Journal of Aquatic Science and Marine Biology
Volume 1, Issue 3, 2018, PP 29-33
ISSN 2638-5481

Effect of Physico-chemical Conditions on the Structure and Composition of Zooplankton Community at Jatinangor, Indonesia

***Yousif R. A[1], Masyamsir[2], Dhahiyat[3], Sunarto[4] and Zahidah[5]**

[1]Department of Fisheries and Wildlife Science, Sudan University of Science and Technology, Khartoum, Sudan

[2,3,4,5] Faculty of Fisheries and Marine Science, Universitas Padjadjaran, Jl.21.Jatinangor, Indonesia

***Corresponding author:** Yousif R. A, Department of Fisheries and Wildlife Science, Sudan University of Science and Technology, Khartoum, Sudan, ramzy@sustech.edu.sd / ramzy173@gmail.com*

ABSTRACT

This study was conducted to evaluate the impact of activities in campus Universitas Padjadjaran (UNPAD) on the water quality as a result of the entery and discharge of pollution materials from laboratories, food courts, agriculture and domestic waste in campus UNPAD to Check dam UNPAD, Ciparanje and Cikuda River. Very limited information is available on the zooplankton status and the effect of water pollution on the zooplankton population of this area. Thus the present study was undertaken to study the seasonal diversity and the physico-chemical properties of water for five sampling localities were selected for the present study depending upon the anthropogenic activities around the Campus UNPAD, water samples at selected points were analysed for pH ranged from 5.45- 8.97, DO 4.3-8.9 mg L-1, BOD 0.27 - 15.78 mg L-1 , PO4 0.080-0.611 mg L-1, NH3-N 0.0001 -1.150 mg L-1, NO3-N 0.333-2.820 mg L-1. The seasonal variations of zooplankton have been described up to generic level, zooplankton consisted of 13 taxonomic groups comprises 43 different genera, the genus are represented by (13 genus of Crustacea, 12 genus of Rotifera, 2 genus of Rhizopoda, 3 genus of Lobosea, 1 genus of Branchiopoda, 1 genus of Adenophorea, 1 genus of Phyllopharyngea, 1 genus of Phylactolemata, 1 genus of Secernetea, 1 genus of Maxillopoda, 3 genus of Ciliatea, 2 genus of Oligohymenophor and 2 genus of Eurotatoria) have been recorded

Keywords: *Pollution, Zooplankton, Water Quality, Check dam UNPAD, Cikuda River.*

INTRODUCTION

The planktonic study is a very useful tool for the assessment of water quality in any type of water body and also contributes to an understanding of the basic nature and general economy of the water body. Plankton occurs in all natural water as well as in artificial impoundments like ponds, tanks, reservoirs, irrigation cannels, etc. Plankton being the primary producer from the lowest trophic level in the food chain of fresh water ecosystem and plays a key role in fish culture (Krishna and Kumar, 2017). The number and species of plankton serves to determine the quality of water body. The structure of aquatic community is important in monitoring the water quality.

The density and diversity of the plankton are greatly influenced by the different physicochemical parameters of water (Wetzel, 1975). Zooplankton is one of the most important biotic elements that impact all functional aspects of aqueous ecosystems including food chains and trophic networks, energy flow, and the circulation of matter, the occurrence and distribution of plankton fauna depend on a number of factors such as climate change, habitat physicochemical properties, and biotic factors (Ahmad et al., 2011; Alexander, 2012; Cottenie et al., 2001; Rajagopal et al., 2010; Richardson, 2008). Environmental factors are also important elements; for instance, water temperature impacts the growth and development of organisms and can influence their mortality (Hall and Burns, 2001). Different species show varied tolerances to increases or reductions in temperature ranges, and particularly sensitive individuals are eliminated by them (Andrulewicz et al., 2008; Tunowski, 2009). Water pH can also have an impact on zooplankton; low pH causes reduced zooplankton abundance, as well as decreased biodiversity and the loss of some species (Dehui, 1995; Ivanova and Kazantseva, 2006; Yamada and Ikeda, 1999). Oxygen

dissolved in water, which is required for the survival of all aquatic organisms, is another important abiotic factor. Oxygen deficiencies can directly influence organism mortality. In addition, indirect influences are observed through predator prey interactions since hypoxia influences mobile species to change their horizontal or vertical distribution (Decker et al., 2004). Many authors (Kudari and Kanadami, 2008; Paturej, 2005, 2006; Pinto-Coelho et al., 2005; Wang et al., 2007; Yildiz et al., 2007).

MATERIALS AND METHODS

The present study results from limnological investigation undertaken during the dry season (July-September 2015) and wet season (December 2015-February 2016), on Check dam UNPAD, Bandung, Indonesia **(**Inlet **S** 06^0 55' 51.26" **E** 107^0 46' 24.35", Centre **S** 06^0 55' 52.24" **E** 107^0 46' 26.85 , Outlet **S** 06^0 55' 54.94" **E** 107^0 46' 27.01" , Cikuda River **S** 06^0 55' 44.78" **E** 107^0 46' 53.52" and Ciparanje **S** 06^0 54' 37.14" **E** 107^0 46' 13.17"). The Check dam UNPAD is chiefly fed by streams which flows from Campus UNPAD. The water samples were collected from selected sites during morning hours in two liters polythene bottles for physico-chemical parameters between 7:00 A.M. to 11:00 A.M. Water temperature, pH, transparency and DO were determined on the sampling sites, while BOD, NH_3, NO_3 and PO_4 were analyzed in the laboratory by using standard methods of APHA (2005). For the plankton analysis, the samples were collected by filtering 10 liters of water filtered through plankton net of 20µ pore size filtering cloth and concentrated up to 100 ml. The concentrated plankton samples were preserved immediately with the help of 5 ml of Lugol's Iodine solution (Edmondson, 1959). The samples were observed under the microscope and identified zooplankton using standard keys and published literature. The zooplankton species have been identified by using keys Edmondson, W.T.(1959) and Adoni, A. D. et al., (1985). Counting was made by putting one drop of concentrate on a slide and observing the content under inverted microscope (Metzer). Results were expressed in No. /ml.

Diversity index Shannon - Weaver (1949) and correlation coefficient were also calculated. Shannon Weaver diversity index (H') was calculated using the following formula:

Shannon - Wiener Index (H) = Σni/N In ni/N

Where:

H = Shannon -Weaver index of diversity;

ni = total numbers of individuals of species,

N = total number of individual of all species.

RESULTS

Physicochemical parameters of water body serves as measure of water quality. Changes in the source of water and rainfall affect physicochemical parameters of water, which also affects the biomass of the aquatic organisms. The physico-chemical parameters of water were given in table 1.

Table1. *The average of physico-chemical Parameters in water during the period of this study*

Seasons / Parameters		Dry season	Wet season	Average
Temperature		23.90±1.35	25.63±1.64	24.77±1.22
Transparency		38.17±4.48	72.90±9.19	55.54±2456
pH		7.19±0.45	7.86±0.39	7.53±0.47
DO		5.61±1.25	5.42±0.59	5.52±0.13
BOD		5.05±2.47	2.64±0.56	3.85±1.70
Orthophosphate		0.194±0.037	0.346±0.067	0.270±0.107
Ammonia (NH_3)		0.0014±0.0007	0.0662±0.0436	0.0338±0.0458
Nitrate (NO_3-N)		0.675±0.360	1.130±0.432	0.903±0.322
Heavy Metals	Pb	0.068±0.043	0.000±0.000	0.034±0.047
	Zn	0.033±0.028	0.034±0.025	0.034±0.007
	Mn	0.034±0.049	0.193±0.297	0.114±0.112

The seasonal variations of zooplankton have been described up to generic level. Zooplankton consisted of 13 taxonomic groups comprises 43 different genera, the genus are represented by (13 genus of Crustacea, 12 genus of Rotifera, 2 genus of Rhizopoda, 3 genus of Lobosea, 1 genus of Branchiopoda, 1 genus of Adenophorea, 1 genus of Phyllopharyngea, 1 genus of Phylactolemata, 1 genus of Secernetea, 1 genus of Maxillopoda, 3 genus of Ciliatea, 2

genus of Oligohymenophor and 2 genus of Eurotatoria) have been recorded (Figure 1).

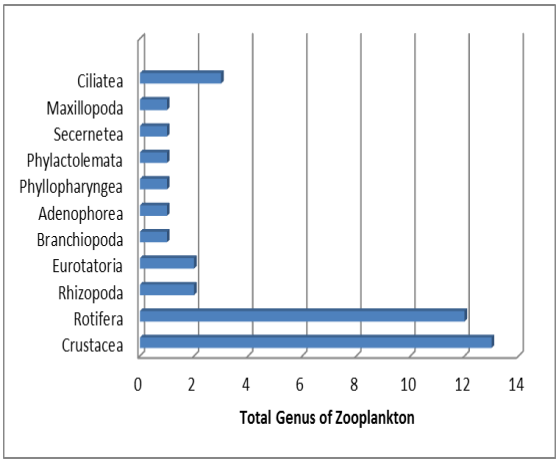

Figure 1. *Total genus of zooplankton during the study*

Table2. *Abundance (ind.L-1) of Zooplankton during the different season*

Stations	The abundance of zooplankton (ind. L^{-1})		Average
	Dry Season	Wet Season	
Inlet	2050	566.7	1308.4
Center	6666.6	3758.3	5212.5
Outlet	13354.2	2466.7	7910.5
Cikuda	650	1204.2	927.1
Ciparanje	121537.5	3875	62706.3

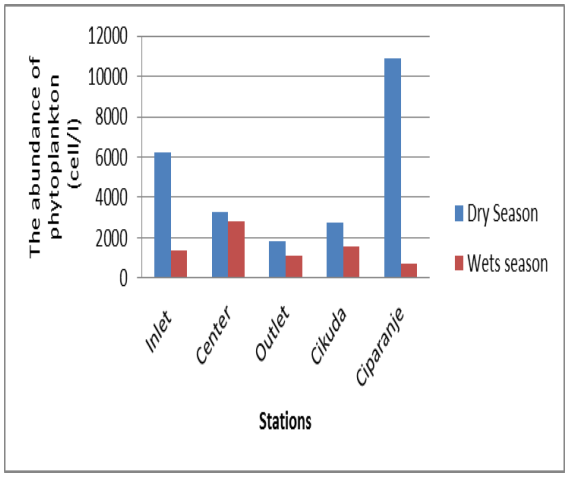

Figure 2. *Abundance of Phytoplankton during the different season*

Table3. *Average of Diversity Index (H') of Zooplankton during the different season*

Stations	(H')	
	Dry Season	Wet Season
Inlet	1.72	1.80
Center	1.66	1.73
Outlet	1.41	1.35
Cikuda	1.64	1.60
Ciparanje	1.34	1.35

The seasonal variation in the species diversity index (H') have been calculated and presented in (Table 3) for all the Five stations.

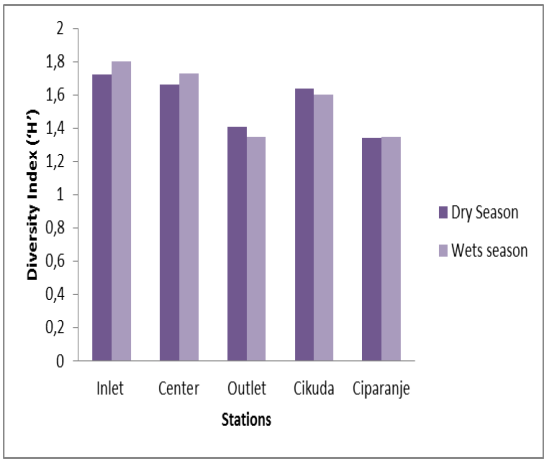

Figure 3. *Average of Diversity Index (H') of Zooplankton during the different season*

DISCUSSION

Zooplankton abundance during the dry season ranged from 650-121537.5 ind.L^{-1} and 3875-566.7 ind.L^{-1} in the rainy months. Table (2) shows the relative abundance for dry and wet seasons in the five sampling areas. In the dry season, the station of Ciparanje had 121537.2 ind.L^{-1} and that is represented by *Keratella* sp, *Nauplius* and *Brachionus* sp. and in wet season Ciparanje also had highest value 3875 ind.L^{-1} and that is represented by *Philodina* sp. *Diaptomus* sp. *Keratella* sp. and *Cyclops* sp.

The physico-chemical parameters of zooplankton communities together form a comprehensive ecosystem and there is interaction between the zooplankton and phytoplankton. These interactions are directly or indirectly subjected to the complex influences (Basawarajeshwari, et al., 2015).

Zooplankton is a good indicator of changes in water quality because it is strongly affected by environmental conditions and responds quickly to changes in environmental quality and also considered to be the ecological indicators of water bodies (Gajbhiye and Desai 1981). Factors such as light intensity, food availability, dissolved oxygen and predation effect the population dynamics of zooplankton. Low pH can reduce their diversity and density (Goldman and Horne, 1994).

A Shannon-Wiener diversity index (H') were calculated for all samples Table (3). Higher diversity at Inlet Check dam UNPAD, as well as at stations on the wet months.

Seasonal changes in zooplankton numbers and diversity indices are shown in (Table 3 and Figure 3). The highest values were 1.80 (wet season in Inlet Check dam UNPAD) for Shannon-Wiener diversity index, when the highest number of species was determined. The lowest values were 1.34 (H') in the dry season in Ciparanje, when a low number of species and a high number of individuals were determined results obtained also indicates low diversity and low species richness during the wet period may be due to environmental stress.

Hawkes (1979) opinion that low diversity is reflection of environmental stresses, comparison of diversity in the five sampling areas in both the wet and dry seasons, Ciparanje in the wet season was found to be least diverse based on the Shannon-Wiener diversity index (H').

Seasonal variation in diversity index (H') of zooplankton of Check dam, Cikuda and Ciparanje during the dry season ranged from (1.34-1.72) and during the wet season (1.35-1.80).

ACKNOWLEDGMENTS

The authors are grateful to the Dean, Faculty of Fisheries and Marine Science, Universitas Padjadjaran, Indonesia, for providing necessary laboratory facilities and we also gratefully acknowledge the financial assistance of University Grant Commissions awarded by Rector Univeritas Padjadjaran for supporting this study through ALG project.

REFERENCES

[1] Adoni, A. D. 1985. Workbook on Limnology, Pratibha Publishers C-10, Gour Nagar, Sagar, India.

[2] Ahmad, U., Parveen, S., Khan, A.A., Kabir, H.A., Mola, H.R.A., Ganai, A.H., 2011. Zooplankton population in relation to physico-chemi- cal factors of a sewage-fed pond of Aligarh (UP), India. BLM 3 (SI2), 336—341.

[3] Alexander, R., (diss.) 2012. Interactions of zooplankton and phytoplankton with cyanobacteria. Univ. Nebraska, 69 pp.

[4] Andrulewicz, E., Szymelfenig, M., Urbański, J., Węsławski, J.M., 2008. The Baltic Sea - What is Worth Knowing. Astra Print Shop, Gdynia, 113 pp., (in Polish).

[5] APHA., Eaton, A.D., Mary, A. and Franson, H. 2005. Standard Methods for the Examination of Water and Wastewater. American Water Works Association.

[6] Basawarajeshwari I, Ramakrishna Reddy, Vijaykumar K. 2015 Zooplankton diversity in fresh water reservoir of Yadigir district, Karnataka state int. J. Curr. Inn. Res.

[7] Cottenie, K., Nuytten, N., Michels, E., De Meester, L., 2001. Zoo-plankton community structure and environmental conditions in a set of interconnected ponds. Hydrobiologia 442 (1-3), 339-350.

[8] Decker, M.B., Breitburg, D.L., Purcell, J.E., 2004. Effects of low dissolved oxygen on zooplankton predation by the ctenophore Mnemiopsis leidyi. Mar. Ecol.-Prog. Ser. 280, 163-172.

[9] Dehui, Z., 1995. Effects of low pH on zooplankton in some suburban waterbodies of Chongqing City. J. Environ. Sci. 7 (1), 31-35.

[10] Edmondson WT. 1959. Ward and Whipple's Freshwater Biology. 2nd Ed. Johan Wiley & Sons Inc., New York, pp.1-1248.

[11] Goldman, C. R., and A. J. Horne. 1983. Limnology. McGraw-Hill Book Co., New York. 464 .

[12] Hall, C.J., Burns, C.W., 2001. Effects of salinity and temperature on survival and reproduction of Boeckella hamata (Copepoda: Cala- noida) from a periodically brackish lake. J. Plankton Res. 23 (1), 97-103.

[13] Hawkes HA. 1979. Invertebrates as indicator of river water quality, In; Biological indicators of water quality. A James and Lillian Evison. (eds) john Wiley and Sons. Great Britain pp.16-30.

[14] Ivanova, M.B., Kazantseva, T.I., 2006. Effect of water pH and total dissolved solids on the species diversity of pelagic zooplankton in lakes: a statistical analysis. Russ. J. Ecol. 37 (4), 264-270.

[15] Krishna P.V. and Kumar Hemanth. 2017. Seasonal Variations of Zooplankton Community in Selected Ponds at Lake Kolleru Region of Andhra Pradesh, India. Int. J. Curr. Microbiol.App.Sci.(2017) 6 (8):2962-2970. doi.org/10.20546/ijcmas.2017.608.355

[16] Kudari, V.A., Kanadami, R.D., 2008. Impact of changed trophic status on the zooplankton composition in six water bodies of Dharwad district, Karnataka state (South India). Environ. Monit. Assess. 144 (1-3), 301-313.

[17] Paturej, E., 2005. Zooplankton of seaside lakes in the coastal region of the Baltic Sea. Wyd. UWM, Olsztyn, 129 pp., (in Polish).

[18] Paturej, E., 2006. Assessment of the trophic state of the coastal Lake Gardno based on community structure and zooplankton-related indices. Electr. J. Polish Agricult. Univ. 9 (2), http://www.ejpau.media.pl/volume9/issue2/art-17.html.

[19] Pinto-Coelho, R., Pinel-Alloul, B., Méthot, G., Havens, K.E., 2005. Crustacean zooplankton in lakes and reservoirs of temperate and tropical regions: variation with trophic status. Can. J. Fish. Aquat. Sci. 62 (2), 348-361.

[20] Rajagopal, T., Thangamani, A., Sevarkodiyone, S.P., Sekar, M., Arch-unan, G., 2010. Zooplankton diversity and physico-chemical con-ditions in three perennial ponds of Virudhunagar district, Tamilnadu. J. Environ. Biol. 31 (3), 265-272.

[21] Richardson, A.J., 2008. In hot water: zooplankton and climate change. ICES J. Mar. Sci. 65 (3), 279-295.

[22] Shannon, C.E. & Weaver, W. 1949. The Mathematical Theory of Communication. University of Illinois Press, Urbana.

[23] Tunowski, J., 2009. Zooplankton structure in heated lakes with differing thermal regimes and water retention. Arch. Polish Fish. 17 (4), 291-303.

[24] Wang, S., Xie, P., Wu, S., Wu, A., 2007. Crustacea zooplankton distribution patterns and their biomass as related to trophic indicators of 29 shallow subtropical lakes. Limnologica 37 (3), 242-249.

[25] Wetzel, R.G. 1975. Limnology, W.B. Sauders CO: Philadelphia pp. 743.

[26] Yamada, Y., Ikeda, T., 1999. Acute toxicity of lowered pH to some oceanic zooplankton. Plankton Biol. Ecol. 46 (1), 62-67.

[27] Yildiz, S¸., Altindağ, A., Ergönül, M.B., 2007. Seasonal fluctuations in the zooplankton composition of a eutrophic lake: Lake Marmara (Manisa, Turkey). Turk. J. Zool. 31 (2), 121-126.

Citation: *Yousif R. A, Masyamsir, Dhahiyat, Sunarto and Zahidah (2018). "Effect of Physico-chemical Conditions on the Structure and Composition of Zooplankton Community at Jatinangor, Indonesia". Journal of Aquatic Science and Marine Biology1(3), pp.29-33*

Copyright: *© 2018 Yousif R. A,, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.*