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STUDIES ON FISHERIES POTENTIALS OF DADIN-KOWA RIVER CONTIUUM GOMBE STATE

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ABSTRACT

Fisheries Potentials with respect to River morpho-metrics using Morpho-Edaphic Index (MEI), Potential fish yield (Y) and Relative Yield Index (RYI) in Dadin-Kowa River Contiuum Gombe State were carried out for a period of Eighteen month, (October, 2019 to March, 2021). River morpho-metrics were applied to estimate the potential fish yield using morpho-edaphic index (MEI) and above five (5µs/m) in all the sampling stations that is 9.7, 9.6 and 9.14µs/m respectively which is greater than 5 and implies higher fisheries potentials in the river, also Potential fish yield estimates were determined using the relationship $Y=23.281*MEI^{0.447}$ recorded as 64.3, 64.0 and 62.6Kg/ha which indicate good yield while the relative yield index (RYI) which is the ratio of estimated yield with estimated fish yield was determined using the relationship RYI= Yobs/Yest ×0.75 was found to be 2.7, 1.4 and 1.3Kg. The results of this study showed that the river exploitation level was moderate (RYI≤3). Good, dissolved oxygen levels, good pH, low-levels of pollution, accounted for the high estimates of the fish yield. Therefore, effective management system, implementation of good fishing regulations and practices should be implemented.

Keyword: fisheries potentials, potential fish yield, morpho-edaphic index, Relative Yield index

INTRODUCTION

The fisheries productivity of an inland aquatic system is commonly measured in terms of kilograms of fresh fish catch per hectare (kg/ha) or per kilometre of river stretch annually, Productivity (in kg/ha/yr) has, therefore, the same dimension as yield in agriculture (Mustapha, 2015).

Fisheries water productivity as production per unit of water volume consumed or dedicated (kg/m^3), has been only recently introduced for inland aquatic systems, especially within the context of the Challenge Program on Water and Food (Brummett, 2006) However, the term water productivity has not yet appeared as a keyword in the bibliographic databases of aquatic and fisheries sciences, where productivity is related to the food web leading to biological production. In contrast, aquaculture water productivity has been studied with more attention, as water in that sector is one of the important economic components of the activity (Brummett 2006).

The productivity of inland fisheries systems results from the interaction among three main types of variables; these are related to human activity, the aquatic habitat and fish communities. In their analyses, fisheries scientists usually identify different classes of habitat and then look for variables that could explain fluctuations in the fish catch in different water bodies belonging to the same

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type of habitat. The observed relationships are being improved as more data sets become available. They have proven very useful in estimating the productivity of fisheries systems for which very few data are available (Du Feu, 2001).

The morpho edaphic index (MEI) is the ratio of total dissolved solids (or conductivity) to mean depth. Ryder (1965) proposed it as a possible index of a lake's biological productivity (sustainable fish catch potential). The relationship is valid to compare lakes within a given category (i.e., in a given geological region), but it should not be used for lakes differing in their water ionic composition or having non-comparable basins. It has, however, been overused, with little consideration of the geological setting (Ryder 1982). Biological fish productivity in a given class of lake is usually given as a direct function of the MEI:

MATERIAL AND METHODS

Dadin Kowa river flows through three Local Government Area of Gombe State namely: Yamaltu Deba, Kwami and Funakaye local Government area of Gombe State in north eastern Nigeria, the river is about 60 kilometers to the east of Gombe town and 5 kilometers north of Dadin Kowa town, it provides drinking water to Gombe metropolis and some part of the state. (Figure 1). The area lies within latitude 10°17 '18" N and longitude 11°30'32 "E of the equator (UBRDA 2012), the immediate area around the river is Bima Mountain. A Reservoir was built at Dadin Kowa town which was officially commissioned in 1984 with the major objective of providing domestic water supply to Gombe town, Irrigation farming around Dadin Kowa and many areas around the river town together with hydroelectric power supply. The river has a capacity of 800 million cubic meters of water and surface are of 30 square kilometers, also, it has potentials as a source of fisheries. (Good life retrieves, 2012).

Three sampling stations was identified for the study across the three Local Government Area, Station 1 at the upstream landing site of the river namely Almakashi town in Funakaye Local Government Area, where human activities like washing, bathing, are taking place. Station 2 is at the midstream which is the middle point of the river at Malleri town in Kwami Local Government Area where there are less human activities due to its distance from entrance, Station 3 is at the downstream which is the deepest part of the river around 30meters deep at the Dammed site at Dadin kowa town in Yamaltu Local Government where irrigation farming is taking place, the distance between each stations is approximately 15kilometer. Three landing centers were used for fish sampling from local fishermen at each of the landing sites.

Determination of Morpho-Edaphic Index (MEI)

The Morpho-Edaphic Index (MEI) is an index of biological productivity (Balogun, 2017) which is expressed as

MEI = Conductivity (μS/L) ÷ Mean depth (m). (Ryder 1974) (Equation 2)

Fish Potential Yield (Y) Estimation:

Estimates of the potential fish yield was determined using the Physico-chemical characteristics of the river and the relationship $Y=23.281*MEI^{0.447}$ (Edward 2013), (Equation 3). Where Y is the potential fish yield in kg/ha, MEI is Morpho-Edaphic Index, which is given in μS/cm and is estimated by dividing the mean conductivity by the mean depth Ryder *et al.,* (1974).

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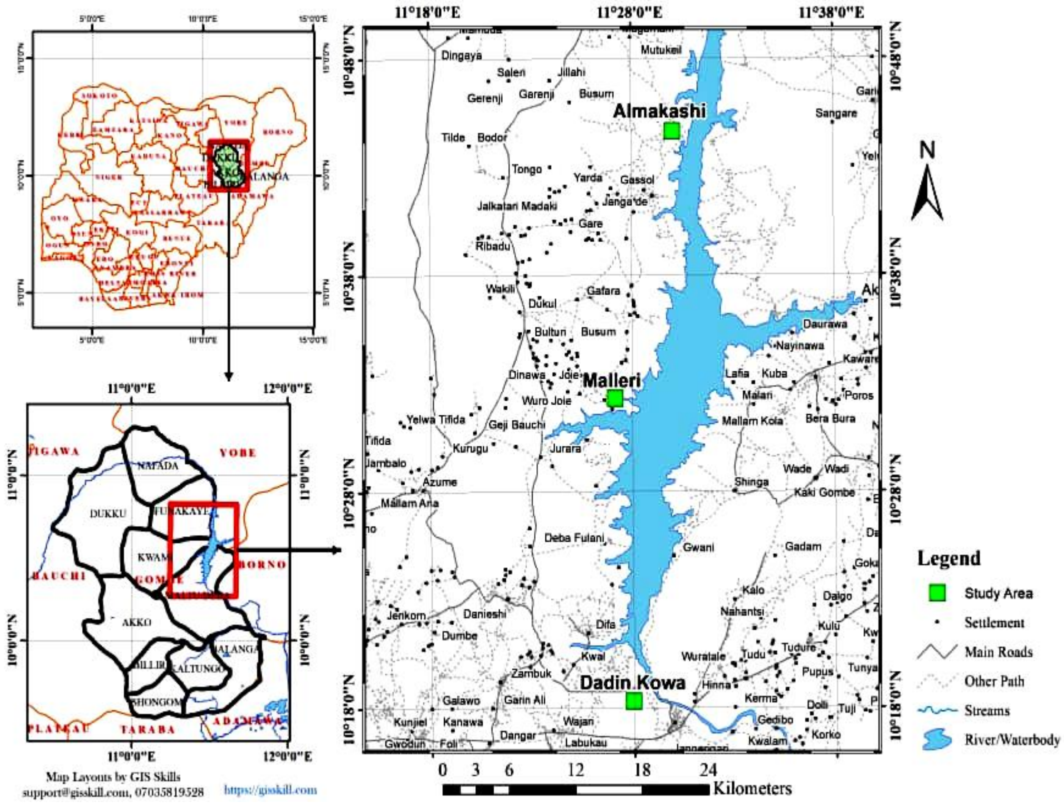

Figure 1: Map of the study area showing various sampling stations and settlement areas (URDM, 2018)

Relative Yield Index Determination

Relative Yield Index (RYI) as a measure of exploitation level is the ratio between the observed catch and the estimated potential yield (RYI=Y_{obs}/Y_{est}). Y_{est} was corrected by a factor of 0.75 for safety margin (Baigún *et al.,* 2018), (Abdullahi, 2017) thus being:

RYI= (Y_{obs}/Y_{est}) x 0.75. (Equation 4)

Where;

Y_{obs} = Observed Yield (which can be obtained from the total weighted fish samples obtained in the field)

Y_{est} = Estimated Potential fish yield (obtain using MEI)

RESULTS AND DISCUSSION

Potential yield indices were presented in Table 1 which indicate that Almakashi site recorded higher Morpho Edaphic Index (MEI) Kg/ha, Potential Fish Yield (Kg) and Relative Yield Index (RYI) (Kg) as 9.7, 64.7 and 2.7 respectively, followed by Dadin Kowa which has 9.6 kg/ha, 64.4kg and 1.4kg, where lowest was in Malleri which recorded 9.1, 62.3 and 1.3 respectively.

Table 1 shows the seasonal characteristics of fisheries potentials where dry season and Almakashi sampling station has higher productivity Morpho Edaphic Index, Potential Fish Yield and Relative Yield Index of 14.7kg/ha, 76.7kg and 2.8kg respectively, while wet season and Malleri recorded the lowest with 7.1, 57.9 and 1.6 respectively (Table 3)

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Table 1: The characteristics of the study sites and the potential yield indices

Characteristics	Study sites Almakashi	Dadin Kowa	Malleri
Geographical Coordinates	$10^0$44'40.584"N $11^0$30'32.574"E	$10^0$19'14.142"N $11^0$28'43.956"E	$10^0$18'38.539"N $11^0$9'13.582"E
Mean Depth (M)	8.0±2.4	10±1.4	11±2.2
Mean Conductivity (µS/cm)	106.8±3.1	96±1.3	91.4±3.4
Morpho Edaphic Index (MEI) Kg/ha MEI = Conductivity (µS/L) ÷ Mean depth (m).	9.7	9.6	9.14
Potential Fish Yield (PFY)(Kg) Y_{est}=23.281*$MEI^{0.447}$	64.7	64.4	62.3
Relative Yield Index (Kg) RYI= (Y_{obs}/Y_{est}) x 0.75	2.7	1.4	1.3

Key: MEI= Morpho Edaphic Index, RYI= Relative Yield Index, Y_{obs}=Total Weight of fish observed in the field, Y_{est}=Potential Fish Yield.

Table 2: Dry Season characteristics of the study sites and the potential yield indices

Characteristics	Study sites Almakashi	Dadin Kowa	Malleri
Geographical Coordinates	$10^0$44'40.584"N $11^0$30'32.574"E	$10^0$19'14.142"N $11^0$28'43.956"E	$10^0$18'38.539"N $11^0$9'13.582"E
Mean Depth (M)	7.0±2.4	11±1.4	10±2.2
Mean Conductivity (µS/cm)	100.8±3.1	98±1.3	77.4±3.4
Morpho Edaphic Index (MEI) Kg/ha MEI = Conductivity (µS/L) ÷ Mean depth (m)	14.7	8.6	7.14
Potential Fish Yield (PFY)(Kg) Y_{est}=23.281*$MEI^{0.447}$	76.7	61.8	57.9
Relative Yield Index (RYI)(Kg) RYI= (Y_{obs}/Y_{est}) x 0.75	2.8	1.7	1.6

Key: MEI= Morpho Edaphic Index, RYI= Relative Yield Index, Y_{obs}=Total Weight of fish observed in the field, Y_{est}=Potential Fish Yield.

The fish potential of the three sites of the Dadin Kowa River ranged between 62.0 to 64.3Kg/ha, this agrees with the statement of (Abubakar, 2006) who stated that flowing tropical river are more productive than deeper lakes, hence the fish yield from Dadin kowa river obtained is similar to the ones found from the works of other researchers such as Oyun reservoir (Mustapha, 2015) in Nigeria, Botanga (66.98 kg/ha) and (Quarcoopome & Amevenku, 2014) in Ghana. The fish potential yield of the Dadin Kowa river is however, higher than the yield of the other tropical river such as River Zaria (38 kg/ha) (Balogun & Auta, 2015), Kontagora River (Ibrahim, Auta, & Balogun, 2013). The high potential yield may be as a result of high conductivity with low depth, hence according to (Edward, 2013) shallow reservoirs in the tropics are said to be more productive than those in the temperate regions.

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Table 3: Wet Season characteristics of the study sites and the potential yield indices

	Study sites		
Characteristics	**Almakashi**	**Dadin Kowa**	**Malleri**
Geographical Coordinates	$10^0$44’40.584”N $11^0$30’32.574”E	$10^0$19’14.142”N $11^0$28’43.956”E	$10^0$18'38.539"N $11^0$9'13.582"E
Mean Depth (M)	10.0±2.4	13±1.4	9±2.2
Mean Conductivity (µS/cm)	111.8±3.1	104±1.3	97.4±3.4
Morpho Edaphic Index (MEI) Kg/ha MEI = Conductivity (µS/L) ÷ Mean depth (m)	11.7	8.6	10.14
Potential Fish Yield(PFY)(Kg) $Y_{est}=23.281*MEI^{0.447}$	68.7	58.4	67.3
Relative Yield Index (Kg) RYI= (Y_{obs}/Y_{est}) x 0.75	2.5	1.6	1.4

Key: MEI= Morpho Edaphic Index, RYI= Relative Yield Index, Y_{obs}=Total Weight of fish observed in the field, Y_{est}=Potential Fish Yield.

The relation yield index of the three study sites fall within a range of 1.3 to 2.8 which coincides with the findings of (Baigún *et al*., 2018) which says Cabra corral river is productive because it has relative yield index of 3.7 which is greater than maximum value of 2.7kg/ha. Other Factors which attribute to the dynamics of Relative Yield Index includes the differences in primary productivity of the water, conductivity, physicochemical parameters, estimated species, and potential fish yield estimates. The Relative Yield Index of the Dadin kowa river cannot be expressed as being over exploited (RYI<3). Thus, these indicate that the river is rich. According to (Imam *et al.,* 2012) RYI value less than 3 indicates moderate exploitation of fish stock. However, the results of this study showed that the river exploitation level was moderate (RYI≤3). Good, dissolved oxygen levels, good pH, low-levels of pollution, accounted for the high estimates of the fish yield. Effective management system, implementation of good fishing regulations and practices should be implemented to conserve the available resources.

CONCLUSION

Good dissolved oxygen levels, good pH, low-levels of pollution, accounted for the high estimates of the fish yield. Effective management system, implementation of good fishing regulations and practices should be implemented to conserve the available resources.

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