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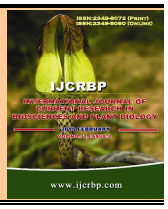

Original Research Article

Variations of Benthic Macro-Invertebrates in Taylor Creek, Biseni, Bayelsa State, Nigeria

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Abstract

The variations of benthic macro-invertebrates of Taylor Creek, Biseni, Bayelsa State was investigated in order to determine the effect of land use on the creek catchments on the aquatic ecosystem. Benthic macro-invertebrate 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 benthic macro-invertebrates in study stations. Data were analyzed using the Microsoft Excel Descriptive Statistics Tool and comparison was made between study stations and between seasons. Result from the study reveal that macro-invertebrates 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 benthic macro-invertebrates between stations in the dry season. There were significant differences ($t>t(c)$) between stations in benthic macro-invertebrates abundance and richness in the wet season. Benthic macro-invertebrates displayed poverty of species, which is characteristic of fresh waters in the Niger Delta. Based on the result of this study, it can be concluded that land based activities did not significantly affect the aquatic system and does not pose an immediate threat to the ecosystem and fisheries of Taylor creek.

Keywords

Benthic
Macro-invertebrates
Spatial
Taylor Creek
Temporal

Introduction

Macro-invertebrates are a very important part of any aquatic ecosystem. In the food chain, they represent the link between microscopic producers and the macroscopic consumers. In addition, they are sedentary and give us a picture of long-term ecosystem integrity and thus a more realistic environmental indicator than plankton which are drifter organisms with very short life cycle. Despite

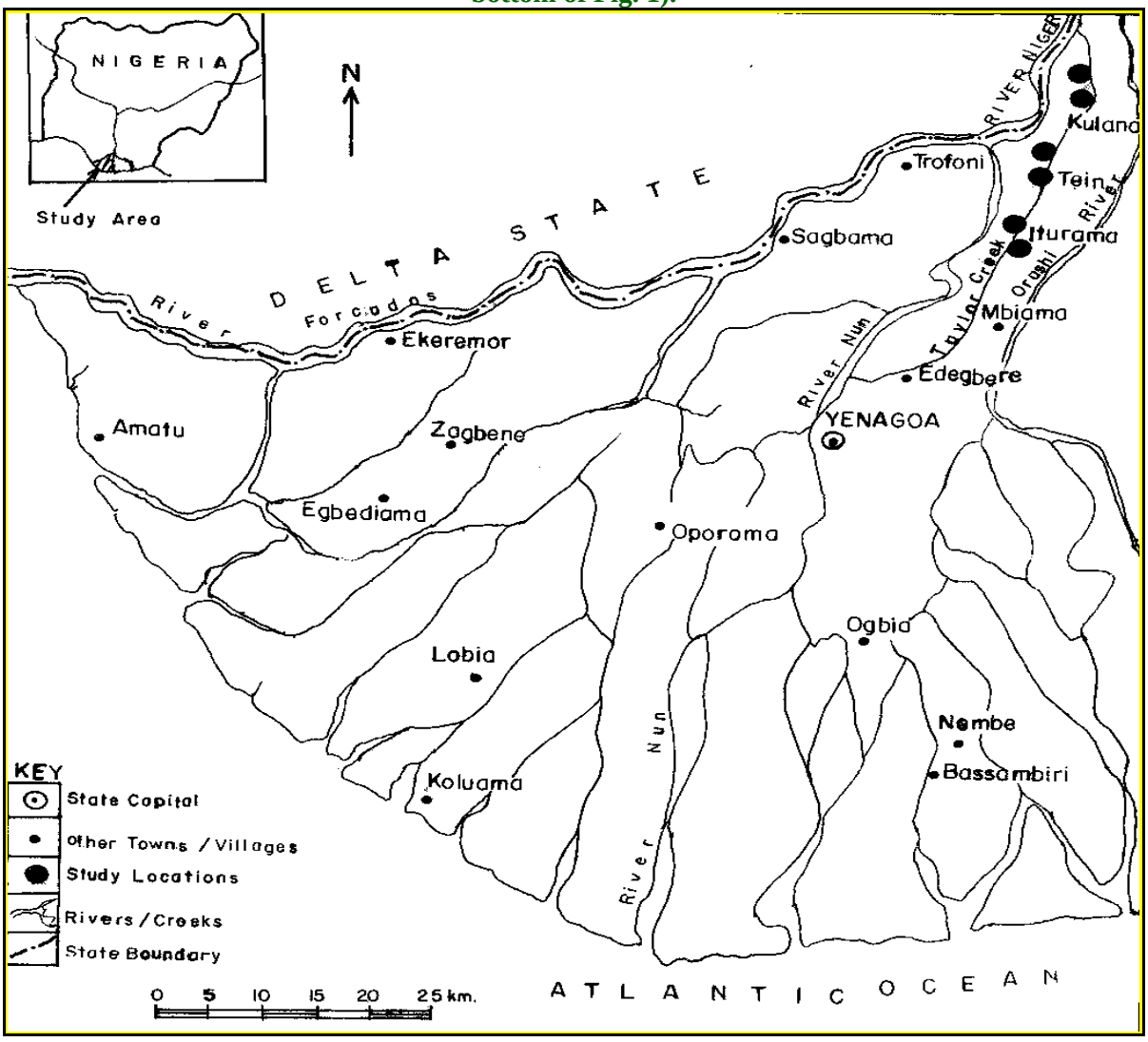
their importance, studies on macro-invertebrates of the Niger Delta of Nigeria are few (Okpuraka, 1985; Onwuteaka, 1992; Nweke, 2002; Ansa, 2005): Only few published works are available on the macro-invertebrate fauna of Taylor creek. Worse still, there are no available published literatures on the Biseni clan catchments of the Taylor creek, despite its importance to the supply regime of the Orashi and River Niger. This research attempts to study the variations of benthic macro-invertebrates in the creek in order to determine the ecological health status of the creek and the effects of land use on the creek catchments on the creek.

Materials and methods

Descriptions of sample stations

Six sampling stations were established to reflect the different forms of land uses in the creek catchments. There coordinates, altitude and unique features are captured in Table 1 and Fig. 1.

Fig. 1: Drainage Map of Niger Delta showing study Area (Stations 1–6 appear sequentially from top to bottom of Fig. 1).



Collection of samples

Benthos samples were collected by using a grab, before being sieved in a 0.5mm mesh size sieve. The benthic materials were washed in water and the left over materials put into bottle containers. Fixing of the samples was done using 10% formalin solution to which Rose Bengal (Dye) was added to selectively stain all the living organisms in the sample.

Table 1. Location of sample stations in Taylor Creek.

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

Analysis of samples

In the laboratory, the washed and preserved sediment with the macro-invertebrates were poured into a white enamel tray and sorted out. Sorting was done with the aid of forceps to pick and separate macro-benthic invertebrates into different types. Smaller benthoses were pipetted out into vials for further examination.

Macro-invertebrates were identified to the lowest taxonomic level using light and stereo dissecting microscope and counted. Identification was done using standard keys (Pennak, 1978; Hawking, 2000).

Data analysis

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

Diversity of the aquatic fauna was determined using the Shannon – Wiener index, equitability (E) of species (Ajao, 1990) and Margalef's diversity as follows:

Shannon-Wiener diversity index given by the formula:

$$Hs = \sum Pi \ In \ Pi \ (Shannon – Wiener, 1963)$$

Where,
Hs = Shannon – Wiener diversity index.
I = Count denoting the ith species ranging from 1–n.
Pi = Proportion that the ith species represents in terms of number of Individuals with respect to the total number of individuals.

Equitability or Evenness by the formula:

$$E=Hs/Log_2S$$

Where,
E = Equitability index.
Hs = Shannon and Wiener index.
S = Number of species in a population.

Species richness by Margalefs (1967) formula:

$$d= (S-1)/ Log_2N$$

Where,
d = species richness index.
S = number of species in a population.
N = total number of individuals in S species.

Results and discussion

The results for the study are presented in Tables 2 to 8. The results from the study are presented in Tables 1 – 8. Table 1 shows the coordinates, elevation and physical features of each study station.

Table 2 presents the numerical counts of each of the available class of macro-invertebrates in the dry season. Table 3 gives the diversity indices of the chironomid species present in each station relative to the total population in dry season. Table 4 shows the numerical count of each macro-invertebrate class in the study station in wet season. Table 5 also shows the diversity ratios of each macro-invertebrate class in each station relative to the population in wet season. Table 6 shows the percentage occurrence of each macro-invertebrate species in the population in the dry season. Table 7 also shows the percentage occurrence of each macro-invertebrate class in the population in wet season. Table 8 displays a check-list of all indicator species organisms and class during both wet and dry season as observed in the study. Species diversity was lower in the dry season than in the wet season as more species were sampled in the wet season (Tables 2 and 4). This may be due to the fact that seasonal changes have an effect on physicochemical parameters of water bodies and thus on growth and productivity of aquatic biota.

Reynolds (1984) stated that when conditions are not ideal for any competing specie that the competitive advantage swings from it to another. In addition, individual species may respond in different ways to combination of environmental factors (George et al, 2010). It is therefore believed that the habitat suffers from frequent variability brought about by seasonal changes. There was also a lack of defined numerical variation in benthic-macro-invertebrates sampled in all the sampling stations. This may be due to the fact that Taylor creek is lotic water body and thus suffers from frequent and rapid variability in water and biotic parameters.

Macro-benthic abundance and composition at all the study stations were low. This is attributable to some ecological imbalance arising from alterations of some important factors governing the abundance and distribution of the benthic communities. Such factors include water quality, immediate substrates for occupation and food availability (Dance and Hynes, 1990). The bottom substrate of Taylor creek varied predominantly from sand to sandy-silt. This may be in part associated with its evolutionary and ecological history. Ecosystems generally increase in species diversity as they grow older in evolutionary time. This kind of low diversity of benthic macro fauna as observed in this study is usual in the Niger Delta. Previous scholars have also recorded low diversity of benthic fauna in the Niger Delta (Hart, 1994; Umeozor, 1995; Ansa, 2005; Hart and Zabbey, 2005; Sikoki and Zabbey, 2006).

Table 2. Relative abundance of benthos in dry season.

Taxa	STATIONS					
	Iturama		Tien		Kalama	
	ST1	ST2	ST3	ST4	ST5	ST6
Chironomidae	15	81	79	38	11	60
ST – Station						

Table 3. Diversity indices of benthos in dry season.

Indices	STATIONS					
	Iturama		Tien		Kalama	
	ST1	ST2	ST3	ST4	ST5	ST6
Margalef's index (d)	0.3692	0.2275	0.2288	0.2749	0.4170	0.2442
Shannon-Wiener index (H)	0.3000	0.2764	0.21889	0.3004	0.2992	0.2588
Evenness index (H)	0.9967	0.9182	0.72696	0.998	0.9940	0.8599
Simpson's dominance index (C)	0.50222	0.5555	0.67697	0.501385	0.50413	0.59388
ST – Station.						

Table 4. Relative abundance of benthos in wet season.

Taxa	STATIONS					
	Iturama		Tien		Kalama	
	ST1	ST2	ST3	ST4	ST5	ST6
Porifera	13	12	14	10	6	6
Oligochaeta	32	12	89	3	17	29
Polychaeta	16	15	38	19	13	17
ST – Station.						

Table 5. Diversity indices of benthos in wet season.

Indices	STATIONS					
	Iturama		Tien		Kalama	
	ST1	ST2	ST3	ST4	ST5	ST6
Margalef's index (d)	2.189	2.423	1.8186	1.7321	2.2324	2.2777
Shannon-Wiener index (H)	0.8528	0.9535	0.8484	0.8279	0.9088	0.8838
Evenness index (E)	0.8528	0.9535	0.8484	0.9796	0.9524	0.8838
Simpson's dominance index (C)	0.18624	0.11957	0.17388	0.1542	0.13734	0.15236
ST – Station.						

Table 6. Species abundance/richness of Benthos in dry season.

Taxa	STATIONS						Total Indiv.	No. of Spp.	% Abund.	% Richness
	ST1	ST2	ST3	ST4	ST5	ST6				
Chironomidae	15	81	79	38	11	60	284	2	100	100
Total	15	81	79	38	11	60	284	2	100	100
ST – Station										

Table 7. Species abundance/richness of Benthos in wet season.

Taxa	STATION						Total Indiv.	No. of Spp.	% Abund.	% Richness
	ST1	ST2	ST3	ST4	ST5	ST6				
Porifera	13	12	14	10	6	6	61	2	16.89	20.0
Oligochaeta	32	12	89	3	17	29	182	4	50.41	40.0
Polychaeta	16	15	38	19	13	17	118	4	32.68	40.0
Total	61	39	141	32	36	52	361	10	100	100
ST – Station										

Table 8. Check list of benthic macro-invertebrates in Taylor Creek.

Taxa	1	2	3	4	5	6
PORIFERA						
Songilla spp	+	+	+	+	+	+
Songilla lacustris	+	+	+	+	+	+
OLIGOCHAETA						
Stylaria lacustris	+	+	+	-	+	+
Dero vagus	+	+	+	+	+	+
Unidentified oligochaeta	+	+	+	+	+	+
Troglochaetus spp.	+	+	+	+	+	+
POLYCHAETA						
Glycera spp	+	+	+	+	+	+
Loandalie spp	+	+	+	+	+	+
Nitoseta spp	+	+	+	+	+	+
Unidentified polychaete	+	+	+	+	+	+
INSECTER: CHIRONOMIDAE						
Chironomous tranualensis	+	+	+	+	+	+
Chironomous abblebiesimia	+	+	+	+	+	+
+Present; -Absent						

The chironomidae were the only taxa in the dry season and were absent in the wet season. This confirms the dominant position of the chironomids among the dipterians, a common phenomenon both in temperate and tropical waters (Ogbeibu, 2001). The wet season showed only three taxa (Polchaeta, Oligochaeta, Porifera). The presence also of polychaetes in the benthic collection may be due to their ability to inhabit sandy and loamy substrates with or without vegetation (Ansa, 2005). Also polychaetes occurring in large numbers in this study area can be attributed to their high level of pollution tolerance as reported by Ajao and Fagade (1990). This is also in agreement with the findings of Chukwu and Nwankwo (2003) that land based activities affect abundance and composition of benthos. The finding of this work has provided us with a better ecological understanding of aquatic resource management of Taylor Creek.

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