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Effect of runoff from alluvial soil on fish diversity from Oko mayon water body Okun owa, Ogun State

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Abstract

In this study, the effect of runoff from alluvial soil on fish diversity in river Oko-Mayon along Sagamu express road between February to August, 2017 was assessed. Fish samples from fishermen using assorted gears were identified to the species level. Soil sample was collected using soil auger from the bank of the river to determine the alluvial level. Water quality parameters were also determined. The results showed that 311 fish species sampled had 13 fin fish species from 12 families. Mochokidae family had the highest percentage composition (21.21%) while the most abundant fish species in the river was Synodontis violacea. The values should be for Physical and Chemical parameter of soil assessed included temperature (27.84±0.90-27.98±0.084)°C, %, sand (75.28±3.85-78.48±9.65), % silt (7.68±1.67-9.60±3.17), % clay (11.92±2.54-17.04±2.83), pH (13.30±0.09-13.37±0.10), Conductivity (84.20±19.77-122.00±25.17), Total dissolved solid (42.20±9.81-60.60±12.34) mg/L, organic carbon (0.61±0.60-0.70±0.45), nitrates (0.11±0.01-0.14±0.02) mg/l, Phosphate (34.16±3.06-42.56±1.50) mg/l, with significant difference ($p<0.05$) except in percentage of sand and silt. The values for physical and chemical parameter of water included temperature (24.95±0.21-28.65±0.21)°C, Transparency (20.50±0.71-22.50±0.71)cm, Electrical conductivity (167.50±0.71-177.50±0.71)□, pH (6.65±0.07-8.74±0.06), Total dissolved solid (83.50±0.71-88.25±0.35)mg/l, Phosphates (0.18±0.01-2.08±0.01)mg/l, Nitrate (0.02±0.00-0.064±0.01) mg/l with significant difference ($p<0.05$) except in transparency. Strong correlation was obtained between total fish catch and total nitrogen in water (1.000), Available phosphorus in soil and total fish catch (0.999), electric conductivity and % silt of soil (0.999), total dissolved solid and % silt of soil (0.998), total dissolved solid and electric conductivity of soil (1.000), available phosphorus and temperature (0.999), available phosphorus and total nitrogen (0.998) of soil and water at ($p<0.05$). The river contributes much to the inland fishery of the State as a result of its high composition of fish species which is an evidence of its high productivity.

Keywords: Alluvial, Okomayon, Diversity, Runoff

Introduction

Water exhibits both physical and chemical properties and the suitability of water for the survival and growth of fish is governed by a myriad of water quality variables (Boyd, 1982). According to (Udo, 2007), the quality of water used in a pond is affected by the chemical properties of the soils on which it runs. Riverine habitats are least studied and likely many species are yet to be discovered. It reveals a high degree of endemism with most endemic fish species living in headwater streams or short stretches of river (Johnson and Arunachalam, 2009). Fisheries are one of the major components in freshwater ecosystem because they provide good quality proteins. Nigeria is highly endowed with both fresh and marine fishery resources. It is generally believed that if these resources are rationally managed and exploited, the country can attain self-sufficiency in fish production.

There are estimated 12,478,818 hectares of

inland water bodies made up of reservoirs, lakes, rivers, ponds and perennial swarms (Ita *et al,.* 1985) and some 741,509 ha of brackish waters, most of which are suitable for aquaculture. At present only about 5,476 ha of these waters are utilized for fish culture (Sikoki and Oyero, 1994). In addition to the above, the nation's 200 nautical mile Exclusive Economic Zone (EEZ) within which she has absolute jurisdiction over all the living resources spans 853km of coastline and covers 192,000 km2 in area. Bayagbona, (1979) estimated that the shellfish potential of the country is approximately 3,500 tonnes; of which she harvests only 2,000 tonnes losing the rest to poachers.

In the inland waters, artisanal and culture fisheries operations are the predominant activities and account for over 90 percent of domestic fish production. These operations cover small – Scale canoe fisheries, and aquaculture activities. Despite the importance of freshwater / inland fisheries as a contributor of about 40 % of the total domestic fish supply in Nigeria, the Nigerian natural lakes and wetland resources have received little attention (FDF, 2013). The fish diversity which is currently recognized worldwide shows 25,000 species, of which 10,000 species are found in freshwater ecosystems. Specialists have estimated that at least 5,000 await discovery. Thus freshwater fish discovery can serve as a platform of livelihood and biodiversity of conservation values (www.fishbase.org). Roughly 40% of the fish consumed in Africa South of Sahara are freshwater fish as compared to a global average of 25%, while West Africa is relatively a large consumer of finfish (Bala *et al.,* 2009). The fish yield of most Inland waters in Nigeria is generally on the decline for causes that may range from inadequate management of fisheries to degradation of water bodies (Odo *et al.,* 2009).

The problems facing fish resource conservation include; the negative effects of frequent policy changes, auditing and sampling, analysis and taxonomy, pollution, management, land reclamation, heavy erosion and drought. Detailed knowledge of the form and function of the river system and responses of fish species is needed for effective fisheries management planning.

Alluvial soils are soils deposited by running water and are often located in existing floodplains. Alluvial aquifers near a river are typically multi layers due to the deposition processes resulting in vertical heterogeneities in hydraulic properties (Kim *et al.,* 2005). Alluvium (from the Latin word, *alluvius*, from *alluere*, "to wash against" is loose, unconsolidated (not cemented together into a solid rock) soil or sediments, which has been eroded, reshaped by water in some form, and redeposited in a non-marine setting (Glossary of geological term, 2012). Alluvium is typically made up of a variety of materials, including fine particles of silt and clay and larger particles of sand and gravel. Activities such as agriculture, silviculture, mining and urbanization leads to contaminated runoff and excessive sediment that disturb physical habitat. These activities coupled with highly erodible soils and locally intense rainfall events create high potential for nonpoint source pollution in water bodies (Ngodhe *et al*., 2014).

Successful experiment has been carried out on the effect of runoff from alluvial soil on Crops, but not much on Fish. This study focused on the effect of runoff from alluvial Soil on fish diversity. The study identified various fish species peculiar to the environment, determined the effect of runoff from alluvial soil on fish diversity of the water body

Materials and methods

Description of study sit

The study was conducted at Oko-Mayon river with location between (Latitude N 6° 49° 30' and Longitude 3° 4° 12' E) of Ogun state Nigeria. It shares boundary and receives influx from Ogunpa River, Ibadan. It is located in Odogbolu Local Government Area of Ogun State. The river serves as a source of livelihood for fishermen, and also a source for sharp sand. The river is open throughout the year for fishing. It's mainly a fishing environment.

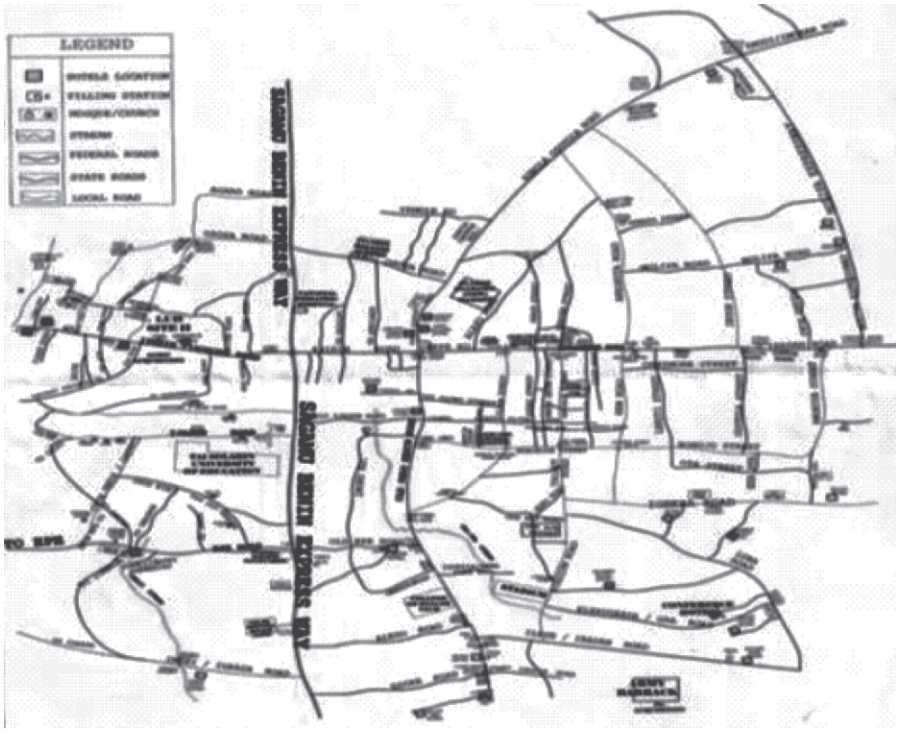

Fig. 1: Road map showing Oko Mayon water body
Source: Mustapha and Lawal (2014)

Sampling design

The sampling station was selected based on presence of alluvial soil and possible diverse species of fish.

Water and soil sampling procedure

Water sample was collected for dry and wet season. Soil sample was collected once.

Sampling technique

Water sample was collected monthly between February to August, 2017 (dry and wet season). Soil auger was also used to obtain the soil sample for analysis while fish samples were collected monthly.

Physical assessment of the water sample

The physical parameter of the water and area was determined *in-situ* and documented using thermometer and secchi disc.

Chemical assessment of the water sample

The parameter analysed from the water sample included Hydrogen ion concentration (pH), Electrical conductivity (EC), Total dissolved solid (TDS), Total Nitrogen (NO_3^{2-}), Available phosphorus (PO_4^{3-}) and nitrate.

Fish sampling method

Fish samples were collected from the catches of fishermen using different fishing gears like gill net, Non-Return valve trap. Fish collected were identified to the species level according to the procedures of **Josef *et al.* (2015)**. In the cases of confusing identities in some species literature on "Field guide to Nigerian Fresh Water Fishes" by Olaosebikan and Raji, (2013) was used.

Species diversity

Species Diversity was calculated using Simpson's Index of Heterogeneity (D), Shannon-Weiner index of General Diversity (H) as reported by (Shokat *et al*., 2010).

$$\text{Shannon Index (H)} = -\sum_{i=1}^{s} p_i \ln p_i$$

$$\text{Simpson Index (D)} = \frac{1}{\sum_{i=1}^{s} p_i^2}$$

In the Shannon index, **p** is the proportion (n/N) of individuals of one particular species found (n) divided by the total number of individuals found (N), **ln** is the natural log, Σ is the sum of the calculations, and **s** is the number of species.

In the Simpson index, **p** is the proportion (n/N) of individuals of one particular species found (n) divided by the total number of individuals found (N), Σ is still the sum of the calculations, and **s** is the number of species.

Soil analysis

Soil sample was collected using soil auger from the bank of the river by drilling into the soil to about 15cm and 30cm at five different points 2m apart for top soil and sub soil respectively, and then stored in an enclosed bag in which it was transported to the laboratory for air drying using the method as described by Abu Hena *et al*., (2004). The various tests carried out on the soil are;

Soil particle size

For soil particle size analysis was done using the method described by Bindu and Ramabhadran, (2010) Soil particle size was calculated using the formula:

$\%\ \text{Sand} = 100-[H_1 + 0.2\,(T_1 - 68) - 2.0]\ 2$

$\%\ \text{Clay} = [H_2 + 0.2\,(T_2 - 68) - 2.0]\ 2$

$\%\ \text{Silt} = 100 - [\%\ \text{Sand} + \%\ \text{Clay}]$

Where H_1 is 1st hydrometer reading

H_2 is 2nd hydrometer reading

T_1 is initial temperature reading

T_2 is final temperature reading.

Organic carbon

Soil sample taken was analysed for organic carbon as described by (Gupta *et al.,* 2012). Percentage organic carbon and organic matter werre calculated with formula;

$$\%\ \text{Organic carbon} = \frac{\text{Final titre value of blank} - \text{Final titre value of the sample}}{\text{Weight of soil}} \times 0.1995$$

$\%\ \text{Organic matter} = \%\ \text{Organic carbon} \times 1.729$

Hydrogen ion concentration determination

10g of soil sample was weighed with a measuring balance into a sample bottle, 20ml of distilled water was added to each sample and then shake vigorously for thirty minutes. Furthermore, the soil sample was dispensed into a 100ml beaker, the values of the soil were taken *in-situ* with a PH-EC meter (Model: Hanna11 9810) according to (Gupta *et al.,* 2012). The probe part of the meter was dipped into the beaker with collected soil sample and readings were taken.

Total nitrogen

Total Nitrogen content of soil sample was analysed using the method by (Gupta *et al.,* 2012). Further reading was done using 6405 UV/VIS spectrometer with wavelength 220nm.

Available phosphorus

For available Phosphorus determination (Gupta *et al.,* 2012) method was also

adopted and futher reading done using 6405UV/VIS spectrometer with wavelength 660nm.

Water quality parameters

The various water quality parameters were measured *in-situ* and *ex-situ* for dry and wet seasons and then analyzed using standard analytical method of American Public Health Association (APHA, 1998). All chemicals used in carrying out the analysis were of high purity and analytical grade. Fresh reagents were used and proper care was taken to avoid chemical contamination.

Transparency

Transparency was determined using a graduated secchi disc having white and black paint for accurate reading at the point of appearance and disappearance in the water.

Surface water temperature

Surface water temperature of the river was taken *in-situ* using a thermometer. The readings are recorded in degree Celsius.

Hydrogen ion concentration (PH) determination

The values of the water were taken *in-situ* with a PH-EC meter (Model: Hanna11 9810). The probe part of the meter was dipped into the beaker with collected water sample from the river and readings were taken.

Total dissolved solid

The PH-EC meter (Model: Hanna11 9810) which has a compartment for determination of dissolved solid was used to determine Total Dissolved Solid (TDS) of the water sample using the probe part for readings.

Electrical conductivity

The PH-EC meter (Model: Hanna11 9810) was also used in determining Electrical conductivity (EC) of the water sample by dipping the probe part of the meter into a beaker with collected water sample from the river for readings.

Nitrate (NO_3^{2-})

The test for NO_3^{2-} was carried out *ex-situ* using method described by Nwankwo, (1995)

This was done according to APHA, (1998)

Reading from the curve = Abs/0.04412

$NO_{3\ ppm}^{2-}$ = Reading from the curve x 2

Phosphate (PO^{3-})

The test was carried for phosphates was done following methods of (APHA, 1998).

Reading from the curve = Abs/0.055

$$PO_{4\ ppm}^{3-} = \frac{\text{Reading from the curve x 2}}{\text{Ml of sample (25)}}$$

Statistical analysis

All the data describing the physical and chemical properties of water and soil sample was subjected to one way ANOVA using Statistical Package for Social Sciences (SPSS version 22) and the means of the data were later separated using DUNCAN multiple range test. However, relationships between physical and chemical parameters of water, soil and fish catch were analyzed using correlation coefficient.

Results and discussion

Fish species composition

The result in Table 1 shows that 311 finfish species from 12 families (*Mochokidae, Cichlidae, Channidae, Bagridae, Anabantidae, Notopteridae, Polypteridae, Clariidae, Momyridae, Gymnarchidae, Shilbeidae, Arapaimidae*) were sampled between April and August meanwhile, Figure 1 shows the percentage composition of the various families sampled. Table 2 shows diversity level of fish stocks as observed in the month of April.

Table 1: Fish species composition of catch sampled at Oko mayon water body

Family	Species	Number	Percentage Composition
Mochokidae	*Synodontis violacea*	81	21.21
Cichlidae	*Coptodon zilli*	51	16.50
Channidae	*Parachanna Africana*	50	16.18
Bagridae	*Chrysichthys nigrodigitatus* *Chryscichthys auratus*	27	8.74
Anabantidae	*Ctenopoma pethereci*	25	8.09
Notopteridae	*Papyrocranus afer*	23	7.44
Polypteridae	*Polypterus sengalus*	17	5.50
Clariidae	*Clarias gariepinus*	15	4.82
Momyridae	*Mormyrus rume*	12	3.88
Gymnarchidae	*Gymnarchus niloticus*	5	1.62
Shilbeidae	*Schilbe mystus*	3	0.96
Arapaimidae	*Heterotis niloticus*	2	0.64
Total		311	100

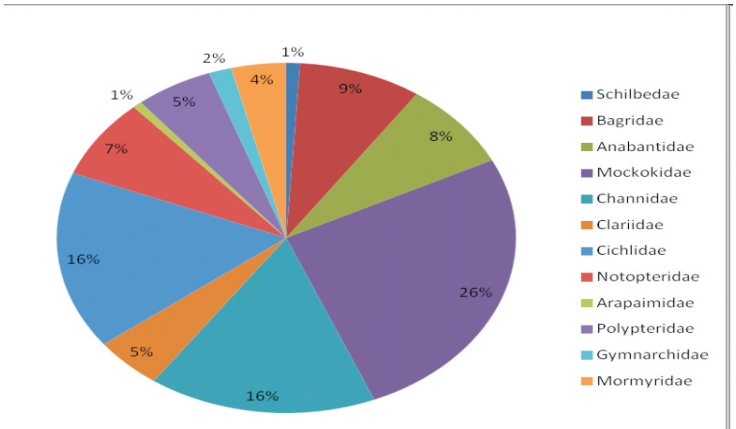

Figure 2: Percentage Composition of Fish sampled by Family from the study area

Table 2: Diversity indices of Oko mayon water body for the month of april and august

Indices	April	August
Simpon index (D)	7.03	6.62
Shannon-weiner index (H)	2.20	2.12

Physical and chemical parameters of alluvial soil at Oko mayo water body

The result in Table 3 indicates the mean physical and chemical parameters of the soil sample in the water body. The mean temperature ranges from (27.84±0.90-27.98±0.084), for the sub soil and the top soil respectively. However, the percentage compositions of the soil ranged from (75.28±3.85-78.48±9.65), (7.68±1.67-9.60±3.17) and (11.92±2.54-17.04±2.83) for sand, silt and clay respectively, meanwhile, the results showed that sand and silt has highest values on the top soil while clay has higher value on the sub rather than the top soil. In terms of the soil pH, EC, TDS, Organic Carbon, Total Nitrogen and available Phosphorus all had high values for the top soil as follows: (13.30±0.09-13.37±0.10) (84.20±19.77-122.00±25.17), (42.20±9.81-60.60±12.34), (0.61±0.60-0.70±0.45), (0.11±0.01-0.14±0.02), (34.16±3.06-42.56±1.50).

Table 3: Mean values of physical and chemical parameters of alluvial soil samples at Oko Mayon water body

	Month (Mean±SD)		
Parameter	**Top soil**	**Sub soil**	**P value**
Temperature(°C)	27.84±0.90[b]	27.98±0.084[a]	0.034
% Sand	78.48±9.65[a]	75.28±3.85[b]	0.511
% Silt	9.60±3.17a	7.68±1.67[b]	0.621
% Clay	11.92±2.54[b]	17.04±2.83[a]	0.147
pH	13.37±0.10[a]	13.30±0.09[b]	0.326
EC	122.00±25.17[a]	84.20±19.77[b]	0.030
TDS	60.60±12.34[a]	42.20±9.81[b]	0.031
Organic Carbon	0.70±0.45[a]	0.61±0.60[b]	0.813
Nitrates	0.14±0.02[a]	0.11±0.01[b]	0.022
Phosphates	42.56±1.50[a]	34.16±3.06[b]	0.001

Means values with different superscript are significant at p < 0.05 across the row

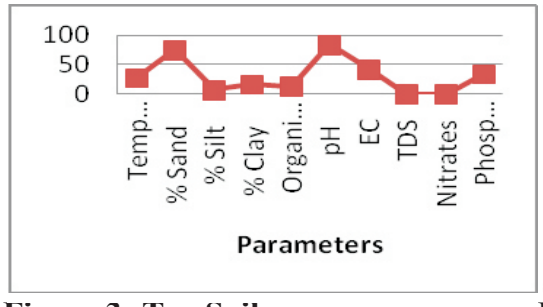

Figure 3: Top Soil

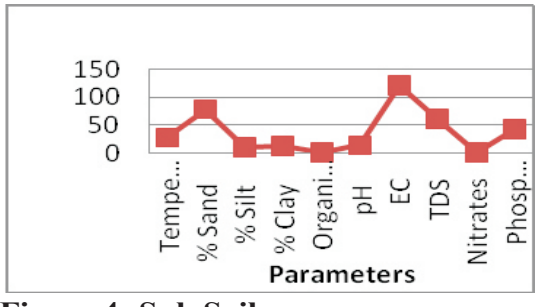

Figure 4: Sub Soil

Physical and chemical parameters of water sample at Oko mayon water body

Water quality attribute of any water body is an essential factor that influences fish survival, reproduction, growth and overall biological production. During the study period seven water parameters were determined and the result revealed that temperature and available Phosphorus were high in April and low in August while EC and TDS were high in August and low in April but Transparency was high in June and low in April. pH on other hand was high in August and low in June with total Nitrogen being high in April and low in June. According to Islam *et al*. (2012) transparency of his study to be 122.33 cm, this disagrees with the result of the study which gave a transparency of (22.50±0.71). Transparency of water bodies indicates the extent to which sunlight can penetrate in order to cause photosynthesis. High transparency enhances primary productivity of the water body (Seah *et al.,* 2011).

The value recorded for pH (8.74±0.06) of the water sample in this study was in agreement with (Lloyd, 1992) who gave a range value of 6.5 - 9.0 for most freshwater species. pH affect fish health and it enhances reproduction of fish species in the water body. At lower pH, reproduction cease in the organism (Lloyd, 1992).

Total nitrogen and available phosphorus were maximum in month of April in their concentration, which correspond with peak of rainy season and as a result of high human activities (washing of clothes, and seasonal vegetation of crops), fertilizer added to plant wash into the water body,

detergent used for washing cloth contains phosphate. The correlation that existed between Total nitrogen and total fish catch agrees with Maruo *et al.* (2006) who stated that nitrogen is an essential element of phytoplankton growth in aquatic environment and is the main nutrient supporting fish production in the open ocean. The temperature mean were (24.95±0.21 - 28.65±0.2 °C). The highest temperature (28.65±0.21°C) was recorded in the month of April and the lowest temperature (24.95±0.21°C) was in August. The transparency ranged from (20.50±0.71-22.50±0.71cm) highest and lowest visibility was in the months of June and April (22.50±0.71cm, 20.50±0.71 cm), respectively. Conductivity was (167.50±0.71-177.50±0.71) with high value in August (177.50±0.71) and low in April (167.50±0.71). Others include; pH (6.65±0.07-8.74±0.06), TDS (83.50±0.71-88.25±0.35)mg/l, Available phosphorus (0.18±0.01-2.08±0.01)mg/l, and Total nitrogen (0.02±0.00-0.064±0.01)mg/l. The month of August recorded the highest value in pH and Total Dissolved Solids with lower value in April (0.064±0.01) but Total Nitrogen was low in June and high in April (0.02±0.00).

Table 4: Mean water quality of Oko Mayon Water Body for the three Sampling months

	Month (Mean±SD)		
Parameter	**April**	**June**	**August**
Temperature (°C)	28.65±0.21[a]	27.15±0.21[b]	24.95±0.21[c]
Transparency(cm)	20.50±0.71[a]	22.50±0.71[a]	21.50±0.71[a]
EC	167.50±0.71[c]	171.00±1.41[b]	177.50±0.71[a]
pH	7.41±0.11[b]	6.65±0.07[c]	8.74±0.06[a]
TDS	83.50±0.71[c]	85.25±0.35[b]	88.25±0.35[a]
Phosphates	2.08±0.01[a]	1.18±0.01[b]	0.18±0.01[c]
Nitrates	0.064±0.01[a]	0.02±0.00[b]	0.03±0.00[c]

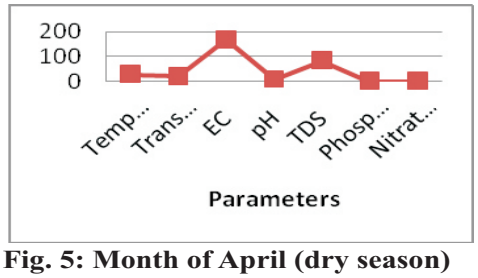

Fig. 5: Month of April (dry season)

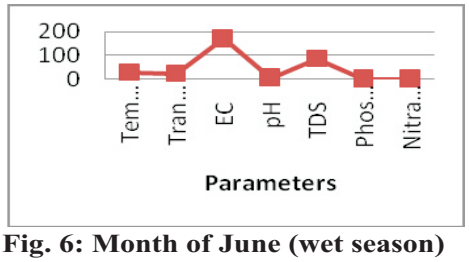

Fig. 6: Month of June (wet season)

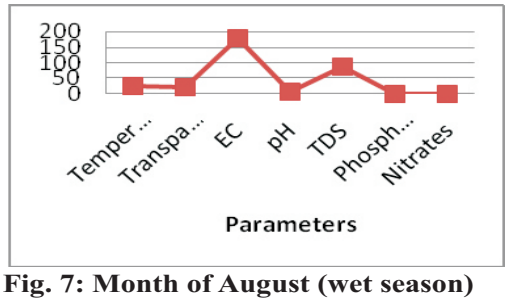

Fig. 7: Month of August (wet season)

The correlation between the physical and chemical parameters of the water, the soil of Oko mayon water body and total fish catch

Table 5 revealed the correlation among the physical and chemical parameters of Oko Mayo water body, alluvial soil and their interactions with the fish species. The results of the correlation indicated that there was positive significant correlation between the parameters: Electric conductivity and % silt of soil (0.999), Total dissolved solid and % silt of soil (0.998), Total dissolved solid and Electric conductivity of soil (1.000), Available phosphorus and Temperature (0.999), Available phosphorus and Total nitrogen (0.998) of soil and water, Total fish catch and Total nitrogen in water (1.000), Available phosphorus in soil and Total fish catch (0.999). However, there was negative significant correlation between %sand and Total nitrogen in water (-0.1000), Available phosphorus and %sand in soil (-0.999) at ($p<0.05$).

Furthermore, at ($p<0.01$) there was positive significant correlation between TDS and EC of the water (1.000), Total nitrogen and Temperature of water (1.000), Total nitrogen and % silt of soil (1.000), Total fish catch and Temperature of water (1.000). But for %sand and Temperature of water (-0.1000), total fish catch and % sand in soil (-1.000) there was negative significant correlation within them.

All factors occurring in any water body whether physical, chemical or biological, influences its ecosystem. An ecosystem being an integrated complex system determines the interaction, survival and sustenance of such aquatic milieu. According to reports by Azizul *et al*. (2006), different species of organisms inhabit different habitats to respond according to the prevailing ecological settings in such habitat.

According to (NCERT Geography, Indian Geography by Kullar), alluvial soil has low proportion of nitrogen, while available phosphorus is adequate. This also agreed with the result of this study that the total nitrogen content in the soil is low with highest value of (0.14±0.02mg/L) while the available phosphorus is in adequate quantity with highest value of (42.56±1.50mg/L) as indicated in Table 5.

Udo (2007) states that aquatic habitat with high percentage of sand has high nutrient seepage capacity, this corresponds with the present study, sand has higher percentage (78.48±9.65) compared to Clay and Silt.

The result of this study shows that the month of April which is dry season has the highest fish harvested compared to August in wet season due to reduced water volume which concentrated the fishes for easier catch ability. This agreed with the findings of Araoye (2005), who reported higher catches during the dry seasons in Asa Dam, Ilorin, Nigeria and Ondo State coastal waters respectively probably due to more intense fishing activities in the dry season. Olawusi Peters (2008) also observed higher catches in Agboyi Creek, Lagos State during the dry season. The dry season is a period of high volume draw-down in reservoirs and lakes.

Water and soil quality of the river was good enough as it encouraged good growth of fish species. Oko Mayo river is an important river in Odogbolu local government of Ogun state contributing so much to the inland fishery of the State. The research shows that the composition of fish species in the river is high which an evidence of its high productivity.

Conclusion and recommendation

The different values of measured physical and chemical parameters of soil and water such as temperature, pH, EC, TDS, total nitrogen and available phosphorus were within permissible limit. Also, the soil has

Table 5: Correlation Matrix of physical and chemical of water and soil, and total fish catch at Oko Mayon Water Body

	Tw	Tsw	ECw	PHw	TDSw	Nw	Pw	Ts	Ss	Sts	Cls	pHs	ECs	TDSs	Cs	Ns	Ps	TF
Tw	1	-.486	-.957	-.601	-.957	1.000**	.702	.874	-1.000**	.906	-.583	.996	.885	.877	.953	.912	.999*	1.000**
Tsw		1	.212	-.406	.212	-.476	-.964	.000	.500	-.811	.993	-.405	-.837	-.846	-.729	-.802	-.532	-.500
ECw			1	.807	1.000**	-.960	-.465	-.977	.952	-.744	.322	-.979	-.712	-.700	-.824	-.754	-.940	-.952
pHw				1	.807	-.611	.147	-.914	.588	-.206	-.298	-.671	-.161	-.144	-.330	-.221	-.558	-.588
TDSw					1	-.960	-.465	-.977	.952	-.744	.322	-.979	-.712	-.700	-.824	-.754	-.940	-.952
Nw						1	.694	.879	-1.000*	.901	-.574	.997	.880	.871	.949	.907	.998*	1.000*
Pw							1	.267	-.713	.938	-.988	.635	.953	.958	.885	.932	.738	.713
Ts								1	-.866	.585	-.115	.914	.548	.533	.685	.598	.847	.866
Ss									1	-.912	.596	-.994	-.893	-.885	-.957	-.919	-.999*	-1.000**
Sts										1	-.873	.864	.999*	.998*	.992	1.000**	.927	.912
Cls											1	-.507	-.894	-.902	-.802	-.865	-.625	-.596
pHs												1	.840	.830	.921	.871	.990	.994
ECs													1	1.000*	.985	.998*	.909	.893
TDSs														1	.982	.997	.901	.885
Cs															1	.994	.967	.957
Ns																1	.932	.919
Ps																	1	.999*
TF																		1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

Key: Tw – Water Temperature, Tsw – Water Transparency, ECw – Electrical conductivity of water, pHw – Water pH, TDSw – Total Dissolved Solids of Water, Nw – Water Nitrate, Pw – Water Phosphate, Ts – Soil Temperature, ECs – Electrical conductivity of soil, pHs – Soil pH, TDSs – Total Dissolved Solids of Soil, Cs – Soil Organic Carbon, Ns – Soil Nitrate, Ps – Soil Phosphate, TF – Total Fish Catch, Cls- % Clay, Sts-% Silt, Ss- % Sand.

high percentage of sand and this yield high productivity of fish species in the water body. The present study therefore confirms that runoff from the alluvial soil directly did not affect the species diversity negatively. *The information gathered from this study will be helpful* in formulating management policies that would be useful in future management of Oko Mayon water body.

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