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COMPARATIVE ZOOBENTHOS INVESTIGATIONS IN THE HISTRIA AND NUNTASI LAKES DURING THE PERIOD 1971 – 1976

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ABSTRACT:
Zoobenthic investigations were carried out in 1971 - 76 in the oligohaline lakes Histria and Nuntasi, at Romanian Black Sea coast. A brief descriptions are given of the different indicator systems used in evaluating trophic status. A method is performed for calculating abundancy index for Chironomidae populations. Based on the correlation between the quotients obtained for the phytoplanktonic indicators and the results furnished by the Chironomids, it was showed that Histria remained mesotrophic while Nuntasi became eutrophic during the last decade.

INTRODUCTION

Since 1971, the Romanian Institute of Marine Researches has been carrying out an extensive study of the trophic ecology of the brackish water lakes Histria and Nuntaşi, both situates in the vicinity of Sinoe Lagoon. This study has included observations of temperature, salinity, dissolved oxygen concentrations, and of phytoplankton, zooplankton, zoobenthos biomass seasonal fluctuations. This paper presents a preliminary account of the ecological conditions of the communities found in the above mentioned lakes.

METHODS

The benthic fauna have been taken with a van Veen - type bottom sampler, covering 225 cm^2. Two samples (of about 85o cm^3

each) were usually taken at one station. A smaller number of samples had to be taken from the littoral zone, since the coarse texture of the rocky sediment (at left shore in Histria), and the presence of macrophytes (in both these lakes) made it difficult to obtain quantitatively reliable samples. Between 18 January 1971 and 2o December 1976, samples were taken monthly from 288 sampling sites. These samples were preserved in 4% formalin, washed and sieved in the laboratory through a o.2 mm mesh. Altogether 4,622 Chironomid larvae were examined. These individuals constitute the primary material of the present work. In the same time, altogether 531 adult specimens were collected with sweep nets on the herbaceous vegetation and studied in the laboratory.

THE TROPHIC - TYPE CHARACTERIZATION

Various biological indicator systems have been developed for assessing the trophic status of lakes. In practice, such indicator systems can also be used for determining the degree of pollution or eutrophication of a lake, although this modell of trophic criterior elucidates static rather than dynamic aspects of modifications. Moreover, RAWSON (4) considers that indicator systems give reliable results only when applied to lakes within a somewhat restricted geographical region.

Attempts also have been made to characterize environmental conditions by the number of species present regardless of whether these species are represented by few or many individuals. Another approach has been to search for ecological dominants and to classify and name communities or associations by their dominant species.

NYGAARD and others (2) have shown that the trophic type of water body may be indicated by the proportions of members of certain algal groups. On the basis of these findings, several formulas have been developed. One of the most suitable is that of NYGAARD: $C = (Cy + Ch + Ce + Eu)/De$. The sum of the Cyanophyceae+ + Chlorococcales + Centrales + Eugleniacea species is divided by the number of Desmidiaceae species. If the quotient (C) is less than 1, the water is oligotrophic. If it ranges between 1 and 2.5, the water body is mesotrophic, and if it is more than 2.5, the water is eutrophic. According to the ROBAN and STADNICIUC (5) data, the following classification is obtained:

	Histria	Nuntaşi
Cyanophyceae	10	11
Chlorococcales	8	11
Centrales	5	3
Euglenlaceae	3	2
Desmidiaceae	11	8

Therefore, the values for primary production indicates that the lake Histria is still mesotrophic (C = 2.36), while the lake Nuntaşi had became moderately eutrophic (C = 3.37).

Among the different animal groups there are certain forms for suitable trophic types. Hence THIENEMANN (6) based his theory of lake typology on the presence or absence of certain Chironomid larvae. In the case of stagnant water communities,some typical stenoxybiont Chironomids, such as *Acricotopus lucens* ZETT. are found in oligotrophic lakes, while some other species such as *Microtendipes chloris* MEIG., *Polypedilum nubeculosum* MEIG. and *Pelopia punctipennis* F. are characteristic of mesotrophic lakes. Euryoxybiont forms, such as *Chironomus plumosus L.*, are most representative of eutrophic lakes.

The disadvantage of all these systems is their strong dependence on the sample size. According to PRESTON (3), the number of species increases as the sample size increases. Especially the records of rare indicator species depend on the total number of specimens counted. Comparable results are obtained if the sample size is kept constant.

THE CHIRONOMID INDICATORY SURVEY

The aim of the present study was to use the Chironomid fauna characteristics for assessing the trophic features of Histria amd Nuntaşi lakes, and compare its suitability for this purpose with that of phytoplankton indicator systems.

As JÄRNEFELT (1) observed, the mean number of species is highest in eutrophic lakes and lowest in oligotrophic, meso- and especially polyhumic waters. However, the total number of Chironomid population (Table 1) was the largest in Histria (22 spe-

Table 1

Abundancy and Biomass of Chironomidae Populations in the Histria and Nuntaşi Lakes

Chironomidae populations:	Histria		Nuntaşi	
	Abundancy index	Biomass -%-	Abundancy index	Biomass -%-
Pelopia punctipennis F.	12.0	0.02	23.4	0.93
Nanocladius bicolor ZETT.	36.8	0.25	-	-
Acricotopus lucens ZETT.	21.4	2.07	23.6	0.87
Paracladius conversus WALK.	-	-	36.4	1.23
Isocladius sylvestris F.	1.3	0.02	51.0	17.41
Isocladius intersectus STAEG.	-	-	45.6	6.13
Isocladius ornatus MEIG.	48.3	37.94	-	-
Isocladius obnixus WALK.	-	-	50.4	18.74
Psammocladius braunai GOETGH.	24.6	0.87	27.1	1.06
Halocladius varians STAEG.	27.6	0.09	-	-
Halocladius variabilis STAEG.	-	-	44.4	2.49
Cricotopus triannulatus MACQ.	17.3	1.50	22.4	1.86
Cricotopus bicinctus MEIG.	-	-	41.5	8.70
Cricotopus festivellus KIEFF.	46.6	1.01	-	-
Cricotopus vierriensis GOETGH.	36.3	1.06	-	-
Cricotopus flavocinctus KIEFF.	30.1	1.09	-	-
Limnochironomus nervosus STAEG.	6.6	0.05	6.9	0.01
Polypedilum convictum WALK.	3.4	0.06	3.4	0.10
Chironomus plumosus L.	48.0	50.70	49.4	16.34
Chironomus semireductus LENZ.	17.4	0.50	37.8	11.25
Tanytarsus eminulus WALK.	1.0	0.01	3.3	0.69
Tanytarsus gregarius KIEFF.	23.2	0.53	30.0	7.36
Tanytarsus exiguus JOH.	2.7	0.01	2.7	0.42
Micropsectra praecox MEIG.	24.1	2.00	0.6	0.01
Micropsectra curvicornis TSHERN.	4.6	0.03	4.0	0.69
Cladotanytarsus mancus WALK.	21.3	0.12	19.6	2.54
Smittia ephemerae KIEFF.	11.6	0.07	7.2	1.17
		100.00		100.00

cies) and smallest in Nuntaşi (21 species). It thus appears as unreliable indication.

In present study the index of abundancy (A) was calculated as follows: A = Y . l n N, where N = the mean number of individuals, Y = total number of years of findings (Table 1). The results seem to indicate close correlation as the regression line converge more steeply, almost identically in both these basins.

Very different patterns were obtained when abundancy index was plotted versus average biomass contribution per population for entire sampling period (Table 1). The distribution was also assumed to indicate that Chironomids are least specifically closely correlated with the trophic conditions. For the sake of comparison, it may be mentioned that among the preponderent, mainly ubiquist representatives there are certain constituents of oligotrophic waters, such as *Cricotopus festivellus* KIEFF. and *Nanocladius bicolor* ZETT. In this survey these species were found to thrive together with mesotrophic ones, such as *Isocladius ornatus* MEIG., *Gricotopus flavocinctus* KIEFF., *C.vierriensis* GOETGH. Between properly euryoxybiotic representatives figurates *Isocladius sylvestris* F., *I.intersectus* STAEG., *I.obnixus* WALK. and *Halocladius variabilis* STAEG. Eutrophication in Nuntaşi Lake changed the species composition and induces decrease of the average production per population in Chironomids. The stenoxybiotic species typical of oligotrophic lakes are most sensitive to eutrophication. Although their biomass increased parallel with slight fertilisation in the mesotrophic Histria, they gradually disappeared from the Nuntaşi and were replaced by euryoxybiotic species preferring eutrophy. These changes were accompanied by a remarcable decrease in biomass and density. This is due to the fact that the water masses are heavily loaded with organic, oxygen - consuming particles, and did not reach oxygen saturation level during the time of the vernal circulation. Although it is not certain whether the degree of saprobity of the hypolimnion is an accurate measure of the total modification rate, it can be used as an approximate index in lakes that are eutrophized. It seemed that, as the phytoplankton biomass grew in Nuntaşi Lake and the community became dominated by blue-green and green algae, accumulation of the excess primary production in the sediments considerably increases the number of saprobiont populations, such as Paracladius conversus WALK., Chironomus semireductus LENZ. and Cricotopus bicinctus MEIG., that prefer also eutrophy.

CONCLUDING REMARKS

A brief review of biological indicator systems showed that many difficulties are encountered when biological indicators are used to assess the trophic status of oligohaline lakes, and the risk of subjective interpretation is considerable. Originally the concept of trophic status was based ou nutrient content but actually can not be based that on lake biology. However, it is unlike for anyone to give in a reasonable interval a rigorous and exhaustive description of entire ecosystem. An alternative is to consider different biological aspects to provide a more comprehensive picture of natural waters as they vary at the different trophic levels.

It is generally considered that oligotrophic waters are of juvenescent character, being transparent and having low nutrient content and virtually no sediments. They may be altered in time by natural eutrophication in to senescent, turbid, eutrophic waters with high nutrient content and deep sediment layers on the substrate. This process is usually slow in the absence of cultural influences.

Between the initial and final stages of the eutrophication process, there are transitional, mesotrophic conditions.During the transition, the abiotic factors as well as the fauna and the flora undergo basic changes. The begining and the final stages may be characterized more definitively than the intermediate stage of the transitional process. There are several species of Chironomidae characteristic of oligo-, meso- or eutrophic conditions. Their existence implied certain qualitative properties of water bodies rather than only quantitative intermediacy on the oligotrophic - eutrophic cline.

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