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Effect of Desilting / Dredging on Bentic Macroinvertebrate Fauna Within the Niger Delta University Tributary of River Nun, Amassoma, Bayelsa State

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ABSTRACT

A survey of benthic macroinvertebrates composition and abundance was studied during the month of March 2019 in River Nun tributary at The Niger Delta University, Amassoma following desilting and dredging activities. This was done in order to determine how desiltation and dredging affects spatial macroinvertebrate dynamics. Three (3) sampling stations were selected and studied reflecting upstream, midstream and downstream areas. Result from the study reveal the presence of three (3) taxa represented by fourteen (14) species: Station 2 showed the highest diversity and the lowest in station 3.The numerical dominance of Mollusca with 52 individuals (40.94%), was followed by Annelida with 46 individuals (36.22%) and lastly Arthropoda with 29 individuals (22.83%) in all stations of the creek. Although there is a poverty of species in the river, the dominance of Mollusca indicates that the creek is in relative stability as mollusk are ecosystem engineers helping to structure aquatic bottom environment, habitat and food for other taxa. Shannon-weiner diversity index showed that stations 2>1>3.It may be concluded that action of desilting and dredging of the creek although needful and usefulas a safety net against seasonal flooding possess an urgent ecological threat to the ecosystem and its fishery.

Keywords: *Desiltation, Dredging, River Nun, Macro-invertebrates, Niger Delta University,Amassoma,*

INTRODUCTION

Desiltation and dredging of rivers and reservoirs is the act of removing earthy materials such as sand and mud from the bed of the river. It is done primarily to improve the hydraulic performance of the river (flow-rate) and to increase the carrying capacity of the river in areas that are prone to seasonal flooding and excessive rains. In recent times, the issue of global flooding as a result of climate change and melting of polar ice is receiving critical reviews. In Nigeria for instance, river nun overflowing its banks has resulted to the submerging of residential homes and other buildingsin Amassoma and the adjoining University community. It is apparent that proactive measures be taken at least to mitigate rising water levels and its damage to terrestrial lands. Gladly, desiltation and dredging is one classical option for dealing with the flooding problem. Therefore the university authorities of the Niger Delta University (NDU) engaged in a proactive measure to desilt the river to mitigate the effect of the rising sea levels and massive rains.

Sadly, the deleterious effect of desiltation and dredging on the ecology of a river and aquatic ecosystems remains a big question mark. Therefore, the biological assessment of desilted and dredged waters is fundamental. Although any biological community within a stream may be used to assess water quality and ecological health, the most commonly used group is the macro invertebrates.

Macroinvertebrates exhibit varying responses to changes in water chemistry, water quality and physical habitat. Each benthic macroinvertebrate response to environmental perturbations and produces measurable, and often predictable, shifts in abundance and composition at the community level (Boothroyd& Stark 2000).

Therefore, there is an urgent need to survey the macroinvertebrate composition and abundance in the River-nun following desiltation and dredging by the NDU management. This will provide useful information to gauge the effect of disiltation on the ecology of the river and for the protection of its fishery.

MATERIALS AND METHOD

Description of Study Area

The study area is River Nun, along the Niger Delta University (NDU), Amassoma axis which received its source of water from the River Niger. The area of study lies between longitude 6o 6' 56.35" E to 6o 6' 49.05". E latitude 4o 58' 11.4" N to 4o 58' 11.15" N in Amassoma community in Southern-Ijaw Local Government Area of Bayelsa State, Nigeria. The river serves as a major source of water supply to the inhabitants for fishing, artisanal dredging, dump Stations etc.

Sampling Sites

Three (3) sampling sites were selected for the purpose of the study. These stations are as follows;

Table1. *Location of sample stations in River-nun at NDU, Amassoma*

Stations	Longitude	Latitude	Location/Notable features
1	04^{o} 58' 11.4" N	06^{o} 6' 56.35" E	Upstream :Opposite The Living Faith Church (Winners Chapel)
2	04^{0}57'32.4''N	06^{0}6'53.42''E	Midstream: Diamond Bank axis in the main campus, NDU.
3	04^{o} 58' 11.15" N	06^{0}6'49.05"E	Downstream: Beans-up area of the main campus, NDU.

Sample Collection

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.

Macroinvertebrate Analysis

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 (Pennark, 1978; Hawking, 2000).

Data Analysis

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-weiner diversity index given by the formula:

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

Where Hs = Shannon – Weiner 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:

$E=Hs/Log2S$

Where: E = Equitability index. Hs = Shannon and Weiner index.

S = Number of species in a population.

Species richness by Margalefs (1967) formula:

$d= (S-1)/ Log2N$

Where: d = species richness index. S = number of species in a population.

N = total number of individuals in S species.

RESULT AND DISCUSSION

Result

The result for the investigation of macroinvertebrates in River-nun is represented in tables2 – 6 and Figures 1 – 5. The study recorded 14 species from three (3) Taxa (Arthropoda, Annelida and Mollusca). Arthropoda has the highest species richness of six (6) species (42.85%), followed by Annelida and Mollusca with four (4) species each (28.57% each) (Table 1).

Table2. *Benthic macroinvertebrates in River nun*

S/N	TAXA	STATIONS		
		1	2	3
	Arthropoda			
1	Cylindroiuluslondinensis	1	3	-

2	Oxidussp	2	2	4
3	Nepacinerea	-	3	-
4	Potamonautessidneyi	1	2	-
5	Ephemerellasp	2	1	4
6	Scolopendrasp	1	3	-
	Annelida			
7	Pheretimasp	5	8	10
8	Erpobdellaoctoculata	1	3	-
9	Tubifexsp	4	5	10
10	Perionyx excavates	-	-	6
	Mollusca			
11	Pila leopolvillensis	3	5	2
12	Planorbidsp	5	7	10
13	Bulinussp	1	4	1
14	Vitneacrystalline	2	5	7

Table 3 shows a checklist of the presence or absence of species in each sampling station

Table3. *Checklist of Benthic Macroinvertebrates in River nun*

S/N	TAXA	STATIONS 1	2	3
	Arthropoda			
1	Cylindroiuluslondinensis	+	+++	-
2	Oxidussp	++	++	++++
3	Nepacinerea	-	+++	-
4	Potamonautessidneyi	+	++	-
5	Ephemerellasp	++	+	++++
6	Scolopendrasp	+	+++	-
	Annelida			
7	Pheretimasp	+++++	++++++++	++++++++++
8	Erpobdellaoctoculata	+	+++	-
9	Tubifexsp	++++	+++++	++++++++++
10	Perionyx excavates	-	-	++++++
	Mollusca			
11	Pila leopolvillensis	+++	+++++	++
12	Planorbidsp	+++++	+++++++	++++++++++
13	Bulinussp	+	++++	+
14	Vitneacrystalline	++	+++++	+++++++

--- Absent + Present

The diversity Indices of the various Taxa in the different study stations are captured in Table 3 below. Shannon-weiner index rev

Table4. *Species Abundance and Diversity Indices of Benthic Macroinvertebrates*

S/N	TAXA/DIVERSITY INDICES	STATIONS 1	2	3
1	Arthropoda	7	14	8
2	Annelida	10	16	20
3	Mollusca	11	21	20
4	Shannon-Weiner Index	2.26	2.32	2.0
5	Evenness	0.678	0.59	0.50
6	Simpsons Index	0.1165	0.4523	0.1306

Table5. *Percentage Species Diversity of Benthic Macroinvertebrates in study stations*

S/N	TAXA	STATIONS 1	2	3	Total	Diversity (%)
1	Arthropoda	5	6	2	13	38.23

2	Annelida	3	3	3	9	26.47
3	Mollusca	4	4	4	12	35.29
	Total	12	13	9	34	100

Table6. *Percentage Abundance of Benthic Macroinvertebrates in study stations*

S/N	TAXA	STATIONS			Total	Abundance (%)
		1	2	3		
1	Arthropoda	7	14	8	29	22.83
2	Annelida	10	16	20	46	36.22
3	Mollusca	11	21	20	52	40.94
	Total	28	51	48	127	100

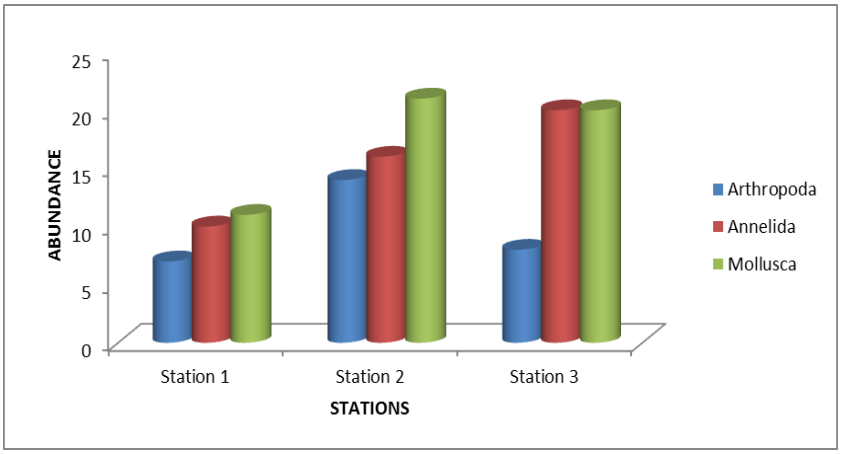

Figure1. *Macroinvertebrate abundance in River nun*

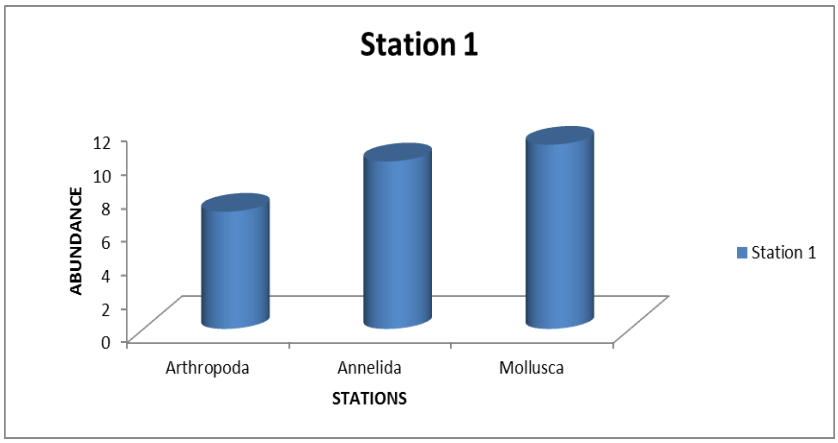

Figure2. *Macroinvertebrate abundance in Station 1 in River nun*

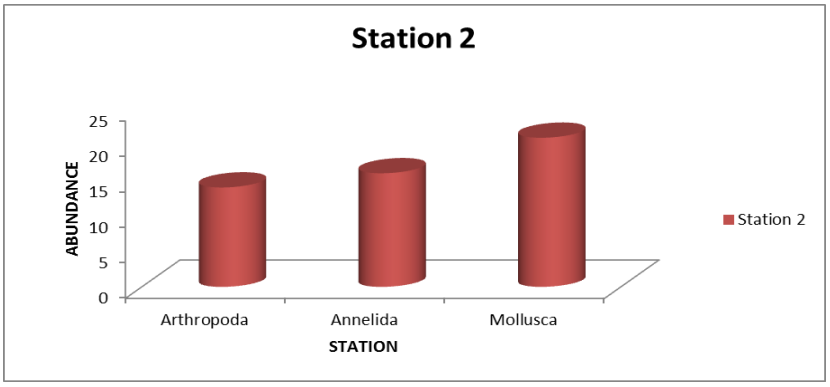

Figure3. *Macroinvertebrate abundance in Station 2 in River nun*

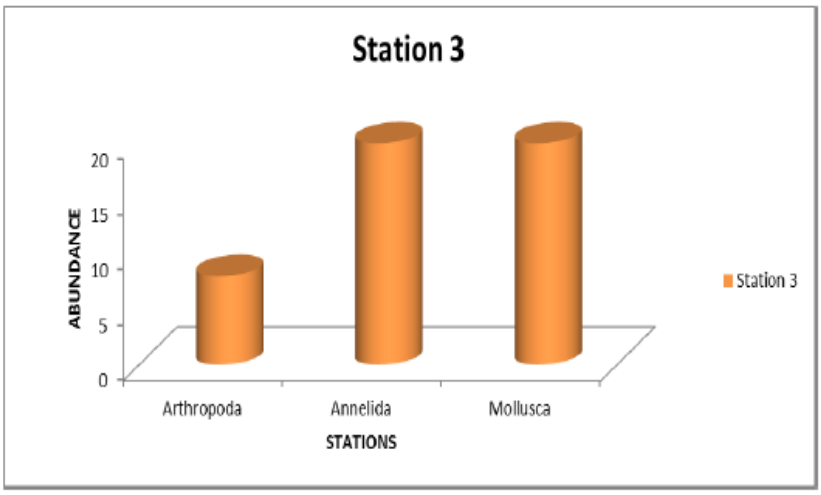

Figure4. *Macroinvertebrate abundance in Station 3 in River nun*

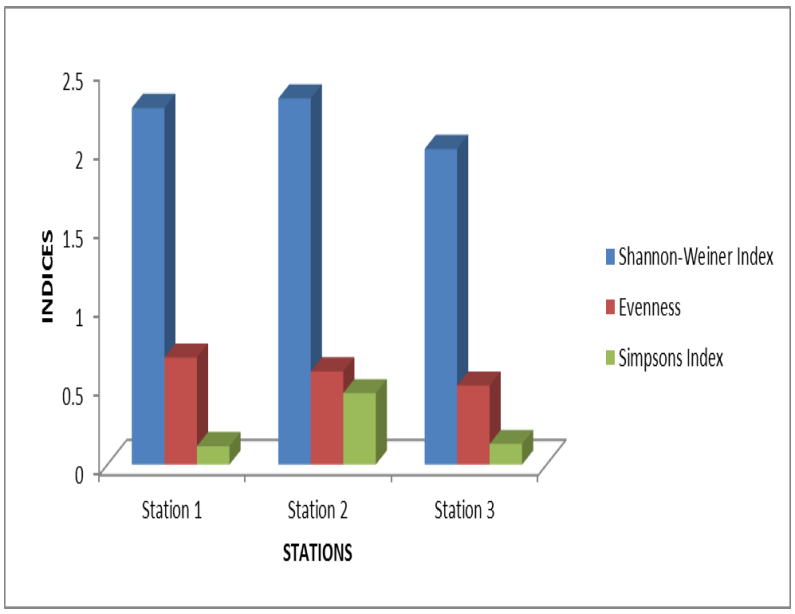

Figure5. *Diversity Indices in River nun*

DISCUSSION

Macro-benthic abundance and composition at the study stations were generally low. 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).

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, 1980). The desilting and dredging of the river altered the entire chemistry and morphology of the river.

Arthropoda dominated the entire study with the presence of 6 species out of the 14 species recorded in the study. This is because aquatic insects are usually the most dominant macroinvertebrates in fresh water bodies. Running waters are highly heterogenous ecosystems, characterized by a constant and gradual change of environmental conditions such as width, depth, water temperature and flow conditions (Allan and Castillo, 2007).Aquatic insects are restricted to lotic habitats.Adu and Oyenyi (2019) recorded a similar dominance of aquatic insects with a total of 1450 aquatic insects from 12 genera and nine families. Evenness in this study showed that station 1>2>3 (0.678>0.59>0.50), suggesting that evenness decreased as we moved from upstream to downstream. Also the lowest amount of evenness may indicate higher

pollution or interference. It means that the lowest amount of evenness shows that the abundance of macroinvertebrate group was not homogenous and some of them were dominant.

Shannon-weiner diversity index showed that 2>1>3 (2.32>2.26>2.0), suggesting that station 3 downstream had the lowest diversity. Species diversity is a measure of environmental stability.Javaid and Ashoik (2013) earlier opined that Shannon-weiner diversity values ranging from 1 to 2 indicate moderately polluted water.Therefore, the lowest Shannon's index indicates that the sampling station 3 areas are affected by stress due to faster moving water currents.A similar trend was determined for pelagic zooplankton of coastal waters of Malven, Maharashtra, india, (Costa and Pai, 2012).

Simpsons Index showed that stations 2>3>1 (0.4523>0.1306>0.1165) indicating some form of stability midstream of the river.

The numerical dominance of Mollusca with 52 individuals (40.94%), was followed by Annelida with 46 individuals (36.22%) and lastly Arthropoda with 29 individuals (22.83%) in all stations of the creek. The dominance of Mollusca indicates that the creek is in relative stability as mollusk are ecosystem engineers helping to structure aquatic bottom environment, habitat and food for other taxa.

Generally, the river displayed low diversity and abundance which indicate poverty of species which may have been induced by desiltation and dredging activities. Based on the findings of this study it can be concluded that though desiltation and dredging may provide a panacea to flooding and erosion, it portends danger for the ecosystem.

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APPENDICES

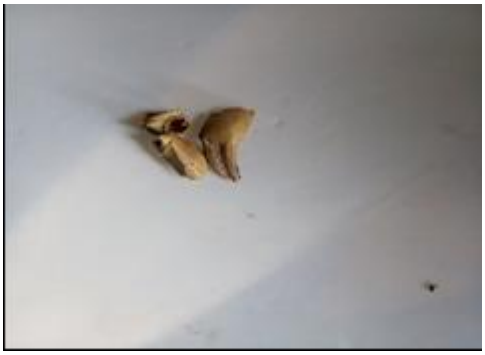

Plate1. *Potamonautessidneeyi*

Plate2. *Cylindroiuluslon*

Plate3. *Simpsons whelk*

Plate4. *Pila globose*

Plate5. *Ephemera danica*

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