

Original Research Article

Ecological studies on benthic community of Asigaga River, Uttarkashi, Uttarakhand, India



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ABSTRACT

The Benthos characteristics of the Asiganga River were analyzed during November 2008-October 2009. The samples were collected from Sangamchatti (Site—S1) and Gangori (Site—S2) at Uttarkashi. A total of 20 benthic genera were recorded in present study belonging to six major groups viz. Ephemeroptera (4), diptera (6), trichoptera (5), coleoptera (2), lepidoptera(1), plecoptera (1) and neuroptera (1). The present study revealed that the water quality of river Asiganga was fairly good for the growth and survival of benthos, and as a result it sustains the higher benthic diversity of Asiganga River.

KEYWORDS

Benthos | Density | Margalef's Index | River Asiganga | Uttarkashi | Uttarakhand

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Introduction

Rivers are the most important freshwater resources because of their support and maintenance of macro and micro ecosystems. These riverine systems carry water from the mountains to the sea, furling the water cycle, coupling land, ocean and the atmosphere (Karr, 1999). Social, economic and political development of mankind has in the past, been largely related to the availability and distribution of freshwater contained in riverine systems.

Benthic organisms are those organisms that live on or inside the deposit at the bottom of a water body (APHA, 1985). These organisms play a vital role in the circulation and recirculation of nutrients in aquatic environments. They constitute the link between the unavailable nutrients in detritus and useful protein materials in fish. Most benthic organisms feed for a wide range of fishes (Adoni, 1985; Arimoro *et al.*, 2007).

Macrobenthic invertebrates are also those organisms often retained by mesh sizes of 0.05 m² (Mason, 1981) although the early stages of many macrobenthic invertebrates species are smaller than this size. Several benthic species are relatively long lived, with life spans ranging from weeks for some opportunistic worms to months or years for larger taxa (Bamikole *et al.*, 2009).

Materials and methods

River Asiganga is located in district Uttarkashi which is formed by the confluence of Kaldi Gad and Gajoli Gad at Sangamchatti (1540 msl). River Asiganga is the one of the major tributary of River Bhagirathi which merges with River Bhagirathi at Gangori (1436 msl). In the present investigation focus were made on the study of benthos of River Asiganga of Garhwal Himalaya.

Two sampling sites viz. S1 (Sangamchatti) and S2 (Gangori) were selected and sampling was done at both the sites at monthly interval from November 2008 to October 2009. For the estimation of benthic diversity samples was collected by quadrat method of 1 sq. feet collected in the glass tube and fixed in 5% formalin. The number of individual in 1 sq. feet convert into 1sq. meter

by multiplying 10.765, because 1m²=10.765 feet². For statistical analysis Margalef Index (1951) were used. Macrozoobenthos were collected from the selected sampling sites using Surber's square-foot sampler (Welch, 1952). For identification of macrozoobenthos, Ward and Whipple (1959), Needham and Needham (1962) and Tonapi (1980) were referred.

Margalef's Index (d): is a measure of species richness and is expressed as:

$d = (S - 1) / \ln N$, Where; d = Species richness index, S = Number of species in the sample, N = Number of individuals in the samples (Margalef, 1951).

Result and Discussion

The nature of bottom substrates is one of the most significant environmental parameters in influencing the biodiversity of stream (Wisely, 1962; Hynes, 1970; Hawkins, 1984; Minshall, 1984; Angrerdi, 1996). The riverine ecosystem of Song River comprises of boulders, pebbles, sand, silt and clay. The sampling site S1 is dominated by big boulders which do not provide a suitable shelter to aquatic benthos while site S2 was dominated by small boulders and cobbles which provide a suitable shelter for aquatic benthic organisms. Ward (1994) also pointed out that the boulders and cobbles are the dominant features of headwater streams.

A total of 20 (twenty) genera (Heptagenia, Epeorus, Baetis, Ephemerella, Pedicia, Antocha, Dixa, Atherix, Chironomus, Simulium, Triaenodes, Leptocella, Hydropsyche, Philopotamus, Limnephilus, Hydrochara, Psephenus, Nymphulla, Perla, Corydalish) of benthic invertebrates fauna belonging to 7 classes (Ephemeroptera, Diptera, Trichoptera, Coleoptera, Lepidoptera, Plecoptera, Neuroptera) and 17 families (Heptageniidae, Baetidae, Ephemerellidae, Tipulididae, Dixidae, Rhagionidae, Tendipedidae, Simuliidae, Leptoceridae, Hydropsychidae, Philopotamidae, Limnephilidae, Hydrophilidae, Psephenidae, Ichneumonidae, Perlidae, Corydalidae) were found in the study. Table 1 shows the total number of families, species and percentage composi-

tion of the macro invertebrate fauna in the study area. Singh and Nautiyal (1990) recorded 30 taxa of macro-invertebrates dominated by Ephemeroptera and followed by Diptera, Trichoptera and Plecoptera in the river Ganges. Sehgal (1990) recorded 57 genera of insects from 11 rivers of the North-Western Himalaya. Joshi (1991) observed 50 genera of insects from Sherkhad stream in Himachal Pradesh and Bhatt and Pathak (1992) recorded 68 genera of insects from various rivers of Kumaon region. Under the present study, 20 genera of aquatic insects dominated by Ephemeroptera and followed by Diptera, Trichoptera, Plecoptera, Coleoptera, Lepidoptera, Plecoptera, Neuroptera and indicates that Asiganga River which has all major components of typical hill stream shows a good distributional pattern of benthic invertebrates.

The population density of benthic macroinvertebrates fluctuates in between 91.17 in/m² at S1 to 1447.84 in/m² at S2. In the present study, population density of ephemeroptera fluctuated in between 16.14 in/m² at S1 and S2 to 635.11 m² at S2. Plecoptera population density ranged in be-

tween 5.38 m² at S1 and S2 to 59.20 m² at S2. Diptera, it fluctuated in between 5.38 m² at S1 to 220.68 m² at S2. Coleoptera, it fluctuated in between 5.38 m² at S1 to 172.23 m² at S2. Trichoptera, it fluctuated in between 26.9 m² at S1 to 699.71 m² at S2. Lepidoptera, it fluctuated in between 5.38 m² at S1 and S2 to 32.29 m² at S1. Neuroptera, it fluctuated in between 10.77 m² at S1 and S2 to 21.53 m² in at S2 (Table 2 and Figure 1).

In site S1 values of Margalef index varied from (H=1.43 to H=3.17). Site S2 recorded Margalef index (H=0.47 to H=3.33) (Table 3 and Figure 2). Margalef index values exhibited their higher values at the upstream site S1, whereas their lower values were obtained from the downstream site S2. High values of diversity indexes in the upstream sections of River Asiganga reflected the stability of the physical and chemical characteristics of the river in the upstream sections. On the other hand low values of diversity found in the downstream sections may be due to the increased influence of human activities.

| Class | Family | Genus |
|---------------|----------------|---|
| Ephemeroptera | Heptageniidae | <i>Heptagenia,</i> <i>Epeorus,</i> |
| | Baetidae | <i>Baetis</i> |
| | Ephmerellidae | <i>Ephemerella</i> |
| Diptera | Tipulid | <i>Pedicia, Anto-</i> <i>cha</i> |
| | Dixidae | <i>Dixa</i> |
| | Rhagionide | <i>Atherix</i> |
| | Tendipedidae | <i>Chironomus</i> |
| | Simuliidae | <i>Simulium</i> |
| Trichoptera | Leptoceridae | <i>Triaenodes,</i> <i>Leptocella</i> |
| | Hydropsychidae | <i>Hydropsyche</i> |
| | Philopotamidae | <i>Philopotamus</i> |
| | Limnephilidae | <i>Limnephilus</i> |
| Coleoptera | Hydrophilidae | <i>Hydrochara</i> |
| | Psephenidae | <i>Psephenus</i> |
| Lepidoptera | Ichneumonidae | <i>Nymphulla</i> |
| Plecoptera | Perlidae | <i>Perla</i> |
| Neuroptera | Corydalidae | <i>Corydalish</i> |

Table 1: Check list of Benthos of River Asiganga, Uttarkashi from November 2008 to October 2009

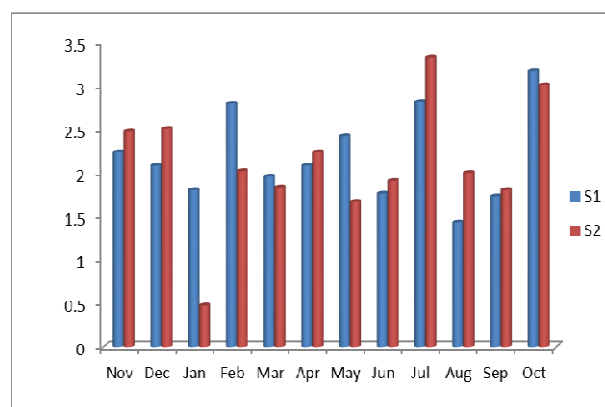


Fig. 1: Graph showing fluctuation in total density of benthos

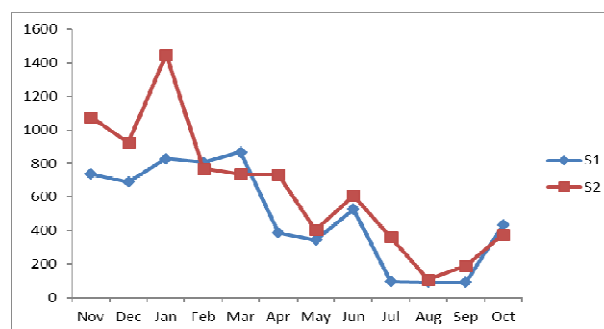


Fig. 2: Margalef Index (d) in River Asiganga from Collection Spots (S₁ and S₂)

| Months | Ephemeroptera | | Plecoptera | | Diptera | | Coleoptera | | Trichoptera | | Lepidoptera | | Neuroptera | | Total | |
|--------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | S ₁ | S ₂ | S ₁ | S ₂ | S ₁ | S ₂ | S ₁ | S ₂ | S ₁ | S ₂ | S ₁ | S ₂ | S ₁ | S ₂ | S ₁ | S ₂ |
| Nov | 317.56 | 635.11 | 43.06 | 59.20 | 102.26 | 199.14 | 21.53 | 26.9 | 252.96 | 156.09 | - | - | - | - | 737.37 | 1076.44 |
| Dec | 296.02 | 355.2 | 32.29 | - | 145.32 | 209.91 | 53.82 | 166.85 | 129.17 | 193.76 | 32.29 | - | - | - | 688.91 | 925.72 |
| Jan | 479.03 | 468.27 | 43.06 | 37.67 | 123.79 | 193.75 | 26.91 | 48.44 | 156.08 | 699.71 | - | - | - | - | 828.87 | 1447.84 |
| Feb | 355.23 | 333.7 | 10.76 | - | 156.09 | 150.7 | 10.76 | 10.76 | 269.11 | 269.11 | 5.38 | 5.38 | - | - | 807.33 | 769.65 |
| Mar | 317.56 | 209.91 | 16.14 | 26.91 | 172.23 | 43.06 | - | 172.23 | 360.6 | 285.26 | - | - | - | - | 866.53 | 737.37 |
| Apr | 129.17 | 156.08 | 5.38 | 10.76 | - | 113.02 | - | 53.82 | 252.91 | 398.28 | - | - | - | - | 387.46 | 731.96 |
| May | 96.87 | 102.25 | 10.76 | 5.38 | 150.71 | 220.68 | 16.14 | - | 69.97 | 75.34 | - | - | - | - | 344.45 | 403.65 |
| Jun | 32.29 | 37.66 | - | - | 80.73 | 102.68 | 10.76 | 26.91 | 392.91 | 430.60 | - | - | 10.77 | 10.77 | 527.46 | 608.62 |
| Jul | 21.52 | 86.1 | - | 10.76 | 5.38 | 64.58 | - | 16.14 | 48.43 | 177.6 | - | 5.38 | 21.53 | - | 96.86 | 360.56 |
| Aug | 16.14 | 16.14 | 5.38 | 16.14 | - | - | 5.38 | - | 64.58 | 75.35 | - | - | - | - | 91.48 | 107.63 |
| Sep | 58.9 | 107.64 | 16.14 | 10.76 | - | - | - | 32.29 | 26.9 | 37.67 | - | - | - | - | 91.17 | 188.36 |
| Oct | 226.05 | 177.6 | 10.76 | 5.38 | 34.66 | 59.2 | 10.76 | - | 172.22 | 134.55 | - | - | - | - | 432.92 | 376.73 |

Table 2: Density of benthos Site S₁ and S₂ of River Asiganaga, Uttararkashi from November 2008 to October 2009

| Months | No. of genera (S) | | Total No. of individuals (N) | | In N | | Diversity index (H) | |
|--------|-------------------|----------------|------------------------------|----------------|----------------|----------------|---------------------|----------------|
| | S ₁ | S ₂ | S ₁ | S ₂ | S ₁ | S ₂ | S ₁ | S ₂ |
| Nov | 12 | 14 | 137 | 189 | 4.91 | 5.24 | 2.24 | 2.48 |
| Dec | 11 | 14 | 122 | 176 | 4.80 | 5.17 | 2.08 | 2.51 |
| Jan | 10 | 13 | 146 | 269 | 4.98 | 5.59 | 1.80 | 0.47 |
| Feb | 13 | 11 | 150 | 143 | 5.01 | 4.96 | 2.80 | 2.02 |
| Mar | 11 | 10 | 161 | 137 | 5.08 | 4.92 | 1.96 | 1.83 |
| Apr | 10 | 12 | 75 | 136 | 4.31 | 4.91 | 2.08 | 2.24 |
| May | 11 | 8 | 62 | 66 | 4.12 | 4.19 | 2.42 | 1.67 |
| Jun | 9 | 10 | 94 | 110 | 4.54 | 4.70 | 1.76 | 1.91 |
| Jul | 9 | 15 | 17 | 67 | 2.83 | 4.20 | 2.82 | 3.33 |
| Aug | 5 | 4 | 16 | 20 | 2.78 | 3.0 | 1.43 | 2.00 |
| Sep | 6 | 7 | 18 | 28 | 2.89 | 3.33 | 1.73 | 1.80 |
| Oct | 15 | 14 | 83 | 75 | 4.41 | 4.32 | 3.17 | 3.01 |

Table 3: Monthly Margalef index of Benthos at Site S₁ and S₂ of River Asiganaga, Uttararkashi from November 2008 to October 2009

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