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DIVERSITY IN ZOOPLANKTON COMMUNITY AS AN INDICATOR OF ORGANIC AND INDUSTRIAL POLLUTION IN HUSSAIN SAGAR, HYDERABAD

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ABSTRACT

Hussain Sagar the freshwater man made lake, situated between tl e twin cities of Hyderabad and Secunderabad has been facing the severe threat of Organic and Industrial pollution for the last one and half decades. The hypereutrophication of the lake is consequently affecting the biota both qualitatively and in abundance. The present investigation deals with the systematic account of net Zooplankton species and their abundance in response to the environmental stress, viz. Organic and Industrial pollutants. The studies reveal that the copepodes and cladocerans form the dominant net zooplankton component followed by rotifers. Significant diversity in the abundance of netzooplankton species has been noticed at different sampling stations in the Hussainsagar lake. The results have been supported with the physico-chemical characteristics of the lake water collected simultaneously.

Hussain Sagar (Lake), situated between the twin cities of Hyderabad and Secunderabad, is the oldest of the five Freshwater takes spotting the hilly landscape of the twin cities. It is spread over three spuare miles, has present water spread of 450 hectares and is situated at an altltude of 345 met res above the sea level. It is a highly eutrophic lake, in fact hypereutrophic, and has been the focus of limnologic investigations since last two decades (Srinivasan et al, 1965 ; Zafar, 1966 ; Munnawar, 1970) in view of sharp increase in pollution (Zafar, 1974) since a good amount of industrial wastes (liquid wastes) and untreated domestic sewage are let into the lake. Its water, therefore, been rightly used only sparsely for secondary purposes and even the fish stocking endeavours of the local state fisheries department have been discontinued for about a decade and half from now.

Yet another feature of Hussain Sagar is the luxuriant growth pattern of water hyacinth, (*Eichornia crassipes*) blanketing vast stretches of the lake all along its circumference, often exhibiting erratic distribution pattern. This unusual but systematic ceaseless luxuriant growth of the *Eichornia* only goes to strengthen its recently established function as an *anti pollutant* and its promise as a pollution control agent through its ability to effectively absorb heavy metals. The poor abundance of carps and occurrence of only handful hard fish species like the Catfish *Mystus* (*Mystus*) *vittatus*, *vittatus* (Bloch), *Heteropneustes fossilis* (Bloch), *Notopterus notopterus* (Pallas) and *Puntius* species (*arenatus* and *stigma*) is only a small pointer to the effect.

Therefore, in view of the highly eutrophic nature of the lake it was reasoned that a study of the net zooplankton organisms and

their abundance, if any, in the various parts of the lake may reveal the effect of organic and industrial pollution on them, The precise nature of the liquid effluents and their effect on the available *biota* have been deferred for future detailed studies since they also involve use of sophisticated electronic analytical instruments and manpower in addition to more extensive limnologic survey and collections (net zooplankton and surface water samples) for meaningful interpretive studies. The present piece of investigations were carried out during the premonsoon months of the preceding year i.e. from April-June, 1979. Weekly limnologic collections of net zooplankton and surface water samples were made and raw water analysed for various water chemistry routines. These were followed by identification studies of the net zooplankton for qualitative and quantitative evaluation.

Systematic investigative studies on the species abundance of net zooplankton in Hussain Sagar are scanty (Dhanapathi, 1974, 1976) and therefore an endeavour has been made to assess these. The present communication is a part outcome of systematic investigations, in progress, in the limnology of Hussain Sagar since May, 1979 last and lay emphasis on the general relationship observed between the net zooplankton and their abundance, if any, in response to environmental stress (Organic and industrial pollutants).

Assuming that a study of the zooplankton species and their abundance and distribution in the different regions of the lake may reveal meaningful results, four sampling stations differing suitably in important limnologic features were selected along the circumference of the lake for the collection of net zocplankton and surface water samples (SWS) for purpose of identification and enumeration of biota and immediate chemical analysis of physico-chemical parameters of water like DO, free CO_2, total alkalinity and chloride besides measurements of pH, turbidity (JTU), temperature etc. The first station, in the immediate vicinity of Hyderabad Boat Club, located in the southern flank of the lake also has the government mint and associated effluent discharge. The second station in Khairatabad, slightly west of the city, is midway along the west flank of the lake and witnesses regular activity on account of the many washermen, human ablutions from the surrounding slums, cattle wading and grazing. The third station is situated in the north west zone of the lake, along the Khairatabad-Begumpeth rail line and is by far the most polluted zone of the lake. It is here that the lake receives its quota of effluents through the Kukatpally nallah that traverses the industrial (Sanath Nagar and Balanagar) belt of the twin cities and brings in its course diverse effluents, rich in industrial wastes. Understandably enough, the pollution influence is more pronounced during summer months following diminshed inflow, increased surface evaporation and related fall in the water level following no precipitation. The fourth station, Secunderabad Sailing Club, lies in the eastern flank of the lake and invariably has luxuriant population of water hyacinth. It too receives untreated domestic wastes from areas around (Fig. I).

The methodology for water chemistry routines are after standard method (APHA, 1975) while ones for collection of net zooplankton as also surface waters are after Babu Rao et. al. (1978). The means of the results of these studies for each station for the period were obtained, after analysis of data (Table 2). The net zooplankton organisms were identified and enumerated from each sample and the means for the month obtained. These results have been tabulated in table 2 while the relationship observed between the number of species (S) to the number of individuals in each species (N)

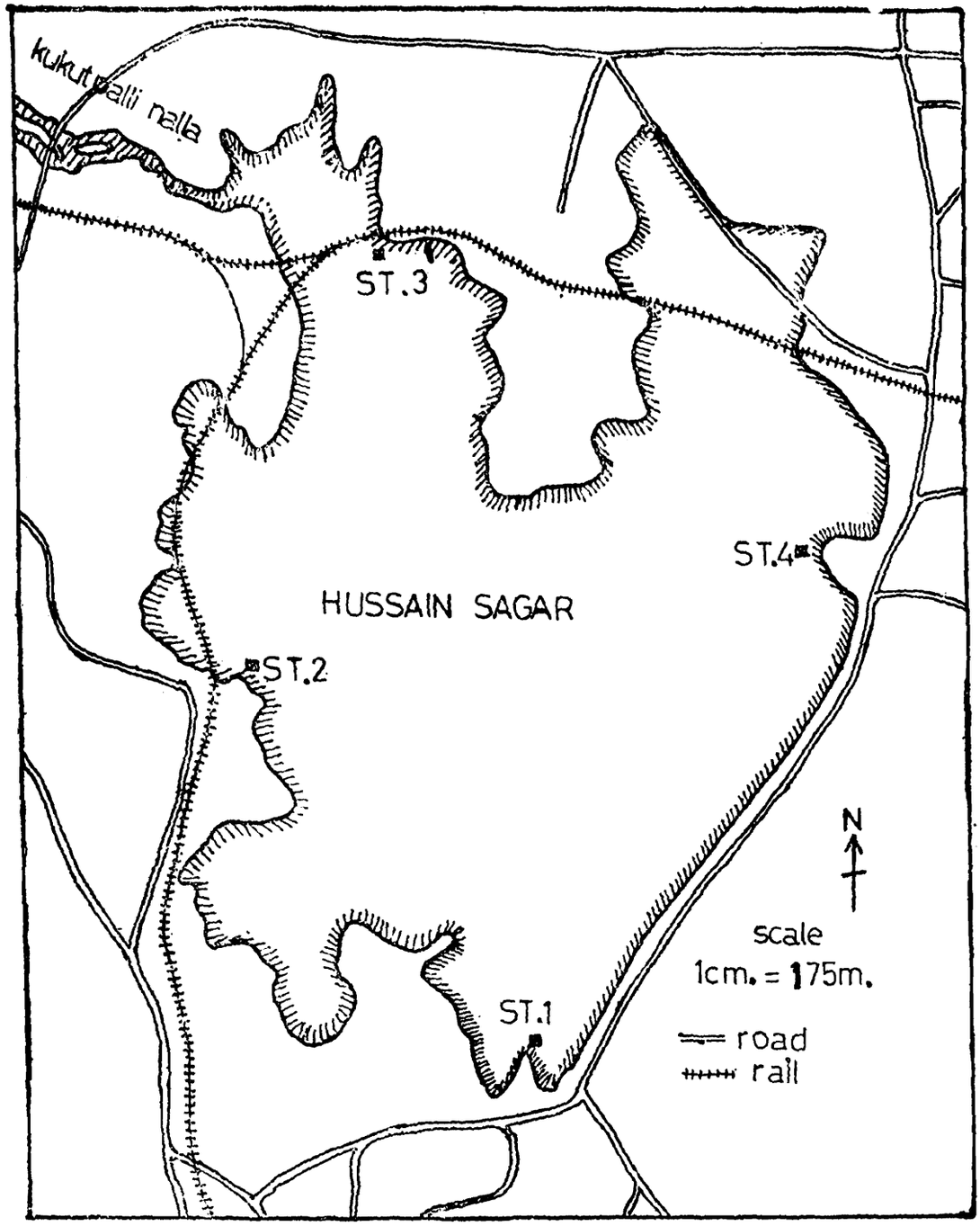

Fig. 1 Map of Hussain Sagar (Lake), Hyderabad showing sampling stations.

TABLE 1. Mean number of individual per species per liter of surface water in Hussain Sagar (Lake), Hyderabad.

Net Zooplankton	Sampling Station I (Hyderabad Boat Club)	Sampling Station II (Khairatbad)	Sampling Station III (Begumeth)	Sampling Station IV (Secunderabad Sailing Club)
I. COPEDODA				
Mesocyclops leucartii (claus)	43	43	07	27
Nauplii	27	07	41	07
Copepodite	07	11	12	14
Heliodiaptomus sp.	05	00	00	02
II. Cladocera (Water fleas)				
Ceriodaphnia				
Cornuta (Daphnidae)	67	27	12	05
Moina micrua Kurz (N inidae)	00	03	02	05
Diaphanosoma Sarai (Richard) [Sididae]	00	01	02	05
Daphni lumholtzi Sars (Daphnidae)	03	01	00	00
III. Rotatoria *Brachionus quadridentata* Herman (Brachionidae)	05	02	00	10
B. caudatus Borrois & Daday	10	02	00	10
B. calcyflorus Pallas	06	00	06	32
B. urceoloris	03	00	00	09
Keratella tropica (Apstein)	06	01	13	04
Platyias quadricornis (Ehrenberg)	00	00	00	02
TOTAL	183	98	102	148

expressed as ratio (N/S) are graphically represented in Fig. 2. [—Assuming the nauplii and copepodites recorded as belonging to *Mesoeyclops leucartii* (Claus)].

It was noted that the copepods and cladocerans form the dominant net zooplankton component followed closely by the rotifera. The adult net zooplankton organisms were found to be less numerous in zooplankton samples from Station 3, where there is more of pollution. The presence of less numerous zooplankton in samples from Station 2, may be attributed to pollution influence following intense washing activity by washermen, slums around, domestic effluents and like factors. Of the 14 species of net zooplankton recorded, only 8 species occur in samples from station 3, the lowest number of types when compared to populations from other sampling stations. These may be more due to pollution influence following inlet of industrial effluence (liquid waters) from the Kukatpally Nalla feeding the lake at this point. This effect appears to be more pronounced on rotifera which otherwise have good species

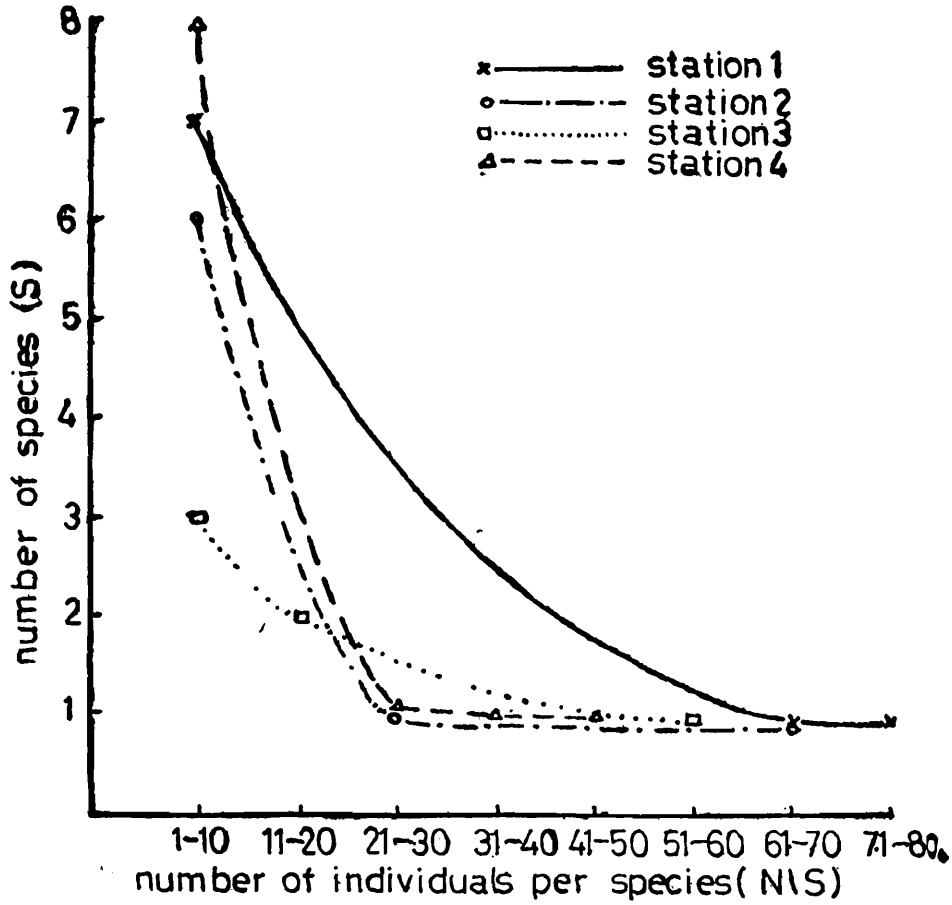

Fig. 2 Number of species (S) to Number of individuals per species (N/S) ratio of the Zooplanktonic Organisms.

TABLE 2. Chemical feature of surface water in Hussain Sagar, Hyderabad

	SS I	SS II	SS III	SS IV
Atm. Temperature	41°C	40°C	42°C	41°C
Wt, Temdesature	07°C	37°C	39°C	37°C
pH	7.9	8.4	8.0	8.3
Turbidity (JTU)	4	8	30	8
Dissolved Oxygen)	4.9 mg/1	1.2 mg/1	Traces	5.2 mg/1
Free CO_2	NIL	NIL	NIL	NIL
Aeidity	NIL	NIL	NIL	NIL
Co_3 Alkalinity	10.0mg/1	4.0 mg/1	80.0 mg/1	70.0 mg/1.
HCO_3 Alkalinity	21.0 mg/1	196.0 mg/1	91.0 mg/1	200.0 mg/1.

composition in other sampling points. Only two brachionid species– *Brachionus calcyflorus* and *Keratella valga* [Ploima, Brachionidae] appear in the samples from the station. Figure 2 graphically illustrates the lowest ratio (N/S) of species (S) to number of individuals (N).

The concave or hollow curves for S and

N/S ratio for Station 2 and 4 indicate absence of environmental stress (Organic and industrial pollutants, in this case) pointing diversity in species compositions in net zooplankton inhabiting these stations while the flattened curve for the same data for station 3 point out rigors due to environmental stress resulting in relatively less number of species having high number of individuals per species.

Table 2 illustrates the analysed chemical features of surface water in Hussain Sagar, during the period of study. The complete absence of dissolved oxygen in water samples from station 3 indicates stress so also low DO values for station 2 which is only second to station 3 in zooplankton species abundance.

Detailed systematic investigations on the influence of industrial effluents on the biota in the lake are in progress and a correlation between the two will emerge only after more samples are analysed from the various sampling points.

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