RESEARCH ARTICLE

Diversity of Zooplankton in some lentic water bodies of Karwar

Vasanthkumar B, Kapsikar Gangadhar B and Deshpande SP

Dept of Zoology, Govt. Arts and Science College, Karwar- Karnataka

Address for correspondence e mail: ugc.bvk@gmail.com

Manuscript details:

Received: 11 December, 2014
Revised : 23 January, 2015
Re-revised 04 February, 2015
Accepted: 28 February, 2015
Published : 30 March, 2015

Editor: Dr. Arvind Chavhan

Cite this article as:
Vasanthkumar B, Kapsikar Gangadhar B, and Deshpande SP (2015) Diversity of Zooplankton in some lentic water bodies of Karwar, *Int. J. of Life Sciences*, 3(1): 43-48.

Acknowledgment:
We are great ful to University Grants Commission for the funding this research under Major Research Project F.No:41-37/2012(SR).

ABSTRACT

Zooplanktons are the microscopic animals present in the water bodies. They play a major role in food chain of any ecosystem. The study was carried in Kali River for the period of Oct 2012 to Dec 2013. Kali River was further divided into six sub stations (rivers). In the present study an effort being made to study the diversity of Zooplankton diversity in different selected sites and their relation with hydro biological parameters.

Key words: Zooplankton, Kali River, Diversity, Correlation and lentic.

INTRODUCTION

Zooplanktons are the microscopic animals found in water bodies. They are the main food for many pelagic fishes. The density of zooplankton in any water body is governed by various physic chemical parameters such as light penetration, temperature, nutrient enrichment, toxic substances, mixing of water, parasites, herbivores and heterotrophic microorganism (Reynolds, 1987). Earlier many researchers worked on the fresh water zooplankton in Indian waters. (Ganapati, 1940; Mohan, 1987; Chaudhary & Pillai 2009; Singh & Balasingh 2011; Dakshini & Gupta 1979; Sarwar, 1996, Tiwari & Chauhan 2006, Abbassi et al. 1996 Sugunan, 1980. Organic pollution is one of the major factors that affect the density Moitra and Bhowmik,(1968, Verma and Munshi 1987, Rao and Durve, 1989).

MATERIALS AND METHODS

The zooplankton samples were collected on monthly basis from five stations located between Kinnar to Hinduwada of Kali River (Fig 1). Planktonic samples were collected by filtering 100 litres of water through plankton net made up of bolting silk. The samples were preserved in 5 % formalin.

Table 1: Stations with coordinates

Name of the Place	Distance from Karwar	Geographical position	Study stations	
Kali River	12.5km	14^0-52'-22" N latitude 74^0-12'-07.22" E longitude	1	Kinnar
	17km	14^0-52'-12.74" N latitude 74^0-13'-18.69" E longitude	2	Siddar ITI
	20km	14^0-52'-15.80" N latitude 74^0-14'-57.06" E longitude	3	Vailawada
	33.7	14^0-53'-40.43" N latitude 74^0-15'-24.06" E longitude	4	Kerawadi
	40.2	14^0-54'-11.65" N latitude 74^0-18'-58.46" E longitude	5	Hinduwada

The preserved samples were brought to the laboratory for qualitative and quantitative analysis and the identification was done with the help of methods described by Hustedt (1930), Venkataraman (1939), Cupp (1943), Subrahmanyan (1946), Prescott (1954), Desikachary (1959 and 1987), Hendey (1964), Steidinger and Williams (1970), Davis (1955), Kasturirangan (1963), Wimpenny (1966), Todd and Laverack (1991) and Perumal et al. (1998); Pennak (1953); Arora (1963); Sehgal (1983); Battish (1992); Murugan *et al*.,(1998). Physico-chemical parameters like Air and water temperature, pH, dissolved oxygen, T.D.S, salinity, conductivity, turbidity, colorimetric were recorded at the sampling site using systronics water analyzer (Model 371). Phosphate, Nitrate, Nitrite, silicate were analyzed in the laboratory titrimetric method as per standard methods for examination of water (APHA 1989, Trivedi and Goel 1984).

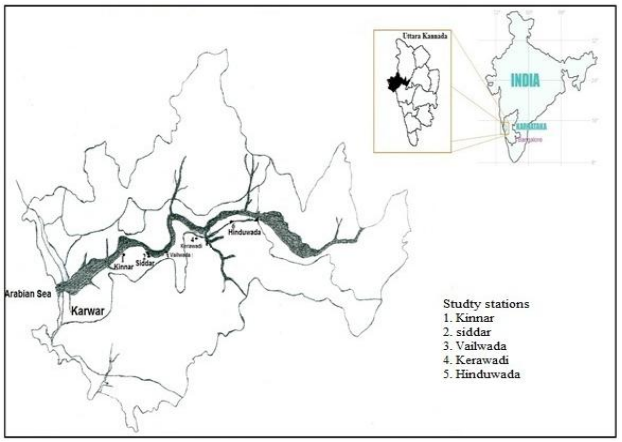

Fig. 1 : Showing Location of study site

RESULTS AND DISCUSSION

Zooplankton community of Kali River comprised of 48 species belonging to 12 groups (Table: 2). Maximum and minimum values of water parameters were given in table 3, 4 and 5. From table 7 it is clear that copepods showed negative correlation with water temperature, turbidity and D.O but positive with pH. Protozoans were positive with water temperature and pH but negative with turbidity and D.O. larval forms showed positive correlation with water temperature and D.O but negative with pH and turbidity.

Table: 2: **Checklist of Zooplanktons**

Sl. No.	Zooplankton Groups	Sl. No.	Zooplankton Groups
1.	**Protozoa**	6.	**Ostracoda**
	Tintinnopsis sp.		*Labidocera* sp.
	Favella sp.		*Oncaea* sp.
	Rhabdonella sp.	**7.**	**Cladocera**
	Globigerina sp.		*Penillia* sp.
	*Acanthometron*sp.		*Evadne*sp.
2.	**Coelenterata**	8.	**Decapoda**
	Obelia sp.		*Lucifera* sp.
	Siphonophora sp.	9.	**Annelida**
3.	**Ctenophora**		Polychaeta:
	Pleurobrachia sp.		*Tomopteris* sp.
4.	**Chaetognatha**		*Spionid* sp.
	Sagittaenflata	10.	**Mollusca(Pteropoda)**
	S. Bedotii		*Creseis acicula*
5.	**Copepoda:**	11.	**Protochordata**
	Acrocalanus sp.		*Doliolum* sp.
	Paracalanus sp.		*Oikopleura* sp.
	*Rhincalanus*sp.		*Salpa* sp.
	Pseudodiaptomus sp.	12	**Larval forms**
	Eucalanus sp.		Copepod nauplius
	*Copilia*sp.		Eupahusidnauplius
	*Macrosetella*sp.		Cirrepedenauplius
	Miocrosetella sp.		Pontellidnauplius
	Undinula sp.		Brachiopod larva
	Acartia sp.		Zoea
	Temora sp.		Cyphonautus larva
	Oithona sp.		Decapod larva
	O. plumifera		Gastropoda
	Euchaeta sp.		Bivalvia
	*Euterpina*sp.		Arachnetcis larva
	Centropages sp.		Fish eggs and larvae

In the present study the concentration of zooplankton was recorded to be minimum in August and maximum in May (2013). Graph (1 to 5). Similar results were noticed by George (1970) and Adoni (1975). Keeping in view the interaction between Zooplankton and their environment, in the present study the total density, seasonal variation in density and correlation with various physico-chemical and biological parameters are dealt and discussed. Among protozoa, *Favella* contributed maximum share and stood first rank in density dominance followed by *Tintinnopsis* whereas minimum density of *Globigerina* was noticed during the study period. *Coelenterata* was comprised by two species (Table: 2) of *Obelia* and *Siphonophora* (0.77 and 0.69/m^3) were contributed less to the total density of the zooplankton. Both the species were absent in the peak southwest monsoon season. The *Pleurobrachia* species belonging to ctenophore group also not contributed much (0.85/m^3) to the total density. In *chaetognata*, *Sagitta enflata* and *S.bedotii*, the latter species showed less density and did not show any marked variation in their standing stock. The copepod was one group which contributed much to the total density of zooplankton and stood second in dominance throughout the study period. Among seventeen species of copepod recorded, the *Euchaeta* has showed minimum density of 0.46/m^3) whereas the species like *Peudocalanus* (103.77/m^3) showed maximum density throughout the study period. Remaining groups did not show any marked variation in density and were found in low density and some of them were completely absent during the southwest monsoon period.

Table: 3 Seasonal Variation in Hydrographical parameters of Station 1 and 2

	Min	Max	Mean	Std. Deviation	Minimum	Maximum	Mean	Std. Deviation
Air temp	3	34	29.2667	7.42069	29	35	30.8	1.82052
Water temp	26	32	29	1.69031	6	32	26.5333	5.91447
pH	7.1	8.5	7.734	0.39122	7.1	8.4	7.5467	0.3852
DO	4	6.9	5.3267	0.88112	4.2	6.3	5.3267	0.58854
salinity	10.2	18.9	13.4667	2.289	10.2	17.6	13.3133	2.42601
TDS	61.5	124	79.44	17.089	63.2	104	77.4067	12.24818
Conductivity	60.2	98.4	72.7693	11.83449	60.2	88.4	69.4487	8.27091
Turbidity	7.1	36.8	17.96	9.24058	7.14	46.8	20.0493	12.17232
Phosphate_P	0.95	65	5.572	16.44183	0.56	124	9.388	31.70809
Nitrate_N	0.48	2.4	1.5327	0.62421	0.4	2.41	1.4607	0.63069
Nitrite_N	0.15	1.18	0.6267	0.29944	0.38	1.08	0.692	0.19807
Silicate_si	144.02	238.1	190.11	27.34331	134.02	205.1	179.72	22.91516

Table:4 Seasonal Variation in Hydrographical parameters of Station 3 and 4

	Min	Max	Mean	Std. Deviation	Minimum	Maximum	Mean	Std. Deviation
Air temp	28	33	30.3333	1.34519	28	32	30.4667	1.18723
Water temp	26	30	28	1.25357	26	30	28.3333	1.1127
pH	7	8.3	7.6733	0.40438	7	8.4	7.6607	0.42786
DO	4.8	6.3	5.4533	0.45335	4.5	6.9	5.4933	0.67025
salinity	8.4	15.6	11.334	2.35801	4.5	12.2	9.1067	2.2343
TDS	62.2	99.8	76.3133	11.50148	61.15	100.2	76.0687	13.62432
Conductivity	59.2	85.4	69.528	9.18711	53.2	83.4	66.8353	9.88069
Turbidity	10.12	46.8	21.6913	10.80996	9.2	46.2	20.8653	11.11588
Phosphate_P	0.66	1.86	1.3207	0.30939	0.59	1.46	1.202	0.26247
Nitrate_N	0.54	2.09	1.2573	0.52709	0.46	2.14	1.132	0.41327
Nitrite_N	0.35	1.28	0.7773	0.3154	0.4	1.21	0.8067	0.26199
Silicate_si	135.1	201.1	180.2	20.06889	125.1	199.9	166.58	21.8768

Table: 5 Seasonal Variation in Hydrographical parameters of Station 5

	Min	Max	Mean	Std. Deviation
Air Temp	30	34	31.2	1.14642
Water Temp	27	30	28.5333	0.74322
pH	6.3	709	58.9933	180.73336
DO	4.5	65.9	9.3133	15.66287
Salinity	1.5	62.1	7.92	15.03131
TDS	61.2	112.2	78.3553	16.5951
Conductivity	55.2	98.4	70.734	12.2188
Turbidity	10.2	56.2	24.8907	13.9655
Phosphate_P	0.95	1.98	1.4533	0.28367
Nitrate_N	0.62	2.86	1.39	0.55006
Nitrite_N	0.31	1.28	0.716	0.3233
Silicate_Si	115.1	189.9	153.83	21.10087

Table: 6 Checklist of Zooplankton groups observed during the study period

Species	Seasons			Species	Seasons		
	Pre Monsoon	Monsoon	Pre Monsoon		Pre Monsoon	Monsoon	Pre Monsoon
Protozoa				**Ostracoda**			
Tintinnopsis sp.	+	+	+	*Labidocera* sp.	+	-	+
Favella sp.	+	+	+	*Oncaea* sp.	+	-	+
Rhabdonella sp.	+	+	+	**Cladocera**			
Globigerina sp.	+	+	+	*Penillia* sp.	+	+	+
*Acanthometron*sp.	+	+	+	*Evadne*sp.	+	+	+
Coelenterata				**Decapoda**			
Obelia sp.	+	-	+	*Lucifera* sp.	+	-	+
Siphonophora sp.	+	-	+	**Annelida**			
Ctenophora				Polychaeta:	+	+	+
Pleurobrachia sp.	+	-	+	*Tomopteris* sp.	+	+	+
Chaetognatha				*Spionid* sp.	+	+	+
Sagittaenflata	+	-	+	**Mollusca(Pteropoda)**			
S. Bedotii	+	-	+	*Creseis acicula*	+	-	+
Copepoda:				**Protochordata**			
Acrocalanus sp.	+	+	+	*Doliolum* sp.	+	-	-
Paracalanus sp.	+	+	+	*Oikopleura* sp.	+	-	-
*Rhincalanus*sp.	+	+	+	*Salpa* sp.	+	-	-
Pseudodiaptomus sp.	+	+	+	**Larval forms**			
Eucalanus sp.	+	+	+	Copepod nauplius	+	+	+
*Copilia*sp.	+	+	+	Eupahusidnauplius	+	+	+
*Macrosetella*sp.	+	+	+	Cirrepedenauplius	+	+	+
Miocrosetella sp.	+	+	+	Pontellidnauplius	+	+	+
Undinula sp.	+	+	+	Brachiopod larva	+	+	+
Acartia sp.	+	+	+	Zoea	+	+	+
Temora sp.	+	+	+	Cyphonautus larva	+	+	+
Oithona sp.	+	+	+	Decapod larva	+	+	+
O. plumifera	+	+	+	Gastropoda	+	+	+
Euchaeta sp.	+	+	+	Bivalvia	+	+	+
*Euterpina*sp.	+	+	+	Arachnetcis larva	+	+	+
Centropages sp.	+	+	+	Fish eggs and larvae	+	+	+

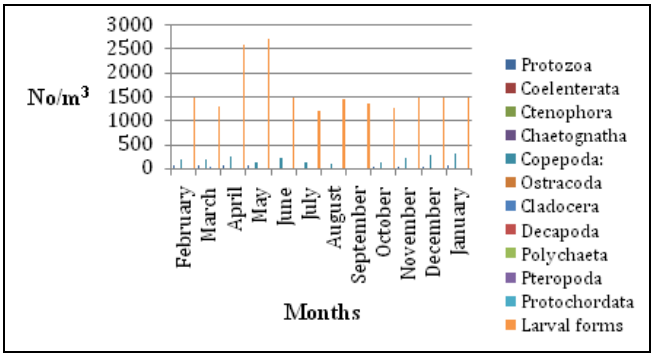

Fig. 2: Seasonal Variation of zooplanton at station I

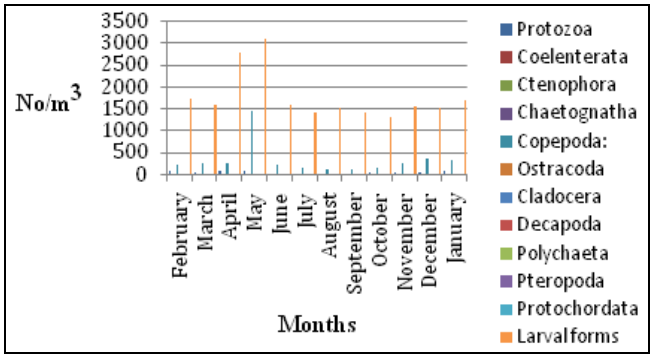

Fig.3:Monthly Variation of Zooplankton at station II

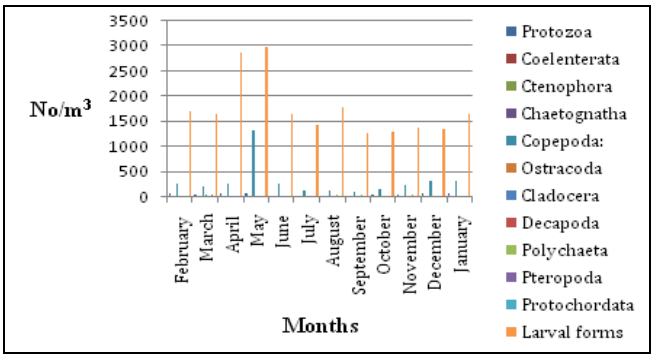

Fig.4:Monthly Variation of Zooplankton at station III

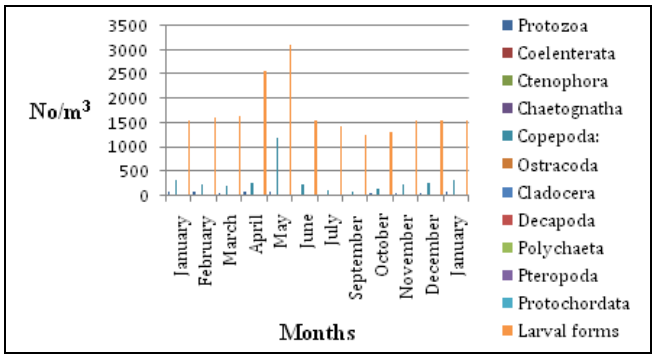

Fig5:Monthly Variation of Zooplankton at station IV

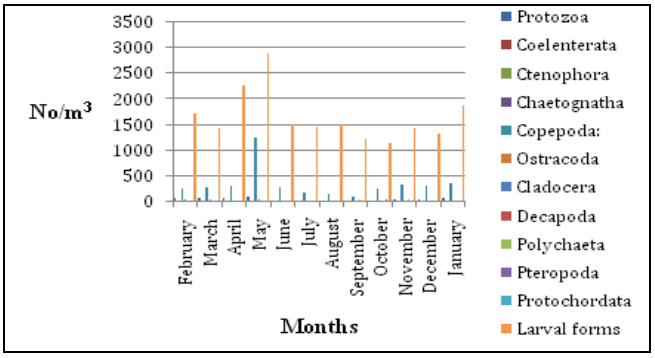

Fig.5: Monthly Variation of Zooplankton at station V

Table: 7 Correlation between abiotic factors and Zooplankton groups

Abiotic/Biotic factors	Copepod	Protozoa	Larval Forms
Water emp	-0.294917	0.48164	0.530464141
pH	0.684274	0.485082	-0.02422473
Turbidity	-0.18596	-0.16872	0.217723
D.O	-0.22505	-0.70938	-0.53832

The largest group which contributed much to the total density of zooplankton was the larval forms This group comprised by different larval forms among which fish egg and larvae and nauplius of copepod and *euphausid* contributed much to the total density of larval as well as zooplankton population. . Among the twelve groups, the larval forms ranked 1st (1264-3067/m^3) followed by copepod (97-1420/m^3) and *protozoa* (41.54/m^3). In all the study stations, the minimum density was observed in the southwest monsoon season whereas maximum peak density was recorded in pre and post monsoon seasons but the former peak was higher than pre monsoon. The larval forms constituted about 83-85% of the total species present in all the stations. *Copepods* constituted 11-13% while *protozoa* constituted only 2-3%.Other groups constituted about 15-17% of the zooplankton diversity. From the study it is clear that the zooplankton population of the study region was found to be dominated by larval forms followed by copepods and protozoans. Therefore it can be concluded that the Kali River has rich biodiversity of zooplankton species.

REFERENCES

Abbassi SA, Arya DS, Hameed AS and Abbassi N (1996) Water quality of a typical; river of Kerala, Punnurpuzha. *Pollut. Res*., 15, 163-166

Adoni AD (1985) Workbook on Limnology, Indian Map Committee, Department of Environment, Government of India.

APHA Standard methods for examination of water and wastewater, 17th Edn., (1989)

Arora HC (1963) Studies on Indian Rotifera. Part. II. Some species of the Genus Brachionus from Nagpur. *Journal of Zoological Society India* 15: 112-121.

Battish (1992) Fresh water Zooplankton of India. Oxford and IBH publishing Co. New Delhi, pp; 233.

Chaudhary R, Pillai RS (2009) Algal biodiversity and related physicochemical parameters in Sasthamcottah lake, Kerala (India). *Journal of Environmental Research and Development*, 3:3

Cupp (1943) Marine Plankton Diatoms of the West Coast of North America.

Dakshini KM, Gupta SK (1979) Preliminary observations of limnological study of three freshwater lakes around Delhi state, India. *Proc. Indian. Nat. Sci. Acad. B*., 45: 564-570.

Davis C (1955) The Marine and Fresh-water Plankton. Michigan State University Press. Michigan.

Desikachary TV (1959) Cyanophyta. Indian Council of Agricultural Research, New Delhi, pp;686.

Desikachary TV, Prema AK, Prsaad SK, Sreelatha PM, Sreedharan VT, and R Subrahmanyan (1987) Marine diatoms from the Arabian Sea and Indian Ocean. Fascia, Madras Science Foundation, Madras.

Ganapati SV, (1940) Geographical aspects of Red Hill Lake. *J.Madras geogr. Assoc*., 25:152-254

George J P (1970) "Limnological Investigations on the Plankton of Govindgarh Lake And Co-relation With Physico Chemical Factors", *Proc. Semi. Ecol. Fish Fresh Water Reservoir*, pp. 37-46.

Hendey NI, (1964) An introductory account of the smaller algae of British coastal waters. Part V: Bacillariophyceae (diatoms). Ministry of Agriculture, Fisheries and Food; Fishery Investigations Series IV. pp. xxii + 317. London, UK: Her Majesty's Stationery Office.

Hustedt F (1930) Bacillariophyta (Diatomeae), In Die Siisswasser-Flora Mitteleuropas. A. Pascher, Ed. Heft 10. Gustav Fischer Verlag, Jena, 466 p

Kasturirangan LR (1963) A Key for the More Common Planktonic Copepods of the Indian Waters. CSIR Publication, New Delhi, India, Pages: 87.

Mohan KS (1987) Bacillariophyceae of two tropical Indian lake of Hyderabad. *Bot. Bull. Academia Sinica*, 28:13-24.

Moitra SK and Bhowmik ML (1968) Seasonal cycle of rotifers in a fresh water fish pond in Kalyani, West Bengal. *Proc. Symp. Recent. Adv. Trop. Ecol*., 359-367.

Murugan N, Murugaval P and Koderkar MS (1998) Indian Association of Aquatic Biologists (IAAB), 1- 47pp

PENNAK RW (1953) Freshwater invertebrates of the United States. New York: The Ronald Press Company. 769 pp.

Perumal PP, Sampathkumar and Santhanam P (1998) Zoopalnkton of Parangipettai Coastal Waters. 1st Edn., Annamali University, Parangipettai.

Prescott GW (1954) How to Know the Freshwater Algae. WM.C Brown Co., Dubuque, Iowa, pp: 211.

Rao NG and Durve VS (1989) Cultural eutrophication of the lake Rangsagar, Udaipur, Rajasthan. J.Environ. Biol. 10 : 127-134

Reynolds CS (1987). The response of phytoplankton communities to changing lake environment. Schweiz Z Hydrol., 49:220-236

Sehgal KL (1983) Planktonic copepods of Freshwater ecosystem. Interprint, new Delhi. 169pp.

Singh RP, Balasingh GS, (2011) Limnological Studies of Kodaikanal Lake (Dindugal District), in Special Reference to Phytoplankton 141 Diversity. *Indian Journal of Fundamental and Applied Life Sciences*, 1:112-118.

Steidinger KA, Williams J (1970) Dinoflagellates. Memoirs of the Hourglass Cruises. Florida Department of Natural Resources, St. Petersburg, FL, USA

Subrahmanya R (1946). A systematic account of the Marine plankton Diatoms of the Madras coast. *Proc. Ind. Acad. Sci*., 24: 85-197.

Sugunan V V (*1980) Seasonal fluctuations of plankton of Nagarjunsagar Reservoir, AP,* India. J. Inland Fish. Soc. India, 12 (1): 79- 91.

Tiwari A, Chauhan SV, (2006) Seasonal phytoplanktonic diversity of Kitham Lake, Agra. *Journal of Environmental Biology*, 27:35-38.

Todd CD and Laverack MS (1991) Coastal Marine Zooplankton: A Practical Manual for Students. Cambridge University Press, Cambridge, ISBN-10: 0521409187.

Trivedi RK and Goel PK (1984). Chemical and biological methods for pollution. Environmental Publication, Karad, India.

Venkataraman G (1939). A systematic account of some south Indian diatoms. *Proc. Indian. Acad. Sci*., 10: 293-368.

Verma PK and Dutta JS Munshi JS (1987) Plankton community structure of Bada reservoir of Bhagalpur (Bihar). *Trop.Ecol*, 28: 200-207.

Wimpenny RS (1966) The Plankton of the Sea. Faber and Faber Ltd., London, Pages: 426.