© 2013 *RELS*
http://rels.110mb.com
rel_sci@yahoo.com

ISSN: 0974-4908
Res. Environ. Life Sci.
6(1) 19-22 (2013)

Diurnal fluctuations in population density of Copepods from Yassbolagh Dam, Markazi, Iran

Alireza Shayestehfar*[1], Samaneh Abdoveis[2] and Sima Aslanfaal
[1]Department of Biology, Faculty of Science, Arak University -38156-8-7349, Iran
[2]Department of Basic Sciences of Water Resources, Khuzestan Water and Power Authority, Ministry of Energy, Iran
***e-mail:** a-shayestehfar@araku.ac.ir

(Received: April 04, 2012; Revised received: January 05, 2013; Accepted: January 18, 2013)

Abstract: The free living copepods are considered as zooplanktons and consume as food by fishes. In the present study diurnal fluctuations in population density of copepods in relation to temperature, dissolved oxygen, pH, acidity and alkalinity were studied in Yassbolagh Dam which is situated in North West to Arak city. The study covered four diel periods in three months of summer, 2008. The Copepods are a sub-class of the class Maxiliopoda, sub phylum Crustacean and phylum Arthropoda, and in this study they were represented by 8 genus, 11 species and three orders (Cyclopoida, Calanoida and Harpacticoida) respectively. Maximum population density observed in D. *lintoni* . The high population density of copepoda in 12 and 18 possibly is due to their diurnal habitat, more water temperature, and relatively moderate oxygen concentration.

Key words: Diurnal fluctuation, Copepods, Physical and chemical parameters

Introduction

Copepods are a group of crustaceans found in the sea and all freshwater habitats. The free living copepods are considered as zooplankton and consume as food by fishes and other aquatic animals. Planktonic copepods are important to global ecology and the carbon cycle (Dürbaum & Künnemann, 1997). The free-living copepods fall into three orders: Cyclopoidea, Includes the well known cyclops, of which there are over a hundred species. Moderately long secondary antennae and the females carry twin egg-sacs. Calanoidea, characterized by long secondary antennae, and in the females, a single egg-sac. Harpacticoidea, Much smaller and usually found foraging on submerged plants as their small antennae do not enable them to swim (Ward and Whipple,1959).

The fluctuations in density of zooplanktonic communities in relation to ecological variables were studied Scholnick (1994), Bezerra *et al.* (1999), Vaidya and Yadav (2008). Many scientists as well as Abele *et al.* (1992), Razouls (1996), Hairston and Bohonak (1998), Boxshall and Jaume (2000), Rezaei (2002), Damotharan *et al.* (2010), published brilliant informations on copepods.

Very few works regarding invertebrates and especially fresh water crustaceans and particularly copepoda, takes place in Iran. The population density of zooplanktons including copepoda in relation to some physical and chemical parameters was study in the cultural sturgeon pool from AG – Ghala in Golestan, North Iran by Soleimani (1998), the population density of zooplankton (including copepoda) in relation to some physico – chemical parameters from Kor river, was study by Khodabandeh (1999).

Materials and Methods

Yassbolagh dam is located at latitude 34^0 32` 36.8`` N and longitude $049^0$ 17` 31.7`` E. The reservoir of this dam has submerged 4.6 hectares of land (Fig.1). It is situated in North West to Arak city. In rainy season the snow and rain water is collected behind the dam and in dry seasons use for watering the villager's farm and garden. It is characterized by Zagrous type of climate which is clearly marked in to four distinct season, vis., spring (March - May), summer (Jun - August), autumn (September - November) and winter (December - February).

The study covered four diel (24h) periods of each month (Jun - August) during the year 2008. The sampling was done 15 Cm below the water surface at an interval of 6 hours on 3rd of each month (Shayestehfar, 1991), from a fixed sampling point (Fig.2).

The air and water temperature and pH, were recorded with the help of a digital portable kit. The dissolved oxygen, acidity and alkalinity were carried out with the help of methods out lines in A.P.H.A. (1980) and Trivedy and Goel (1986).

To study the abundance of copepods, the water was collected in a 2L plastic bag with a wide cap and then it was transferred to the Arak University Lab. The water sample then agitated and few drops of water introduced to a Gridded Sedge wick Rafter Counting Cell with 1/ml capacity and observed under light microscope. The procedure was repeated many times and finally the average population was calculated. The method of preservation and identification of copepods was based on Ward and Whipple (1959). Codification correlation, ANOVA and Correlation test were used for analyzing the bio-metrical study.

Results

The diurnal variations of physical and chemical parameters are shown in table1. The Copepods are a sub-class of the class Maxiliopoda, sub phylum Crustacean and phylum Arthropoda, and in this study they were represented by the orders Cyclopoida,

Fig.1: The Location of Yasbolagh dam, (photo from Tageo.com)

Calanoida and Harpacticoida and families Cyclopida, Diaptomiae and Harpacticidae respectively.

They are totally 8 genus with representing 11 species as shown in Table 2. The relative proportion of species population shows that:

D. *lintoni* > *A. darwini* > *C.* columbianus > *C. bicuspidatus* >*H. chelifer and M. aequatorialis* >*C. canadensis* >*E. phaleratus* >*M. donaldsoni* >*P. affinis* >*M. pumilis*

The relative population of Order shows that;
Cyclopoida > Calanoida > Harpacticoida

The month wise analysis revealed that the total population density of copepods was more in Jun, moderate in August and low in July relatively. The diurnal fluctuations of population density indicate that it was high at 12, moderate at 18, less at 24, and least at 6 o'clock. The four diel periods population density of copepoda is shown in Table 2. The abundance of phytoplankton was high and the water looked always greenish through out this study. The atmospheric temperature rise during the illuminated hours of day

Fig. 2: The Location of sampling site

Table-1: Diurnal variations in physical and chemical parameters in Yassbolagh dam (Jun to Aug. 2008)

Months	Times of Sampling (Diel Hours)	Atmospheric Temperature (°c)	Water Temperature (°c)	Dissolved Oxygen (ppm)	Acidity (ppm)	pH (mg/l)	Alkalinity (mg/l)
June	6	21	20.3	8.2	-	7	87.5
	12	28	27.2	6.7	-	7.5	92.8
	18	23	21.9	6.9	-	7.3	90.6
	24	20.5	20.1	7.3	-	7.1	89.2
July	6	23	22	7.5	-	7	93.4
	12	34	33.5	5.3	-	7.8	102.3
	18	31	30.4	6.4	-	7.2	99.8
	24	24	23.6	6.9	-	7.2	97.4
Augest	6	19	18.8	9.7	-	7	73.2
	12	28.5	27.9	7.8	-	7.4	84.7
	18	22	21.4	7.2	-	7.2	75.9
	24	21	20.5	7.5	-	7	75.8

Table-2: The population density of copepoda of Yassbolagh dam (Jun to Aug. 2008)

Zooplankton Population	Months															Total
Sampling Months	June					July					August					
Sampling Time	6	12	18	24	Total	6	12	18	24	Total	6	12	18	24	Total	-
Phylum: Arthropoda	7	216	150	22	395	2	42	14	6	64	13	112	76	8	219	678
Class:Maxillopoda	7	216	150	22	395	2	42	14	6	64	13	112	76	8	219	678
Sub Class: Copepoda	7	216	150	22	395	2	42	14	6	64	13	112	76	8	219	678
Order: Cyclopoida	6	171	121	19	316	1	32	10	5	48	10	86	55	6	157	521
Family: Cyclopoida	6	171	121	19	316	1	32	10	5	48	10	86	55	6	157	521
Genus: Ectocyclops	0	18	12	2	32	0	3	1	1	5	1	9	7	0	17	54
Species *phaleratus*	0	18	12	2	32	0	3	1	1	5	1	9	7	0	17	54
Genus: Cyclops	1	68	51	10	130	0	12	3	1	14	4	29	19	3	55	201
Species: *bicuspidatus*	1	23	18	4	46	0	4	1	0	5	2	10	6	1	19	70
Species: *canadensis*	0	20	16	4	40	0	3	0	0	3	1	7	4	1	13	56
Species: *columbianus*	0	25	17	2	44	0	5	2	1	8	1	12	9	1	23	75
Genus: Microcyclops	1	14	9	1	25	0	2	0	0	2	0	6	3	0	9	36
Species: *pumilis*	1	14	9	1	25	0	2	0	0	2	0	6	3	0	9	36
Genus: Megacyclops	0	16	12	2	30	1	2	1	0	4	0	8	6	1	15	49
Species: *donaldsoni*	0	16	12	2	30	1	2	1	0	4	0	8	6	1	15	49
Genus: Mesocyclops	3	41	28	2	74	0	10	3	2	15	4	26	15	1	46	135
Species: *aequatorialis*	1	18	13	1	33	0	4	1	1	6	1	11	7	0	19	58
Species: *darwini*	2	23	15	1	41	0	6	2	1	9	3	15	8	1	27	77
Genus: Paracyclops	1	14	9	2	26	0	3	2	1	6	1	8	5	1	15	47
Species: *affinis*	1	14	9	2	26	0	3	2	1	6	1	8	5	1	15	47
Order: Calanoida	0	27	16	1	44	1	7	3	1	12	2	16	13	1	42	98
Family: Diaptomidae	0	27	16	1	44	1	7	3	1	12	2	16	13	1	42	98
Genus: Diaptomus	0	27	16	1	44	1	7	3	1	12	2	16	13	1	42	98
Species: *lintoni*	0	27	16	1	44	1	7	3	1	12	2	16	13	1	42	98
Order: Harpacticoida	1	18	13	2	34	0	3	1	0	4	1	10	8	1	20	58
Family: Harpacticidae	1	18	13	2	34	0	3	1	0	4	1	10	8	1	20	58
Genus: Harpacticus	1	18	13	2	34	0	3	1	0	4	1	10	8	1	20	58
Species: *chelifer*	1	18	13	2	34	0	3	1	0	4	1	10	8	1	20	58

due to solar heat and the temperature drops down at night. Always water temperature recorded less than air temperature, Maximum average of air and water temp., recorded in July 12 o'clock and the minimum in August 6 am. Monthly analytical average of water temperature showed that; July> Jun>August, While diurnal fluctuation obtained that; 12am< 18pm< 24pm<6 .In August the maximum and in July the minimum oxygen concentration were recorded. The average fluctuation of dissolved oxygen was more in July and moderate in Jun and August. pH showed approximately same fluctuation with maximum 7.8 (12 noon) in July. Alkalinity showed a wide average fluctuation in July but in August it was narrow.

Month wise analysis showed that a total individuals of 678 were collected in which the maximum population density record in Jun (395) and less in July (64).

In biometrical analysis, there is an inverse relationship between atmospheric temperature with dissolved oxygen and a direct relationship with pH and alkalinity (sig<0.05).

Discussion

In the present study the air temperature generally fluctuates more than water temperature which is in agreement with Welch(1952) as it takes approximately 1 calorie of energy to heat 1cm³ of water 1°C., for an equal volume of air, this temperature rise requires only about 0.0003 calories, which is in agreement with Molles (2005). The high contents of dissolved oxygen is an indication higher count of organisms in unite environment. Rutter (1953) and Ahmed (1990) discussed the relationship of temperature and dissolved oxygen. The inverse relation between oxygen and water temperature observed in this investigation which is in agreement with Soleimani (1998), is possibly due to the aerobic metabolism of organism and microorganism in the water body as well as less capacity of No parasitic copepod found in the present investigation. Possibly the high population density of copepoda in 12 and 18 is due to their diurnal habitat, more water temperature, and relatively moderate oxygen concentration.

Maximmum population density of *D. lintoni*, through out the investigation may be due to wide tolerance optimum range of this species.

Acknowledgment

The authors are great full to the office of "Water Researches and Engineering Standards of Iran Khuzestan Water and Power Authority" for their financial support of the presented research work.

References

A.P.H.A., A.W.W.A., W.P.C.F: Standard methods for the examination of water and west water. American public health association, New York, , 1134 (1980).

Abele, L. G., T. Spears, W. Kim, and M. Applegate: Phylogeny of selected maxillopodan and other crustacean taxa based on 18 ribosomal nucleotide sequences: a preliminary analysis. *Acta Zoologica*, **73**: 373-382 (1992).

Ahmed M.: Hydrobiological studies of Woher reservoir Aurangabad (Maharashtra State), India. *J. Environ. Biol*., **11**: 355-343 (1990).

Bezerra, M. A. O., Miranda, J. C. A., Ferreira, C. J. A., Ishii, I. H. and Moreno, I. H.: Studies on the zooplankton community of the Miranda River Basin, Miranda, MS. Annals of the 2nd Symposium on Natural and Socio-economic Resources of the Pantanal. *Management and Conservation*. Embrapa/CPAP, Corumbá, p. 237-248 (1999).

Boxshall, G. A. and D. Jaume: Making waves- The repeated colonization of fresh water by copepod crustaceans. *Advances in Ecological Research*, **31**: 61-79 (2000).

Damotharan, P., Vengadesh Perumal, N., Arumugam, M., Perumal, P., Vijayalakshmi, S. and Balasubramanian, T.: Studies on Zooplankton Ecology from Kodiakkarai (Point Calimere) Coastal Waters (South East Coast of India), Res. J. Biol. Sci., **5**: 187-198 (2010).

Dürbaum, J. and Künnemann, T.: Biology of Copepodes: An Introduction., *en.wikipedia. org/ wiki/ Copepod* - Cached (1997).

Hairston, N. G. and Bohonak, A. J.: Copepod reproductive strategies: Life-history theory, phylogenetic pattern and invasion of inland waters. Journal of Marine Systems, **15** :23-34 (1998).

Khodabandeh G.: Ecology of fresh water zooplankton from Kor river, Fars - Iran. Thesis submitted for the award of MSc. Zoology To Azad University Kazeroun, Iran. p 90 (1999).

Molles, Jr. and Manuel C.: Ecology, Concepts and applications, 3rd edition, McGrowHill Higher Education, Boston, p 622 (2005).

Razouls, C. and Copépodes I.: Les Copépodes libres. *In*: Traité de Zoologie. Crustacés VII, fasc.2.J. Forest, ed. Masson, Paris, p 571-638 (1996).

Rezaei-Marnani, Hamid: Ecological Studies on Zooplankton from the Straits of Malacca With Special Reference to Copepods. Ph.D. thesis, Universiti Putra Malaysia. (2002).

Ruttner, F.: Fundamentals of Limnology (Transl. by D.G. Frey and F.E.J. Frey) University of Turonto, Canada, Pp.342 (1953) .

Scholnick, David A.: Seasonal variation and diurnal fluctuations in ephemeral desert pools. *Hydrobiologia*, **294**: 111-116 (1994).

Shayestehfar, A.: Ecology of fresh water zooplankton. Thesis submitted for the award of PhD Zoology To Marathwada University Aurangabad, India. p 159 (1991).

Soleimani A.: Sturgeon developmental proseses in relation to zooplankton population density from AG- Ghala sturgeon research fish culture, Ag – Ghala, Golestan. Thesis submitted for the award of MSc. Zoology to Azad University Kazeroun, Iran. p 71 (1998).

Trivedy, R.K. and Goel, P.K.: Chemical and Biological methods for water pollution studies. Environmental publication, p 251 (1986).

Vaidya S.R. and Yadav U.K.R.: Ecological study on zooplankton of some fresh water bodies of Katmandu valley with reference to water quality. *J. Nat. His. Mus*., **23**: 1-11 (2008).

Ward and Whipple.: Fresh water biology (2nd Edition) John Wiley and Sons, INC, USA, p 248 (1959).

Welch, P. S.: Limnology, 2nd edition, MacGraw-Hill Book Co. New York, p326 (1952).