# Numerical simulations and fish diversity in relation to physico-chemical parameters of four aquatic stations in Badagry Division, Lagos, Nigeria


## Abstract

This study investigated common fish assemblages in four aquatic stations (Gbaji, Topo, Agboju and Ajegunle) in relation to physico-chemical parameters of its water and as well simulates numerical values of the physico-chemical parameters for year 2024. Data were collected and computed using standard methods and algorithm machine learning model respectively. Statistical tools employed include ANOVA and Pearson correlation (*r*) test. All the parameters (except turbidity, chemical oxygen demand and biochemical oxygen demand) were within standard permissible limits. The results of Pearson's correlation analysis showed that increase in amount of fish species in the sampling stations was significantly and strongly linked to the decrease in value of biochemical oxygen demand ($r = -0.571$, $P=.05$), total dissolved solids ($r= -0.696$, $P=.05$) and conductivity ($r=-0.882$, $P<0.01$) while increase in number of fish species was significantly and strongly linked to the increase in value of dissolved oxygen($r= 0.991$, $P=.05$). However, salinity ($r= 0.387$), sulphate ($r = 0.212$) and turbidity ($r= 0.282$) had weak positive relationship with the number of fish species. The prediction by the machine learning algorithm modeling systems revealed that at Agboju, total hardness would exceed permissible limit in February and September, carbondioxide ($C0_2$) in February, May and June, 2024.On the other hand, level of $C0_2$ at Ajegunle would exceed permissible limit in January, May, August and September, and total hardness in November, 2024. For both Agboju and Ajegunle, turbidity and chemical oxygen demand level would exceed limits throughout the months in year 2024. Hence, effects of higher parameters could results in declination of distribution of demersal fish species which often shuttle between the water bottom and surface.



**Keywords: Fish diversity, numerical simulations, correlation, water quality.**


## 1. Introduction

Water is affected by an array of physical, biological and chemical factors which in turn influence the species diversity and composition, as well as productivity and physiological conditions (Anwan *et al*., 2021). When various physical and chemical or biological factors are available in suitable qualities, it promotes an increased metabolic and reproductive activities and growth for aquatic organisms. Chindah (2004) reported that the physico-chemical parameters of an aquatic ecosystem depend largely upon the season and some other environmental factors such as anthropogenic activities, among others. Studies have shown that seasonal variations in physico-chemical parameters have an important role in the distribution, periodicity, quantitative and qualitative composition of freshwater biota (Negi *et al.*, 2012; Ogbuagu and Ayoade, 2012). For instance, Ogidiaka *et al.* (2012) studied the physico-chemical parameters of Ogunpa River in Ibadan and reported that low dissolved oxygen levels result in anaerobic decomposition products such as hydrogen sulphide, ammonia and methane gases, and these products are all deleterious to aquatic organisms. However, Ayo-Olalusi and Ayoade (2017) reported that values obtained for physico chemical parameters in the waters of Lagos Lagoon complex were within the acceptable levels for survival, metabolism and physiology of aquatic organism. Sharma *et al*. (2007) has opined that monitoring the physico-chemical parameters is very important for studying the influence of these parameters on the distribution of various components of biodiversity. Therefore, this study aims to determine the relationship between the physico-chemical parameters and fish assemblages from four aquatic stations in Lagos, Nigeria and as well simulates the value of these physico-chemical parameters for year 2024.

## 2. Materials and methods

### 2.1 Sampling Stations

Aquatic stations examined for this study were Gbaji, Agboju, Topo and Ajegunle which were located within Badagry Division of Lagos State, Nigeria (Figure 1). Gbaji (Lat. $6^o$ 20'N, Long.$3^o$ 0'E) and Topo (Lat. $6^o$ 20' N, Long. $3^o$ 02'E) are tributaries of Badagry creek, Agboju site is a tributary of Lagos Lagoon located on Latitude $6^o$ 40' N and Longitude $3^o$ 20'E while Ajegunle (Lat. $6^o$ 40' N, Long.$3^o$ 22' E) is a tributary of Ajegunle creek. Gbaji and Topo are located in Badagry Local Government Area (LGA), Agboju is located in Amuwo Odofin LGA while Ajegunle is located in Ajeromi Ifelodun LGA.

### 2.2 Collection of water sample and assessment of fishers' catch composition

Sample of water were collected twice every month from the four sampling stations (Gbaji, Agboju, Topo and Ajegunle) for a period of 24 months (January 2018 to December, 2019) in line with standard procedures provided by APHA (2005). At each station, two sampling points were chosen. The category of fish species landed at each station was noted using both virtual observation and taking of photograph at the sampling site while the numbers of each species in the catch were recorded when fishers sorted their catches at the landing site. Thereafter, the pictures of unidentified specimens were brought to the laboratory for identification by experts at the Department of Fisheries, Lagos State University.

### 2.3 Determination of physico-chemical parameters

Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), alkalinity, total hardness, sulphate, nitrate, phosphate, turbidity and Carbon dioxide ($C0_2$) were determined in the laboratory using methods described by APHA (2005). Temperature, pH, conductivity, salinity, Total Dissolved Solid (TDS), and dissolved oxygen of the water samples were measured in-situ by using a mercury-in-glass thermometer, HQ40D Portable Multi Meter (pH, Conductivity, Salinity, TDS, ORP and ISE for water, USA) and DO meter (Method: HACH 8157) while water turbidity was measured using nephelometer (Analite portable nephelometer Model 156, Mcvan Instrument, Mulgrave).

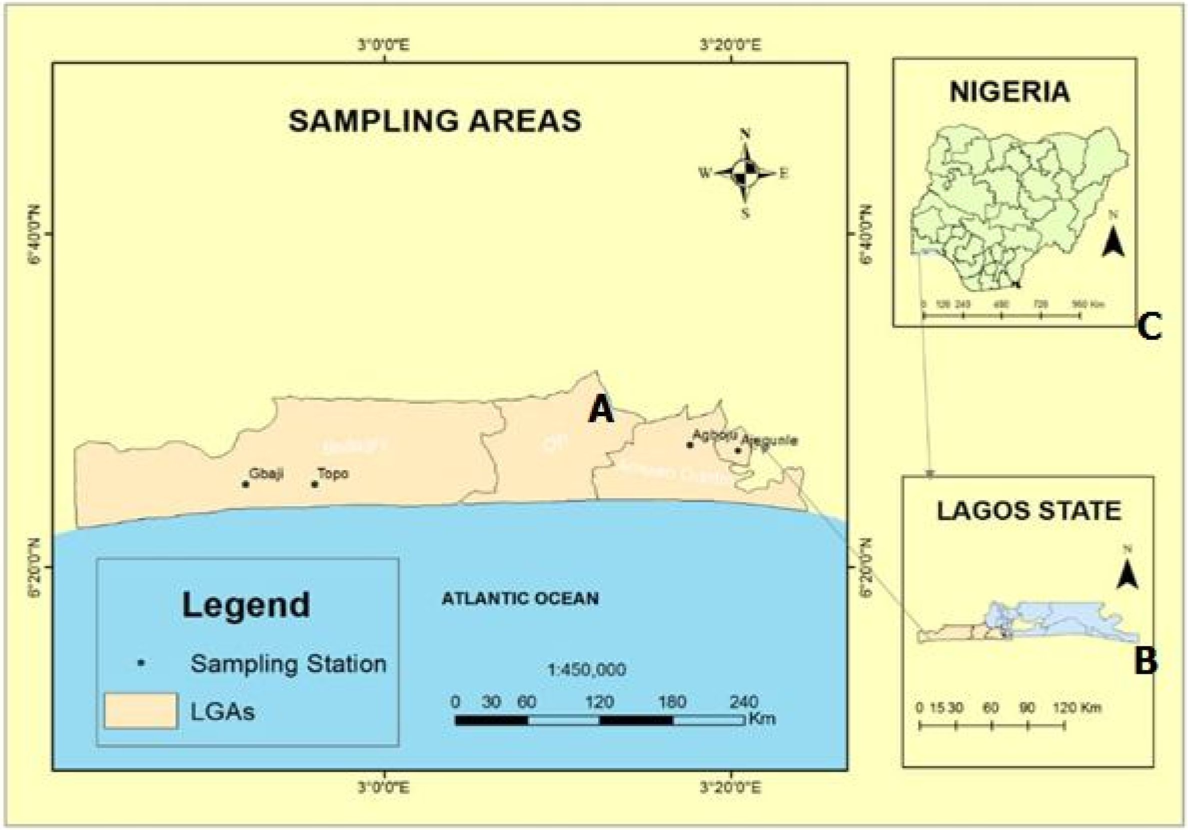


**Figure 1: Locations of sampled stations**
**A= Badagry division, B= Lagos State and C=Nigerian map**

### 2.4 Simulation of levels of physico-chemical parameters in the sampling stations

The modeling system employed for the simulation was algorithm machine learning model. Raw data (Physico-chemical parameters in water) were coded into machine language accordingly. A website was designed using the algorithm machine for the prediction as shown below. With this website, the concentration of physical and chemical properties of the selected aquatic ecosystems can be predicted.

i. **Url for physico-chemical parameters (prediction):**
**https://www.wolframcloud.com/obj/b449e356-3d59-4b89-a2ab-f2913f1d1d17**

#### 2.4.1 Coding of the Data for Modeling

Raw data of sample of water collected twice every month from the four sampling stations (Gbaji, Agboju, Topo and Ajegunle) for a period of 24 months were coded as follows. The coded values assigned to the physico-chemical parameters were in the orders: Alkalinity-1, temperature-2, biochemical oxygen demand (BOD)-3, conductivity-4, total dissolved solids (TDS) -5, carbondioxide-6, total hardness-7, chemical oxygen demand (COD)-8, turbidity-9, phosphate-10, dissolved oxygen (DO)-11, pH-12, salinity-13, sulphate-14 and nitrate-15.

#### 2.4.2 Coding of Sampling Stations, frequency of sampling and months

Agboju was coded as 1, Gbaji as 2, Ajegunle-3 and Topo as 4. The number of collection per month was designated as 'attempt'. The first time of collection was assigned 1, while second collection was assigned 2. Month of January was coded as 1, February-2, March-3, April-4, May-5, June-6, July-7, August-8, September-9, October-10, November-11 and December-12.

**2.5 Statistical Analyses**

All Data for spatio-temporal physico-chemical parameters were computed with the Statistical Package for Social Scientists (SPSS) version 20.0 software. The computed data were tested by one-way Analysis of Variance (ANOVA) and Pearson correlation while Least Significance Difference (LSD) Post-hoc test was used to separate the means. The level of significance was set at $P=.05$ except for the Pearson correlation where both $P<0.01$ and $P=.05$ were considered. The prediction of future variance in physico-chemical parameters at the sampling stations were done via model and developed website for this study.

## 3.RESULTS

### 3.1Spatio-temporal variation of water physico-chemical parameters

The spatio-temporal variation of water physico-chemical parameters in the stations are presented in figure 2**.** Water in Gbaji had average temperature of 28.08±1.88$^o$C, Agboju (28.62±2.14$^o$C), Topo (27.98±1.99$^o$C) while Ajegunle had average temperature of 29.19±1.78$^o$C. However, there was no significant difference in spatio-temporal variation in regards to the values of water temperature across the sampling stations. The results showed significant difference (P=.05) between the values of dissolved oxygen (DO) recorded in Ajegunle (6.42±1.58mg/L) in comparison with values of dissolved oxygen recorded in Gbaji (8.76±0.99mg/L), Agboju (7.92±1.48mg/L) and Topo (7.93±2.12mg/L). The trend of values of pH across the sampling stations was 6.94±0.98 at Gbaji to 7.62±1.18 at Ajegunle. On the other hand, the mean pH in Agboju was 7.35±0.56 while Topo had pH of 7.13±0.77. Among the sampling stations, Agboju had the highest alkalinity (52.90±10.12mg/L), followed by Gbaji (51.35±8.26mg/L) and then Topo (50.65±7.38) while the least alkalinity was recorded at Ajegunle (46.75± 4.21mg/L). However, there was no significant spatio-temporal variation in values of alkalinity recorded between Topo and Gbaji stations and pH across the stations.

The least values of biochemical oxygen demand (BOD) was recorded in Topo (214.66± 22.39mg/L) while the highest was recorded in Ajegunle (229.50±29.73mg/L).While BOD recorded at Agboju was 222.54±21.64mg/L, Gbaji had 215.48±30.21mg/L. All the values of BOD across the stations were significantly different (P=.05). The highest value of total dissolved solids (TDS) was recorded at Gbaji (135.89±6.96mg/L), followed by Topo (132.88±5.23mg/L), then Ajegunle (130.97±11.38mg/L), while the least was recorded in Agboju (127.45± 10.48mg/L). There was significant (P=.05) spatio-temporal variation for the TDS across the sampling stations. The mean values of carbondioxide ($C0_2$) in Gbaji, Agboju, Topo and Ajegunle were 8.40±1.11mg/L, 8.42±1.75mg/L, 8.19±0.99mg/L and 10.24±1.19mg/L respectively. However, only values of $CO_2$ from Ajegunle was significantly (P=.05) higher than values of $C0_2$ from other sampling stations. There was significant (P=.05) spatio-temporal variation in values of total hardness recorded from the sampling stations with the highest total hardness recorded in water from Ajegunle (244.25±10.91mg/L), followed by Agboju (211.65±16.82mg/L), then Topo (208.67±9.55mg/L) while Gbaji (203.45±12.89mg/L) had the least value of total hardness. The phosphate level in water from Gbaji, Agboju, Topo and Ajegunle were 5.13±1.48mg/L, 8.69±1.12mg/L, 4.89±1.82 mg/L and 7.12±2.02mg/L respectively. However, only the values of phosphate recorded in Gbaji and Topo had no significant spatio-temporal variations. Similarly, there was no significant spatio-temporal variation in the values of salinity across the stations. Specifically, salinity levels of 0.589±0.06ppt, 0.774±0.040ppt, 0.620±0.082ppt and

0.924±0.06ppt were recorded in water sampled from Gbaji, Agboju, Topo and Ajegunle respectively. Significant (P=.05) spatial variation were recorded for conductivity across the stations. The order of values of conductivity in µs/cm recorded across the stations was 225.27±10.97, 233.59±45.60, 237.60±40.48 and 268.65±36.41 from Gbaji, Agboju, Topo and Ajegunle respectively. The respective values of nitrate from Gbaji, Agboju, Topo and Ajegunle respectively were 6.86±0.94mg/L, 5.32±1.16mg/L, 5.22±1.44mg/L. and 7.12±1.64mg/L. However, there was no significant spatio-temporal variation in the values of nitrate recorded across the sampling stations. Ajegunle had the highest value of chemical oxygen demand, COD (240.46±25.18mg/L) while Gbaji had the least value of 192.86±14.44mg/L. Values of COD in Agboju and Topo were 237.62±15.70mg/L and 198.50±18.34mg/L respectively. All the values of COD across the sampling stations are significantly different (P=.05).

The differences in the concentrations of sulphate from Gbaji (4.68±1.65mg/L), Agboju (5.98±2.09mg/L) and Topo (4.79±1.24mg/L) were not statistical significant. However, value of sulphate recorded in Ajegunle (8.78±0.98mg/L) were significantly (P=.05) higher when compared with the other three sampling stations. While there was no significant spatio-temporal variation between values of turbidity recorded at Topo (41.68± 9.15 NTU) and Ajegunle (41.63±7.08 NTU), values of turbidity in Gbaji (39.65±8.26 NTU) and Agboju (45.37±9.69NTU) were significantly (P=.05) different. Furthermore, level of turbidity at both Topo and Ajegunle varies significantly (P=.05) from turbidity level at both Gbaji and Agboju.

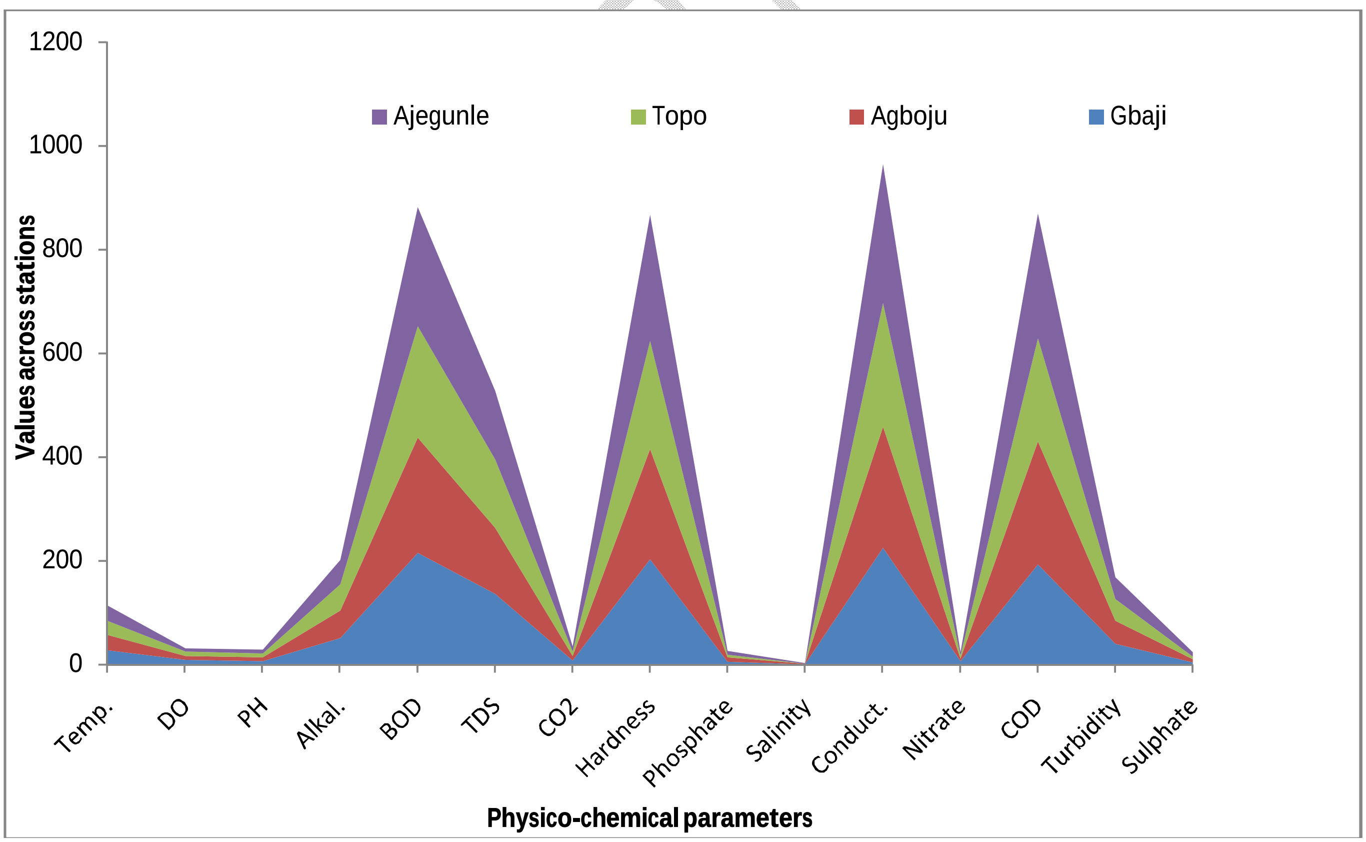

**Figure 2: Spatio-temporal variation of water physico-chemical parameters from the sampled stations**

**3.2 Fish species and its correlation with physicochemical parameters**

Sixteen (16) fish species were most common at the four stations (Table 1). Across the stations, *Tilapia guineensis* constituted 17.80%, 15.70%, 20.82% and 17.22% of the fish species recorded at Gbaji, Agboju, Topo and Ajegunle respectively. But the least percentage was observed in *Sardinella maderensis*(1.05%) in Gbaji, *Sardinella aurita* (1.79%) and *Bathysoleapro fundicola* (1.79%) in Agboju, *Papyrocranus afer* (0.79%) and *Pellonula leonensis* (0.79%) in Topo, and *Liza falcipinnis* (1.73%) in Ajegunle.

The results of Pearson's correlation analysis to estimate the association between the water quality and the distribution of fish species across the sampling stations was shown in Table 2. The population/abundance of the fish species was negatively correlated to three parameters (BOD, TDS and conductivity) and positively correlated to twelve physico-chemical parameters (Temperature, Dissolved Oxygen, Alkalinity, Carbondioxide, Total Hardness, Phosphate, Salinity, Nitrate, Chemical Oxygen Demand, Sulphate, Turbidity and pH). The increasing of fish species amount in the sampling stations was significantly and strongly linked to the decrease in value of Biochemical Oxygen Demand ($r = -0.571$, P=.05), Total Dissolved Solids ($r = -0.696$, P=.05) and Conductivity ($r = -0.882$, $P < 0.01$) while increasing of fish species was significantly and strongly linked to the increase in value of Dissolved Oxygen($r = 0.991$, P=.05). However, only Salinity ($r = 0.387$), Sulphate ($r = 0.212$) and Turbidity ($r = 0.282$) had weak positive relationship with the fish species amount.

**Table 1: Relative Abundance of Most Common Fish Species caught in the sampling Stations**

| **Fish Species** | **Gbaji** | **Agboju** | **Topo** | **Ajegunle** | **Overall Relative Abundance** |
|---|---|---|---|---|---|
| *Caranx hippos* | 67 (11.70) | 46 (6.86) | 82 (16.11) | 51 (8.87) | 246 (10.58) |
| *Sardinella aurita* | 27 (4.71) | 12 (1.79) | 43 (8.45) | 12 (2.09) | 94 (4.04) |
| *Sardinella maderensis* | 6 (1.05) | 27 (4.04) | 27 (5.30) | 57 (9.91) | 117 (5.03) |
| *Ethmalosa fimbriata* | 67 (11.70) | 82 (12.26) | 18 (3.54) | 32 (5.57) | 199 (8.56) |
| *Tilapia guineensis* | 102 (17.80) | 105 (15.70) | 106 (20.82) | 99 (17.22) | 412 (17.71) |
| *Chrysichthys nigrodigitatus* | 64 (11.17) | 42 (6.28) | 31 (6.09) | 67 (11.65) | 204 (8.77) |
| *Papyrocranus afer* | 20 (3.49) | 27 (4.04) | 4 (0.79) | 12 (2.09) | 63 (2.70) |
| *Callinectes pallidus* | 18 (3.14) | 47 (7.02) | 12 (2.36) | 52 (9.04) | 129 (5.54) |
| *Oreochromis niloticus* | 40 (6.98) | 65 (9.71) | 71 (13.95) | 32 (5.57) | 208 (8.94) |
| *Sarotherodon melanotheron* | 32 (5.58) | 35 (5.23) | 43 (8.45) | 12 (2.09) | 122 (5.25) |
| *Bathysoleapro fundicola* | 42 (7.33) | 12 (1.79) | 19 (3.73) | 20 (3.48) | 93 (4.00) |
| *Pegusa lascaris* | 18 (3.14) | 46 (6.88) | 12 (2.36) | 50 (8.70) | 126 (5.42) |
| *Pellonula leonensis* | 20 (3.49) | 24 (3.59) | 4 (0.79) | 15 (2.60) | 63 (2.70) |
| *Eleotris vitata* | 9 (1.57) | 47 (7.02) | 14 (2.75) | 42 (7.30) | 112 (4.82) |

| | | | | | |
|---|---|---|---|---|---|
| *Solenocera africana* | 20 (3.49) | 27 (4.04) | 5 (0.98) | 12 (2.09) | 64 (2.75) |
| *Liza falcipinnis* | 21 (3.66) | 25 (3.74) | 18 (3.53) | 10 (1.73) | 74 (3.18) |
| **Total** | **573** | **669** | **509** | **575** | **2326** |

**Values in parenthesis are percentages**

**Table 2: Pearson correlation between the physico-chemical parameters and fish species assemblages**

| **Parameter** | **Correlation Coefficient** | **Nature of relationship** |
|---|---|---|
| Temperature | 0.569 | Strong |
| Dissolved Oxygen | 0.991* | Strong |
| Alkalinity | 0.585 | Strong |
| Biochemical Oxygen Demand | -0.571* | Strong |
| Total Dissolved Solid | -0.696* | Strong |
| Carbondioxide | 0.970 | Strong |
| Total Hardness | 0.978 | Strong |
| Phosphate | 0.891 | Strong |
| Salinity | 0.387 | Weak |
| Nitrate | 0.916 | Strong |
| Chemical Oxygen Demand | -0.643 | Strong |
| Sulphate | 0.212 | Weak |
| Turbidity | 0.282 | Weak |
| pH | 0.694 | Strong |
| Conductivity | -0.882** | Strong |

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

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

### 3.3 Model for predictions of future values of physico-chemical parameters

For the prediction, the machine learning algorithm modeling systems generated the decision tree whose Geometric Mean Probability Density was 0.0297462, Mean Cross Entropy (3.51505), Mean Deviation (8.51192) and Standard Deviation of 14.8721. Figure 3 showed comparison plot for the machine learning model for physico-chemical parameters. The outcome of the plot showed a perfect prediction as most of the predicted values was not farther disjointed from the principle of line of best fit. The probability density Histogram for the machine learning model for physico-chemical parameters is presented in Figure 4 which illustrates the trend of frequency of prediction of future values for the water physico-chemical parameters when the coded value for each attempt, location, and parameters has been input. However, figure 5 presented the Residual plot for the machine learning model for physico-chemical parameters, which illustrates that there was both close and wide gap between the initial actual values of parameters measured during the sampling periods and the forecasted values for future.

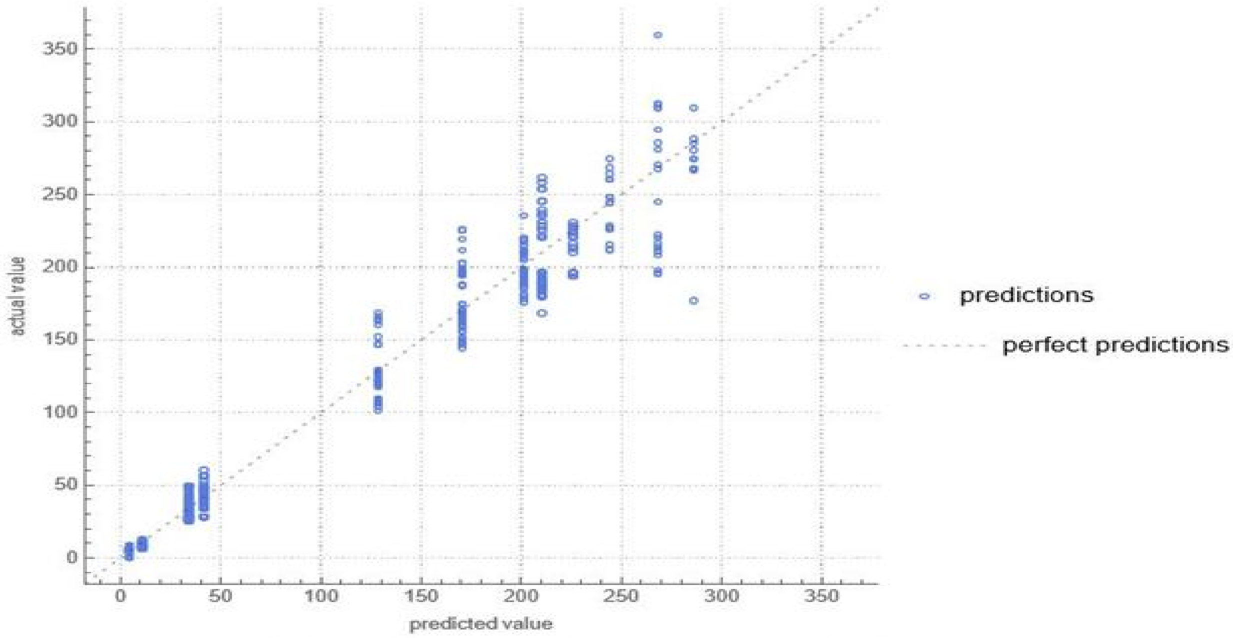


**Figure 3: Comparison plot for the machine learning model for physico-chemical parameters**

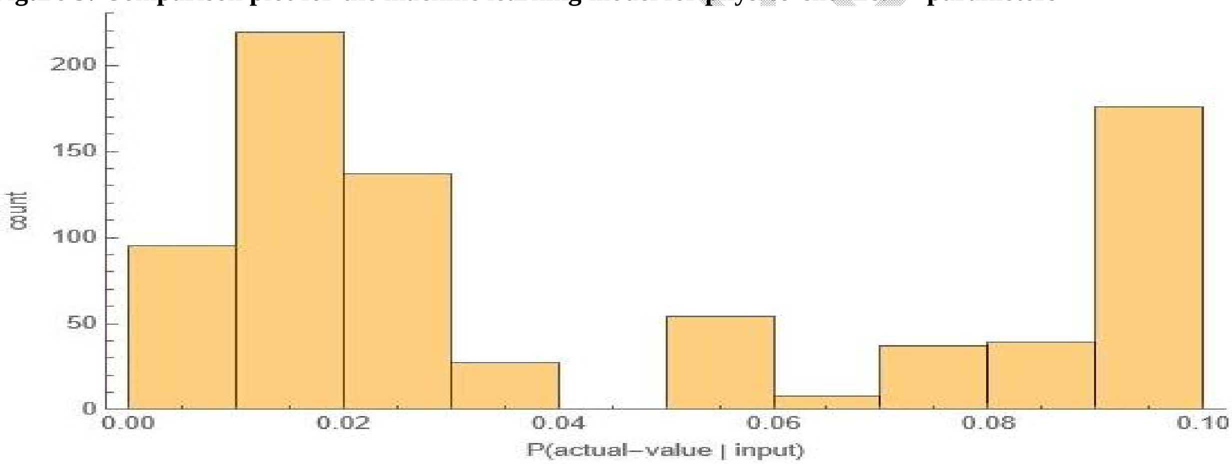


**Figure 4: Probability Density Histogram for the machine learning model for physico- chemical parameters**

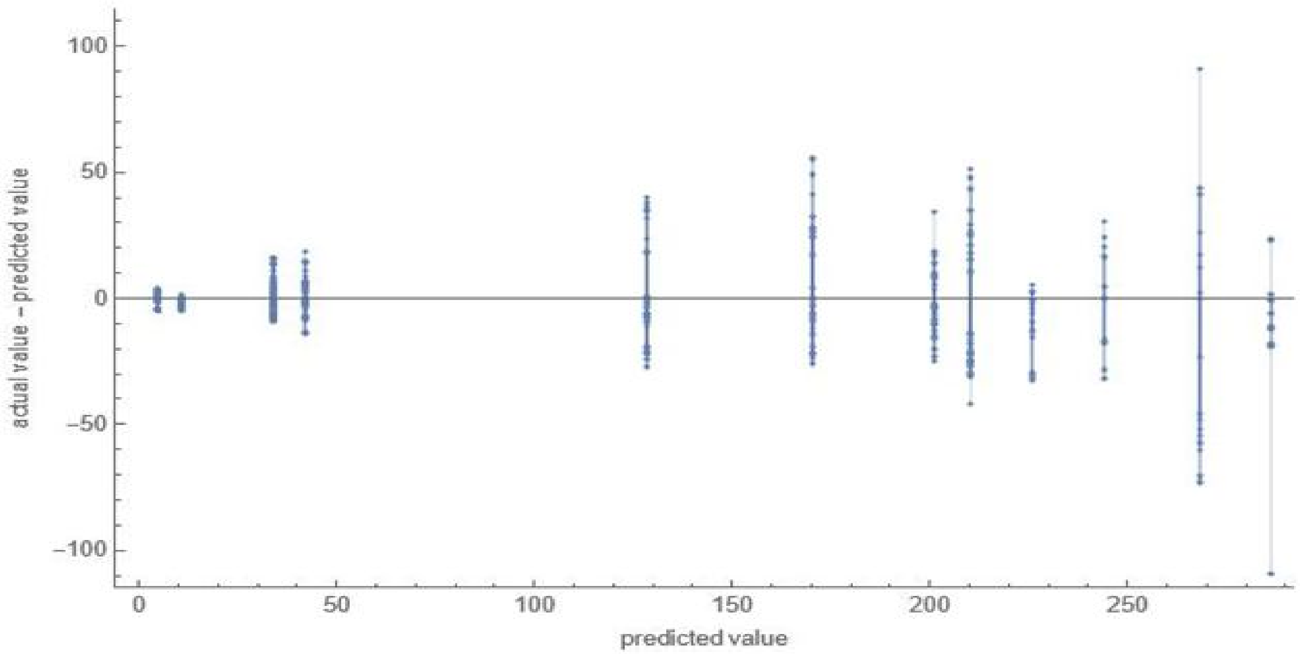


**Figure 5: Residual Plot for the machine learning model for physico-chemical parameters**

### 3.4 Outcome of Prediction using machine learning algorithm model

Results of machine learning algorithm modeling systems indicated that Agboju and Ajegunle would have 26% of its water parameters (specifically total Hardness, carbondioxide, chemical oxygen demand, and turbidity) exceeding permissible limit at certain months in year 2024. For Agboju site, mean hardness would exceed limit in February and September (Figure 6) while that of Ajegunle site would exceed limit in November. For carbondioxide at Ajegunle site, mean $C0_2$ would exceed limit in January, May, August and September (Figure 7) while that of Agboju site would exceed limit in February, May and June. As shown in figure 8, chemical oxygen demand at both sites (Agboju and Ajegunle) would be above limits throughout the year. Similarly, turbidity level for these stations (Figure 9) would be above limit threshold.

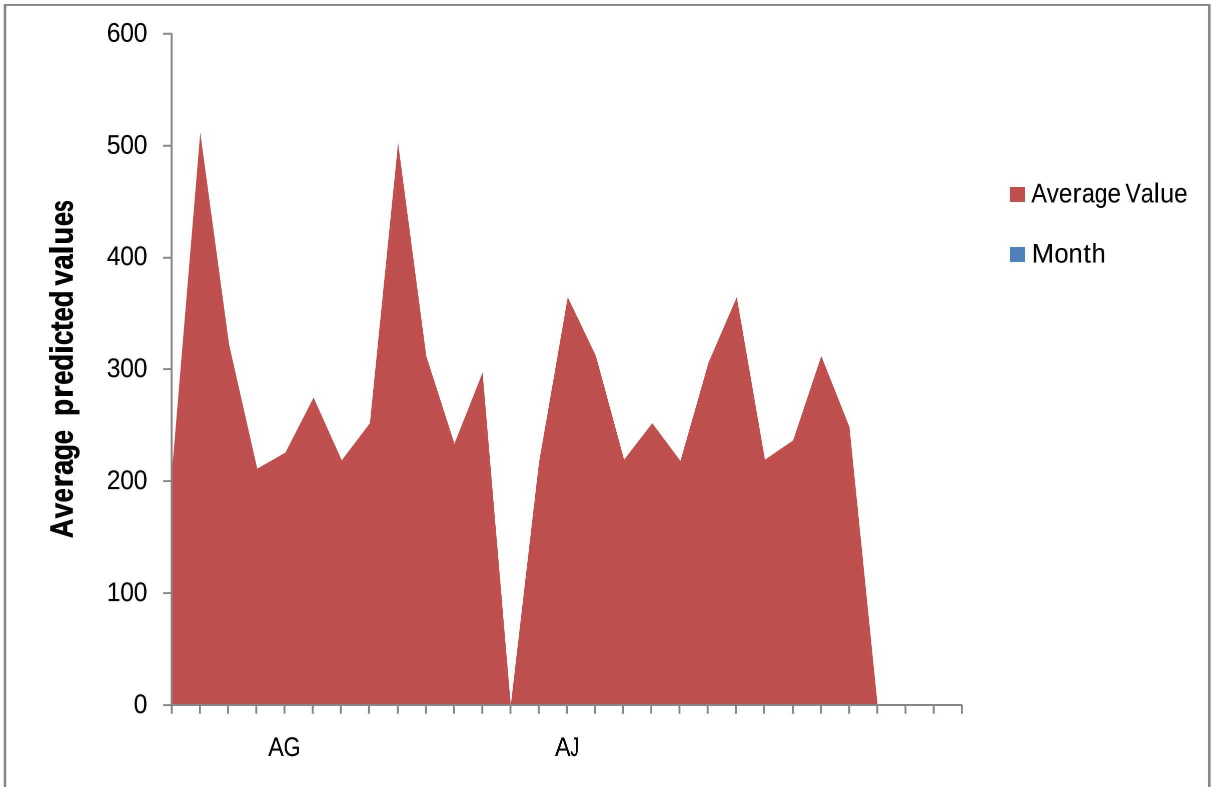


**Figure 6: Average value predicted for hardness at Agboju (AG) and Ajegunle (AJ) for 2024 (Jan-Dec)**

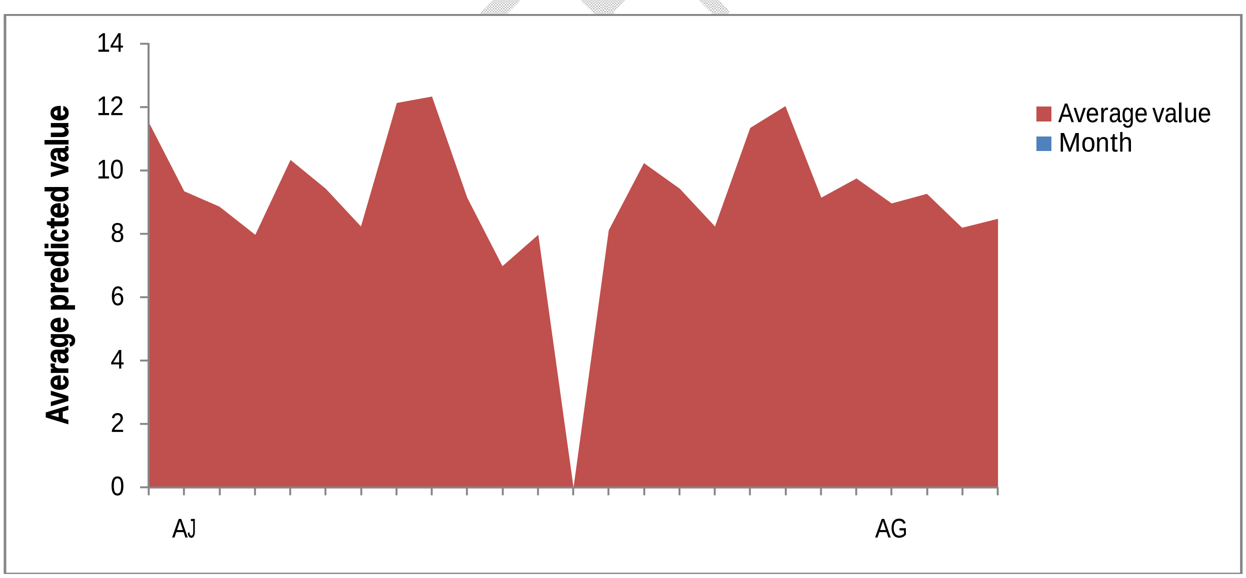


**Figure 7: Average value predicted for carbondioxide at Ajegunle (AJ) and Agboju (AG) for 2024 (Jan-Dec)**

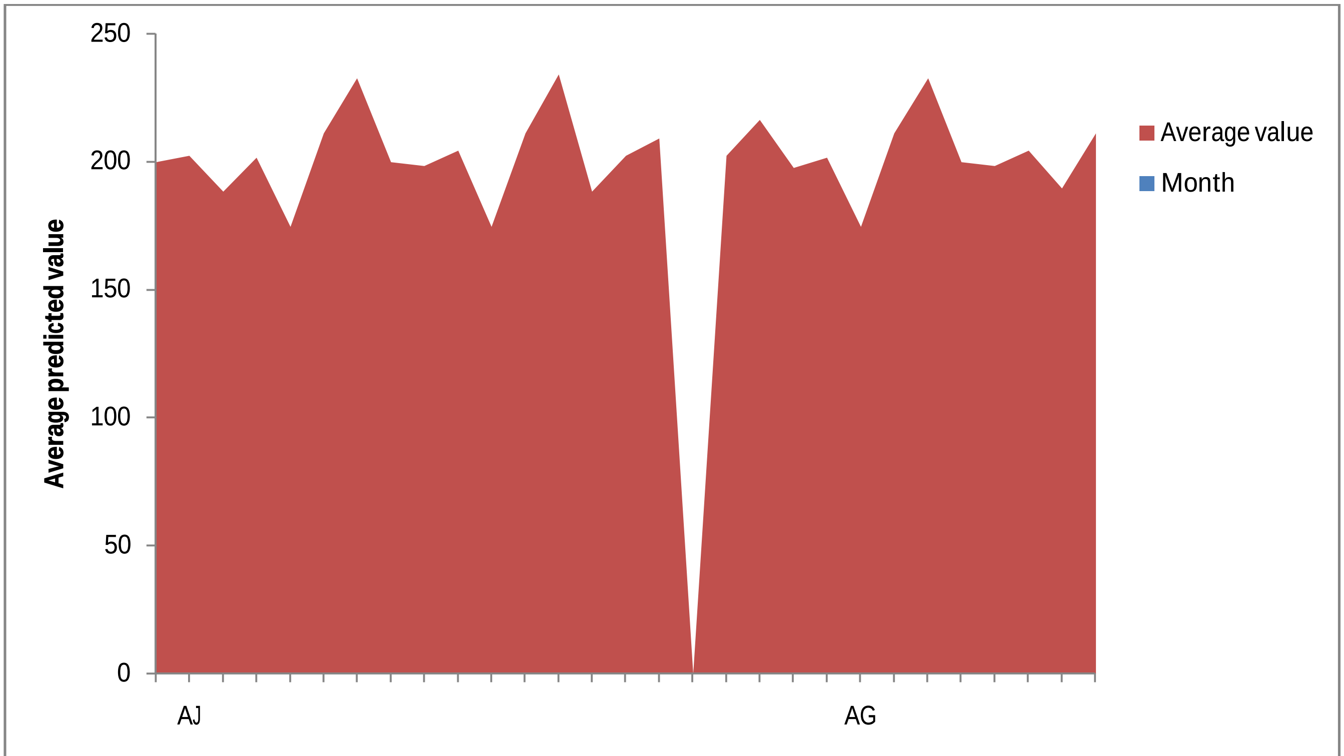


**Figure 8: Average value predicted for chemical oxygen demand at Ajegunle (AJ) and Agboju (AG) for 2024 (Jan-Dec)**

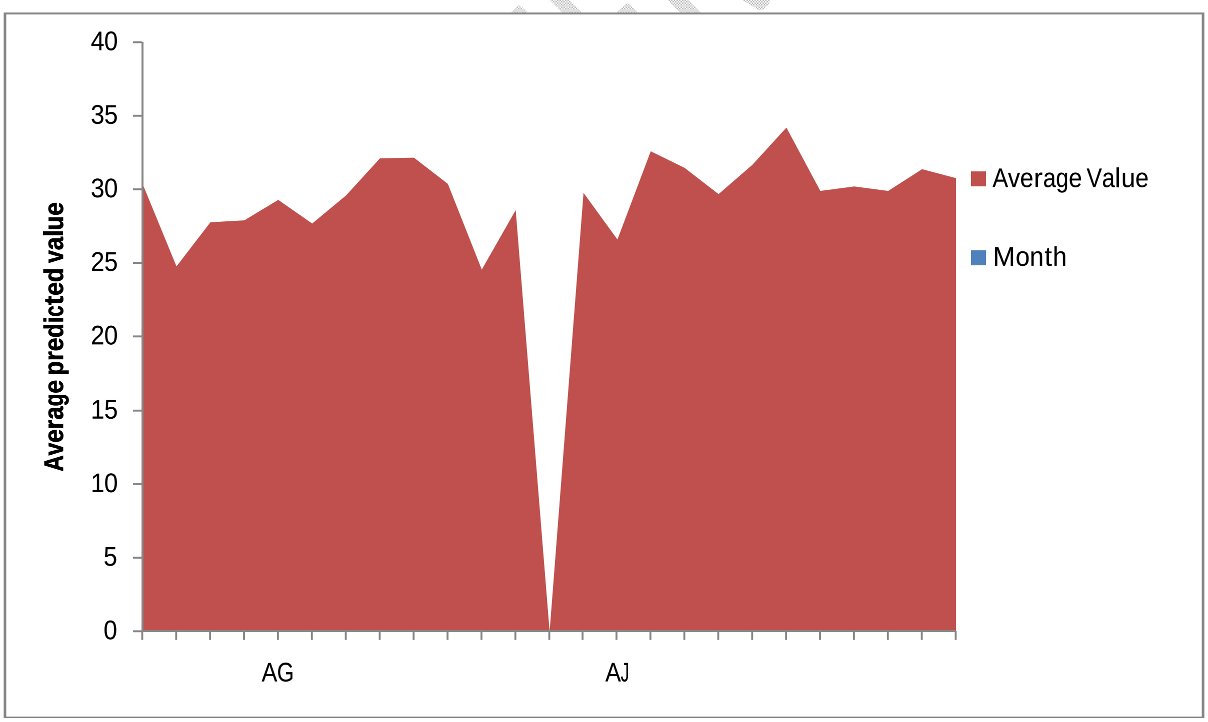


**Figure 9: Average value predicted for turbidity at Ajegunle (AJ) and Agboju (AG) for 2024 (Jan-Dec)**

## 4. Discussion

The spatio-temporal variation of dissolved oxygen, temperature, salinity, pH, phosphate and nitrate in this study that were not significantly different across the aquatic ecosystems suggest that there could be an easy migration of the aquatic biota to any of the aquatic ecosystem incase their primary habitat is altered. Similar observation for the above parameters has been reported by Mekuleyi *et al.* (2019) during the early survey of the environmental health status of Ajegunle, Gbaji, Agboju and Topo aquatic stations. Among the fifteen physico-chemical parameters examined in this study, only the values of biological oxygen demand, turbidity, chemical oxygen demand across the sampling stations, with carbondioxide at Ajegunle exceeded the recommended maximum permissible limit of 40mg/L, 5NTU, 40mg/L, $\leq$ 10mg/L respectively (USEPA, 2018; WHO, 2017). High biological oxygen demand, chemical oxygen demand, and turbidity across the sampling stations, could imply sequential alteration in the quality of the water which might be due to unregulated and none monitoring of the anthropogenic activities of the users of these aquatic ecosystems. However, the values of all water parameters recorded in this study were lower in comparison to that of Ologe Lagoon (Ndimele and Kumolu-Johnson, 2012) and Majidun River (Oladunjoye and Fafioye, 2016) but were higher than those reported in Lekki Lagoon (Kuton *et al*., 2021), Owo river (Clarke *et al*., 2019), and in water from Wadi Hanifah, Saudi Arabia (Abdel-Baki *et al*., 2013).

A total of sixteen (16) fish species were common across the four stations where *Tilapia guineensis* constituted the highest percentage of the catch while *Papyrocranus afer* and *Pellonula leonensis* were the least. The highest number of fish (669**)** and lowest (509) were obtained from Agboju and Topo respectively. Getting more *T. guineensis* in this study could suggest that Cichlid family were prominent in Nigerian water bodies. For instance, Benedicta *et al.* (2008) identified 46 species belonging to 28 genera and 16 families in the flood plain of Cross River, Nigeria with members of the bagridae family forming the most abundant followed by the cichlids and clariidae. Bolarinwa and Okeowo (2017) divulged that the eight major fishes commonly found in the coastal waters of Lagos State of Nigeria were *Pseudotolithus senegalensis, Coptodon zilli, Trachinotus goreensis, Polydactylus quadrifilis, Pomadasy jubelini, Ethmalosa fimbriata, Chrysichthys nigrodigitatus* and *Sphyraena piscatorum*. However, Olawusi-Peters (2008) investigated the fish species abundance, frequency of occurrence, number of occurrence of fishes in Agboyi creek in Lagos State and observed the occurrence of 25 species belonging to 17 families in which *Coptodon zillii* constituted 81.52% of the catch followed by *Oreochromis aureus, O. niloticus* and *Hemichromis fasciatus*. In this study, the increase in amount of fish species obtained across the sampling stations was significantly and strongly linked to the decrease in value of biochemical oxygen demand, total dissolved solids and conductivity but significantly and strongly linked to the increase in value of dissolved oxygen. Therefore, highest numbers of fish recorded in Agboju station could be attributed to its low total dissolved solid and biochemical oxygen demand levels. However, the over water quality parameters in this study especially for most of the parameters being within permissible limits indicated that the water is suitable for fish life in all the stations.

The prediction by the machine learning algorithm modeling systems revealed that total hardness in Agboju would exceed permissible limit in February and September, carbondioxide level would exceed permissible limit in February, May and June, while turbidity and chemical oxygen demand (COD) level would be above limits throughout the months in year 2024. Moreso, this study divulged that level of total hardness at Ajegunle station would exceed limit in November, 2024 while carbondioxide level would exceed permissible limit in January, May, August and September. However, COD and turbidity would exceed limits in these stations throughout the twelve months in year 2024. Though, aquatic organism in this water bodies can still thrive but the effects of these higher parameters could results in declination of distribution of demersal fish species which often shuttle between the water bottom and surface. As revealed by Recknagel (2001), machine learning has been effectively applied to ecological modeling and ecological time-series modeling. Synonymous to the outcomes of simulation using machine learning algorithm in this study, Akita *et al.*(2020) reported that physicochemical particularly pH influences the spatial distribution of species in Densu Estuary. Also, Niyoyitungiye *et al.*(2019), disclosed that number of fish species and water physico-chemical have both very strong negative and positive correlation.

## 5. Conclusion

The study has established that there exist a significant relationship between increase in amount of fish species and decrease in value of biochemical oxygen demand, total dissolved solids and conductivity while increase in number of fish species was significantly and strongly linked to the increase in value of dissolved oxygen. Across the stations, *Tilapia guineensis* constituted highest fish species, followed by *Sardinella maderensis* and *Liza falcipinnis* while *Papyrocranus afer* and *Pellonula leonensis* were the least in term of abundance. The study has also revealed how physico-chemical can be predicted using the machine learning algorithm modeling systems. Such prediction could facilitate pro-activeness of aquatic monitoring towards providing panacea to aquatic quality deterioration often generated by anthropogenic sources. The study further divulged that at Agboju, total hardness would exceed permissible limit in February and September, carbondioxide in February, May and June. On the other hand, level of total hardness at Ajegunle station would exceed limit in November, 2024, and carbondioxide in January, May, August and September. However for both Agboju and Ajrgunle, turbidity and chemical oxygen demand (COD) level would exceed limits throughout the months in year 2024. Thus, positive action is required by water monitoring agencies as effects of higher water parameters could results in declination of distribution of demersal fish species which often shuttle between the water bottom and surface.

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