International Journal of Science and Technology Volume 2 No. 3, March, 2013

Species Diversity and Equitability Indices of Some Fresh Water Species in Aba River and Azumini Blue River, Abia State Nigeria

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ABSTRACT

The study was on species diversity and equitability of some freshwater organisms in Aba River and Azumini blue river, Abia state, Nigeria. A survey of the sources of pollutants and the distribution system were executed to enhance designation of sampling points and establish water shed conditions. A Plankton net of 80µM mesh and 18cm diameter was used to collect the Planktons. Shannon's diversity index , H= - (∑(Pi In Pi) while Pi is the proportion of the total number of specimen expressed as a proportion of the total number of species for all species in the ecosystem was applied to establish diversity. The species evenness index (E) was calculated as E= H/H max. H max is the maximum possible value of H and it is equivalent to InS. Therefore E= H/Ins. The equability values (i.e Pileo's evenness index, J) for Aba river was 0.1492 while that of Azumini blue river was 0.7724. The Shannon Weinner's index of species diversity (H) for Aba river was 2.5649 while that of Azumini blue river was 1.5031.

Keywords: *diversity, species, Azumini,Aba, plankton, Shannon Weinner,Pileos,Survey*

1. INTRODUCTION

To count the number of species, we must define what constitutes a species. There are several competing theories or species concepts; (Marden 1997). The most widely accepted are the morphological species concept, the biological species concept, and the phylogenetic species concept. Although the morphological species concept is largely outdated as a theoretical definition , it is still widely used. According to the concept, species are the smallest groups that are consistently and persistently distinct and distinguishable by ordinary means, (Cronquist 1978).

Soe (2006), noted that, the more the species diversity in an ecosystem, that is the greater the number of species contributing to it, the healthier and more resilient to pressure the ecosystem is likely to be. In the work, *what determines species diversity?* Pennisi (2006), observed that countless species of plants, animals and microbes fill every crack and crevices on land and in the sea. They make the world go 'round'. Converting sunlight to energy that fuels the rest of life, cycling carbon and nitrogen between inorganic and organic forms and modifying the landscape.

Strictly speaking, species diversity is the number of different species on a particular area (species richness) weighed by some measure of abundance such as number of individuals or biomass. Another measure - evenness, is the relative abundance with which each species is represented in an area. An ecosystem where all the species are represented by the same number of individuals has high species evenness. An ecosystem where some species are represented by many individuals, and other species are represented by very few individuals has a low species evenness. This study seeks to establish the equitability and species diversity of some species in the study area so as to bring to the fore the level of ecosystem stability associated with the various water bodies investigated.

2. MATERIALS AND METHOD

In line with HMSO (1990), a Plankton net of 80µM mesh and 18cm diameter was used to collect the Planktons, wet microscopy of samples was conducted to establish filaments of spirogyra, cells of *Chlamydomonas* and *Closterium sp* , Direct counting of some invertebrates in the sampled area was executed in accordance with William (1996). The following invertebrates were counted; *Aestna sp* (Dragon fly larva), *Baetis sp* (May fly), *Eristolis sp* (Dronefly larve), larvae of Culex,mosquito, *Nepa sp* (Water scorpion), *Eretis sp* (Dystiscid beetle), *Gerris sp* (Pond skater), *Herpobdella sp* (leech) Tadpoles at various development stages were equally counted directly. The species were established using indexed animals and plants.

Shannon's diversity index, H= - (∑(Pi In Pi) while Pi is the proportion of the total number of specimen! expressed as a proportion of the total number of species for all species in the ecosystem. The product of Pi In Pi for each species in the ecosystem was summed, and multiplied by – I to get H. the species evenness index (E) was calculated as E=

H/H max. H max is the maximum possible value of H and it is equivalent to InS. Therefore E= H/Ins.

3. RESULT

3.1 Distribution of Some Species in the Study Area

- The fingerlings of *Tilapia sp* were common in sampling points: AZ1, AZ2, AZ3, and AB2.
- Spirogyra:- this common is sampling point AZ1, AZ2, AZ3, AB1, AB2, AB3, AB4 and AB5. However, the Azumini blue river had a luxuriant growth of green algae at the bottom of the water body. The growth conferred greenish blue colour to the water body
- Chlamydomonas:- these were recorded at sampling points AZ1, AZ2, AZ3, AB1, AB2, AB3, AB4,AB5.
- *Closterium sp*:- was common at sampling points AB1, AB2
- Aestina sp:

Table 1: Distribution of some species in the study area

Aquatic lives observed	AZ 1	AZ 2	AZ 3	AB 1	AB 2	AB 3	AB 4	AB 5
Fingerlings *Tilapia sp*	4	3	3	-	3	-	-	-
Spirogyra sp	20	17	13	8	7	6	5	7
Chlamydomonas sp	10	9	8	7	5	-	5	-
Closterium sp	-	-	-	5	3	-	-	-
Aeshna sp (dragonfly larva)	-	-	-	3	2	-	-	-
May fly (baetis)	2	2	-	1	1	-	1	-
Larva of dronely fly*(eristolis)*	-	-	-	-	4	-	2	-
Culex mosquito larva.pupa	-	-	-	10	13	-	12	-
Water scorpion *(Nepa)*	-	-	-	1	1	-	1	-
Dytiscid beetle *(Eretes)*	13	5	6	12	7	4	2	-
Water measurer *(Hydronmetra)*	-	-	3	-	-	-	-	-
Pond skater *(Germs)*	-	-	2	2	1	-	1	-
*Herpobdella (*Leech*)*	-	-	-	2	1	-	-	-
Tadpoles	-	-	-	4	4	-	2	-

Key:
(Obigbo Rd)

AZ…. = Azumini blue river — AB… = Aba river
\+ = Positive (observed activity) — - = Negative (not observed)

- Clamydomonas:-These were recorded at sampling points
AZ1, AZ2, AZ3, Ab1, AB2, AZ3, AB4, AZ5.
- *Closterium sp* (sicke shaped unicellular algae):- Closterium sp. Was common at sampling points. AB1 and AB2.
- *Aestina sp* :- this present at sampling points AB1, AB2
- May fly (baetis, an insect):- May fly was common in sampling points AZ1, AZ3, AB1, AB2, AB3
- Dronefly (larva form) this was common in sampling points : AB2 and AB4
- Larva of culex mosquito:- This was recorded at sampling points : AB1 AB2, AB4 and EFF
- Water scorpion (an insect):- It was recorded in point AB1, AB2, AB4
- Dytiscid beetle (an insect):- This was present in sampling point AZ1, AZ2, AZ3, AB1, AB2, AB3, AB4.
- Water measurer (an insect):- Was recorded in sampling points AZ3,
- Pond skater (an insect):- was recorded in sampling points AZ3, AB1, AB4, AB4
- *Herponbdella sp* (an annelid):- Was present at sampling points AB1 and AB2.
Tadpoles:- Were present at sampling points AB1, AB2, and AB4

The Determination of Species Diversity Using Shannon Weiner's Index
Surface Water Community: Aba River

Table for Shannon Weiner's index of species diversity in Aba river

Species	Number(n_i)	$n_i/N=P_i$	$(P_i)^2$	P_i Log e (P_i)
Tilapia sp	3	0.0192	0.00037	-0.0029
Spirogyra sp	34	0.2179	0.04750	-0.0145
Chlamydomonas sp	17	0.1090	0.01190	-0.0527
Closterium sp	8	0.0513	0.00260	-0.0155
Aestina sp	5	0.0321	0.00103	-0.0070
Mayfly *(baetis sp)*	3	0.0219	0.0005	-0.837
Dronefly larva *(Erisolis sp*	6	0.0385	0.00148	-0.0096
Mosquito larva *(culex)*	35	0.2244	0.05035	-0.1505
Water scorpion*(Nepa sp)*	3	0.0192	0.00037	-0.0029
Dystiscid beetle *(Eretis sp)*	25	0.1603	0.0257	-0.0941
Pond Skater *(Gerris sp)*	4	0.0256	0.00066	-0.0048
Herpobdella sp	3	0.0192	0.00037	-0.0029
Tadpoles	10	0.0641	0.0041	-0.0225
Total	**156(N)**			**-0.3828**

3.2 Shannon Weinner's Index of Species Diversity (H)

$-\sum P_i$ Log e (P_i) = - (-3.3828)
= 2.0312

H_{max} = Log e S i.e Log .e X 13
= 2.5649

3.3 Pileos's Evenness Index (J) or Equitability

J = (H) / (H_{max}) i.e - $\sum P_i$ log (P_i) / Log e S
= 0.3828/2.5649
= 0.1492

The Determinations of Species Diversity Using Shannon Weiner's Index
Surface Water Community: Azumini Blue River

Table 4: Calculation of Shannon Weiner's index of species in Azumini river

Species	Number(n_i)	$n_i/N=P_i$	$(P_i)^2$	P_i Log e (P_i)
Tilapia sp	10	0.0833	0.0069	-0.2070
Spirogyra sp	50	0.4167	0.1736	0.3648
Chlamydomonas sp	27	0.2250	0.0506	-0.3356
May fly sp	4	0.0333	0.0011	-0.1133
Dystiscid (Eretis sp)	24	0.0250	0.0006	-0.0922
Water measurer	3	0.0250	0.0006	0.0922
Skater (*Gerris sp*)	2	0.0167	0.0003	-0.0683
Total	**120**		**0.2731**	**-0.5031**

3.4 Shannon Weinner's Index of Species Diversity (H)

$-\sum P_i$ Log e (P_i) = - (-1.5031)
= 1.5031

H_{max} = Log e S i.e Log e 7
= 1.9459

3.5 Pileos's evenness index (J) or Equitability

J = (H) / (H_{max}) i.e - $\sum P_i$ log (P_i) / Log e S
=1.5031/1.9459

= 0.7724

4. DISCUSSION

The equability values (i.e Pileon's evenness index, J) for Aba river was 0.1492 while that of Azumini blue river was 0.7724. The Shannon Weinner's index of species diversity (H) for Aba river was 2.5649 while that of Azumini blue river was 1.5031. Result indicates very low number of species in areas of high human activities. Sampling points AB2 and AZ3 recorded the highest evenness of species, that can be attributed to their relatively low human activity as compared with other sampling points . Azumini river recorded diversity index of 1.5031 and equitability (evenness) index of 0.7724. On the other hand the lowest diversity index of 0.3828 and equitability (evenness index) of 0.1492 was recorded at Aba river.

Mayden (1997), noted that species richnes and species evenness are probably the most frequently used measures of the total biodiversity of a region. Species diversity is also described in terms of the phylogenetic diversity or evolutionary relatedness, of the species present in an area. For example, some areas may be rich in closely related taxa, having evolved from a common ancestor that was also found in that same area, whereas other areas may have an array of less closely related species descended from different ancestors.

Scientists expect that the scientifically described species represent only a small fraction of the total number of species on earth today. Many additional species have yet to be discovered, or are known to scientists but have not been formally described. Scientists estimate that the total number of species on earth could range from about 3.6 million up to 117.7 million, with 13 to 29 million being the most frequently cited range (Hammond, 1995; Cracraft, 2002).

The estimation of total number of species is based on extrapolations from what we already know about certain groups of species. For example, we can extrapolate using the ratio of scientifically described species to undescribed area. However, we know so little about some groups of organism, such as bacteria and some types of fungi, that we do not have suitable baseline data from which we can extrapolate our estimated total number of species on earth. Additionally, some groups of organisms have not been comprehensively collected from areas where their species richness is likely to be richest (for example, insects in tropical rainforests). These factors, and the fact that different people have used different techniques and data sets to extrapolate the total number of species, explain the large difference between the lower and upper figures of 3.6 million and 117.7 million, respectively.

While it is important to known the total numbers of species on earth, it is also informative to have some measure of the proportional representation of different groups of related species (e.g. bacteria, flowering plants, insect, birds, mammals). This is usually referred to as the taxonomic or phylogenetic diversity. Species are grouped together according to shared characteristics (genetic, anatomical, biochemical, physiological, or behavioural) and this gives us a classification of the species based on their phylogenetic, or apparent evolutionary relationships. We can then use this information to assess the proportion of related species among the total number of species on earth.

Most public attention is focused on the biology and ecology of large, charismatic species such as mammals, birds, and certain species of trees (e. g. mahogany, sequoia). However, the greater part of Earth's species diversity is found in other. Generally overlooked groups. Such as mollusks, insects, and groups of flowering plants

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