COMPOSITION AND DYNAMICS OF A FRESHWATER MACROBENTHIC COMMUNITY. I.OLIGOCHAETA

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ABSTRACT

The paper deals with the composition and dynamics of oligochaera of a feshwater habitat and records that ecological aspects of macrobenthic community cannot be well expressed if (i). the population densities of the species, (ii). temporal variation in population and the regulating factors, (iii) species diversity, and (iv) eveness. component of diversity are not considerd.

INTRODUCTION

The composition and dynamics of communities depend on the biological properties of the component species, each of which is evolving under selection pressures that depend upon the circumstances of the species .The biological identity and properties of the individual species provide the picture of community composition and dynamics when considered collectively. Hence both an individualistic approach to species level as well as collective approach considering all the species together is important to explain the ecology at community level.

Many ideas and problems are subsumed by the term 'population dynamics' . Solomon (1971) defined three basic aspects relating to the dynamics of populations (a) the process determining the abundance of a species in particular habitat (b) the causes of variation in the abundance, and (c) the mechanism (if any) by which the number of species are regulated. The authors, however, feel that the dynamics of macrobenthic population cannot be well expressed if some aspects like (i) the population densities of the species in particular habitat, (ii) temporal variation in population densities and regulating factors, (iii) species richness or diversity, and (iv) evenness component of diversity are not cosidered along with the spectrum of the organisms indentified up to possible lowest taxonomic hierarchy.

Keeping these in background the present communication deals with autoecology of oligochaetes from community comopsition and dynamics viewpoint.

MATERIAL AND METHODS

Monthly sampling was done for one year (Oct, '85 to Sept. '86) following standard mathods, described in detail else where (Sinha et al, 1989). Seven samples were taken at one time and the values of the present study are their average. Community composition of oligochaetes (Table 1) has been shown by detailed taxonomic identification usually up to species level while the population densities have been expressed as individuals per square meter. The species diversity was estimated with Shannon-Weaver's (1964) information theroretic index (Longuet-Higgins,1971), Simpson's index (1949) and Margalef index (1949) while eveness has been calculated following Pielou (1969) and has been presented in Table 2.

RESULTS AND DISCUSSION

A total of fourteen species were recorded as constituents of the community (Table1) belonging to three oligochaete families- Tubificidae, Aeolosomatidae and Naididae, with considerable variation in spe-

Table1. Species composition and period of minimum and maximum occurrence of oligochaetes.

Family/Taxon	Max. No./Month		Min. No./Abs./Month		% F.O. **
TUBIFICIDAE					
Branchiura sowerbyi	885	Aug. '86	89	Nov. '85	100.00
Branchiodrilus hortensis	178	Jul. '86	Abs.	in Dec. '85, May & Jun. '86	75.00
Tubifex tubifex	194	Jul. '86	Abs.	in Dec. '85 & Sep. '86	83.33
Auledrilus americanus	25	Jul. '86	Abs.	in all months	8.33
Limnodrilus undekemianus	233	Oct. '85	Abs.	in Jan., Mar., Apr. & Jun.' 86	66.66
L. angustipenis	279	Jul. '86	Abs.	in Feb. & Sept. '86	83.33
L. claparedianus	177	Mar. '86	Abs.	in all months expt. Jul. '86 & Jul.	16.66
L. hoffmeisteri	14	Mar. '86	Abs.	in all months expt. May '86 & Jul.	25.00
AELOSOMATIDAE					
Aelosoma sp.	789	Jul. '86	Abs.	in Oct. '85	91.66
NAIDIDAE					
Chaetogaster sp.	130	Jul. '86	Abs.	in Nov. '85, Jan., Apr. & Sep. '86	58.33
Dero pectinata	140	Oct. '85	Abs.	in all months expt. Jan., May & Jul. '86	33.33
Dero sp.	352	Jul. '86	Abs.	in Oct. '85	91.66
Pristina sp.	29	Jan. '86	Abs.	i all months expt. Apr. & Jul. '86	25.00
Bratislavia bilongata	08	Apr. '86	Abs.	in all months expt. in Jan. '86	16.66

** F.O. = Frequency of Occurrence in the year round samples.

Table 2. Seasonal variation in population density, species diversity and eveness component of species diversity of oligochaetes.

Month	No. Sp.	No. of indiv.	Av. Ind. Sp.	% of tot. Sp.	Sp. Diver. *1	Sp. Diver. *2	Sp. Diver. *3	eveness *4
Oct. '85	7	893	127.57	50.00	2.190	0.8119	0.883	0.779
Nov.	7	329	46.57	50.00	2.391	0.8370	1.035	0.852
Dec.	6	524	87.33	42.85	2.367	0.7845	0.798	0.916
Jan. '86	9	581	65.44	64.28	2.794	0.8322	1.256	0.882
Feb.	7	472	67.42	50.00	2.681	0.8346	0.954	0.955
Mar.	9	821	91.22	64.28	2.819	0.8407	1.192	0.890
Apr.	8	1266	158.25	57.14	2.350	0.7448	0.979	0.784
May	8	972	121.50	57.14	2.190	0.7614	1.017	0.730
June	6	1541	256.83	42.85	1.647	0.7602	0.681	0.637
Jul.	13	2998	230.61	92.85	2.978	0.8395	1.498	0.805
Aug.	8	2059	257.37	57.14	2.459	0.7572	0.917	0.820
Sep.	5	1101	220.20	35.71	2.203	0.5711	0.769	0.949

* 1= Species diversity-Shanon-Weaver, * 2=Simpson, * 3=Margalef
* 4=Eveness coponent of species diversity-Pielou.

cies richness (Table2) during the twelve-month period of study. Remarkable variation in the period of maxima and minima of the population of individual species was observed (Table1) and no species other than *Branchiura soewrbyi* - a tubificid, was found to be present throughout the period of investigation. While considering the trend of seasonal succession of the community July was the most and November the least suitable period when highest and lowest population densities (2998 /m^2 and 329/m^2) were recorded respectively. The higher population density of oligochaetes after the onset of rainy season (July) may be attributed to the increased quantity of their preferred food-the organic material (for naidids) and bacteria (for tubificids and some naidids) (Brinkhurst, 1970) due to rise in allochthonus materials nad their subsequent degradation. The ability of oligochaetes to withstand considerable oxygen deplition in their environment is an essential adaptation to their niche within the community. Brinkhurst (1972) suggested that the competition is avoided by selective digestion of bacteria within the sediments which leads to a degree of collaboration as the feces of one species of the worm become the preferred food for another species. This is probably the ecological basis of very close clumping of individuals and ocurrence of high population density.

Since two communities with the same number of species can differ in species diversity if one community has fewer very rare species than the other, the species diversity becomes a major dereminant of the number of species co-existing in communities.The Shanon-Weaver diversity index ranged from minimum 1. 647 (June) to maximum 2.978 (July). This index is regarded as the most appropriate measure of diversity of species while Wittaker (1977) reported that the index is a useful measure to express the relative importance value since it is calculated by dividing the density or productivity of one species by the total of importance value of all the species in the community. The calculated diversity value to be determined by the distribution of relative value among the species in the sample and not by the number of species as it is nearly the same (2.391, 2.367, 2.350) for the samples of different sizes (7-329/m^2 , 6-.524/m^2 , and 8-1266/m^2) in Noveember '85 December '86 and April '86 respectively. Furthermore, the diversity value 1.647 was obtained for the sample having six species (June) while a higher value 2.203 was found for the sample with even lower (5,September) species number. Pianka (1977) opined that species diversity can be calculated with Simpson's (1949) index in which the proportional abundance of a species is taken into account. Following this, the diversity so calculated ranged from 0.760 (June) to 0.840 (March) with deviation from the Shanon's trend of variation (Table 2).

As the Margalef diversity index proportionately fluctuates with increase and decrease in both species and individual richness, it gives the idea of species diversity similar to Simpson's index. In the present study, however, the higher and lower values of diversity index (Margalef) are of these samples by which the higher and lower relative importance values have been calculated.

Pielou (1969) expressed the view that the diversity in the sense of richness in species should be the number of species in the community and not the relative importance values or ratios based indices and hence he put forward the mathematical formula for determination of the 'evenness component of diversity' and termed it as 'evenness' which is regarded to denote a balanced relation between the species and individual richness of a sample. As the calculated values of evenness (Table 2) also show it is sample size dependent value and it decreases as the number of species in the community increases although the relative importance value and/or equitability and also the diversity index for the month of December and April are nearly the same while the evenness value show considerable variation (0.916 and 0.794 respectively).

In conclusion it can be said that description of a community from the four different aspects provides the picture of population dynamics and the species diversity. High population density of oligochaetes as observed and discussed are due to a high degree of coexistance made by competition avoidance mechanism of the group from trophic and habitat viewpoint.

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