRODUCTION IN ILORIN WEST LOCAL GOVERNMENT AREA, NIGERIA

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Abstract : The study examined the effects of microclimate on fish production in Ilorin West local government area. The study was conducted to determine fish responses to its microclimate on daily basis at different seasons of the year and also to determine the quality of water for pond fish culture. Experimental research of earthen pond was set up at Atiku Road located in Adewole Housing Estate area for a period of two years which spanned between 2014-2015. Temperature of the pond water was recorded at different depth intervals of 30 cm, 60 cm, 90 cm and 120 cm respectively. The pond water was sampled and analyzed for ammonia, nitrate content, dissolved oxygen, Biochemical Oxygen Demand (BOD), suspended solids, pH, electrical conductivity and turbidity level to determine its chemical properties and reveal the quality of water using standard laboratory methods. The amount of feed consumed was measured on monthly basis. The rate at which fish gained weight was also noted. Both descriptive and inferential analysis of correlation and regression were carried out to find out the strength of relationships between fish weight, feed and temperature. The temperature of the depth of pond water that is most critical for fish production using earthen pond was determined. The study revealed that the average temperature of the water ranges between 26.83 °C and 29.96 °C. The month of January recorded the lowest temperature of 26.83 °C, while the highest of 29.96 °C occurred in the month of February, thus giving the range of over 3 °C per annum. The results also showed that fish does not cluster at 30 cm depth which has the lowest temperature but between the depth interval of 60 cm and 90 cm throughout the seasons.

Key words: Microclimate, Fish Production, Temperature, Ammonia, PH,

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INTRODUCTION

Fish farming has enormous potentials of improving the nutritional standard of the masses. The average protein intake in Nigeria is about 19.38 grams/head/day which is far below the Food and Agriculture organization (FAO) requirement of 75 g/head/day (FAO, 1995). Fish contains higher percentage of protein than meat and is important for its high nutritive value and significance in improving human health. The microclimate of fish is an important determinant factor in fish production. Arvil (1967) asserted that everything originated in water, everything is sustained by water.

Water quality is determined by various physico-chemical and biological factors (), as they may directly or indirectly affect its quality and consequently its suitability for the distribution and production of fish and other aquatic animals (Moses, 1992). The status of water bodies after receiving various kinds of pollutants alters its quality and its characteristics physically, chemically and biologically. All living organisms have tolerable limits of water quality parameters in which they perform optimally. A sharp drop or an increase within these limits has adverse effects on their body functions (Davenport, 1993; Kiran, 2010).

Therefore, the role of various factors within the micro environment of fish such as temperature, transparency, turbidity, water colour, carbon dioxide, pH, alkalinity, hardness, ammonia, nitrite, nitrate, primary productivity, biochemical oxygen demand (BOD), plankton population etc. cannot be over emphasized for maintaining a healthy aquatic environment and for efficient fish production. Thus the proper management of these environmental factors becomes imperative for the survival and optimum fish growth and yield. This study attempts to investigate the responses of fish to the microclimate of pond and how it affects its growth and development.

THE STUDY AREA

The experimental site is located in Adewole, along Atiku drive Ilorin west local government area of Kwara state (figure 1). Ilorin city is located between latitude 80 24'N and 80 36' North of the equator and between longitudes 4 10'E and 4 36' East of the Greenwish meridian (Oyegun, 1983). The city has an approximate area of 150 sq.km and by 1991 census, a population of about 512,026, which has grown over the years to 847,582 (NPC, 2006), thus making a lot of demand on fish production.

Ilorin has a humid tropical climate which is characterized by wet and dry seasons. The temperature of Ilorin ranges between 33 °C to 34 °C between November and January while from February to April, the value ranges between 34 °C to 37 °C . The mean monthly temperatures are usually very high varying from 25 °C to 28.9 °C. Rainfall in Ilorin is controlled by two surface opposing winds of the moist south west monsoon wind and the dry northeast continental winds, it exhibits great variability both temporally and spatially. The total annual rainfall in the area is about 1,200 mm (Olaniran, 2002). Relative humidity in Ilorin during the wet season is between 75% and 80%, while in the dry season it is about 65% (Tinuoye, 1990). The period of dry season is characterized by a long sunshine hours of between 6.5 - 7.7 hours daily from the month of November to May (Olaniran, 1983; Jimoh, 2008). However, during the rainy season sunshine reduces drastically most especially during the month of August break (July-August) to 3 - 4 hours daily. This kind of climate support fish farming. However, most fish ponds suffer flooding during the period of high and prolonged rainfall.

The vegetation of the area is situated in the guinea savanna belt of Nigeria; this vegetation type is characterized by scattered trees and grasses which are mostly common in the transitional zone of deciduous forest of the south and dry savanna grassland of the north.

The climate of the study area exhibits a definite wet season and a marked dry season in response to the pressure pattern resulting in the seasonal shift of pressure belts associated with apparent mark of the overhead sun and also in response to the Inter tropical Discontinuity between the moist south west monsoon wind and the dry North east continental wind. Mean monthly temperature rises between 29.2 °C in the month of July to 37 °C during the month of March (Areola, 2007; Olanrewaju, 2010).

The city is drained mainly by River Asa and its tributaries namely; Rivers Aluko, Alalubosa, Okun, Osere, Agba, and Atikeke (Jimoh and Iroye, 2009), and this gives the whole drainage basins a dendritic pattern. These rivers are highly seasonal in flow and the flood plains of these rivers are used for fish farming in Ilorin.

The dominant occupation of the people in Ilorin is mainly civil servant and traders. Majority of government ministries can be found within the city. Residents of the city also engaged in primary occupations such as farming (cultivating crops such as maize, vegetables and fishing), bakery and blacksmithing. The occupation of the indigenous people are farming and trading.

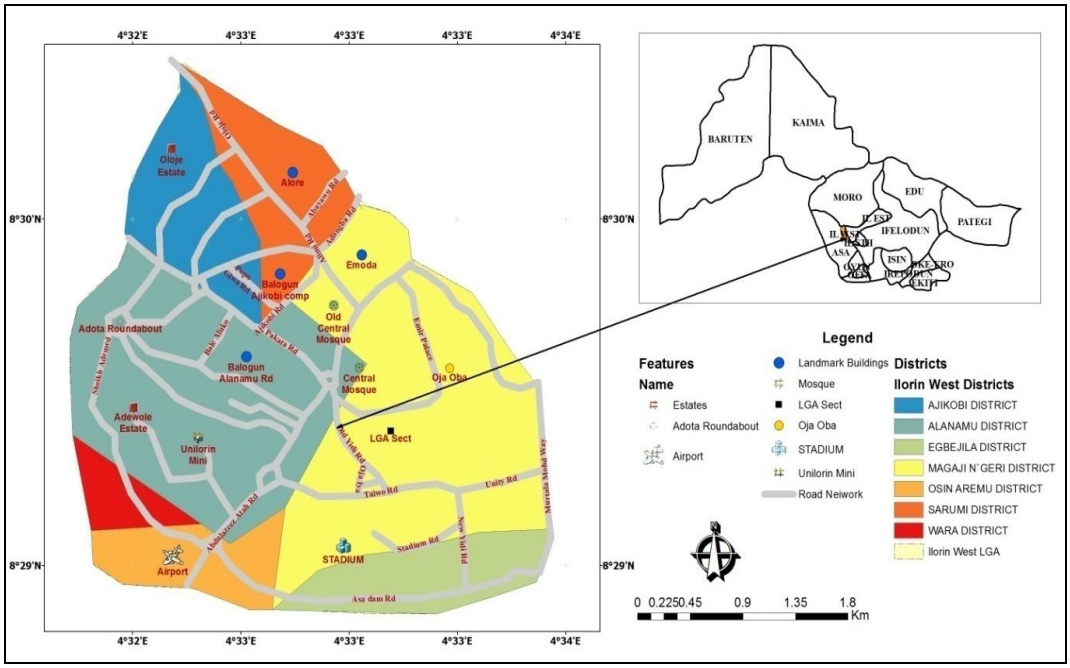

Figure 1. Map of Ilorin West LGA of Kwara State
Source: Digitized from Google Earth Pro. (2015)

MATERIALS AND METHODS

Data used in this study were primary in nature. The primary source of data were water temperature for four varying depth intervals (°C), the physico-chemical properties of the ponds, weight of fish as they grow from fingerlings to table size and weight of feed consumed. The sample of the pond was collected with a clean container to prevent contamination. The sampling was done midstream by dipping the sampling container at approximately 20 - 30 cm below the water surface. Daily water temperature at different depth intervals of the ponds were grouped on monthly basis to correspond with the monthly weight gained by fish. The parameters were calculated, grouped and summarized using descriptive statistics of mean to produce a quantitative summary which were tabulated. Other data were gathered from already existing and published works such as text book, government reports, journals, news, internet and website.

RESULTS AND DISCUSSION

PATTERNS OF VARIATION IN WATER TEMPERATURE

Highest temperature was mostly observed in the evening. Increase in temperature with depth experienced might not be unconnected with the fact that water react sluggishly at absorbing and emitting of radiant energy (figure 2). Heat gain during the afternoon is retained and this keeps

the water body warmest mostly in the evening and also causes temperature increase with depth. Pond water temperature decreases at the depth of 120 cm because the convectional distribution of heat is no longer active at this depth. Figure 2 shows the mean temperature of pond water at all depths considered.

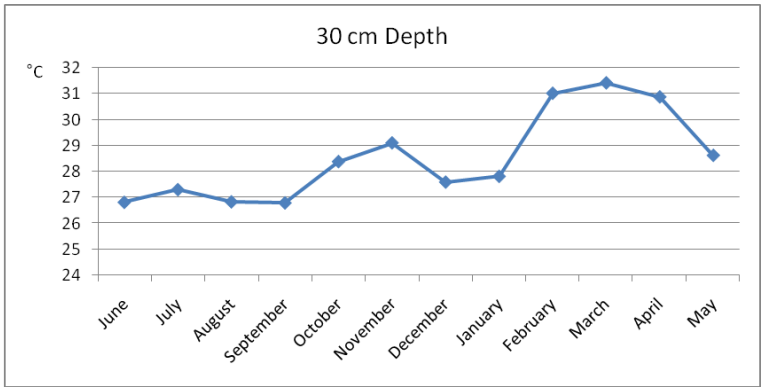

Figure 2. Average Temperature of Pond Water
Source: Field Survey, 2015

The average temperature of the water ranges between 26.83 and 29.96 °C. The month of January recorded the lowest temperature of 26.83 °C, while the highest 29.96 °C occurred in the month of February, thus giving us a range of over 3 °C per annum. This finding makes the pond water considered suitable for fish production because it is in broad agreement with the conclusion of Santhosh and Singh (2007) which put the temperature of suitable water for production of fish at between 24 °C and 30 °C. The range of 26.83 °C and 29.96 °C is subsumed within the range of Santhosh and Singh (2007) threshold values.

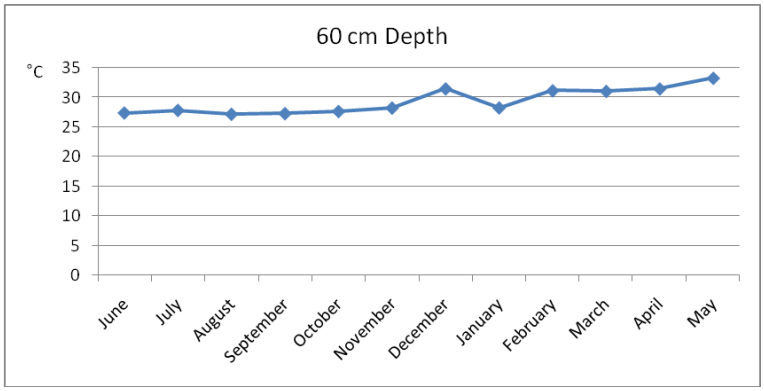

Figure 3. Average Temperature of Pond Water at 30 cm Depth
Source: Author's Field Survey, 2015

The pattern of mean monthly temperature at 60 cm depth is quite steady between the month of June and October. These are the month of rainy season, though, there was no much rain during this period but air temperature was not too high and this must have been responsible for the consistent low water temperature reported. However, this trend was interrupted with a sudden rise in water temperature in December. The highest mean monthly temperature was recorded in the month of May. This might be linked with slight metabolic activities of fishes.

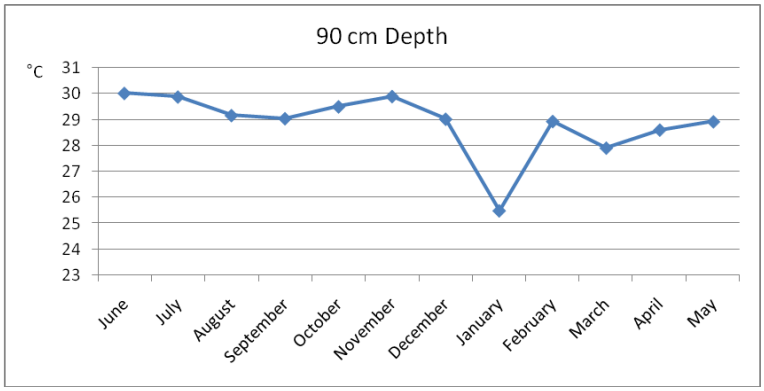

Figure 4. Average Temperature of Pond Water at 60 cm Depth.
Source: Author's Field Survey, 2015

The trend of temperature pattern at this depth assumed a concave shape between July and October and a convex shape between October and December. The implication is that there was a decline in water temperature at the depth of 90cm between the period of July through October and inverse is the case during October and December.

The month of January recorded the least temperature while the month of February exhibited the highest temperature. The pattern of temperature variation observed at this depth resemble that at 90 cm depth, the only difference is that here temperature of the water is lower. It is not surprising since fishes hardly cluster at this depth. Generally, water temperature was higher between February and May at all depths considered. This coincides with the months of dry season when the area used to experience heat wave. The sudden fall of temperature observed during the month of January could be associated with harmattan wind (among other factors) which reaches its peak during this month.

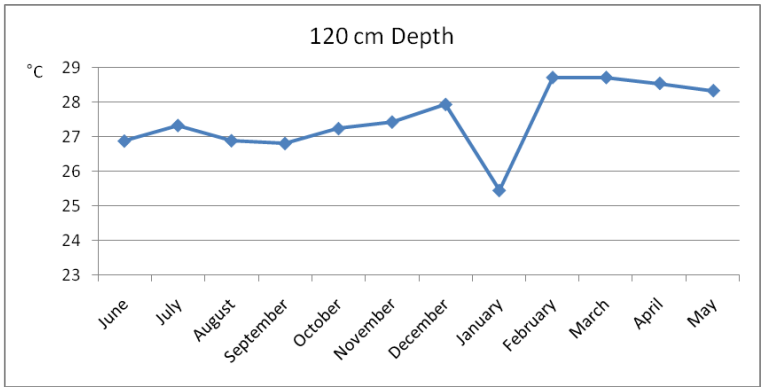

Figure 6. Average Temperature of Pond Water at 120 cm Depth
Source: Author's Field Survey, 2015

CONCLUSION AND RECOMMENDATIONS

Fish is an important source of animal protein for many households. Food and Agriculture Organization (FAO, 2007), opines that fish contributes more than 60 % of the world supply of protein especially in the developing countries such as Nigeria. The role of various factors within the micro environment of fish development and growth are very vital in the process of fish production. The study revealed that the average temperature of the water ranges between 26.83 °C

and 29.96 °C, the month of January recorded the lowest temperature of 26.83 °C, while the highest of 29.96 °C occurred in the month of February, thus giving the range of over 3 °C per annum.

The implication of the findings is that the untapped potentials for fishing production must be optimally harness to step down the loss of foreign exchange and as such provide employment for many along the fish value chain, which will contribute to poverty reduction and ultimately foster sustainable economic development in Nigeria.

Once the level of inputs and waste produced are greater then what the pond can contain, water quality starts to deteriorate and the ponds carrying capacity is reached, hence productivity declines. However, in order to prevent this situation, fish should be stocked based on the pond carrying capacity for the specific pond management.

Static water should be maintained during the course of production and when the water quality begins to deteriorate, it should be changed to avoid mortality or diseases.

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