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Zooplankton, especially Rotifer and Cladoceran Communities of the spring and rainwater streams (Nai) in Kirthar range, Sindh, Pakistan

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Abstract:

A study on zooplankton diversity of Kirthar Range was investigated during early spring (March) 2005. Four *nais* (hill torrents) and three springs were included in the study area. A total of 31 zooplankton species were documented from different water bodies of this area. Rotifera was the most diverse group representing 26 species and it was found dominating most of the water bodies. *Brachionus* was the most diverse genera in rotifers, with 8 species including *B. rubens, B. plicatilis, Hexarthra mira, Keratella cochlearis* and *K. valga* . Cladocera was less diverse and represented by 5 species in which *Moina* was the most numerically important genus. No two cladoceran species co-occurred in the same water body. In the rotifer-dominant water bodies, cladocera was absent or poorly present, while higher populations of the same were seen in rotifer-poor environments. Adult copepods were not seen however, appearance of nauplii in samples indicated their occurrence. The distribution of zooplankton species is discussed in relation to water chemistry of these water bodies.

Keywords: Zooplankton, Kirthar Range, Sindh

1. Introduction:

The Kirthar Range forms the boundary between the Lower Indus Plain (east) and southern Balochistan (west). The environment of Kirthar area is dry and arid, where water from *nai* (rain-fed hill torrents) and springs play vital role in human and animal life and agriculture. The Kirthar National Park is one of the largest wildlife reserves in Pakistan. It lies 135 km north of Karachi in the Sindh region and is approximately 300,000 ha in area. The national park includes the Kirthar Mountains which extend in an eastward direction for about 150 miles (240 km) to the south with decreasing elevation. Elevations in the park range from a minimum of 60 m to a height of 2171 m above sea level (Flam, 2006). Nai Gaj is the largest *nai* in the south Indus basin. It is the only *nai* that crosses the Kirthar Range and collects water from a wide catchment area of Balochistan. Finally it drains down into Manchar Lake (Leghari *et al.,* 2002). Ghazi Shah is located in Johi Taluka, about 32 km southwest of Johi town (26° 27'N 67° 28'E). The primary source of water, in surroundings of Ghazi Shah, is a perennial spring, Ghazi Shah Spring, located approximately 4 km to the west within the outer hills of the Bhit range of Sindh Kohistan at a height of 397 m above sea level (Flam, 2006). Nang spring is also a perennial spring, however, it sometimes dries up. It has a stronger flow of water. The local people have installed a flour mill utilizing the powerful water flow. Nai Nang is second large *Nai* after Nai Gaj. Its flood season lasts for a short period of time and it rarely fills up to dangerous level.

The temperature in the region begins to increase in March and remains high (>35 °C) until October which is considered the summer season. Sindh receives about 127 mm of rainfall in the summer and about 50 mm in the winter. In addition to its natural heritage the Kirthar National Park is also rich in

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cultural and archaeological value. In the north-east lies the world's largest known fort, Rannikot, which traverses terrain not unlike the Great Wall of China. The Hub Dam lies to the south west and is regarded as Pakistan's third largest dam and a major water source for the city of Karachi.

There are many small water bodies including springs and *nai* in Kirthar region. Some of those water bodies were selected for the present study. Previously some studies on water chemistry and algal flora of some springs and *nai* of Kirthar region were investigated (Leghari *et al.*, 2002a, 2002b, 2004). However, studies on zooplankton fauna have not been undertaken. The present investigation thus primarily aimed to document the zooplankton diversity in these water bodies of the Kirthar area.

2. Material and Methods:

Water and zooplankton samples were collected from seven water bodies **(Table 1)** located in Kirthar Range. These included 3 spring water and 4 rain-fed water bodies (*nai*). Zooplankton samples were collected by vertical hauls from surface to 1m-depth using a plankton net of 55 µm mesh size. At least three samples from each water body were collected within few meters range. All the samples of each station were then pooled in one. The samples were preserved in 4-5% formalin on the spot. The surface temperature was measured using a mercury thermometer. The other parameters like salinity and conductivity were recorded by a portable conductivity meter (Cond 315i/SET, WTW), total dissolved solids (TDS) was measured by Ecoscan TDS5, and pH was recorded by Ecoscan pH5. Zooplankton samples placed in a Sedgwick-Rafter counting cell were observed and identified under a stereo microscope (Swift M3300-D). Zooplankton species were identified according to the keys and illustrations given by Ward & Whipple (1959), Mizuno & Takahashi (1991 and Battish 1992). Comparative abundance of zooplankton was noted visually and samples were carefully observed for rare species.

Table 1. Water quality parameters at different sampling stations of Kirthar Range, Pakistan.

St. No.	St. Name	Time	Temp. (°C)	pH	Salinity (ppt)	E. cond. (µS/cm)	TDS (ppm)
1	Nai Gaj	10:20	18.0	8.1	0.1	113.0	72.32
2	Ghazi Shah Spring	13:00	25.0	8.0	0.1	161.0	103.04
3	Nang Spring	13:50	36.4	8.0	0.3	176.4	112.896
4	Nai Kai	15:40	25.0	7.5	0.3	160.1	102.464
5	Nai Nang	15:10	25.0	8.1	0.5	353.4	226.176
6	Nai Looni	16:10	27.0	7.6	1.0	2250.0	1440
7	Lal Bagh Spring	11:30	26.0	7.4	0.1	165.0	105.6

3. Results:

The water was slightly alkaline at stations 1, 2, 3 and 5, with pH ≥8.0 **(Table 1).** Salinity was in below 0.5 ppt, except at Nai Looni, where the water was slightly brackish (1.0 ppt) with a higher TDS (7.6 ppt) and conductivity (2250 µS/cm). Slightly higher salinity (0.4 ppt) and TDS (1.1 ppt) were also noted at Nai Nang. A total of 31 zooplankton species including 26 rotifers and 5 cladocerans were recorded. Rotifers predominated in most of the water bodies while cladocerans were found less abundant **(Table 2).** Among the rotifers, eight species belonged to *Brachionus* genus and three species to *Keratella*. Two species each were from *Lepadella* and *Monostyla*. All the observed cladocerans are considered inhabitants of shallow and weedy ponds. Copepod nauplii but not their adults were observed in the samples.

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Table 2. Occurrence of zooplankton species at different stations of Kirthar Range, Pakistan.

Name of species	St. 1	St. 2	St. 3	St. 4	St. 5	St. 6	St. 7
ROTIFERA							
Brachionus angularis	-	-	-	-	+	-	+
B. dimidiatus var. *quarteria*	-	-	-	-	+	+	-
B. falcatus	-	-	-	-	-	-	+
B. leydigi var. *rotundus*	-	-	-	-	+	+	-
B. quadridentatus	-	-	-	-	-	+	+
B. rubens	-	-	-	+	+++	+++	-
B. urceolaris	-	-	-	-	+	-	-
B. plicatilis	-	-	+	-	+++	+	-
Euchlanis triquata	-	+	-	-	-	-	-
Filinia longiseta	++	-	-	-	+	+	+
Hexarthra mira	-	-	-	-	++	+++	+
Keratella cochlearis	++	-	-	+++	-	++	-
K. quadrata	-	-	-	-	-	-	+
K. valga	-	+++	-	+	-	+	-
Lecane curvicornis	-	-	++	-	-	-	-
Lepadella patella	-	+	-	-	-	-	-
L. elliptica	-	-	-	+	-	+	-
Monostyla bulla	-	-	-	-	-	-	+
M. furcata	-	-	-	-	-	-	+
Mytilina sp.	-	+	-	-	+	-	-
Notholca sp.	-	++	-	+	+	+	+
Philodina sp.	-	-	-	-	-	-	+
Polyarthra trigla	-	-	-	-	+	+	-
Pompholynx complanta	-	-	-	-	-	-	+
Tetsudinella patina	-	-	-	-	-	-	+
Trichocerca sp.	-	-	-	-	+	+	-
CLADOCERA							
Alona castata	-	-	-	-	-	-	+
A. rectangula	-	-	-	-	-	+	-
Macrothrix hirusticornis	-	-	-	++	-	-	-
M. spinosa	-	-	-	+++	-	-	-
Moina brachiata	+++	-	-	-	-	-	-

- absent + present ++ fairly present +++ abundant

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Zooplankton were least diverse in Nai Gaj and Nang Spring (St. 1 and St. 3) where only two rotifer and one cladoceran species were found. Nang Spring had comparatively warm water (36.4 ºC). A higher water temperature (35-38 ºC) was also recorded at a fissure of Ghazi Shah Spring (St. 2) (Leghari *et al.*, 2002). Stations like Ghazi Shah Spring and Nai Nang showed comparatively higher species diversity as well as higher populations of rotifera. Nai Looni (St. 6), a slightly brackish water body with higher salt content (1.0 ppt), showed the highest number of zooplankton species (14 species) with abundance of *B. rubens* and *H. mira*. Higher populations of *B. rubens* and *B. plicatilis* were also noted at Nai Kai (St. 5). At Lal Bagh Spring (St. 7), *Keratella* and *Monostyla* were the dominant genera. Stations like Ghazi Shah and Nai Kai (St. 2 and St. 5) were totally devoid of cladocerans whereas at Nai Gaj and Nang Spring (St. 1 and St. 3) higher populations of cladocerans were observed. In general no two cladoceran species co-occurred at any station. No copepod species was documented from these water bodies because adult copepods were not caught. However, appearance of nauplii in the samples substantiate their presence.

4. Discussion:

Our results showed the majority of the zooplankton species were rotifers with low numbers of crustacean zooplankton. *Brachionus* was the most diverse genera followed by *Keratella*. Most of the species belonging to *Brachionus* and *Keratella* are typically cosmopolitan species (Mengestou *et al.*, 1991). The abundance of *Brachionus* species in rotifer faunas is evident in tropical areas (Green, 1972; Pejler, 1977; Fernando, 1980; Sharma and Michel, 1980) as well as in subtropical areas (Shao *et al.*, 2001; Baloch and Soomro, 2004). It is widely accepted that *Brachionus* genus is considered to be the indicator of eutrophic water bodies (Gannon and Stemberger, 1978; Hakkari, 1978; Maemets, 1983) and does not dominate in non-eutrophic environments (Sanoamuang and Savatenalinton, 2001). *Brachionus* genus occurs in freshwater to brackish eutrophic environments (Baloch *et al.*, 2004). Water of stations 1-3 and 5 was slight alkaline (Table 1). No *Brachionus* species was found at stations 1 and 2, however, they contributed very low populations at stations 3 and 5. Their absence probably gives indication of low fertility of these water bodies. Low conductivity and TDS at these stations also indicate that these water bodies are poor in nutrient content.

Another rotifer, *Hexarthra mira*, also appeared at stations 5 and 6. *B. rubens* represents eutrophic indicator species. *B. plicatilis*on the otherhand, is reported to be an indicator of pollution in brackish water with low alkalinity (Rao and Mohan, 1977). *H. mira* is also considered as an indicator species of eutrophication (Roberto *et al.*, 1998; Miura and Cai, 1990; Work and Havens, 2003). The higher conductivity and TDS of these water bodies reflect their higher trophic status. The dominance of these species is evidence of their preference to eutrophic water bodies. The rotifers that occurred at station 7 showed a mixture of meso-eutrophic species. Although *Brachionus* species occurred at station 7, the majority were of *Keratella* and *Monostyla* species, which are considered as indicators of clean running water (Beach, 1960; Baloch, 2000). The lower pH of this water body supports the fact (Table 1).

Cladocera was the second dominant group. However, no adult copepod was recorded. Cladocera was either absent or poorly represented in rotifer-abundant water bodies and vice versa. A similar zooplankton community structure was observed by Cottenie, *et al.*, (2001) in 33 interconnected shallow ponds.

Previous studies on Nai Gaj (Leghari *et al.*, 2002b), Ghazi Shah and Kai springs (Leghari *et al.*,2002a) and Nang spring (Leghari *et al.*, 2004) show higher conductivity and TDS than ours. This is mainly because they collected samples during dry season while our studies were undertaken during flood season. We found majority of rotifers and low populations of crustaceans. Generally rotifers establish populations earlier than crustaceans.

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From the present study it can be concluded that zooplankton fauna of Kirthar area is less diverse. Rotifera generally predominates in most of the water bodies where *Brachionus* species are most diverse and preferred comparatively more fertilized environments. *Keratella* on the other hand occurred in clean water bodies. Crustaceans were less diverse. The area of Kirthar range is very vast with several hundred water bodies. Samples for the present study were collected from those areas only which were easily accessible. An extensive study will further unveil the complete picture of zooplankton community structure of this area.

5. References:

Baloch, W. A. and A. N. Soomro, (2004) Rotifers of the adjacent areas of Hyderabad, Sindh. Pakistan Journal of Zoology **36:** 319-322.

Baloch, W.A., (2000) Occurrence of Planktonic communities in River Indus, at Kotri Barrage, Sindh, Pakistan. Proceedings of Pakistan Congress of Zoology **20:** 77-83.

Baloch, W.A., A. N. Soomro and S.I.H. Jafri, (2004) Zooplankton of highly saline water, near Hyderabad. Sindh University Research Journal (Sci. Ser.) **36:** 25-28.

Battish, S. K. (1992) Freshwater Zooplankton of India. Oxford and IBH publishing co. Pvt. Ltd. N. Delhi.

Beach, N.W. (1960) A study of the planktonic rotifers of the Presque Isle County, Michigan. Ecological Monograph **30:** 339-357.

Cottenie, K., N. Nuytten, E. Michels and L. De Meester. (2001) Zooplankton community structure and environmental conditions in a set of interconnected ponds. Hydrobiologia **442:** 339–350.

Fernando, C. H. (1980) The freshwater zooplankton of Sri Lanka, with a discussion of tropical freshwater zooplankton composition. Int. Rev. ges. Hydrobiol. **65:** 411–426.

Flam, L. (2006) Archaeological research in western Sindh: The Kirthar mountains, Sindh Kohistan and excavations at Ghazi Shah: Sindh past, present and future. 152-184.

Gannon, J. E. and R. S. Stemberger, (1978) Zooplankton (especially crustaceans and rotifers) as indicators of water quality. Trans. American Microscopic Society **97:**16-35.

Green, J. (1972) Latitudinal variation in associations of planktonic Rotifera. Journal of Zoology London **167:** 31–39.

Hakkari, L. (1978) On the productivity and ecology of zooplankton and its role as food for fish in some lakes in central Finland. Biological Research Reports of University Gyvaskyla **4:** 3-87.

Leghari, S.M, T.M. Jehangir, M.Y. Khuhawar and A. Leghari. (2002a) Water quality and water assessment of Ghazi Shah and Kai Springs of district Dadu, Sindh, Pakistan. Online Journal of Biological Sciences **2:** 39-42.

Leghari, S.M, T.M. Jehangir, M.Y. Khuhawar, A.D. Rajper and A. Leghari. (2002b) Physico-chemical and biological study of Gaj and Nai Nalli of district Dadu, Sindh, Pakistan. Biologia (Pakistan) **48:** 293-306.

Leghari, S.M, T.M. Jehangir, M.Y. Khuhawar and A. Leghari. (2004) Some studies on Nang Spring and torrents of Khar center, Khirthar National Park, Gadap area, Malir, Karachi, Sindh, Pakistan. Sindh University Research Journal (Sci. Ser.) **36:** 5-10.

Maemets, A. (1983) Rotifers as indicators of Lake types in Estonia. Hydrobiologia **104:** 357-361.

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Mengestou, S., Green, J. and Fernando, C.H., (1991) Species composition, distribution and seasonal dynamics of rotifera in a Rift Valley Lake in Ethiopia. Hydrobiologia **209**: 203-214.

Miura, T. and Cai Q.H., (1990) Annual and seasonal occurrences of the zooplankter observed in the north basin of Lake Biwa from (1965-1979) Contribution from the Otsu Hydrobiological station, Kyoto University No.337.

Mizuno, T. and Takahashi, E., (1991) An illustrated guide to freshwater Zooplankton in Japan. Tokai University press.

Pejler, B., (1977) On the global distribution of the family Brachionidae (Rotatoria). Arch. Hydrobiol. Suppl. **53:** 255–306.

Rao, R.K & Mohan, P.C. (1977) Rotifers as indicators of pollution. Curt. Sci . **46:** 190.

Roberto, E. Torres-Orozco B. and S.A. Zanatta. (1998) Species composition, abundance and distribution of zooplankton in a tropical eutrophic lake: Lake Catemaco, México. Revita de Biologia Tropical **46:** (online).

Sanoamuang, L and S. Savatenalinton, (2001) The rotifer fauna of Lake Kud-Thing, a shallow lake in Nong Khai Province, northeast Thailand. Hydrobiologia **446/447:** 297-304.

Shao, Z., P. Xie, and Y. Zhuge (2001) Long-term changes of planktonic rotifers in a subtropical Chinese lake dominated by filter-feeding fishes. Freshwater Biology **46:** 973–986.

Sharma BK, RG Michael. (1980). Synopsis of taxonomic studies on Indian Rotatoria. Hydrobiologia **73:** 229-236.

Ward, H.B. and Whipple, G.C., (1959). *Freshwater Biology*. John Wiley and Sons.

Work, K.A. and K.E. Havens. (2003) Zooplankton grazing on bacteria and cyanobacteria in a eutrophic lake. Journal of Plankton Research **25:** 1301-1307.

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