

Monthly Vertical Occurrence of Some Copepods in a Pond in Rajshahi City

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Abstract: A weekly study on the monthly vertical occurrence of some copepods in a pond in Rajshahi city was conducted for a period of 10 months from December, 2001 to September, 2002. Four genera of copepods, *Cyclops* sp., *Mesocyclops* sp., *Merocyclops* sp. and *Diatomus* sp. were observed. Dominancy of *Cyclops* sp. was noted. They showed different pattern of vertical movements. Each type of copepods was always found to be abundant near the surface during morning and evening. They were found to be in lesser number in the noon samples. On the seasonal basis these were found in winter. The roles of water temperature, p^H, dissolved oxygen (DO), free CO₂ and alkalinity in the abundance of copepods were discussed.

Key words: Copepods, p^H, CO₂, DO and alkalinity

INTRODUCTION

Phytoplankton accelerates zooplankton growth exerting nutrient substance and supply themselves as food for fish. Zooplankton provides the necessary amount of protein required for the rapid growth and development of different organs of fishes. Zooplankton constitutes important food items of carnivorous fishes. The larvae of most fishes feed mostly on zooplankton^[1]. Growth and abundance of zooplankton varies with season and depth and depends upon meteorological and water properties^[2]. Temperature plays an important role in the vertical distribution of zooplankton.

The diurnal vertical movements of zooplankton in freshwater ponds have been studied by Yacovino^[3] and Ali *et al.*,^[2] who worked in detail on the monthly variation and depth wise abundance of zooplankton. Bhuiyan and Nessa^[4] worked on the quantitative study of the zooplankton in relation to certain physicochemical factors.

MATERIALS AND METHODS

A. The Study Pond: The present investigation was undertaken in a fish pond situated behind the Kazla bazaar, which is very near to Rajshahi University campus. The pond is rectangular in shape and has an area of about 14,000 m² with an average depth of 3.64 m. The depth of the pond varies throughout the year due to rise and fall of water level. Rainfall is the only water source of the pond. The pond receives direct sunlight throughout the day.

B. Sample Collection: Samples of water and zooplankton were collected at weekly interval from surface, middle and bottom layer of water at 6 am, 12 pm and 6 am. Water temperature was recorded by a centigrade thermometer and p^H was noted in the field by digital p^H meter. Dissolved oxygen was determined immediately by titration method following the Winkler's method (APHA-1976) and other chemical parameters such as free CO₂, CO₃ and HCO₃ alkalinity were estimated according to the procedure given by Welch^[5]. Weather elements of Rajshahi were collected from Bangladesh Meteorological Department regional station, Rajshahi.

Zooplankton Analysis: Zooplankton samples, for qualitative and quantitative analysis, were collected in one litre capacity pyrex glass bottle and preserved permanently in Transeau's solution. The zooplankters were identified following the methods described in Ward and Whipple^[6]. The preserved zooplankton were stirred gently for equalization in distribution from which a sub-sample was drawn with a dropper into the Sedgwick Rafter counting cell. The average number of the plankters was then calculated after three times identification of the same sample. Counting was done under compound microscope.

RESULTS AND DISCUSSIONS

Physicochemical parameters of water were recorded and their monthly mean values are shown in Table-1. The air temperature was recorded high during summer and lowest in winter. The air and water temperature showed positive relationship (r=0.98) in between them.

Table 1: Monthly fluctuation of physico-chemical parameters of the study pond.

Month	Air Temp. (oC)	Water Temp. (oC)	DO (mg/l)	CO ₂ (mg/l)	CO ₃ (mg/l)	HCO ₃ (mg/l)	pH
Dec' 01	18.33	19.31	4.33	1.64	4.97	122.72	8.16
Jan'02	18.12	18.63	4.21	3.28	3.11	120.76	8.06
Feb'02	19.46	19.73	3.96	0	11.22	126.06	8.59
Mar'02	25.25	23.72	4.42	2.53	3.89	127.22	8.14
Apr'02	28.58	29.68	4.05	0	13.14	143.22	8.71
May'02	28.00	29.09	3.74	0	14.47	146.71	8.46
Jun'02	28.91	29.36	3.71	0	7.92	127.97	8.53
Jul'02	28.58	31.43	4.03	0	22.75	115.14	8.52
Aug'02	29.42	30.22	4.25	0	10.92	114.11	8.46
Sep'02	29.08	29.41	4.30	0	14.39	117.67	8.36
Mean ± SD	25.37± 4.55	26.06± 4.87	4.10± 0.24	0.75± 1.20	10.68± 5.69	126.15 ± 10.48	8.40± 0.20

Table 2: Monthly vertical distribution of four genera of copepods (units/l) in the study pond

Month	<i>Cyclops</i> sp			<i>Mesocyclops</i> sp			<i>Merocyclops</i> sp			<i>Diaptomus</i> sp			Monthly total no of copepod
	Sur	Mid	Bot	Sur	Mid	Bot	Sur	Mid	Bot	Sur	Mid	Bot	
Dec' 01	167	261	345	24	66	94	33	40	61	49	79	103	1322
Jan'02	151	227	284	50	94	123	20	24	34	53	134	180	1374
Feb'02	145	185	267	11	18	9	25	20	26	30	62	110	908
Mar'02	130	216	274	18	28	16	22	23	24	40	62	91	944
Apr'02	181	259	305	68	125	156	5	6	4	65	139	206	1519
May'02	97	180	220	35	54	78	10	20	13	41	92	109	949
Jun'02	84	167	179	40	57	76	17	51	88	0	0	0	759
Jul'02	46	120	183	25	27	42	74	76	119	13	24	20	769
Aug'02	57	95	125	15	21	26	57	88	114	0	0	0	598
Sep'02	40	66	86	24	17	28	35	29	47	0	0	0	372
Total	1098	1776	2268	310	507	648	298	377	530	291	592	819	9514

The direct relationship between air and water temperature was also reported by Miah *et al.*,^[7] Begum *et al.*,^[8] and Bhuiyan *et al.*^[9]. The highest water temperature was recorded during summer months which was also reported by Ganapati^[10] for pond water. The high p^H value indicated pond water alkaline in nature. The alkaline nature of pond water was reported by Bhuiyan and Nessa^[4]. The highest p^H value was recorded in spring. p^H showed positive relationship with HCO₃ alkalinity (r=0.34) and same relationship was also noticed by Begum *et al.*,^[11] in pond water. Dissolved oxygen showed positive relationship with free CO₂ (r=0.64) which conform with the result of Michael^[12], Verma^[13] and Ali *et al.*,^[14]. HCO₃ alkalinity showed negative relationship with DO (r=-0.39) and free CO₂ (r=-0.15).

Monthly vertical occurrence of four genera of copepods were recorded (Table-2). The highest density of copepods (1519 units/l) was recorded in April and lowest (372 units/l) in September 2002. *Cyclops* sp was dominant (5142 units/l) among the copepods in the present study. The peak was found in winter, which might be due to the optimum physical condition, favourable range of p^H level (p^H 8.59), dissolved oxygen and alkalinity. The total copepod number was always found to be abundant near the surface during early morning and evening and lesser number in noon sample. To ensure better oxygen consumption the copepods migrate towards surface layer. But at noon the lower temperature of the bottom layer and detritus and debris of that layer might be the cause of high concentration of copepods of bottom layer. This is in

conformity with the finding of Beeton^[15], Tash and Armitage^[16], Michael^[17] and Nasar^[18] who reported that addition to light, possibly dissolved oxygen and free CO₂ also affect planktonic movement. This was true in the present investigation, too. For the high CO₂ content at bottom in morning the copepods migrate to the surface, for the high temperature copepods were less in noon and higher in evening collection for lower sunlight.

Population of *Cyclops* sp showed highly positive relationship with free CO₂ (r=0.52), HCO₃ alkalinity (r=0.47) and dissolved oxygen (r=0.22). It showed inverse relationship with water temperature (r=-0.66), p^H (r=-0.22) and CO₃ alkalinity (r=-0.54).

Mesocyclops sp showed positive relationship with HCO₃ alkalinity (r=0.51), p^H (r=0.05) and free CO₂ (r=0.21) and negative relationship with water temperature (r=-0.06), dissolved oxygen (r=-0.1) and CO₃ alkalinity (r=-0.19).

Merocyclops sp showed positive relationship with water temperature (r=0.36), p^H (r=0.04), and CO₃ alkalinity (r=0.35). It showed negative relationship with dissolved oxygen (r=-0.08), free CO₂ (r=-0.24) and HCO₃ alkalinity (r=-0.76).

Diaptomus sp showed positive relationship with dissolved oxygen (r=0.18), free CO₂ (r=0.47) and HCO₃ alkalinity (r=0.58) and negative relationship with water temperature (r=-0.05), p^H (r=-0.14) and CO₃ alkalinity (r=-0.32).

The distribution and abundance of zooplankton in the pond under the present investigation appeared to be related with the favourable water p^H, alkalinity and dissolved oxygen content of the pond. The high temperature on the surface water acts as an important barrier for the upward migration of zooplankton during noon. The surface layer of water was rich in copepods because of availability of food in this layer. In the present study each type of copepods was always found in abundance in bottom layer of water at morning and evening while at noon, they were sometime absent at surface layer and found at bottom layer. So, it was observed that temperature was the most important factor for the vertical migration.

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