ANALYSIS OF ZOOPLANKTON AND THEIR MONTHLY VARIATION OF KADALUNDI RIVER ESTUARY, KERALA, SOUTH INDIA

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ABSTRACT

The analysis of Zooplankton and their monthly variation were carried out during July 2016 to June 2017 from Kadalundi River, Kerala, India. Among zooplankton 17 species were reported from the 3 selected stations and these species belonging to Crustaceae, Maxillopoda, Nematoda, Protozoa, Rhizopoda and Rotifera (Table, 1, 2 and 3). Out of these 17 species 6 are Rotifera, 5 are Protozoa and 3 are Maxillopoda. Crustaceae, Rhizopoda and Nematoda contributed 1 species. The rotifers are mainly *Asplanchna sp*., *Branchionus sp., Colurella sp., Lecane sp., Monostyla sp.* and *Notholca sp.* The Protozoan are mainly *Difflugia sp., Loxophyllum sp.*,*Paramoecium sp., Pelomixa sp.* and *Vortecella sp.* The Maxillopod are mainly *Diaptomus sp., Harpacticoid sp.* and *Nauplius sp.* The Crustaceans are mainly *Ostracoda sp.,* Rhizopod are mainly *Foraminifera sp.* and from Nematoda, *Nematode sp.* was reported from three stations. Maximum number of species was reported in the three stations in the month of April and minimum species was reported in the month of July. The maximum number of species was reported in station-A (147) and minimum number of species was reported in station-A (27). The maximum number of species was reported in station-B (147) and minimum number of species was reported in station-B (28). The maximum number of species was reported in station-C (188) and minimum number of species was reported in station-C (42).

Keywords: Zooplankton, Shannon-Weiner index, species richness, species evenness, Kadalundi river, Kerala.

INTRODUCTION

Zooplankton is small aquatic organisms that float freely in the water column of lakes, ponds, wetlands, river and oceans. The size of zooplankton is varying from ultra to macro. The fresh water zooplanktons are dominated by four major groups of animals that include protozoan, crustacean, cladoceran and copepods. The larval stages of large number of animals such as fish, crustaceans, jellyfish, worms and annelids are also included in zooplanktons. Zooplankton community shows highly sensitive to the variation of environment as a result, change in their abundance and species diversity can provide important indications of environmental disturbance. The zooplankton community showing respond to wide variety of disturbances includes nutrient loading, acidification, temperature, and turbidity and fish densities. Zooplankton forms the most important animal group of aquatic environment constituting a major portion of the diet of fish and other aquatic inhabitants. The estuaries and river show the composition and seasonal succession of zooplankton community is much variable than in the sea. Many adult Fish species also rely on zooplankton for prey. Because of their intermediate trophic position and interactions with nutrient cycling, zooplankton play key roles in the functioning of lake ecosystems (Dodson and Frey. 2001).

MATERIALS AND METHODS

The physicochemical parameters and phytoplankton productivity of Kadalundi River, Kerala, the experiment is started from First July 2016 to 30th June 2017. The areas selected for the study were three different stations of Kalalundi river estuary, borderline of Malappuram and Kozhikkode district of Kerala. The stations are Heros Nagar (Station-A), Palakkal (Station-B) and Keezhayil (Station-C). Kadalundi-Vallikkunnu Community Reserve has been constituted as per G.O. (MS) No. 66/2007 F & WLD dated 17.10.2007 under Section 36(c) of Wildlife Protection Act 1972. It is located on the Western side of the Northern Kerala, in Kozhikode and

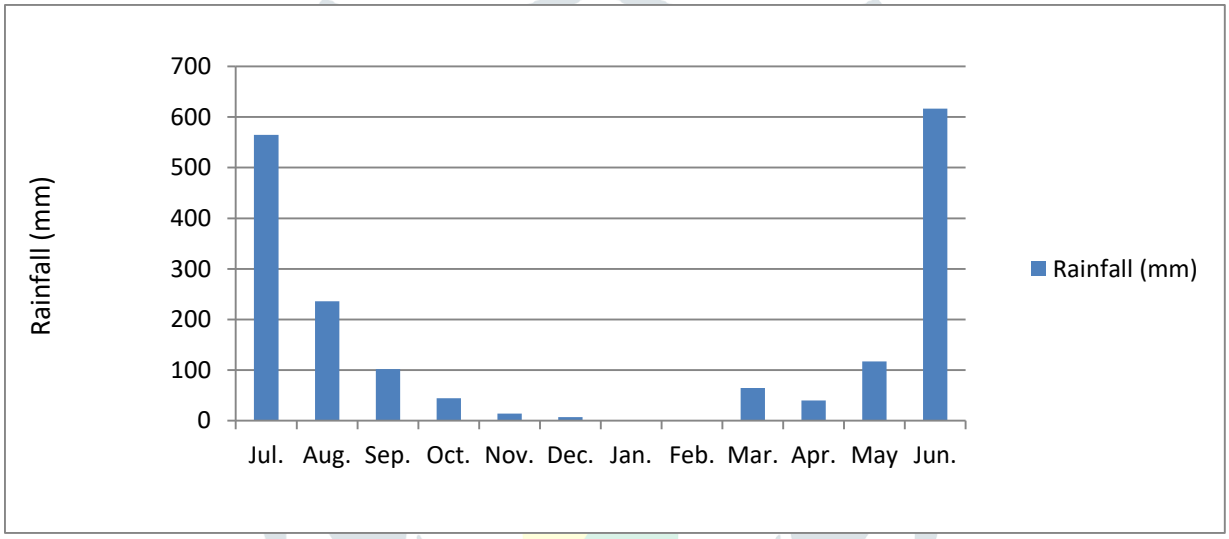
Malappuram districts on the river mouth of Kadalundipuzha spreading in the estuary. River Kadalundi is originated from Cherakambam mala which is 1160 M. Kadalundi River is one of the four most important rivers flowing through Malppuram and Kozhikkode district of Kerala. It extends in Kadalundi of Kozhikode Taluk of Kozhikode District and Vallikunnu of Thirurangadi Taluk of Malappuram District. The total extent of the Community Reserve is 153.8415 ha. The water samples were taken every month for the study and it continued up to 12 months. Zooplankton samples were collected at monthly intervals from the surface waters by horizontal towing of plankton net(0.35 mouth diameter), made up of blotting silk(cloth No. 10, mesh size 158 µm) for 20 minutes. These samples were preserved in 5% formalin and used for qualitative analysis. For the quantitative analysis of zooplankton, a known quantitative of water (200L) was filtered through a bag net of same mesh size and the numerical plankton analysis was carried out using a binocular microscope. The zooplanktons were identified using standard study of APHA (1995).

RESULTS

Among zooplankton 17 species were reported from the 3 selected stations and these species belonging to Crustaceae,Maxillopoda, Nematoda, Protozoa, Rhizopoda andRotifera (Table, 1, 2 and 3). Out of these 17 species 6 are Rotifera, 5 are Protozoa and 3 are Maxillopoda. Crustaceae, Rhizopoda and Nematoda contributed 1 species. The rotifers are mainly *Asplanchna sp., Branchionus sp., Colurella sp., Lecane sp., Monostyla sp.* and *Notholca sp.* The Protozoans are mainly *Difflugia sp., Loxophyllum sp., Paramoecium sp., Pelomixa sp.* and *Vortecella sp.* The Maxillopods are mainly *Diaptomus sp., Harpacticoid sp.*and *Nauplius sp.* The Crustaceans are mainly *Ostracoda sp.,* Rhizopods are mainly *Foraminifera sp.* and from Nematoda, *Nematode sp.* was reported from three stations. Among Rotifera, *Asplanchna sp.* was reported maximum in 3 stations. The *Branchionus sp.* was reported minimum in station-A and station-C, *Notholca sp.* in station-B. *Asplanchna sp.* was reported maximum in station-B (38) followed by station-C (37) and station-A (35). *Branchionus sp.* was reported maximum in station-B (29) followed by station-C (26) and station-A (24). *Notholca sp.* was reported maximum in station-C (34) followed by station-A (31) and station-C (22). Among Protozoans, *Paramoecium sp.* was reported maximum and *Pelomixa sp.* was reported minimum in 3 stations. *Paramoecium sp.* was reported maximum in station-C (96) followed by station-B (66) and station-A (58). *Pelomixa sp.* was reported maximum in station-C (23) followed by station-B (17) and station-A (13). Among Maxillopods, *Nauplius sp.* was reported maximum in 3 stations and *Diaptomus Sp.* was reported minimum in 3 stations. *Nauplius sp.* was reported maximum in station-A (162) followed by station-B (152) and station-C (138). *Diaptomus Sp.* was reported maximum in station-C (77) followed by station-B (55) and station-A (50). Among Crustaceae, *Ostracoda sp.* was reported maximum in station-C (164) followed by station-A (117) and station-B (101). Among Rhizopoda, *Foraminifera sp.*was reported maximum in station-C (206) followed by station-A (141) and station-B (116).The *Nematode sp.* was reported was reported maximum in station-A (19) and station-C (19) followed by station-B (13).The total population density of station-A, B and C was 960, 928 and 1267 respectively (Table.1, 2 and 3). The maximum number of species was reported in three stations in the month of April and minimum species was reported in the month of July. The maximum number of species was reported in station-A (147) and minimum number of species was reported in station-A (27).The maximum number of species was reported in station-B (147) and minimum number of species was reported in station-B (28).The maximum number of species was reported in station-C (188) and minimum number of species was reported in station-C (42).The maximum species richness was reported in station-A (2.833) in the months of September, October, November, December, January, February, April and May. The minimum species richness was reported in station-A (1.945) in the month of July. The maximum species richness was reported in station-B (2.833) in the months September, October, November, December, January, March, April and May. The minimum species was reported in station-B (2.079) in the month of July. The maximum species richness was reported in station-C (2.833) in the months of September, October, November, December, January, February, March, April and May . The minimum species was reported in station-C (2.397) in the month of July (Table.4,

5 and 6).The maximum species evenness was reported in station-A (0.96) in the months of January and March. The minimum species evenness was reported in station-A (0.88) in the months of July and August. The maximum of species evenness was reported in station-B (0.96) in the months of April and May. The minimum species evenness was reported in station-B (0.86) in the month of December. The maximum of species evenness was reported in station-C (0.94) in the month of January. The minimum species evenness was reported in station-C (0.85) in the month of June (Table.4, 5 and 6).The maximum Shannon-Wiener index was reported in station-A (2.73) in the month of January. The minimum Shannon-Wiener index was reported in station-A (1.72) in the month of July. The maximum Shannon-Wiener index was reported in station-B (2.72) in the months of April and May. The minimum Shannon-Wiener index was reported in station-B (1.89) in the month of July. The maximum Shannon-Wiener index was reported in station-C (2.66) in the month of January. The minimum Shannon-Wiener index was reported in station-C (2.16) in the month of July (Table.4, 5 and 6).

Average rainfall recorded during 2016-17 in the study area



Monthly variation of Zooplankton in different stations of Kadalundi River from July, 2016 to June, 2017

Table: 1. Station-A

Zooplankton	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Total	Percentage
Ostracoda sp.	4	7	10	12	8	9	7	8	12	17	14	9	117	12.187
Diaptomus sp.	0	2	3	5	6	5	3	3	4	6	9	4	50	5.208
Harpacticoid sp.	3	6	9	8	8	7	5	4	6	11	9	8	84	8.750
Nauplius sp.	10	13	16	18	16	12	9	11	12	19	16	10	162	16.875
Nematodes	0	2	2	3	2	2	2	1	2	2	1	0	19	1.979
Difflugia sp.	0	2	4	4	3	4	2	3	4	6	8	3	43	4.479
Loxophyllum sp.	0	1	3	4	4	3	4	5	6	10	8	5	53	5.520
Paramoecium sp.	2	4	6	5	4	3	2	4	6	11	8	3	58	6.041
Pelomixa sp.	0	0	1	2	1	1	1	2	0	3	2	0	13	1.354
Vortecella sp.	0	2	2	3	3	2	2	2	4	8	5	3	36	3.750
Foraminifera sp.	5	11	13	15	13	10	8	10	13	19	16	8	141	14.687
Asplanchna sp.	2	2	3	4	3	2	2	2	3	6	4	2	35	3.645
Branchionus sp.	0	1	3	2	2	2	2	2	2	5	3	0	24	2.500
Colurella sp.	0	2	2	3	3	2	2	2	3	5	4	2	30	3.125
Lecane sp.	1	2	2	4	3	3	2	2	3	6	4	2	34	3.541
Monostyla sp.	0	2	3	4	2	2	1	2	4	6	3	1	30	3.125
Notholca sp.	0	1	2	2	2	3	2	2	4	7	4	2	31	3.229
Total Population Density	27	60	84	98	83	72	56	65	88	147	118	62	960	

Table: 2. Station-B

Zooplankton	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Total	Percentage
Ostracoda sp.	4	6	9	11	9	8	6	6	8	13	12	9	101	10.883
Diaptomus sp.	0	2	4	6	4	3	3	5	8	10	7	3	55	5.926
Harpacticoid sp.	4	5	8	12	10	9	8	8	10	13	10	7	104	11.206
Nauplius sp.	8	9	13	17	16	14	10	11	14	18	15	7	152	16.379
Nematodes	0	0	2	2	2	1	1	0	1	2	2	0	13	1.400
Difflugia sp.	2	3	4	5	3	3	3	5	6	9	7	3	53	5.711
Loxophyllum sp.	0	2	2	4	3	3	2	6	8	10	8	3	51	5.495
Paramoecium sp.	2	4	6	7	7	5	3	4	6	10	9	3	66	7.112
Pelomixa sp.	0	1	2	2	2	1	1	1	2	3	2	0	17	1.831
Vortecella sp.	0	0	2	3	2	2	2	2	3	6	3	0	25	2.693
Foraminifera sp.	6	6	7	10	8	8	7	8	11	19	17	9	116	12.500
Asplanchna sp.	1	2	3	4	2	2	2	2	5	7	6	2	38	4.094
Branchionus sp.	0	1	2	2	2	2	2	2	3	6	5	2	29	3.125
Colurella sp.	1	2	3	3	2	2	1	2	3	4	3	1	27	2.909
Lecane sp.	0	2	3	4	3	2	2	2	4	6	5	1	34	3.663
Monostyla sp.	0	2	3	3	2	1	2	1	3	5	3	0	25	2.693
Notholca sp.	0	0	1	2	2	1	1	2	3	6	4	0	22	2.370
Total Population Density	28	47	74	97	79	67	56	67	98	147	118	50	928	

Table: 3. Station-C

Zooplankton	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Total	Percentage
Ostracoda sp.	8	12	14	18	11	9	10	12	16	21	18	15	164	12.943
Diaptomus sp.	2	3	4	8	6	6	7	6	7	13	10	5	77	6.077
Harpacticoid sp.	5	11	13	17	10	8	10	10	12	18	14	10	138	10.891
Nauplius sp.	8	12	17	18	16	11	12	14	17	24	21	15	185	14.601
Nematodes	0	2	2	3	2	2	2	1	2	2	1	0	19	1.499
Difflugia sp.	2	3	4	4	6	5	3	7	8	10	9	5	66	5.209
Loxophyllum sp.	2	3	4	5	6	5	4	6	8	10	8	4	65	5.130
Paramoecium sp.	3	4	7	11	7	4	5	6	9	18	14	8	96	7.576
Pelomixa sp.	0	2	2	3	2	1	2	2	2	4	3	0	23	1.815
Vortecella sp.	0	0	2	3	2	2	3	3	5	8	6	2	36	2.841
Foraminifera sp.	8	12	16	21	15	13	12	16	18	29	28	18	206	16.258
Asplanchna sp.	0	2	3	5	5	2	2	3	3	6	4	2	37	2.920
Branchionus sp.	0	1	2	2	2	1	2	2	3	4	5	2	26	2.052
Colurella sp.	2	3	4	4	3	2	1	1	2	4	3	1	30	2.367
Lecane sp.	1	2	3	4	3	3	2	3	5	6	3	1	36	2.999
Monostyla sp.	1	2	3	3	3	2	1	2	2	4	3	1	27	2.131
Notholca sp.	0	2	3	3	2	2	2	3	5	7	4	1	34	2.683
Total Population Density	42	76	103	132	101	78	80	97	124	188	154	90	1265	

Monthly variation of Shannon and Wiener diversity index of Zooplankton in different stations of Kadalundi River from July, 2016 to June, 2017

Table: 4. Station-A

Months	Species Richness (H_{max})	Species Evenness (E)	Shannon-Wiener Index (H^I)
Jul.	1.945	0.88	1.72
Aug.	2.772	0.88	2.43
Sep.	2.833	0.89	2.53
Oct.	2.833	0.90	2.56
Nov.	2.833	0.91	2.58
Dec.	2.833	0.94	2.67
Jan.	2.833	0.96	2.73
Feb.	2.833	0.93	2.63
Mar.	2.772	0.96	2.65
Apr.	2.833	0.94	2.66
May	2.833	0.95	2.70
Jun.	2.639	0.93	2.45

Table: 5. Station-B

Months	Species Richness (H_{max})	Species Evenness (E)	Shannon-Wiener Index (H^I)
Jul.	2.079	0.91	1.89
Aug.	2.639	0.92	2.43
Sep.	2.833	093	2.64
Oct.	2.833	0.91	2.58
Nov.	2.833	0.95	2.70
Dec.	2.833	0.86	2.43
Jan.	2.833	0.94	2.65
Feb.	2.772	0.92	2.54
Mar.	2.833	0.94	2.65
Apr.	2.833	0.96	2.72
May	2.833	0.96	2.72
Jun.	2.484	0.92	2.28

Table: 6. Station-C

Months	Species Richness (H_{max})	Species Evenness (E)	Shannon-Wiener Index (H^I)
Jul.	2.397	0.90	2.16
Aug.	2.772	0.91	2.53
Sep.	2.833	092	2.61
Oct.	2.833	0.90	2.56
Nov.	2.833	0.92	2.62
Dec.	2.833	0.93	2.64
Jan.	2.833	0.94	2.66
Feb.	2.833	0.89	2.53
Mar.	2.833	0.93	2.63
Apr.	2.833	0.91	2.59
May	2.833	0.92	2.60
Jun.	2.708	0.85	2.29

DISCUSSION

The Zooplankton and their monthly variation of Kadalundi river estuary, Kerala were studied. The water is more polluted rep throughout the year of 2016 to 2017. The river showing the much pollution because of dumping the large number of home wastes, plastics and other effluents reached in water bodies. The three stations more polluted due the presence of human excreta. The station-B and station-C contain the shells of perna and crossostrea that makes the color changes of water. When there is an abundance of algae, water quality diminishes because water filtration process becomes more difficult as filters get clogged more easily. Increase in algae also increases chlorine demand and disinfection byproducts formation. The zooplankton respond rapidly to the abundance of phytoplankton and it play very important role in aquatic food webs. The pollution hazards on the people and the ecosystem of selected coir retting yards in the backwater of Kadalundi River Calicut was studied by centre for water resources development and management Kunnamangalam. The preliminary report about Beypore River biology was studied (John, J. and K.M. Alexander 1968). The enrichment of phytoplankton and zooplanktons in the water may change the taste of drinking water. Seasonal variation in dissolved oxygen content is related to temperature and biological activities (Chapman and Kimstach, 1992).

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