



Studies on Crustacean Diversity in the Aquatic Habitats of Udhampur District, Jammu and Kashmir, India

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ABSTRACT

Crustacea, form an important component of aquatic biotic community. These organisms act as important link in the aquatic food chains besides being viable indicators of trophic status of the aquatic ecosystems. Crustacea are vital for stability and integrity of an aquatic ecosystems. The present study in this context involved a survey of various aquatic habitats of Udhampur district of Jammu province of Union Territory of Jammu and Kashmir. This investigation recorded 17 species of crustacea belonging to 14 genera and 9 families from aquatic habitats of Udhampur district. The crustacean fauna recorded include 10 species of Cladocera, 4 species of Copepoda, 2 species of Decapoda (freshwater Crab) and 1 species of Ostracoda. The percental contribution of different groups of crustacea followed a trend Cladocera (58.8%) > Copepoda (23.5%) > Decapoda (17.6%)>Ostracoda (5.8%) in Udhampur. Further the lentic habitats recorded a rich crustacean diversity as compared to lotic habitats.

Keywords: crustacea, lentic, lotic

INTRODUCTION

Crustacea form an important component of aquatic biotic community and include animals like crabs, shrimps, crayfish, lobsters, krill, barnacles and varied type of zooplanktonic components like cladocera, copepoda, ostracods etc. Crustacea as a taxonomic group, with its rich diversity (numerical & structural), has been elevated to the status of sub-phylum comprising of six classes viz., Remipedia, Cephalocarida, Branchiopoda, Maxillopoda, Ostracoda and Malacostraca (Martin and Davis, 2001).

Crustacea, colonise every type of habitat viz., aquatic, semi aquatic and even edaphic environments (Frey, 1980; Kikuchi, 1994; Defaye and Heymer, 1996). Crustacea consume great quantities of phytoplankton from the open water zone, and influence primary production (Tonno *et al.*, 2003).

Crustacea act as an important link in aquatic food chains. These are vital indicators of trophic status of the water body. Without crustacea,



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aquatic ecosystems would collapse as many crustacea are at the base of aquatic food chains. (Howick and Wilhm, 1984; Lampert and Sommer, 1997). The economic value of crustacea is well documented (Kutty, 2005; Prabhakar and Roy, 2009).

Considering this many workers have investigated and highlighted different aspects of crustacean biology viz., taxonomical studies (Nayar, 1971; Raghunathan and Kumar, 2002; Sharma and Sharma, 2009), energy transfer in aquatic food chains (Dadhick and Sexena, 1999; Sinha and Islam, 2002), bioindicators of water quality (Jha and Bharat, 2003; Padmanabha and Belagali, 2008) and seasonal abundance (Patra and Dutta, 2004; Kiran et al., 2007; Bhoite and Pawar, 2025).

In the context of Jammu and Kashmir state, some data is available about investigation of different aspects of crustacea from Kashmir province (Qadri and Yousuf, 1980; Balkhi and Yousuf, 1992; Ahangar et al., 2012; Shah and Pandit, 2013). However, crustacea as group has almost remained neglected in Jammu province. But for some isolated works (Gupta, 2002, Sharma et al., 2005; Sharma et al., 2012, Kotwal and Sharma, 2020; Kotwal, 2020; Kour et al., 2024) crustacea has almost remained unexplored in this part of the country.

MATERIALS AND METHODS

Udhampur, a hilly district of Jammu province is located between 32° 34' N to 39° 30' North latitude and 74° 16' E to 75° 38' East longitude. It is bordered by Rajouri district in north, Doda district in Northwest, Anantnag in west and Jammu in south-east. It is situated about 66 Km from Jammu at an average elevation of 676 m above msl. About 12 aquatic habitats, which include 7 lotic (flowing) and 5 lentic (stagnant), from different parts of Udhampur district were surveyed for the physico-chemical and biotic analysis. For collection of plankton, approximately 100 litres of water was filtered through plankton net of standard bolting cloth No. 25 (0.03 – 0.04 μ mesh size). The filtrate was taken in plastic vials and preserved in 5% formaldehyde solution. The macro crustacea (Decapoda) samples were collected by using fine mesh cast nets (mesh size 4mm) with the help of an expert fisherman. The collected samples were fixed in 10% formaldehyde solution and brought to laboratory for taxonomic studies. These samples were brought to laboratory for qualitative and quantitative studies following the standardised protocols. (Ward and Whipple, 1959; Edmondson and Winberg, 1971; Pennak, 1978 and APHA, 1985).

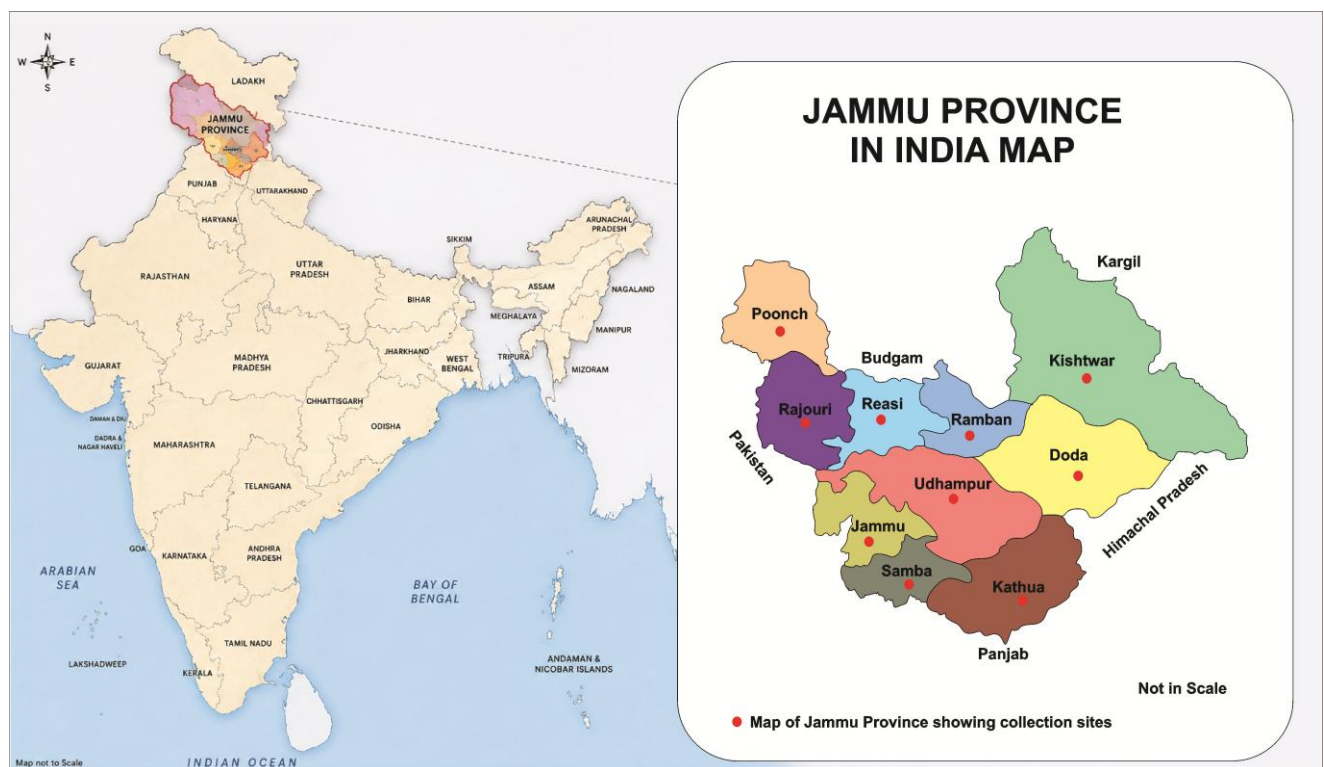


Figure 1: Map of India Showing study area in Jammu province

$$\text{Number/l} = \frac{C \times 1000m^3}{A \times D \times F}$$

Where C= Number of organisms counted
A= Area of field
D= Depth of the field (mm)
F= Number of fields counted.

The quantitative estimation of macro-crustacea was done by the Catch Per Unit Effort (CPUE) technique as per Maunders et al., 2006.

$$\text{CPUE} = \frac{\text{Total Number of macro crustacean sampled}}{\text{Number of Catch Efforts}}$$

Statistical analysis: The data obtained was subjected to standard statistical analysis indices.

RESULT AND DISCUSSION

During the present investigation of some aquatic habitats of Udhampur district total 17 crustacean species viz., *Daphnia similis*, *Daphnia magna*, *Daphnia rosea*, *Ceriodaphnia reticulata*, *Simocephalus serrulatus*, *Scapholeberis kingi*, *Moina brachiata*, *Alona rectangula*, *A. guttata*, *Macrothrix laticornis*, *Mesocyclops hyalinus*, *Cyclops bicolor*, *Eucyclops agilis*, *Paradiaptomus greeni*, *Macrobrachium dayanum*, *Maydelliatelphusa masoniana* and *Stenocypris* sp. belonging to 14 Genera viz., *Daphnia*, *Simocephalus*, *Scapholeberis*, *Moina*, *Ceriodaphnia*, *Alona*, *Macrothrix*, *Mesocyclops*, *Cyclops*, *Paradiaptomus*, *Eucyclops*, *Macrobrachium*, *Maydelliatelphusa* and *Stenocypris* and 9 Families viz.,

Daphnidae, Moinidae, Chydoridae, Macrothricidae, Cyclopidae, Diaptomidae, Cyprididae, Palaemonidae and Gecarcinucidae, were recorded.

The crustacea recorded from study area include, 10 species of Cladocera, 4 species of Copepoda, 2 species of Decapoda and 1 species of Ostracoda. The percental contribution of different groups of crustacea, as shown in figure 2, follows the trend, Cladocera (58.8%) > Copepoda (23.5%) > Decapoda (11.7%) > Ostracoda (5.8%) in aquatic ecosystems surveyed presently in Udhampur district of Jammu province. Similar observations have been made by Green et al., 2005 and Wang et al., 2007.

The distribution pattern of crustacea revealed that lentic habitats of udhampur recorded 15 crustacean species viz., *Daphnia similis*, *D. magna*, *D. rosea*, *Simocephalus serrulatus*, *Scapholeberis kingi*, *Moina brachiata*, *Ceriodaphnia reticulata*, *Alona rectangula*, *A. guttata*, *Macrothrix laticornis*, *Mesocyclops hyalinus*, *Cyclops bicolor*, *Paradiaptomus greeni*, *Eucyclops agilis* and *Stenocypris* sp. belonging to 12 Genera viz., *Daphnia*, *Simocephalus*, *Scapholeberis*, *Moina*, *Ceriodaphnia*, *Alona*, *Macrothrix*, *Mesocyclops*, *Cyclops*, *Paradiaptomus*, *Eucyclops*, *Stenocypris*; 7 Families viz., Daphnidae, Moinidae, Chydoridae, Macrothricidae, Cyclopidae, Diaptomidae and Cyprididae; 3 Orders viz., Diplostraca, Cyclopidae and Podocopida and 3 classes viz., Brachiopoda, Maxillopoda and Ostracoda.

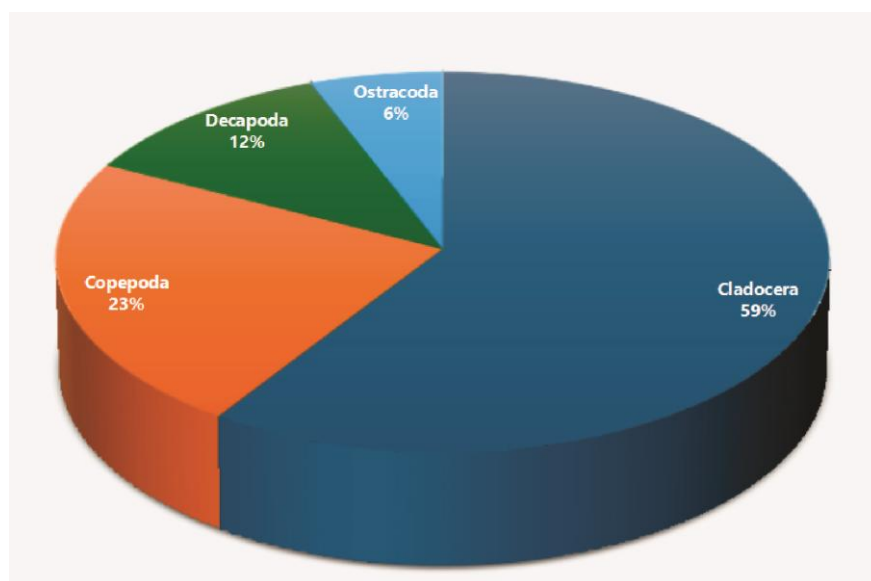


Figure 2: Percental Composition of Crustacean Fauna in Udhampur District

Table 1: List of Cladocera reported from the freshwater habitats of Udhampur district (J&K)

S. No.	Name of Cladocera
1.	<i>Daphnia magna</i>
2.	<i>Daphnia rosea</i>
3.	<i>Daphnia similis</i>
4.	<i>Simocephalus serrulatus</i>
5.	<i>Scapholeberis kingi</i>
6.	<i>Ceriodaphnia reticulata</i>
7.	<i>Macrothrix laticornis</i>
8.	<i>Moina brachiata</i>
9.	<i>Alona rectangula</i>
10.	<i>Alona guttata</i>
11.	<i>Eucyclops agilis</i>
12.	<i>Mesocyclops hyalinus</i>
13.	<i>Cyclops bicolor</i>
14.	<i>Paradiaptomus greeni</i>
15.	<i>Stenocypris sp</i>
16.	<i>Macrobrachium dayanum</i>
17.	<i>Maydelliatelphusa masoniana</i>

Further, the lotic habitats recorded presence of 7 crustacean species viz., *Daphnia similis*, *D. rosea*, *Moina brachiata*, *Eucyclops agilis*, *Stenocypris sp.*, *Macrobrachium dayanum* and *Maydelliatelphusa masoniana* belonging to 6 genera viz., *Daphnia*, *Moina*, *Eucyclops*, *Stenocypris*, *Macrobrachium* and *Maydelliatelphusa*; 6 families viz., *Daphnidae*,

Moinidae, *Cyprididae*, *Cyclopidae*, *Palaemonidae* and *Gecarcinucidae*; 4 Orders viz., *Diplostraca*, *Podocopida*, *Cyclopoida* and *Decapoda* from 4 Classes viz., *Branchiopoda*, *Maxillopoda*, *Ostracoda* and *Malacostraca*.

Perusal of Table 2 & 3 clearly highlights the quantitative and qualitative richness of crustacea in lentic habitats in comparison to the lotic habitats. In this context, the Ramnagar pond recorded highest Species Diversity Index (2.095) and Species Richness Index (1.785). One of the investigated lentic systems, the Sangur Bowli, did not record any crustacean faunal element which may be attributed to regular water drawl by local population.

The rich diversity of crustacea in lentic habitats, as compared to lotic habitats may be attributed to the rich autochthonous production and to some extent the allochthonous production in these habitats. These findings are in concordance with the observations made by Raghunathan, 1983; Sharma, 1991; Balkhi and Yousuf, 1996 and Kotwal and Sharma, 2020.

A specific habitat preference has been recorded in some species during present investigation. In this context prevalence of *Alona rectangula*, *A. guttata*, *Macrothrix rosea*, *Scapholeberis kingi* and *Maydelliatelphusa masoniana* was found in the aquatic habitats with vegetation cover and macrophyte growth.

Table 2: Diversity Indices of Crustacea Inhabiting the Aquatic Habitats of Udhampur.

Aquatic Habitat	Taxa	Individuals	Dominance	Margalef's Index	Shannon Wiener Index	Simpson Index
Lotic Habitats						
Tikkri Stream	4	48	0.4019	0.775	1.083	0.5981
Narsoo Nallah	1	7	1	0	0	0
Kotli Nallah	3	19	0.4294	0.6792	0.9592	0.5706
Malvar Stream	3	20	0.4905	0.6676	0.8568	0.505
Chennani Nallah	0	0	0	0	0	0
Samroli Nallah	2	9	0.5556	0.4551	0.6365	0.4444
River Tawi	0	0	0	0	0	0
Lentic Habitats						
Chennani reservoir	4	28	0.3699	0.9003	1.139	0.6301
Ramnagar pond	10	155	0.1406	1.785	2.095	0.8594
Sangar Pond	6	73	0.2265	1.165	1.591	0.7735
Sangur Bowli	0	0	0	0	0	0
Bye pass pond	7	88	0.1955	1.34	1.746	0.8045

Table 3: Statistical Data of Crustacea Inhabiting Lentic Habitats of Udhampur.

Crustacea	Density	Relative Density	Frequency	Relative Frequency	Abundance
<i>Daphnia similis</i>	0.012	0.95	20.0	3.70	0.06
<i>Daphnia magna</i>	0.008	0.63	20.0	3.70	0.04
<i>Daphnia rosea</i>	0.028	2.23	20.0	3.70	0.14
<i>Simocephalus serrulatus</i>	0.096	7.62	60.0	11.1	0.16
<i>Scapholeberis kingi</i>	0.036	2.85	20.0	3.70	0.18
<i>Moina brachiata</i>	0.18	14.28	60.0	11.1	0.30
<i>Ceriodaphnia reticulata</i>	0.068	5.39	20.0	3.70	0.34
<i>Alona rectangula</i>	0.228	18.09	60.0	11.1	0.38
<i>Alona guttata</i>	0.036	2.85	20.0	3.70	0.18
<i>Macrothrix laticornis</i>	0.048	3.80	40.0	7.40	0.12
<i>Cyclops bicolor</i>	0.20	15.87	60.0	11.1	0.33
<i>Mesocyclops hyalinus</i>	0.092	7.30	20.0	3.70	0.46
<i>Paradiaptomus greeni</i>	0.068	5.39	20.0	3.70	0.34
<i>Eucyclops agilis</i>	0.056	4.44	40.0	7.40	0.14
<i>Stenocypris sp.</i>	0.104	8.25	40.0	7.40	0.26

Table 4: Statistical Data of Crustacea Inhabiting Lotic Habitats of Udhampur.

Crustacea	Density	Relative Density	Frequency	Relative Frequency	Abundance
<i>Daphnia similis</i>	0.005	2.65	14.2	7.11	0.04
<i>Daphnia rosea</i>	0.023	12.2	28.5	14.2	0.08
<i>Moina brachiata</i>	0.020	10.6	28.5	14.2	0.07
<i>Eucyclops agilis</i>	0.061	32.4	42.8	21.4	0.14
<i>Stenosypris sp.</i>	0.074	39.2	42.8	21.4	0.17
<i>Macrobrachium dayanum</i>	0.0038	2.01	28.5	14.2	0.013
<i>Maydelliathelphusa masoniana</i>	0.0017	0.9	14.2	7.11	0.012

Table 5: Physico-chemical parameters of Aquatic habitats of Udhampur

S. No	Aquatic Habitat	Atm. Temp. °C	Water Temp. °C	pH	FCO ₂ (mg/l)	DO (mg/l)	CO ₃ ²⁻ (mg/l)	Cl ⁻ (mg/l)
Lotic								
1.	Tikkri Stream	27.0	20.0	7.2	7.7	6.8	Ab	7.48
2.	Samroli Nallah	27.0	18.0	7.6	2.9	4.4	Ab	18.84
3.	Narsoo Nallah	28.0	18.0	7.4	2.8	5.8	Ab	15.58
4.	Malvar Stream	29.0	21.5	7.7	3.4	10.4	Ab	14.48
5.	Chennani Nallah	21.0	15.0	8.5	Ab	9.8	25.82	18.51
6.	River Tawi, Udhampur	29.0	17.0	7.7	Ab	6.6	43.52	17.78
Lentic								
7.	Kotli Nallah	27.5	21.0	7.8	Ab	7.5	8.36	9.27
8.	Sangur Bowli	29.0	24.0	7.2	2.5	2.8	Ab	5.38
9.	Bye pass pond	31.0	22.5	7.1	3.5	4.8	Ab	16.68
10.	Ramnagar pond	28.5	20.0	6.8	7.5	4.5	Ab	11.63
11.	Chennani reservoir	23.0	16.0	8.4	Ab	6.7	21.3	33.29
12.	Sangar pond	26.0	20.0	7.2	4.7	3.4	Ab	11.32

The strong affinity of these species (*Alona rectangula*, *A. guttata*, *Macrothrix rosea*, *S. kingi* and *Maydelliatelphusa masoniana*) for vegetation demonstrates their phytophilous nature. Further the littoral zones can be regarded as preferential region for these crustacea in aquatic habitats. Similar observations have been made by Scourfield and Harding, 1996; Sharma *et al.*, 2012; Kotwal, 2020.

In this context some species viz., *Moina micrura*, *Ceriodaphnia cornuta*, *Stenocypris sp.*, *Mesocyclops hyalinus* and *Paradiaptomus greeni* were recorded to be quite prevalent in the limnetic zones and hence can be regarded as open water species (Fernando, 1980).

A perusal of Table 3 & 4 reveals that *Alona rectangula* recorded maximum Density, Relative density, frequency and abundance in both lentic habitats while *Stenocypris sp.*, recorded its prevalence in lotic habitats investigated during present investigation. Dominance of these crustacean species can be attributed to their adaptability and tolerance to the physico-chemical and biotic parameters (Shah and Pandit, 2013; Kotwal, 2020).

Perusal of Table 5 reveals the variations in some physico-chemical parameters prevailing in lotic and lentic water bodies investigated randomly (one time) in the different periods of the year during present study. It has been observed that the Atmospheric temperature ranged from 21.0°C - 31.0°C, water temperature from 15.0°C - 24.0°C, pH from 6.8 - 8.5, free carbon dioxide from 0-7.5mg/l, dissolved oxygen content from 2.8 to 10.4 mg/l, Carbonate from 0 - 43.52 mg/l while Chloride content varied between 5.38 to 33.29 mg/l.

CONCLUSION

The investigation of aquatic habitats (5 lentic and 7 lotic) established presence of 17 species of crustacea belonging to 14 genera and 9 families in Udhampur district of Union Territory of Jammu and Kashmir. Family Daphnidae of class Branchiopoda was recorded as the most dominant family contributing 10 crustacean species inhabiting the freshwaters of udhampur district. Further some crustacean species recorded specific habitat preferences.

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Conflict of interest

The authors declare no competing interests.

Data Availability Statement: Not applicable.

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