Sjournals
Scientific Journals
Scientific Journal of Zoology (2013) 2(1) 1-5
ISSN 2322-293X

Contents lists available at Sjournals
SCIENTIFIC JOURNAL OF ZOOLOGY
Journal homepage: www.Sjournals.com

Original article

Seasonal variability in some physicochemical parameters of water of AMADI-AMA creek, Niger delta

B.B. Otene[a,*], S.I. Iorchor[b]

[a]*Department of Fisheries and Aquatic Environment, Faculty of Agriculture, Rivers State University of Science and Technology Nkpolu-Oroworukwo, Port Harcourt, Nigeria.*
[b]*Department of fisheries, Akperan Oshi College of Agriculture, Yandev, Gboko Benue State, Nigeria.*

[*]Corresponding author; Department of Fisheries and Aquatic Environment, Faculty of Agriculture, Rivers State University of Science and Technology Nkpolu-Oroworukwo, Port Harcourt, Nigeria.

ARTICLE INFO

Article history:
Received 12 January 2013
Accepted 21 January 2013
Available online 31 January 2013

Keywords:
Seasonal variability
physicochemical parameters
Amadi-Ama Creek
Niger Delta

ABSTRACT

The seasonal and spatial variations of some water parameters in Amadi-Ama creek were investigated from January, 2009 to December, 2010 (24months) from 6 sampling stations. Water samples collected were analyzed following the standard limnological methods of APHA. Data were analyzed using sample statistical method of mean and subjected to ANOVA for significant difference at $p \leq 0.05$. All the variables investigated except pH, BOD, NO_3^{-2} and PO_4^{-2} showed seasonal variation with higher values in the dry season than the wet season except turbidity. Spatially, all the variables except water temperature, ambient temperature and nitrate differed significantly.

1. Introduction

Amadi-Ama Creek is located in Port Harcourt Local Government Area of Rivers State and lies between longitude 5^0 60'E-6^0 60'E and latitude 6^0 06'N-6 07'. The area is characterized by extensive interconnection of creeks. The annual rainfall of the Niger Delta is between 2000-3000mm per year. It is within the tropical equatorial region characterized by high atmospheric (ambient) temperature of 27.5^0C and relative humidity fluctuating between 70-90% (Gobo, 1988). Dry season lasts for about six (6) months between November-April with occasional

rainfall. Generally, rain falls throughout the year in Niger Delta particularly in Port Harcourt. Heavy runoffs are been aided by climate especially in the wet season which create room for ease of distribution of terrigeneous materials in the aquatic ecosystem. The area is a typical estuarine tidal water zone with little fresh water input but with extensive mangrove swamps, inter-tidal mud flats and influenced by semi-diurnal tidal regime. The stretch of the coastal front of the creek has high human population density without pronounced or proper waste management infrastructures. This results to indiscriminate dumping of wastes. Untreated wastes from the abattoir located close to the creek are released into the aquatic ecosystem thereby polluting the water. In slaughterhouses, blood and paunch contribute greatly to the wastewater loads which affect the water variables. Boyd (1982) disclosed that physicochemical parameters refer to all physical, biological and chemical variables affecting the desirability of water for any particular use. It is therefore pertinent to note that the physicochemical parameters of an aquatic ecosystem depend largely upon the season and some other environmental factors such as anthropogenic activities and among others (Chindah, 2004). Variation in physicochemical variables depends on seasons and the nature of wastes introduced into the water body.Chindah (2003) reported that values of temperature, dissolved oxygen, biological oxygen demand and others recorded in the dry season varies from that of the wet season.

2.1. Study area

Amadi-Ama Creek is located in Port Harcourt Local Government Area of Rivers State and lies between longitude 5^0 60'E-6^0 60'E and latitude 6^0 06'N-6 07'.The catchment area of the creek falls within the mangrove freshwater swamp and lowland rain forest. The area is a typical estuarine tidal water zone with little fresh water input but with extensive mangrove swamps, inter-tidal mud flats and influenced by semi-diurnal tidal regime. The area is characterized by extensive interconnection of creeks. Along the shores of this creek are Port-Harcourt Trans-Amadi industrial layout, establishments, Port- Harcourt Zoological garden, markets and several communities which include, Amadi, Nkpogu, Oginigba, Woji, Azubie, Abuloma and host of others.

2. Materials and methods

2.1. Water sampling

Six sampling stations were established at least 500m apart along the banks from the Rumukalagbo to the Nkpogu axis through Woji to Abuloma jetty. This survey was carried out to identify and locate the sampling points. Monthly surface water sample was collected for twenty-four consecutive months for physico-chemical analysis using 500ml plastic containers with screw caps. Collection of samples from the stations was always between 9 and 12hrs each time.Water samples were collected just a few centimeters below the water surface at each of the six respective stations. The plastic containers were then labeled appropriately and transported to the laboratory immediately after collection for further analysis.

2.2. Analytical methods

The physico-chemical analysis of water samples followed the standard limnological methods of ALPHA (1998).

The water and ambient temperature (oc) was measured using (in-situ) mercury-in-bulbs thermometer at the various stations each time of sampling and were recorded in the field notebook. The turbidity of the water sample was measured/taken in-situ using the secchi disc. Water samples for DO and BOD were collected from the respective stations with 70ml bottles followed by the addition of winkler solution 1 and 11. The pH values of the water samples were determined in the laboratory using an EIL model 720 PH meter or model EC10 Hach. Conductivity was determined from the water sample using Griffin Conductance Bridge. Alkalinity was determined from the titration of 0.02 N_2S0_4 until methyl orange colour changed from yellow to pink. Phosphate was determined using stannous chloride method adapted for the estimation of phosphate-phosphorus. Nitrate was determined using Brucine method.

3. Results and discussion

Table 1 presents the seasonal physico-chemical parameters of Amadi-Ama creek while table 2 shows the spatial values of the same parameters.The highest spatial range of temperature (28.14-31.62 and 29.60-

32.90)(water and ambient) with the means 30.32±0.86°c and 31.20±0.92 were observed in stations 4 and 6 respectively. The dry season water temperature ranged from 29.40-31.62°C with the mean value of 30.60±0.07°C while the wet season water temperature ranged from 27.42-30.63°C with a mean of 29.51±0.09°C.The dry season ambient (air) temperature ranged from 30.80-32.90°C with a mean value of 31.30±0.40°C while the wet season ambient temperature ranged between 29.0-31.80°C with a mean value of 30.63±0.08°C.This is in line with the range observed in some tropical water bodies .This agrees with the reported range of 21-31 in the Cross river system (Akpan and Offem,1993) and in the Niger Delta system (Ewa 1988).The seasonal variation with higher dry season value than the wet season also agrees with Akpan and Offem (1993).This is also similar to the observation of Chindah and Braide (2004) for the Elechi creek. The highest range of turbidity (8.0-12.0) with the mean 10.17±0.58NTU was obtained in station 6.The dry season and wet season values ranged from 6.0-12.0 with the mean of 7.82±0.16NTU and 8.94±0.19NTU.This range of turbidity is in line with that reported by Davies et al, (2008) but contrary to dry season minimum in many tropical water system like Egborge (1972) for warri River, Courant et al. (1985) for Niger Delta. The maximum turbidity in this station could be attributed to dredging going on in the area.

Table1

Seasonal mean values of physicochemical parameter of water.

Parameters	Dry Season	Range	Wet Season	Range
Water temp. (°C)	30.60±0.07[a]	29.40-31.62	29.51±0.09[b]	27.42-30.63
Ambient temp. (°C)	31.30±0.40[a]	30.80-32.90	30.63±0.08[b]	29.0-31.80
Turbidity (NTU)	7.82±0.16[b]	6.0-12.0	8.94±0.19[a]	6.0-12.0
DO(mg/l)	3.72±0.44[a]	2.10-16.4	3.49±0.041[a]	1.8-16.20
pH	7.15±0.05[a]	6.10-7.90	7.13±0.04[a]	6.2-7.8
Alkaline(mg/l)	60.73±0.61[a]	42.0-72.0	59.40±0.47[b]	51.0-71.0
BOD(mg/l)	3.95±0.40[a]	0.40-13.80	4.01±0.38[a]	0.40-13.40
NO_3^{2-} (mg/l)	0.63±0.12[a]	0.05-0.89	0.63±0.03[a]	0.30-1.40
PO_4^{2-} (mg/l)	0.06±21.62[a]	0.05-0.10	0.06±5.64[a]	0.05-0.10

Means with similar superscripts are not significantly different (P<0.05)

Table 2

Spatial variation of physicochemical parameter of water.

Parameter/Station	1	2	3	4	5	6
Water Temp.(°C)	29.88±0.96[a]	29.98±0.99[a]	29.95±0.90[a]	30.23±0.86[a]	30.17±0.93[a]	30.11±0.60[a]
Range	27.42-31.22	28.14-31.52	28.33-31.52	28.14-31.62	27.62-31.62	28.61-31.20
Ambient Temp. (°C)	31.08 ± 0.98[a]	31.11±0.18[a]	30.01±5.63[a]	31.20±0.66[a]	3.22±0.87[a]	31.20±0.92[a]
Range	29.00 – 32.6	29.30-32.80	30.80-32.30	29.80-32.1	29.30-32.60	29.60-32.90
Turbidity (NTU)	7.25±1.11[d]	7.25±0.94[d]	8.08±1.10[c]	8.46±132[bc]	9.08±1.35[b]	10.17±1.58[a]
Range	6.00-10.00	6.00-9.00	6-10	6.00-11.00	6.00-11.00	8.00-12.00
DO(mg/l)	3.27±0.70[C]	3.26±0.55[c]	3.27±0.67[c]	10.63±4.63[a]	5.25±3.22[b]	4.06±1.99[bc]
Range	2.1-5.2	2.2-4.1	1.8-4.8	26-16.4	3.0-12.7	2.1-12.90
pH	7.20±0.19[ab]	7.34±0.22[a]	6.88±0.34[c]	7.01±0.39[bc]	7.69±0.14[ab]	7.22±0.55[a]
Range	6.9-7.46	7-7.7	6.2-7.4	6.1-7.6	6.00-7.60	6.40-7.90
Alkaline (mg/l)	60.54±2.36[a]	61.04±2.37[a]	60.63±3.56[c]	57.46±5.31[b]	59.33±6.32[ab]	61.44±5.60[a]
Range	54-66	54-64	54-68	42-68	51-72	54-72
BOD(mg/l)	1.94±0.83[C]	2.65±0.48[ab]	2.21±0.79[b]	10.45±2.84[a]	3.40±1.60[b]	3.23±0.84[b]
Range	0.40-3.30	2.0-3.9	0.40-3.20	1.90-13.8	2.0-8.40	2.0-4.80
NO_3^{2-} (mg/l)	0.94±1.73[a]	0.62±0.27[a]	0.59±0.35[a]	0.59±0.22[a]	0.50±0.21[a]	0.54±0.23[a]
Range	0.5-0.89	0.30-1.13	0.05-1.40	0.17-0.98	0.20-0.93	0.26-0.96
PO_4^{2-} (mg/l)	0.05±0.02[a]	0.06±0.02[a]	0.08±0.03[a]	0.06±0.02[b]	0.06±0.03[b]	0.05±0.02[b]
Range	0.0-0.09	0.00-0.09	0.00-0.10	0.00-0.08	0.00-0.09	0.00-0.08

Means with similar superscripts are not significantly different (P<0.05)

The maximum range of DO (2.60-16.40) with the mean 10.63±4.63 was recorded in station 4. The dry and wet season values ranged from 2.10-16.4 and 1.80-12.60.This is in line with that observed by Chindah (2003 and 2004) in Tropical Estuary, Niger Delta but differs from that of Otobo (1995) in Nun river in Niger Delta which was attributed to environmental factors.

The highest pH range (7.0-7.77) with the mean 7.34±0.22 was reported in station 2.The dry and wet season values ranged from 6.10-7.90 and 6.2-7.8.This is in line with the 5.5-5.6 observed by Erondu and Chindah (1991 and 1999) in New Calabar River. The non seasonality in pH in this study is in line with that of so many African water bodies (Akpan and Offem, 1993).

The maximum range of conductivity(14400-56000) with the mean 33939.58±1806µs/cm was obtained in station 2.The dry and wet season values ranged from 1,100-53210 and 12300-5600.The higher value of conductivity recorded in the wet season than the dry season is contrary to the finding of Ekeh and Sikoki (2003) in New Calabar river but in line with Davies et al.,(2008) in Trans-Amadi creek and King and Nkanta (1991)who reported higher conductivity in the wet season than the dry season. This was attributed to the influx of allochtonous and inorganic material from the surrounding catchment area during the flood.

The maximum range of alkalinity (54-72) with the mean 61.44±5.60mg/l was obtained in station 6. The dry and wet season values ranged from 42.0-72.0 and 51.0-71.0.The higher range of value of alkalinity recorded in the wet season than the dry season is contrary to Onoha et al.,(2010) in the Lagos Lagoon and Olusanya (1988) but in line with Davies et al.,(2009) in Minichinda Stream. The seasonality in total alkalinity in this study is in agreement with the observation by Deekae (2008) in Luubara creek, Otene (2008) in Minichinda Stream and Hall et al. (1977) in the middle and lower Zambezi estuary.

The maximum range of biological oxygen demand (BOD) (1.90-13.80) with the mean 10.45±2.84 was obtained in station 4. The dry and wet season values ranged from 0.40.-13.80and 0.40- 13.40.The higher range of value of BOD recorded in the dry season than the wet season is contrary to Chindah and Braide(2004) but in line with Davies and Otene (2009) in Minichinda Stream.

The maximum range of Nitrate (0.05-1.40) with the mean 0.59±0.35mg/lwas obtained in station 3. The dry and wet season values ranged from 0.05-0.89 and 0.30- 1.40.The higher range of value of Nitrate recorded in the wet season than the dry season in this study is in line with Davies (2008), Nwankwo (1996) and Ebere (2002) but contrary to Chindah(2004) in Niger Delta Tropical Estuary.

The highest phosphate range (0.00-0.10) with the mean 0.08±0.03 mg/l was reported in station 3.The dry and wet season values ranged from 0.05-0.10 and 0.05-0.10.This is in line with the acceptable limit of 0-0.10mg/l in flowing waters recommended by USEPA (1976) and USGS (2007).The observation is contrary to that of 0.43-3.52mg/l of Chindah and Nduaguibe (2003) in tankfarm waste water in the Lower Bonny River, Niger Delta.

4. Conclusion

This study revealed that many among the variables investigated differed significantly, season- ally and spatially. Considering the significance of the creek to the community, waste water treatment should be applied so as to minimize the influence on water quality.

References

APHA, 1998. Standard methods for the examination of water and waste water 20th (ed) Washington D.C 1213 pp

Akpan, E., Rand Offem, J.O., 1993. Seasonal variation in water quality of the Cross River,Nigeria.Revue Hydrobio.Tropical science,26(2), 95-103

Boyd, C.E., 1982.Water quality management for pond fish culture. P31- 53

Chindah A.C., 2004. Response OF Periphyton community to salinity Gradient in Tropical Estuary Niger Delta.Pollution Journal of Ecology.52(1), 83-89.

Chindah, A.C., 2003.The physicochemistry,phytoplankton and periphyton of a Swamp forest Stream in the lower Niger Delta. Scentia Aficana,

Chindah, A.C., Braide, S.A., Oranye, R.O., 2004. Response of a common Niger Delta wetland Catfish to changes in pH. Niger Delta Biologia 4(2), 56-65.

Chindah, A.C., Nduaguibe, U., 2003. Effects of tankfarm wastewater on water Quality in the Lower Bonny River, Niger Delta.Journal of Nigerian Environmental Society, 2 (2),210-214

Davies O.A., Otene, B.B., 2009. Zooplankton Community of Minichinda Stream, Port Harcourt, Rivers State, Nigeria**.** European Journal of Scientific Research Vol.26 No.4 (2009), pp.490-498

Davies, O.A., Abowei, J.f.N., Otene, B.B., 2009. Seasonal Abundance and distribution of Plankton of Minichinda stream,Niger Delta, Nigeria. eurojournals 2(2009), pp.20 –30

Ebere, N., 2002. The impactof oil refinery effluents on the distribution, abundance and community structure of macro-enthos in Okrika Creek. PhD. Thesis, Dept of Biological Sciences, RSUST, Port Harcourt.383pp

Egborge, A.B.M., 1972. A preliminary checklist of the zooplankton organisms of the River Osun in the Western State of Nigeria.Nigeria journal of science 6(1), 67-71.

Ekeh, I.B., Sioki, F.D., 2003. The state and seasonal variability ofsome physico- chemical parameters in the New Calabar River, Nigeria, Supp. and Acta Hydrobiologia 5,45-60.

Erondu, E.S., Chindah A.C., 1991. Variation in the physicochemical features and phytoplankton of the New Calabar River at Aluu, Rivers State, Nigeria. NIMOR Technical paper75, 1-18

Gobo, A.E., 1988. Relationship between Rainfall Trends and flooding in the Niger Delta-Benue River Basin.Jor of meterology of UK. 13 (132), 220- 224.

Hall, A., Valente, I.M.C.B.S., Davis, B., 1977. T he Zambezi River in Mosambique:The physicochemical status of the middle and the lower Zambezi prior to the closure of the Cabora Bassa Dam.Freshwater Biol.,7, 187-206.

Nwankwo, D.I., Gaya, E.A., 1996.The algae of an estuarine mariculture site in South western Nigeria. Tropical freshwater Biology 5, 1-11.

Onoha, P.C., Nwankwo, D.I., Vyuvern, M., 2010. Chlorophyll-a dynamics in relation to environmental parameters in a tropical lagoon. Journal of American Science 2010, 6(12)

Otobo, A.J.T., 1995. The ecology and fishery of the Pygmy Herring Sierratherissa Leonensis (thys Van Dan Audenacrde (1969) (Clupeidae) in the Nun river and Taylor Creek of the Niger Delta. Ph.D Thesis University of Port Harcourt. 221p.

United States Geological Survey (USGS), 2007. Relationship between selected water quality Variable and climatic factors. http://www.publ.water .usgs.gov./sir20075117.

USEPA, 1976. National pollution discharge Elimination system. Concentrated animal feeding Operations fed. Regis 40(225) 54183.US Government Printing Office Washington D.C.