IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 4 Issue 4, April 2017
ISSN (Online) 2348 – 7968 | Impact Factor (2016) – 5.264
www.ijiset.com

Physico Chemical and Benthic Macro Invertebrate Analysis of Usumani Stream in Abiriba, Ohafia L.G.A. Abia State

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ABSTRACT

The physico chemical factors in any water body determine the water quality and by extension the abundance and diversity of life forms in such aquatic habitat. Usumani stream is an important source of water for a mirage of domestic purposes like cooking, bathing, washing, irrigation and drinking. It also harbours wild life like fish which is an important source of protein. Given the relative importance of the stream and increased anthropogenic activities in the river, the analysis of its physico chemical and benthic macro invertebrate status becomes relevant. The physico chemical and benthic macro invertebrate analysis of Usumani stream in Abiriba, Abia State was studied over a period of three (3) months – June to August. The benthic macro invertebrates were collected using the kick sample method. The chloride value ranged from 74.42 to 107.41 mg/l with a mean value of 92.52 mg/l, electrical conductivity ranged from 0.23 to 0.55 mg/l with a mean value of 0.41 mg/l, the pH ranged from 7.01 to 7.46 with the mean value of 7.31. The physico chemical factors varied within the months and were within the acceptable standards of SON (Standard Organization of Nigeria). There was no significant difference in the monthly concentration of pH, Electrical conductivity and biochemical dissolved oxygen when subjected to one way analysis of variance test. However, dissolved oxygen, temperature and chloride had significant difference. The check list of macro invertebrate revealed: Odonata (19.17%), Ephemerophtera (115.02%), Plecoptera (8.13%), Coleoptera (2.06%), Hemiptera (3.46%), Arachnida (4.71%), Mollusca (47.51%). The Ephemeroptera showed more diversity in the two stations. Mollusca showed diversity in station 1, Coleoptera and Hemiptera were not present in station 2 but were seen in station 1. The results indicated that human interaction influenced the physico chemical interaction of the stream to an extent. The stream may be suitable for other domestic uses except drinking.

Keywords: Physico-Chemical, Benthic Macro invertebrates, Usumani Stream

Introduction

Water that is of good drinking quality is important for man's continued existence (FAO, 1997). Water quality is essentially determined by its physical as well as its chemical characteristics. The quality of water both for drinking and other uses deteriorates due to inadequate treatment plants, direct discharge of untreated sewage into rivers and streams, in addition to inefficient management of piped water distribution system (UNEP, 2002).This has caused many serious health implications for users. In many developing countries, increasing agricultural activities, urbanization and industrialization have also increased contamination of streams, rivers, lakes, streams and reservoirs which are usually the main sources.

Water pollution is the contamination of water bodies. This is a form of environmental degradation that occurs when pollutants are directly and indirectly discharged into water bodies without adequate treatment to remove harmful compounds (Laws, 2000). Water pollution affects the entire biosphere-plants and organisms living in these bodies of water. In almost all cases the effect is damaging not only to individual species and population but also to the natural biological communities (Laws, 2000). Water pollution is a major global problem which requires ongoing evaluation and revision of water resource policy at all levels (International down to individual aquifers and wells). It has been the leading worldwide cause of deaths and diseases (Duluzio, 2013). Water is typically referred to as polluted when it is impaired by anthropogenic contaminants and either does not support human use such as drinking or undergoes a marked shift in its ability to support its constituents biotic communities such as fish . Therefore, it is of vital importance to monitor and stimulate water quality parameter to ascertain whether the water is still suitable for various uses.

Natural phenomena such as volcanoes, algal bloom, storms and earthquakes also cause major changes in water quality and the ecological status of water (WHO, 2002). Due to population explosion, moderate to rapid urbanization and also economic and technological constraints to adequately treat the available water before use, people depend heavily on water sources of doubtful quality in the absence of better alternatives. According to Abdo, (2005), effluents are composed mainly of organic matter such as carbon, nitrogen and phosphorus which promotes growth of zooplanktons as well as macro benthic invertebrates. Organic matter also stimulates the growth of decomposers such as bacteria and fungi. Nitrogen, phosphorus and potassium are inorganic matter, these elements especially phosphorus stimulates growth of microscopic plants and nitrogen promotes overgrowth of aquatic vegetation which degrades water quality (Wetzel, 2001).

Contamination of the environment by the effluent is viewed as an international problem because of the effect on the ecosystem in most industrial activity and populace and their attitude towards waste disposal and management which usually lead to increasing level of pollution in the environment (Abdo, 2005).

The physico chemical properties of any aquatic ecosystem simply refer to the physical and chemical component of water. They are important in the determination of its productivity and have effect also on its quality, quantity and distribution (Keith, 2010). The physico chemical properties of an aquatic ecosystem capable of influencing the abundance and diversity of life forms include; biochemical oxygen demand (BOD), hydrogen ion concentration (pH),temperature, dissolved oxygen (DO), conductivity, chloride.

Macro invertebrate is a term used for invertebrate fauna that can be captured by a 500 µm net or sieve. This includes; arthropods (insects, mites, crayfish), molluscs (snail, limpet, mussels and clams), annelids (segmented worms), nematodes (roundworms) and Platyhelminthes (flatworms), (Voshell, 2002).These macro invertebrates spend most of their juvenile life or larval form under water and live multiple years in water. Macro invertebrates are used as indicators of water quality. All organisms need certain conditions to survive and multiply. Since each aquatic organisms has specific tolerance to chemical and physical condition, the presence or absence of a particular organism reveal a lot about the water body that is being studied (Lawlar, 2000). A species which is normally present in an aquatic ecosystem under specific conditions is called an indicator organism. Pathogens are also used as water quality indicator. Bacteria are an example of a pollution indicator. Pathogens are of great importance in the study of water quality. Many diseases around the world are linked to water as carrier of bacteria and parasites. All samples being inspected or tested for human consumption should be tested for pathogens. Some of these pathogens are associated with faecal material (Caduto, 1990).

Pollution often affects the level of dissolved oxygen in water. Certain organisms cannot live in areas of low dissolved oxygen, the macro invertebrates serve as a biological index for monitoring the health and pollution level of a fresh water (Merrit and Cummins, 1996).Some aquatic communities are naturally low in oxygen or go through low oxygen phases. For example, it would be unreasonable to expect a pond community to have the same habitat as a fast flowing stream because ponds absorb more of the sun's heat energy and retains it for a long period of time, so they tend to be warmer than fast flowing streams, because of this heat retention and lack of motion will decrease the oxygen present. Ponds usually have much lower oxygen than streams. This critical difference affects every aspect of pond food web (Reid and Zim, 2001). Therefore, biological indexes designed for fast flowing stream cannot be used to accurately assess the water quality of ponds.

Scientists studying water quality have developed an index for classifying streams by counting the number and categories of macro invertebrate community. If lots of organisms that are intolerant of low oxygen levels and pollution are found living in the stream, then the water is assumed to be good. If the only organisms found are those that tolerate low levels of dissolved oxygen, then the water can be considered poor quality and possibly polluted (Mereta *et al.,* 2013). Some organisms are pollution intolerant, thereby, need high level of DO, and are sensitive to chemicals and fertilizers. The water quality needed for these organisms is very high. Some are fairly tolerant, that is they can survive low DO, and medium to high nutrient levels. Many of them are scavengers or bottom feeders. Some are moderately intolerant organisms; they can survive in areas of low level of nutrients from farm runoff, occasional sedimentation, medium to low levels of DO fluctuations in the water (Lawlar *et al*., 2000). While some are pollution tolerant, that is they can survive in low DO, high nutrient level sewage and sedimentation. Most of these organisms are bottom feeders and they actually eat organic matters that may be clogging the stream. There are 3 main types of macro invertebrates depending on their general shape and characteristics; they are worms, molluscs and arthropods (Thorp and Covich, 1991).

MATERIALS AND METHOD

Study Area

The research was carried out in Usumani in Abiriba at Amogudu in Ohafia Local Government Area of Abia State, Nigeria. The survey area is located in the South-eastern part of Nigeria, with the coordinates 5° 42 ' N, 7° 44 ' E / 5.700° N 7° E. In Abiriba there are two seasons within a year which is the rainy (April - October) and dry season (November - February).

Usumani stream is a lotic (flowing) freshwater which takes its source from Uronta going round the village and empties into the Atlantic ocean via Enyim river in Calabar, Cross iver state capital in Nigeria (personal communication with Okum in the 9th of June, 2015). Usumaniis one of the biggest streams in Abiriba and it divided into two based on gender issues, the upper part is used by men while the part after the bridge that divides the stream is used by women.

Sample Stations

For convenience, two stations were mapped out according to accessibility and differences in degree of human activities within different parts of the stream. These stations were designated as Usumani station (US) one (1), and two (2).

US - 1

This station was shallow and is located at the beginning of the stream having no human interaction. It had many raffia palms by its sides and bushes also. This region has a map location of Lattitude: N 5° 42.2276 ', Longitude: E 7° 43.7752 ', (Google maps, 2015). In this part of the stream the water flow is low, there were few water lettuce floating in water, water striders and fingerlings were seen in the water. The distance to this part from the main road is about 5 km.

US - 2

The station is situated at the main road which is a bridge (landmark), where the water flows to the other side. Opposite the stream is a Catholic church and a brick making factory. Activities that are carried out here include ; washing, swimming, bathing, water extraction using tanks fitted or mounted to lorries, or heavy duty vehicles. At both sides of the stream were thick vegetation, water lettuce was in abundance, floating in the middle of the stream. The map location or coordinates of this region has a Lattitude: N 5° 42.1504 ', Longitude: E 7° 43.7378 ', (Google maps, 2015). The water flow at this station was high, water striders were abundant and snails were seenupon a closer look inside the water.

Sample Collection

Water samples were collected from the stream on 29th of every month, (from June to August, 2015) in the morning hours between 9:30 am - 12:00 pm. All samples (water and benthic macro invertebrates) were packed appropriately in a bucket and carried to laboratory where different analysis was carried out. The biochemical dissolved oxygen and other tests were done immediately.

Macro invertebrate Collection

The samples were collected using a kick sample method (Barbour *et al.*, 1999). Materials used were bucket, a round metal sieve and an aquarium net, forceps, and containers. During sample collection the dip or aquarium net and round metal sieve (mesh size 15 µm) were used to disturb the littoral zone and bottom sediments for 5 minutes, they are positioned in the direction of water flow so that water will wash anything coming out from the bottom sediment into the net, the benthic organisms were kept in the bucket and separated from debris by using a forceps to pick them one after the other. The round metal sieve was also used to disturb the vegetation in other to capture organisms hiding in them.

Macro invertebrate Identification

The benthic fauna was stored and preserved in absolute ethanol and identifications were carried out in the laboratory. This was done by using the magnifying lens and appropriate taxonomic keys and textbooks.

Physico chemical parameters

The sampling was done twice a month, beginning and end of the sampling months (June to August, 2015). The water samples were collected using reagent bottles (for DO and BOD).When collecting the samples for DO and BOD air bubbles were prevented from entering the -1 litre -collecting can by replacing the cover of the can while still inside the water.

Temperature

Readings of the air and water temperatures were taken at each station using the 0 - 50^oC Mercury-in-Glass thermometer. The thermometer was exposed to air for 3-4 minutes while it was lowered in water to a depth of 5cm) for 3 - 4 minutes before readings were taken.

Conductivity

This was measured using an already calibrated HACH Conductivity Meter (HACH CO. 150) by dipping conductivity probe into a beaker containing the sample and taking the reading from the meter directly at 25^oC.

Total Dissolved Solids

An evaporating dish was cleaned with distilled water and heated in an oven at 105^oC for 1hr. The dish was stored in a desiccator and weighed before use. 100ml (V) of well-mixed water sample was filtered through a standard glass fibre filter under slight suction. The filtrate was transferred to a pre-weighed dish and evaporated to dryness on a hot water bath. The evaporating dish was dried for 1hr in an oven at 180^{o}C, cooled in a desiccator and weighed. The increase in weight (M_t) over that of the empty dish (M_d) represents the total dissolved solids. The total dissolved solids (TDS) were calculated using this equation:

$$\text{Total Dissolved Solids (mgl}^{-1}\text{)} = \frac{M_t - M_d}{V} \times 1000$$

Where M_t is the weight of the dish and dried residue (mg), M_d is the weight of the dish (mg) and V is the water sample volume (ml).

pH

The pH of the water sample collected was measured in the laboratory using a digital pH meter/ thermometer (Hach EC 20). The pH meter electrode was first calibrated using a two –point calibration with buffer solutions of pH 7 and 4. After calibration, the pH electrode was immersed into beakers containing the water samples. The pH was allowed to stabilise for about 2 minutes before the reading was taken.

Dissolved Oxygen

A 250ml stoppered bottle was immersed beneath the water surface, the stopper was removed until the bottle was filled and then stoppered tightly under the water to exclude air bubbles. The dissolved oxygen was then fixed by adding 1ml of Winkler's Solutions A (Manganese (II) Sulphate) followed by 1ml of solution B (Potassium Iodide). After Winkler's solution A and B were added to the water, the stoppered bottle was inverted several times to mix the sample and the reagents. The Potassium Iodide in solution B reacts with Manganese in solution A to form a brown precipitate of Manganous Iodide. The precipitate was allowed to settle completely for 15minutes; the precipitate settled in the lower half of the bottle leaving clear solution above. In the laboratory, the precipitate was dissolved with 1ml of concentrated Sulphuric Acid (H_2SO_4). 100ml of the water sample was titrated against 0.0125M sodium thiosulphate solution ($Na_2S_2O_3$) to a pale yellow colour. At this point 2 drops of starch indicator was added and swirled to mix, the titration was continued until the colour changed from the blue black to colourless. The dissolved oxygen was calculated with the formula.

Dissolved Oxygen = $\frac{Volume\ of\ Sodium\ Thiosulphate\ (ml)}{Volume\ of\ Sample\ (ml)}\ x\ \frac{1000}{10}$

Where, 10 and 1000 are constants.

Biochemical Oxygen Demand (BOD_5)

Two hundred and fifty millilitre dark reagent bottles were used to collect water samples as in the case of Dissolved Oxygen. They were then wrapped in a black polythene bag. The samples were transported back to the laboratory and incubated for 5 days at a temperature of 20^{o}C. At the end of this, the oxygen content of the water samples were fixed, and subsequently determined by the same process as that of the Dissolved Oxygen. The Biochemical Oxygen Demand of the sample was calculated thus:

BOD_5 (mg1^{-1}) = $DO_0 - DO_5$

Where DO_0 = Dissolved Oxygen at the time the water sample was collected and DO_5 = Dissolved Oxygen at day 5

Chloride

This was determined by the MOHR's method as described by APHA (1998). This method employed Silver Nitrate as titrant and Potassium Chromate as the indicator. The Chloride ion present in the water sample was precipitated as white Silver Chloride. Firstly, a reddish-brown colour comparison blank was prepared by adding 1ml potassium chromate to 100ml distilled water in a clean conical flask and titrated with 0.0141M Silver Nitrate solution. It was shaken gently and left to stand. 1ml Potassium Chromate indicator was added to 100ml of water sample and titrated, with constant stirring, with 0.0141 M Silver Nitrate to the colour comparable to blank. The value of chloride ion concentration was obtained by the following equation:

$$\textbf{Cl (mgl}^{-1}\textbf{)} = \frac{35453 \text{ x } M \text{ x } (V_1 - V_2)}{V_s}$$

Where:

V_1 = volume of titrant for the sample (ml)

V_2 = volume of titrant for the blank

M = Molarity of Silver Nitrate and

V_s = volume (ml) of the sample used (100ml).

Data analysis

The physicochemical analysis was calculated using the mean and standard deviation while the analysis of variance test was used to determine the significant difference between the parameter in the two different stations. The abundance was calculated using the percentage of the result .The bio diversity of macro invertebrates in Usumani stream was calculated using Shannon index, with the formula: $H = \sum (p_1)[Lnp_1]$ Where:(p1) is the relative abundance of species,"I" is the community.

RESULTS

Macro Invertebrates

A total of 224 benthic macro invertebrates comprising of 159 Arthropods and 65 Molluscs were recorded. A detailed list of the organisms is shown in table 1.1. The abundance of these macro invertebrate species in the two stations is shown in table 1.2. Ephemeroptera showed the highest percentage abundance in station 2 with the value of 80.77% , while the value recorded for station 1 is 34.25%. For Odonata, the percentage abundance of 10.62% was recorded in station 2 and 8.91% in station 1, making it the second highest in the two stations combined for the Arthropoda phyla. The Mollusca showed the highest percentage abundance in station 1 with the value of 41.1%, while the percentage abundance of 6.41% was recorded in station 2. In station 1, Ephemeroptera and Mollusca showed more diversity (0.37), while Coleoptera showed the least diversity (0.08) (Table 1.3). In station 2, Coleoptera and Hemiptera showed no diversity because they were not present while the highest diversity was seen in Odonata (0.23). The total number of organisms found during the three month study in station 1 is 146 while 78 were found in station 2.

Table 1.1: Macro invertebrates species recorded in Usumani stream

Phylum	**Class**	**Common name**	**Order**	**Family**	**Species**
Arthropoda	Insecta	Stonefly	Plecoptera	Pelidae	*Dinacra cephalotes.*
		Dragonfly	Odonata	Libulledae	*Libullela quadrimaculata*
		Beetle	Coleoptera	Gyrinidae	*Gyrinus sp.*
		Mayfly	Ephemeroptera	Ephemerellidae	*Ephemerella ignite.*
			"	Baetidae	*Cloeon dipterum, Centroptilum pennulatum.*
			"	Agrionidae	*Agrion sp.*
		Gaint water bug	Hemiptera	Belostomatidae	*Abedus herberti.*
	Arachnida	Spider	Araneae	Euctenizidae	____
		Daddy long legs spider	"	Pholcidae	____
Mollusca	Gastropoda	Freshwater snails	____	Thiaridae	*Melanoides sp*
		"	_____	Planorbidae	*Bulinus globosus. Gyraulus sp.*
		"	_____	Lymaeidae	*Lymnae natalensis.*

Table 1.2: Macro invertebrate abundance in the two stations

ORDER	STATION 1	STATION 2
Odonata	13(8.91%)	8(10.62%)
Ephemeroptera	50(34.25%)	63 (80.77%)
Coleoptera	3(2.06%)	0 (0%)
Hemiptera	5(3.43%)	0 (0%)
Arachnida	5(3.43%)	1 (1.28%)
Mollusca	60(41.1%)	5 (6.41%)
Plecoptera	10(6.85%)	1 (1.28%)
Total	**146 (100%)**	**78 (100%)**

Table 1.3: Macro invertebrate species diversity (H) in Station 1

Species	No of Individuals	(p_1)	$[Lnp_1]$	$(p_1)[Lnp_1]$
Odonata	13	0.09	2.407	0.22
Ephemeroptera	50	0.34	1.078	0.37
Plecoptera	10	0.07	2.659	0.19
Coleoptera	3	0.02	3.912	0.08
Hemiptera	5	0.03	3.506	0.11
Arachnida	5	0.03	3.506	0.11
Mollusca	60	0.41	0.891	0.37
Total	146	0.99		1.45

Table 1.3: Macro invertebrate species diversity (H) in Station 2

Species	No of Individuals	(p_1)	$[Lnp_1]$	$(p_1)[Lnp_1]$
Odonata	8	0.10	2.30	0.23
Ephemeroptera	63	0.81	0.21	0.17
Plecoptera	01	0.01	4.60	0.046
Coleoptera	00	0	0	0
Hemiptera	00	0	0	0
Arachnida	01	0.01	4.60	0.046
Mollusca	05	0.06	2.81	0.17
Total	78		0.99	0.656

Physico Chemical Parameters

The Summary of data obtained from the physicochemical parameters is shown in Table (1.4). The mean value recorded for chloride in station 1 is 106.42 and 78.64 in station 2. The range in both stations is from 73.23 to 107.70 mg/l which is within the acceptable limit of Standard Organisation of Nigeria (SON) and it show a significant difference when when data from the two station was subjected to Analysis of Variance test (ANOVA).

pH has a mean value of 7.27 in station 1 and 7.34 in station 2 and ranges from 6.8 to 7.6.It is within the limits allowable by Standard Organisation of Nigeria as shown in the table. Analysis of Variance shows no significant difference from the table.

Electrical conductivity as shown in the table has station 1 as 0.38 while station 2 is 0.45µs.The range is from 0.22 to 0.59 which is within the acceptable standards of Standard Organisation of Nigeria. There was no significant difference in conductivity values for the two stations when subjected to Analysis of Variance test.

Temperature has a mean value of 25.93 in station 1 and 26.15 in station 2. It ranged from 25.6 to 26.2 and is within the standard set by Standard Organization of Nigeria. The Analysis of Variance test showed a significant difference.

The dissolved oxygen in station 1 was found to be 8.62 while 5.78 was recorded in station 2, with the range of 4.80 to 11.20 mg/l.

The biochemical dissolved oxygen in station 1 is 7.18 while station 2 has 6.7. The range is 3.60 to 12.30 which is within the standard acceptable by the Standard Organisation of Nigeria and has no significant value in the Analysis of variance test.

Table 1.4: Summary of data obtained from the physicochemical parameters with ranges in parenthesis.

Parameters	Station 1 (X ± S.e)	Station 2 (X ± S.e)	P- value	SON
Chloride (mg/l)	106.42 ± 1.24 (104.09-107.70)	78.64 ± 5.71 (73.23-88.3)	> 0.05	250
pH	7.27 ± 0.27 (6.98 - 7.61)	7.34±0.27 (6.80 - 7.50)	< 0.05	6.5 -8.5
Electrical conductivity (µs)	0.38 ± 0.12 (0.22-0.523)	0.45 ± 0.12 (0.33-0.590)	< 0.05	1000
Temperature (°c)	25.93 ± 0.22 (25.6 - 26.2)	26.15±0.21 (26.0 - 26.5)	> 0.05	Ambient

Dissolved oxygen (mg/l)	8.62 ± 1.87 (5.50-11.20)	5.78 ± 0.56 (4.80 - 6.40)	> 0.05	Unknown
Biochemical oxygen demand	7.18 ± 2.91 (3.60-11.20)	6.7 ± 4.14 (3.80-12.30)	< 0.05	50

DISCUSSION

Physico Chemical Parameter

The highest value for Chloride was recorded in station 1 (107.41 ± 0.41), in the month of August, while the lowest was recorded in station 2 (76.41 ± 2.52), in July. The mean Chloride value for the two stations was 92.52 ± 15.02 and was within the SON's standard (250). Chloride ranged between 73.23 to 107.70 mg/l (table 1.2). The presence of chloride in drinking water sources can be attributed to the dissolution of salt deposit, irrigation drainage in the stream. Low to moderate concentration of Chloride adds palatability to water while excessive concentration of Chloride affects the taste of the water (Akomeah *et al.*, 2011).

The highest value pH was recorded in station 2 (7.45 ± 1.68) in August, while the lowest was recorded in station 1 (7.01 ± 0.04) in July. The mean pH value for the two stations was 7.31 ± 0.26 and was within the SON's standard (6.5 - 8.5). The pH ranged from 6.80 - 7.61 (table 1.2) and was within SON's range.The ph scale ranges from 0 -14, a of 7 is neutral while substance less than 7 is acidic, While pH greater than 7 is basic .If the pH of the water is too high or too low, the macro invertebrates living in it will be adversely affected. Most freshwater invertebrates prefer a pH range of 6.5 - 9.0, although, some can live in water with pH level outside this range (Keith, 2013). Humans have high tolerance for water pH, but values greater than 11 and that lower than 4 can cause skin and eye irritation. A pH value below 2.5 will cause irreversible damage to skin and organ. There was no significant difference (P< 0.05), when ANOVA test was performed.

The highest value of conductivity was recorded in station 1 (0.55± 0.55) in the month of August, while the lowest was recorded in station 1 (0.23 ± 0.03) in June. The mean conductivity value for the two stations was 0.414 ± 0.26 and was within the SON's standard (1000). The conductivity ranged between 0.22-0.59, and was within SON's standard and there was no significant difference (P<0.05) in the stations when (ANOVA) was performed. All values recorded that are within standard is considered safe in drinking water and the conductivity of water depends on nutrients and ions present in the stream in water (Gray, 2004).

The highest value of temperature was recorded in station 2 (26.5± 0.07) in June, while the lowest was also recorded in station 1 (25.85 ± 0.07). The mean temperature from the stations was 26.04 ± 0.23 and was within SON's standard (ambient). The temperature ranged from 25.6 - 26.5 and was within SON's standard, and there was significant difference (P > 0.05), in the stations when ANOVA test was performed. The lack in variation might be because of proximity in location.

The highest value for dissolved oxygen was recorded in station 1 (10.4± 1.13) in June, while the lowest was also recorded in station 2 (5.6± 1.13). The mean temperature from the stations was 7.2 ±1.98 and was within SON's standard although it is unknown. The dissolved oxygen ranged from 4.80 - 12.30 and was within SON's standard. There was a significant difference (P>0.05) in the stations when ANOVA test was performed. When dissolved oxygen increases or decreases it has an effect on the water quality and benthic macro organisms present. If the dissolved oxygen concentration is below a certain level (1-2 mg\ l), the benthic organism show reduced growth and survival rate (Akindele and Makali, 2001).

The highest value for biochemical oxygen demand was recorded in station 2 (12.30 ±1.20) in the month of June, while the lowest in July (3.95±0.21).the mean temperature from the stations was 7.11±3.29 and was within SON's standard (50).The biochemical oxygen demand ranged between 3.80 - 12.30 and was within SON's standard. There was no significant difference ($P<0.05$).

Benthic Macro invertebrate Status of Usumani Stream.

The benthic macro invertebrate phyla seen in freshwater are Annelida, Arthropoda and Mollusca (Alam *et al*., 2008). However, this study confirmed the presence of only two phyla, Arthropoda and Mollusca**.**And the families found within these phyla have been reported in the Nigerian waters (Egborge,1994; Yoloye,1998). The difference in the benthic macro invertebrates faunal composition of these two stations sampled, suggests that the physical nature of the freshwater environment is a major determinant of its macro invertebrate composition.

In the study site, station 1 is relatively lotic, while station 2 is slow moving. The greater diversity in the lotic system has been confirmed by Gullan and Craston, (1994), the water flow influences the transport of particles, thus, makes food available for aquatic fauna and maintains high level of dissolved oxygen. In Table 1.2, the macro invertebrates composition in station one were more abundant may be due to, the availability of food and high dissolved oxygen present. The diversity varied among the benthic organisms in the two stations. Hemiptera and Coleoptera were not present in station 2, but were found in station 1. Only one Arachnida was found in the 3 months study in station 2 while five were found in station 1.Ephemeroptera has a higher diversity in station 1 than in station 2 (Table 1.3). Ephemeroptera and Mollusca had the same diversity value in station 1 (0.37) and in station 2 (0.17).

The Shannon Weiner diversity index values (H) states that values above 3.0 indicate that the habitat structure is stable while values less than 1.0 indicates pollution and degradation of habitat structure (Shannon, 1948; Mandaville, 2002). Based on values obtained from the study, station 1 = 1.45 while station 2 = 0.656. That means station 1 is fairly stable while station 2 is polluted.

One important macro invertebrate community indicator is the total number of Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa in a sample. An increasing EPT richness value correlates with increasing water quality (Rothrock *et al*., 1998).Many studies have indicated that Ephemeroptera, Plecoptera and Trichoptera show a negative response to anthropogenic disturbance in aquatic systems (Ode *et al*., 2005). The presence of Ephemeroptera and Plecoptera only, in this study is therefore an indication, that the water is fairly stable. Although, there was abundance of molluscs in station 1, such yardstick should not constitute the basis for ascertaining pollution free status. Since molluscs are known to exhibit high propensity to tolerate pollution (Merrit, and Cummin, 1996).

Conclusion and Recommendation

The rationale behind this work was to study the physico chemical and biological attribute of Usumani stream in other to see how they show difference in the contrasting stations and months, so as to assess the limnological status of the stream. In the absence of prior knowledge of the environmental conditions, this study established a baseline for future comparison. The study revealed monthly variations in water quality, the distribution of different macro invertebrate community and their diversity which was used to predict pollution. Some of the physic chemical parameters varied greatly monthly and most were within the allowable limits when compared Standard Organization of Nigeria (S.O.N).

Although there is no recorded bacteriological analysis carried out in the stream but on the basis of some physico chemical test and following standard criteria, Usumani stream can be generally considered for industrial, agricultural and municipal use but not for drinking due to the result gotten when the macro invertebrates predicted pollution in station 2 of the stream and fairly stable in station 1. Studies should be carried out in microbial and other physicochemical aspect, in other to thoroughly assess the stream to bring out an acceptable water quality.

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