



Diversity of Zooplankton in River Siang of Arunachal Pradesh, India

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Abstract

Zooplankton is a group of micro-organisms which do not have strong power of locomotion and usually move by being drifted by water current. In up-stream region of River Siang, they were less in numbers in most of the sampling sites. During the study period, 24 different genera of zooplankton were recorded from the River Siang. The recorded zooplanktons were classified into 5 different groups, among which, Protozoans were represented by 6 genera (22%); Rotifera by 7 genera (30%); Cladocera by 5 genera (22%); Ostracoda by 1 genus (4%) and Copepoda were represented by 5 genera (22%).

Keywords: Zooplankton; Seasonal Variations; Diversity; River Siang; Arunachal Pradesh

Introduction

Limnology is an inter-disciplinary science which involves a great deal of detailed field as well as laboratory studies to understand the structural, functional aspects and problems associated with the fresh water environment, from a holistic point of view [1]. Aquatic biodiversity is threatened primarily by human abuse and mismanagement of both living resources and the ecosystems that support them. Most of the ponds are getting polluted due to domestic waste, sewage, industrial and agricultural effluents. The requirement of water in all lives, from micro-organisms to man is a grave problem today because all water resources have reached a point of crisis due to unplanned urbanization and industrialization.

Floodplain lakes are common features of the river systems in North East India. The floodplain lake of Assam is a highly productive system producing around 100 kg ha⁻¹yr⁻¹ from Indian reservoirs [2]. The floodplain lakes form an important component of inland aquatic resources of northeastern India, exhibit significant fishery potential and are mainly located in the states of Assam. Little is known so far about biological productivity of these interesting ecotones in general, and about composition, abundance and ecology in zooplankton in particular [3] from certain floodplains lake of Assam. While

Sharma [4] studied their ecology in Deepor Beel (Ramsar Site), some of the workers who made significant contributions in zooplankton and phytoplankton are Edmondson, Boney, Hobro and Willen, Pennak, Ramakrishnan and Sarkar, Bhati and Rana, Islam et al., Acharjee et al., Daimari et al., Kar and Barbhuiya, Salve and Hiware, Nikam, Veerrendra et al, Singh and Sharma, Rajagopal et al. [5-19]

Study site

The River Siang is the largest river of Brahmaputra river system, originating from Chema Yungdung Glacier near Kubi at 5150 m in Tibet. Popularly known as Tsang-Po in Tibet, it flows in the West–East direction. After traversing a distance of about 1625 km in Tibet, it takes a turn in south direction, enters the territory of India near Tuting in the Upper Siang district of Arunachal Pradesh, and flows through North–South direction in East Siang district towards Assam and finally merges with Lohit and Dibang in Assam, becoming the mighty River Brahmaputra (Das et. al. 2014a, Das et. al. .2014b, Das and, 2015) [20-23].

Materials and Methods

Plankton samples, from the River Siang, were collected using plankton net made of bolting silk cloth (Nylobolt No 25 standard) having a mesh size of 0.2 mm. The plankton net was first tied to a weight and attached to a stick marked at 50 cm.

The net was allowed to dip till it reached the mark and dragged for a distance of 24.39 m. The plankton samples were collected by filtering 6 litres of water from the studied site in the river and preserved in 5 % formalin in 50 ml capacity plankton sampling tube. The planktons were studied by the Lackey's drop method under a LABOMED- make binocular light microscope in the laboratory and first sorted out into different groups using a Microscope; detailed taxonomic identification was done with the help of following standard keys and literature. Counting was done by using Sedgwick- Rafter Counting Cell [24-27].

Results and Discussion

River Siang is Hill-Stream first order river; has colluvial (landslide from adjacent hill slopes delivering sediments and organic matter) valley segment and pool-riffle type of reach. This reach type is most commonly associated with small to mid-size streams and is a quite prevalent type of reach in the rheophilic zones. On the other hand, runs are generally laminar flow of water with sandy substratum. Pools, riffles and runs are generally found to dominate the micro-habitat type with frequent occurrence of trench pools. This river is said to be more entrenched based on V-shaped valley segment. The substrate type has been found to be dominated by gravels and cobbles with frequently-occurring quite large number of boulders and some bed rocks.

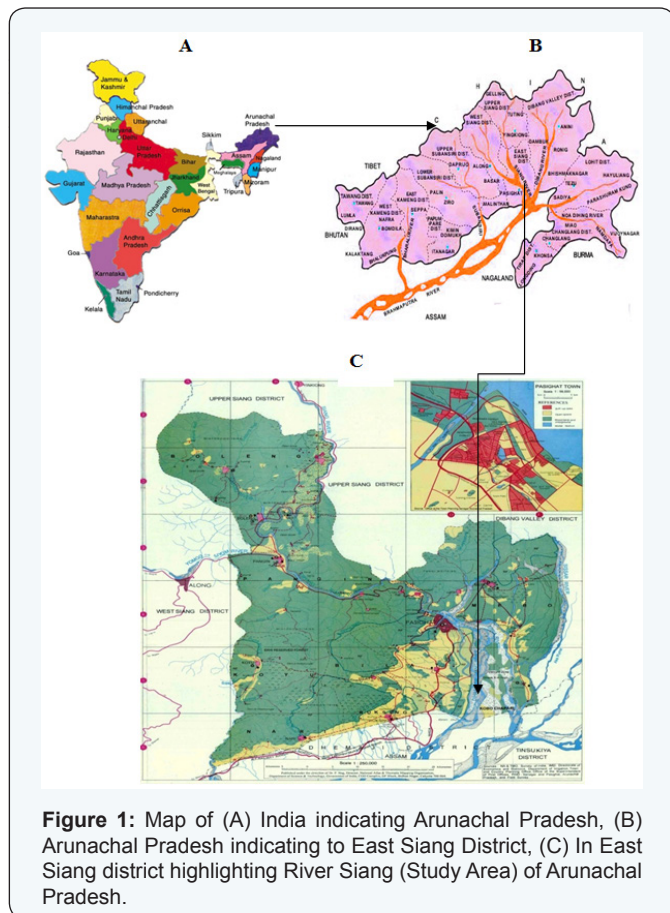


Figure 1: Map of (A) India indicating Arunachal Pradesh, (B) Arunachal Pradesh indicating to East Siang District, (C) In East Siang district highlighting River Siang (Study Area) of Arunachal Pradesh.

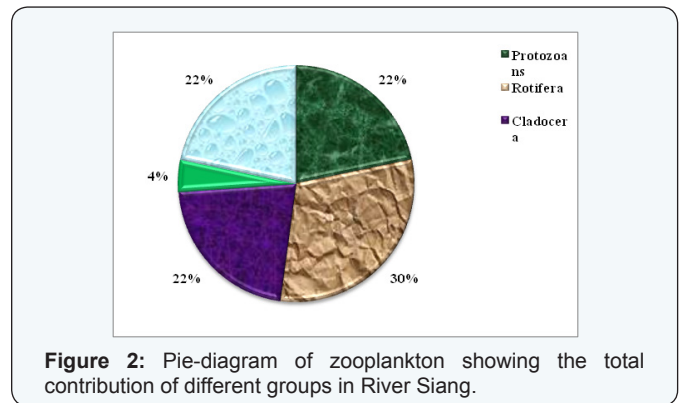


Figure 2: Pie-diagram of zooplankton showing the total contribution of different groups in River Siang.

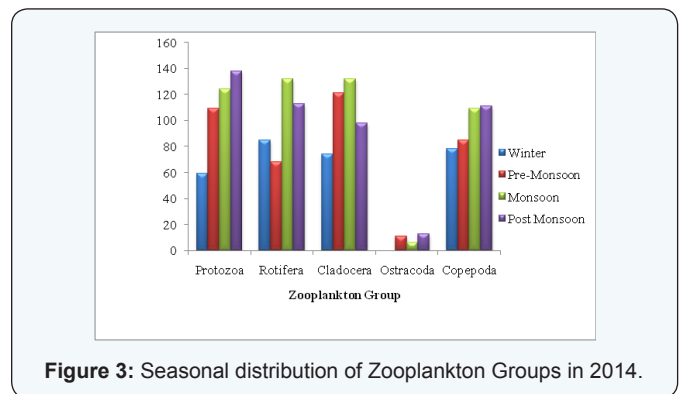


Figure 3: Seasonal distribution of Zooplankton Groups in 2014.

In River Siang, it had been observed that Rotifers were found to be dominant group; while, Ostracoda were found to be a less abundant group during the whole study period (Figures 1-3). The study revealed that the increase in the number of zooplankton was in accordance with the temperature and its habitat. This study also showed that zooplankton species survive in the neutral condition in River Siang. It has been observed that fish density and plankton number are having relationship with water temperature which is in conformity with Chakravarty et al. [28]. Variation in bio chemical activity, velocity, volume, substrate, cover, water sources and a number of additional features operating seasonally [29] may be possible factor for variation in temperature.

During monsoon season, adverse effect on planktonic forms has been recorded particularly at certain gradient zones. It is apparent that sudden influx of water in the river during that season should be the causative factor for such phenomenon. The same view was also observed by Barner [30]. Occurrence of zooplankton in rapids and upstream and some portion of mid stream of River Siang have been found to be very less. It has been observed that increase in water current and turbidity affects zooplankton adversely.

In River Siang, the highest population of zooplankton (453) is found in monsoon season, while the lowest (296) in the winter season. Species richness (S) was highest (24) in monsoon and lowest as (20) in both winter and pre-monsoon seasons. Species diversity index (H') recorded between 3.004

and 2.711; maximum in post monsoon and minimum in winter. Simpson index of dominance (D) ranged between 0.07843 and 0.5644 maximum in winter and minimum in post monsoon. Simpson index of diversity (1-D) recorded 0.9436 post monsoon and 0.9216 in winter season. Evenness (e^H/S) ranged between

0.8766 and 0.7523; maximum in post monsoon and minimum in winter seasons. Margalef index (D) was recorded between 3.761 and 3.268; maximum in monsoon and minimum in pre-monsoon seasons (Tables 1-3) [31].

Table 1: Habitat Characteristics of Siang River.

Habitat Characteristics						
Stream Order	Microhabitat Type	Cover Type	Substrate Type	Riparian Land Use	Signs of Erosion	Valley Segment
First Order	Rifle, Cascade,	Under cut bedrock, Overhanging, Depth, Turbulence Cover, Small Woody Debris.	Boulders Cobbles, Gravels and Fine Sands	Human Habitation, Fishing, Protected Areas as Reserved Forest and Agricultural Use	Visible	Colluvial

Table 2: Status of Zooplankton recorded in different seasons and different year.

Sl. No	Group	Genera	2014			
			Winter	Pre-Monsoon	Monsoon	Post Monsoon
1	Protozoa	<i>Actinophrys sp.</i>	+	+	+	+
2		<i>Amoeba sp.</i>	+	+	+	-
3		<i>Arcella sp.</i>	+	+	+	+
4		<i>Ceratium sp.</i>	+	+	+	+
5		<i>Paramecium sp.</i>	+	+	+	+
6		<i>Peridinium sp.</i>	+	+	+	+
7	Rotifera	<i>Asplanchna sp.</i>	+	+	+	+
8		<i>Brachionus sp.</i>	+	+	+	+
9		<i>Lecane sp.</i>	+	-	+	+
10		<i>Filinia sp.</i>	+	-	+	+
11		<i>Keratella sp.</i>	+	+	+	+
12		<i>Philodina sp.</i>	+	-	+	+
13		<i>Polyarthra sp.</i>	-	+	+	+
14	Cladocera	<i>Alona sp.</i>	+	+	+	+
15		<i>Bosmina sp.</i>	+	+	+	+
16	Cladocera	<i>Ceriodaphnia sp.</i>	-	+	+	+
17		<i>Daphnia sp.</i>	+	+	+	+
18		<i>Moina sp.</i>	+	+	+	+
19	Ostracoda	<i>Cypris sp.</i>	-	+	+	+
20	Copepoda					
		<i>Cyclops sp.</i>	+	+	+	+
21		<i>Diaptomus sp.</i>	+	+	+	+
22		<i>Eucyclops sp.</i>	+	+	+	+
23		<i>Mesocyclops sp.</i>	+	-	+	+
24		<i>Neodiaptomus sp.</i>	-	+	+	+

+ = Present of Zooplankton in Season

- = Absent of Zooplankton I Season

Table 3: Species Richness and different diversity indices of Zooplankton in 2014.

Sl. No	Seasons	Indices (2014)						
		Number of Individuals	Number of Species (Richness) (S)	Species Diversity (H/)	Simpson Diversity Indices		Evenness (e ^{H/S})	Margalef Index (D)
					Simpson Index of Dominance (D)	Simpson Index of Diversity (1-D)		
1	Winter	296	20	2.711	0.07843	0.9216	0.7523	3.339
2	Pre-Monsoon	335	20	2.779	0.07352	0.9265	0.8054	3.268
3	Monsoon	453	24	2.941	0.06557	0.9344	0.7893	3.761
4	Post Monsoon	399	23	3.004	0.05644	0.9436	0.8766	3.673

Conclusion

The study revealed that the increase in the number of zooplanktons was in accordance with temperature and its habitat. This study also showed that zooplankton species survive in neutral condition. The status of the River Siang could said to be eutrophic as indicated by the diversity of zooplankton; it can be concluded that the zooplankton are enough to enrich the water quality of River Siang and suitable for fish production.

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