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Spatial and temporal variations of zooplankton in Taylor Creek, Biseni, Niger Delta, Nigeria

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A B S T R A C T

The spatial and temporal variations of zooplanktons in Taylor creek, Biseni, Bayelsa State was investigated in order to determine the effect of human activities on the creek catchment in space and time. Zooplanktons were collected and examined monthly for one year, in six sampling stations. The sampling period included both wet and dry seasons. Species composition, numerical abundance and diversity indices were determined for zooplanktons in study stations. Data were analyzed using the Microsoft Excel Descriptive Statistics Tool and compares made between study stations and between seasons. Result from the study reveal that zooplanktons were more abundant in the wet season than in the dry season. There were no significant differences ($t<t(c)$) in abundance and richness of zooplanktons between stations in the dry season. There were significant differences ($t>t(c)$) between stations in zooplankton abundance and richness in the wet season. There were however no established trend of variability. Rotifera were the dominant taxa in the dry seasons. This is indicative of organic pollution. However, the presence of Copepoda taxa in moderate numbers signals a modest ecosystem but tilting towards decline. Therefore, until and unless remedial and corrective attitudinal measures are taken, it will be difficult to maintain indeed restore the water quality of Taylor creek to near perfect limits.

Introduction

Zooplanktons are microscopic animals that reside in aquatic ecosystems. They together with phytoplankton are a vital link in the aquatic food chain. They serve a useful bridge between the microscopic planktonic primary producers and the macroscopic higher carnivores(consumers) at different trophic levels. As such, they are also early indicators of trophic shift and imbalances in aquatic systems. Their study is thus very

germane in the determination of creek integrity in threatened aquatic ecosystems. Taylor creek is one of such water body. There is a dearth of a substantial data base of zooplankton for most water bodies including Taylor creek. This study therefore attempts to examine the spatial and temporal variations of zooplankton in Taylor creek in order to gauge the effect of human activities on the creek and perhaps provide data for further studies, information and impetus for action.

Materials and Methods

Description of study area

Taylor creek is a lotic, non-tidal fresh water environmental unit. It is situated in the Biseni clan, although the creek stretches into Gbaran clan in Yenagoa local government area of Bayelsa State in the Niger Delta. The location of the sampling site is at Kalama, Tien and Iturama all in Biseni clan.

The Longitudes, Latitudes, Elevations (m) and Description/ Notable features are presented in the following table.

Collection of Samples

Zooplankton samples were collected using plankton nets of 55u mesh size. The net was held slightly dipped into water against the water current or flow. The filtrate was collected and put into tiny vials containing water. This procedure was repeated for each sampling station. Each sample was fixed on the spot with 2 drops of 4% formalin reagent (Plates 1–6).

Zooplankton analysis

Analyses for plankton samples were done at the Institute of Pollution Studies (IPS) Rivers State University of Science and Technology, Port Harcourt. Formalin fixated samples were analysed for species abundance and Taxa-richness of zoo-plankton.

The samples were allowed to stand for 46 hours before 50ml of pipetted concentrated sample volumes were obtained. A sub sample of 1ml was then taken and transferred into a sedge-wick rafter counting chamber (slides).

Identification and enumeration was done using a leitzwetzlar binocular dissecting microscope at a magnification of 20-400 for zooplanktons for each sample station using standard keys.

Data analysis

Means were calculated for plankton parameters. Three indices were used to estimate species diversity.Shannon-weiner diversity index given by the formula:

$$\sum_{I=1}^{S} (ni/n) \ln (ni/n)$$

Evenness by the formula:

$$E = H'' / \ln s$$

Species richness by Margalefs (1951) formula: $d = (s-1)/\ln n$

Where:

H”= Species diversity, S= Number of families, n= Total number of animals
ni=Number of each family.

T-test statistics was employed to determine the relationship and sources of variability between stations in the determined parameters of zooplankton.

Results and Discussion

The result for the investigation of zooplankton in Taylor creek is represented in tables 2–4 and figures 2 and 3.

The study recorded a high diversity of plankton communities. Some species of zooplankton occurred across seasons while others were absent or very few across seasonal boundaries.

In general, species diversities were higher in the wet season than in the dry season. Onyema *et al.* (2010) recorded higher bio-indices zooplankton between November and February, 2010 which is in contrast to the findings of this work. However, this seasonal trend of higher and lower densities of zooplankton during the wet and dry seasons respectively, agrees with the result of other investigators in tropical West Africa (Chindah and Braide, 2003). This trend may be as a result of the fact that zooplankton populations are indeed subject to extensive seasonal fluctuations reflecting hydrologic processes, recruitment, food source, temperature and predation. Another reason for the seasonal disparity in zooplankton taxa can also be attributable to the presence of meroplanktons. These type of zooplankton are only planktonic in the larval stage and metamorphosise to other faunal forms, unlike holoplankton which stay planktonic their entire life.

Also, there was a preponderance of the taxa Rotifera as observed in the dry season. This type of dominance of Rotifera is an indication of organic pollution (Kumari *et al.,* 2007). A similar preponderance of Rotifera was observed in the Lakes of Nagpur city which was exposed to large amounts of organic pollutants (Kumari *et al.,* 2007).

T-test statistics revealed that there was no significant difference between stations in all the measured biological parameters in dry season [t<t(c)].

This may be due to high mobility and turnover rate of zooplankton in the water column which makes it difficult to evaluate cause- effect relationship across sampling stations.

In the wet season, T-test statistics revealed that there was a significant difference [t>t(c)] between station1 and station 2. There were also significant differences [t >t(c)] between station1 and station 5, station 1 and station 6, between station 4 and station 5 and lastly between stations 4 and 6. There were no significant differences [t<t(c)] between other stations. There was however no established trend. The reason for the differences observed between stations in the wet season may be as a result of the emergence of taxa's that were absent in the dry season and the increase in number of species that were present in the dry season.

Copepods were more abundant in the dry season than in the wet season.

One reason for the abundance of the copepods in dry season as compared to the wet season is their ability for broad physiological tolerance ranges. The copepods genus Acartia for instance is able to tolerate hypersaline waters and temperature ranges of 0^0–40^0C.

In conclusion, higher species diversity were observed upstream than downstream of the creek. This may be due to the fact that upstream stations are far removed and shielded from land based stressors. This has confirmed the assertion that land based activities greatly affect aquatic integrity.

Table.1 Location of sample stations in Taylor Creek

Station	Longitude	Latitude	Elevation (m)	Description/ Notable features
1 (Iturama)	$05^0$14’29.0’’N	$006^0$32’06’’E	10.5	Adjacent make-shift market.
2 (Iturama)	$05^0$14’32.4’’N	$006^0$32’09’’E	0.8	Floating aquatic weeds
3 (Tien)	$05^0$14’36.7’’N	$006^0$32’11.0’’E	4.0	Laundry activities
4 (Tien)	$05^0$14’39.8’’N	$006^0$32’15.6’’E	14.9	Laundry activities
5 (Kalama)	$05^0$14’3.4’’N	$006^0$32’14.8’’E	15.0	Laundry activities
6 (Kalama)	$05^0$14’40.4’’N	$006^0$32’24.2’’E	9.9	Uninhabited area.

Table.2 Relative composition of zooplankton in dry season in all stations

Taxa	*St1	St2	St3	St4	St5	St6
Copepoda	10	27	16	7	6	20
Rotifera	40	45	45	33	56	47
Protozoa	140	40	33	49	38	39
Colenterata	4	5	8	4	9	4
Porifera	29	1	15	3	4	5
Molusca	0	8	0	2	0	5
Total no. of individuals.	223	126	117	98	113	120
Margalef’s index (d)	2.68	3.10	2.73	2.83	2.75	3.13
Menhinick index (d)	6.76	7.28	6.42	6.54	6.44	7.31
Shannon – diversity index (H’)	2.43	2.50	2.38	2.36	2.33	2.49
Shannon-wiener index (H)	1.055	1.0850	1.0349	1.0285	1.0128	1.0833
Evenness index (E)	0.8768	0.9011	0.903	0.897	0.88371	0.8997
Simpson’s dominance index (C)	0.1109	0.09914	0.10994	0.11245	0.11817	0.10194

St – Station.

Table.3 Relative composition and diversity indices of zooplankton in wet season

Taxa	St1	St2	St3	St4	St5	St6
Copepoda	15	24	3	7	13	4
Rotifera	94	70	32	29	66	77
Cladocera	49	20	4	22	23	54
Rhizopoda	39	2	3	0	5	4
Hydrarachina	1	2	3	29	5	8
Molusca	0	0	1	0	0	0
Insecta	35	8	10	22	9	16
Ostracoda	19	14	6	39	58	10
Margalef's index (d)	5.26	5.86	6.29	5.195	4.49	5.24
Menhinick's index (d)	12.78	13.48	13.29	12.07	10.39	12.33
Shannon-diversity index (H')	1.395	1.243	1.2674	1.29984	1.0838	1.1450
Shannon-wiener diversity index (H)	3.212	2.8621	2.9184	2.9930	2.4955	2.636
Evenness index (E)	0.9449	0.8415	0.8854	0.90811	0.79590	0.7912

*St - Station

Table.4 Checklist of zooplankton in Taylor Creek

Taxa	1	2	3	4	5	6
COPEPODA						
Megadiaptomusspp	+	+	+	+	+	+
Dinptomusnauplus	+	+	+	+	+	+
Paradiaptomusspp	+	+	+	-	+	+
Cyclops nauplus	+	+	+	+	+	+
ROTIFERA	+	+	+	+	+	+
Branchionusspp	+	+	+	+	+	+
B. falcatus	+	+	+	+	-	+
Monostylaspp	+	+	+	+	+	-
Cephalodelaspp	+	+	+	-	+	+
Monospilusdisper	+	+	+	+	-	+
Rotariaspp	+	+	+	+	+	+
Asplanchinaspp	+	+	+	+	+	+
Rhilodinaspp	+	+	+	-	+	+
Macrothrixlaticornis	+	+	+	-	+	+
Euchlanistriquestra	+	+	+	+	+	+
E. dilatata	+	+	+	+	+	+

Colurellaancinata	+	+	+	+	+	+
Epiphanes senta	+	+	+	-	+	+
PROTOZOA						
Tintinopsisspp	+	+	+	+	+	+
T. conicus	+	+	+	+	-	+
T. senensis	+	+	+	+	+	+
Sphenoderiaspp	+	+	+	+	+	+
Trinerialinearer	+	+	+	+	+	+
Amoeba spp	+	+	+	+	+	+
CLADOCERA						
Daphiniaspp	+	+	+	+	+	+
Daphiniapulex	+	+	+	+	+	+
Polyphemus spp	+	+	-	+	+	+
P. pendiculus	+	+	-	+	-	+
Chydorusovalis	+	+	-	+	+	+
Limnoculanusmacrurus	+	-	+	+	-	+
Simocephalusspp	+	+	-	+	+	+
COELENTERATA						
Cordylophoralacustris	+	+	+	+	+	+
INSECTA:						
Aquatic ant	+	+	+	+	+	+
Insect lavae	+	-	-	+	-	+
Dividaelavae	+	+	+	-	+	+
Tipusidelavae	+	+	+	+	+	+
Dipterianlavae	+	+	+	-	+	+
Heptageniaspp	+	+	+	+	-	-
Chironomusspp	+	+	+	+	-	-
MOLUSCA						
Planobisspp	-	+	+	+	-	+
PORIFERA						
Spongillalacustris	+	+	+	+	+	+
RHIZOPODA						
Amoeba spp	+	+	+	-	+	+
A. limicola	+	+	+	+	+	+
HYDRARACHNA						
Hydrovolziaspp	-	+	+	+	+	+
Pilariaspp	-	-	+	+	-	+
Thermacarusminuta	+	+	-	+	-	-
OSTRACODA						
Cypresspp	+	+	+	+	+	+
Cyclocypresspp	+	+	+	+	+	+
Paracyclopsspp	+	+	+	+	+	-
Simoceph	+	+	+	+	-	+

+ = present - = absent

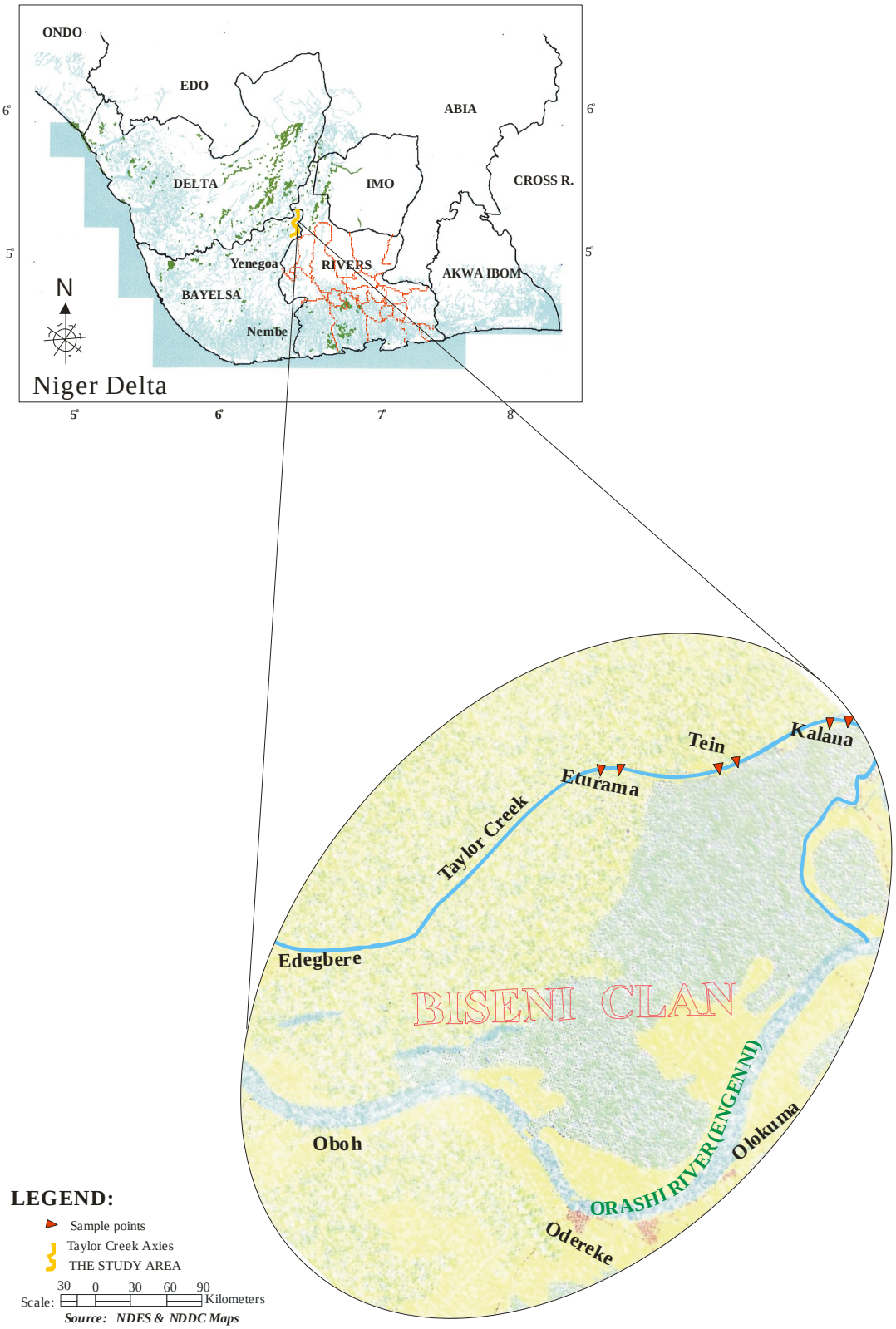


Fig. 1.1: Map of Niger Delta showing Taylor Creek in Biseni Clan the Study Area

Plate.1 Station 1 downstream of Taylor creek, IturamaBiseni

Figure.2 Relative composition of zooplankton in dry season

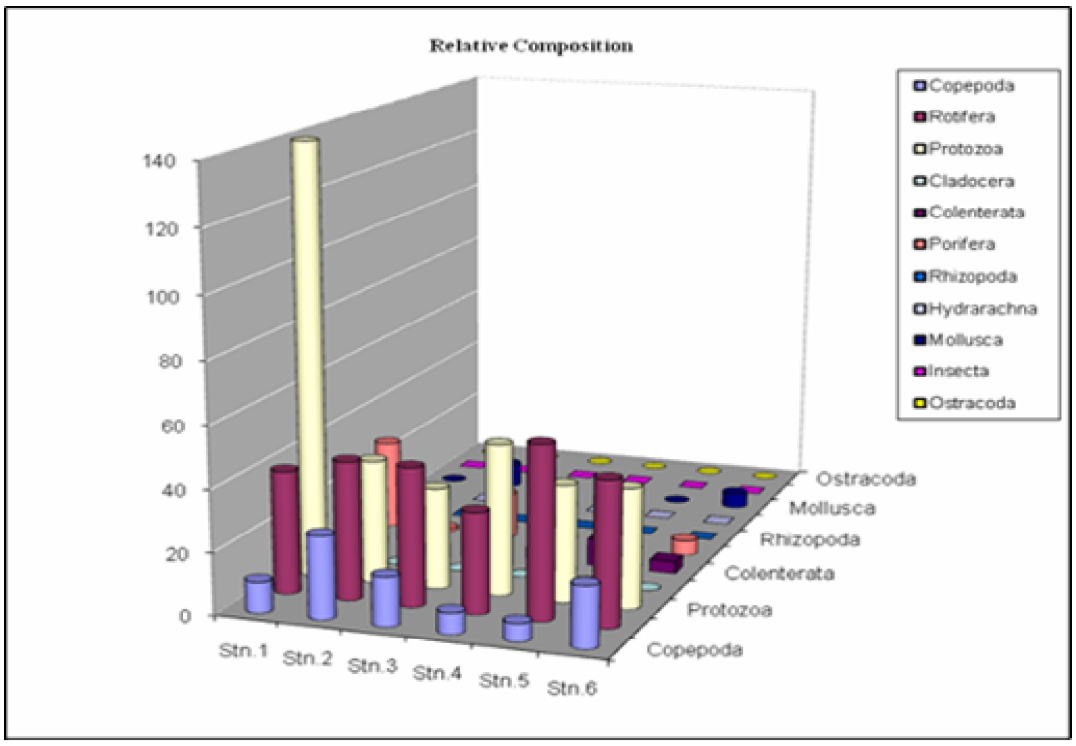
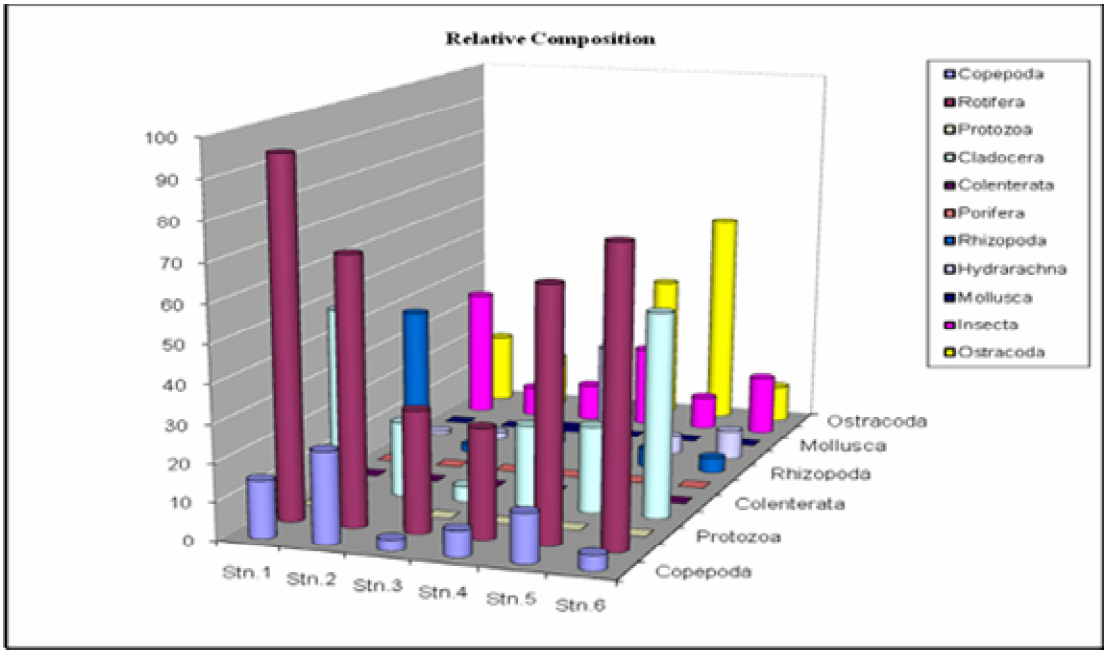


Figure.3 Relative composition of zooplankton in wet season



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