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A NOTE ON THE ECOSYSTEM HEALTH OF A GLACIER-FED RIVER PINDER FROM CHAMOLI GARHWAL, UTTARAKHAND

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Abstract: The paper deals with a summarized account of ecological characteristics and biological productivity of river Pinder which is well known for its water quality conducive for the most important schizothoracine fishery of Uttarakhand. It was observed that the low water temperature and clarity of water favours good populations of phytobenthos and macrozoobenthos which in their turn supports the population quality of fishes. Overall 32 plankton species, 23 macrozoobenthic and 24 fish species were recorded.

Keywords: River, Pinder, Plankton, Benthos, Fish

Introduction

Pinder is one of the important glacier-fed streams of Garhwal Himalaya which originates from Pindari glacier in latitude 30º5' and longitude 80º 1' at an elevation of about 3810 m (Fig 1). At Karnprayag it joins with the river Alananda in latitude 30o 15' 43'' and longitude 79o 15' 28'' (720m). Health of an ecosystem depends upon its water characteristics and biological productivity. The most important ecological driver is the temperature of system which restricts the growth of plants and metabolism in fishes.(Bisht et.al. (2005). Apart from this the change in water temperature also stimulates spawning in fishes (Singh et.al., 1985). Riverine resources of Garhwal region are extensively studied by different workers for their ecological characteristics. Some important contributors are Badola and Singh (1981), Dobriyal and Singh (1981,1987, 1988), Dobriyal et.al. (1983, 1991, 1992, 1993, 1999, 2002, 2009, 2011), Dobriyal (1985, 1991, 2003, 2006), Nautiyal (1985), Dobriyal and Kumar (1988), Sharma (1991), Khanna et.al. (1992,1993), Kumar and Dobriyal (1992,1996,1999), Dobriyal and Joshi (1993), Dobriyal and Kotnala (1999 and 2005), Balodi et.al. (2004), Nautiyal et.al. (2004), Gusain and Gusain (2005), Kumar et.al. (2006), Rautela, et.al. (2009), Dobriyal and Dobriyal (2015), Katoch et.al. (2015), Koshal et.al. (2016), Bahuguna and Dobriyal (2018), Goswami and Dobriyal (2018) and Sagir et.al. (2018). Present study is an addition to knowledge on the health characteristics of Pinder river.

Material and Methods

The study was conducted for 24 months during 1981-82 in the river Pinder at Karnprayag. Physico-chemicalm parameters were studied by the standard methods (Welch, 1948 and APHA, 1975). Biological parameters (Plankton and Macrozoobenthos) were studied as per standard methods (Welch, 1952; Ward and Whipple, 1966). Fishes were identified with the help of Day fauna (1889).

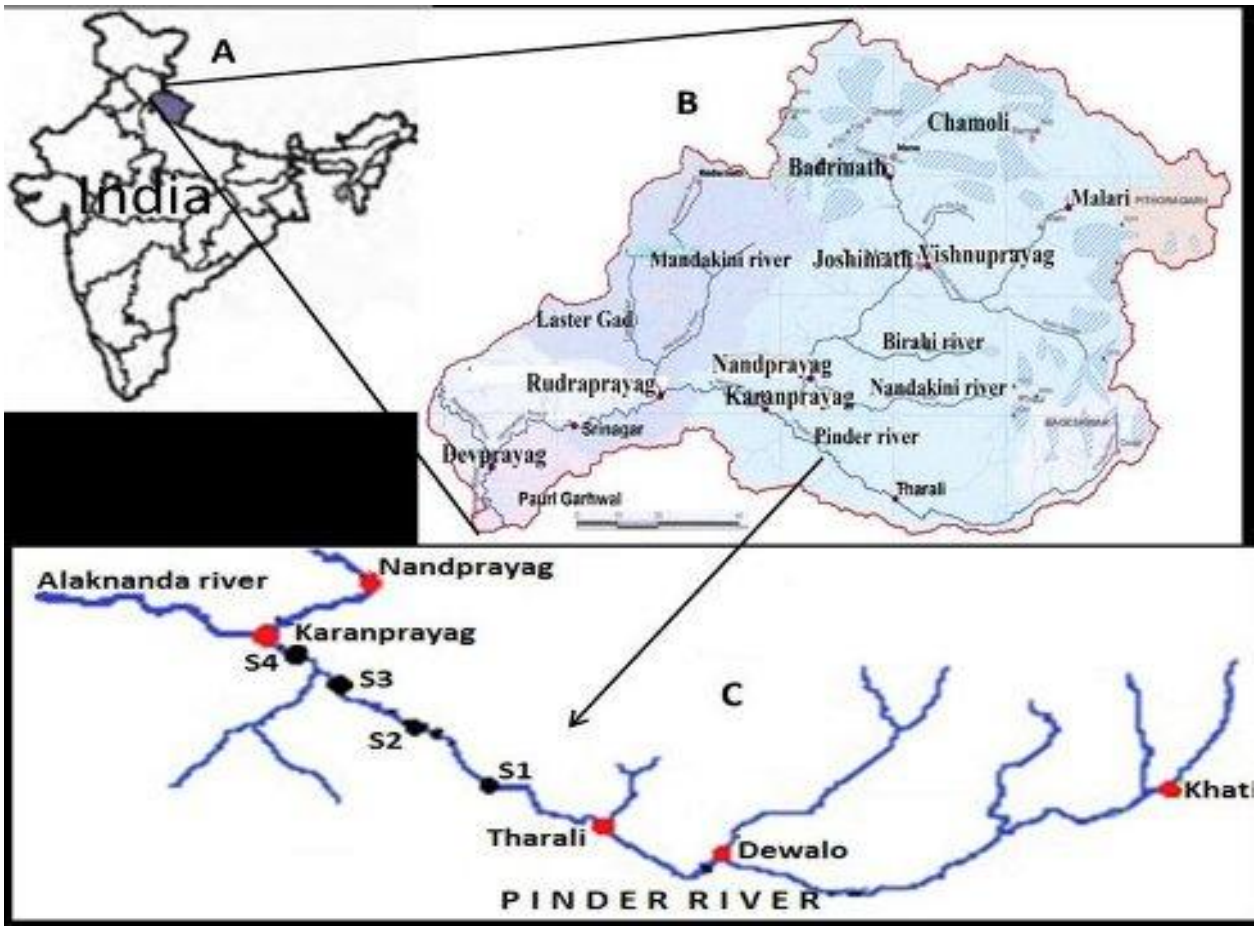

Fig 1 : Location of river Pinder (Courtsey: researchgate.net) and landing sites

Results and Discussion

The meteorological data and ecological quality of the river Pinder is presented in Table 1.

Summary of biotic profile of the stream which contain the average fluctuation limit in zooplankton, phytoplankton, macro-zoobenthos and fishes is presented in Table 2.

The level of dominance of each plankton species is presented in Table 3. Zooplankton were represented by 4 species, chlorophyceae by 11 species, bacillariophyceae by 10 species and Myxophyceae by 6 species.

Qualitative analysis and level of dominance of the macro zoobenthic fauna is presented in Table 4. The most rich order of benthos was Trichptera with 6 species followed in decreasing order by Diptera (5 species), Ephemeroptera (4 species), Coleoptera (3 species) and odonata (2 species).

Table 1: Meteorological and ecological quality of river Pinder (1981-82)

SN	Parameters	Fluctuation limit
1.	Transparency (cm)	12.0 ± 2.0 (Monsoon) - Clear up to the bottom
2.	Discharge of the stream (Cumec)	28.0±2.0 (Winter) – 320.0 ± 65.0 (monsoon)
3.	Current velocity ($m.sec^{-1}$)	0.45 ±0.8 (spring) – 1.76 ± 0.45 (monsoon)
4.	Water temperature (^oC)	8.7 ± 0.7 (winter) – 17.5 ± 1.3 (summer)
5.	pH	7.5 ± 0.1 (monsoon) – 8.3 ± 0.1 (monsoon)
6.	Turbidity (JTU)	25.0 ± 1.0 (winter) – 337.5 ± 44.0 (monsoon)
7.	Dissolved oxygen ($mg.l^{-1}$)	6.9 ± 2.1 (monsoon) – 12.6 ± 0.8 (spring
8.	Free CO_2 ($mg.l^{-1}$)	Nil (winter) – 1.0 ± 0.2 (monsoon)
9.	Total alkalinity ($mg.l^{-1}$)	47.6 ± 4.6 (monsoon) – 74.4 ± 5.6 (winter)

Table 2: Biotic profile of river Pinder (1981-82)

SN	Biota	Fluctuation limit
1.	Zooplamkton ($units.l^{-1}$)	172 ± 52 (monsoon)- 390± 25 (autumn)
2.	Phytoplankton ($units.l^{-1}$)	1720 ± 726 (monsoon)- 7719 ± 378 (spring)
3.	Benthic Trichopterans ($units.m^{-2}$)	26.2 ± 4.9 (monsoon)- 140.2 ± 21.9 (summer)
4.	Benthic Ephemeropterans ($units.m^{-2}$)	14.2 ± 6.5 (monsoon) – 76.5 ± 16.2 (summer
5.	Benthic Plecopterans ($units.m^{-2}$)	5.6 ± 1.8 (monsoon) – 42.8 ± 7.2 (summer)
6.	Benthic Coleopterans ($units.m^{-2}$)	17.2± 4.2 (monsoon) – 20.0 ± 4.0 (autumn)
7.	Fish species in catch (SN_x)	10 ± 2 (monsoon)- 20 ± 4 (autumn)

Table 3: Plankton species dominance river Pinder (1981-82)

Biota	SN	Name of pecies	Level of dominance
Zooplankton (Crustaceans)	1	*Daphnia*	Nil- Rare
	2	*Bosmina*	Nil- Rare
Zooplankton (Rotifers)	3	*Cyclops*	Nil- Rare
	4	*Brachionus*	Nil- Rare
	5	*Keratella*	Nil- Rare
Phytoplankton (Chlorophyceae)	6.	*Spirogyra*	Rare- Common
	7	*Ulothrix*	Rare- Common
	8	*Cladophora*	Common- Abundant
	9	*Oedogonium*	Rare- Common
	10	*Hydrodictyon*	Rare- Common
	11	*Zygnema*	Rare- Common
	12	*Hildenbrandia*	Nil- Rare
	13	*Dinobryon*	Nil- Rare
	14	*Microspora*	Nil- Rare
	15	*Tribonema*	Nil- Rare
	16	*Ankistrodesmus*	Nil- Rare
Phytoplankton (Bacillariophyceae)	17	*Navicula*	Common - Abundant
	18	*Fragillaria*	Common - Abundant
	19	*Cymbella*	Common - Abundant
	20	*Synedra*	Common - Abundant
	21	*Nitzschia*	Common - Abundant
	22	*Diatoma*	Rare- Common
	23	*Gomphonema*	Rare- Common
	24	*Cocconeis*	Rare- Common
	25	*Asterionella*	Rare- Common
	26	*Cyclotella*	Rare- Common
Phytoplankton (Cyanophyceae)	27	*Rivularia*	Rare
	28	*Lyngbya*	Rare
	29	*Anabena*	Rare
	30	*Phormidium*	Rare
	31	*Anacystis*	Rare
	32	*Oscillatoria*	Rare

Table 4: Macro-Zoobenthic species dominance river Pinder (1981-82)

Biota	SN	Name of pecies	Level of dominance
Order- Epemeroptera (Nymphs)	1	*Caenis*	Common
	2	*Baetis*	Common
	3	*Ephemerella*	Common
	4	*Nemoura*	Rare
Order- Plecoptera (Nymphs)	5	*Perla*	Rare
	6	*Isoperla*	Rare
	7	*Neoperla*	Rare
Order- Coleoptera (Larvae)	8	*Psephenus*	Common
	9	*Promoresia*	Rare
	10	*Hydrophilus*	Rare
Order- Trichoptera (larvae)	11	*Hydropsyche*	Common
	12	*Stenopsyche*	Common
	13	*Rhyacophila*	Rare
	14	*Limnephilus*	Rare
	15	*Neophylax*	Rare
	16	*Glossosoma*	Common
Order- Diptera (Larvae)	17	*Chironomus*	Common
	18	*Simulium*	Common
	19	*Antocha*	Common
	20	*Tipula*	Rare
	21	*Atherix*	Rare
Order- Odonata (Larvae)	22	*Cordulia*	Rare
	23	*Epicordulia*	Rare

Dominance level of different fishes is presented in Table 5. Which indicates that there are 24 fish species belonging to 10 genera. The dominat family was Cyprinidae which was represented by 7 genera and 14 species. Family sissoridae was represented by 2 genera and 5 species while the family cobitidae by only 1 genera and 5 species. The overall catch composition of fishes in river in Pinder is represented in Fig 2. Which shows that the dominant fish catch was of Schizothoracine fishes (78 %) followed by Tor sps (8 %), Garra and Crossocheilus (6 %) and other miscellaneous fishes (8%) which included minor carps and loaches. It has been pointed out by the ecologists that the biotic and abiotic parameters are interdependent and any change in one of them is likely to produce significant change in other. Water temperature was noticed to be one of the main controlling factor, the so called driver in river Pinder which can be directly correlated to spawning requirement of Schizothoracids which form bulk of fishery in Pinder. Current velocity is another driver in Pinder which showed that during its maxima in winter the biotic population decreases while in winter and summer months it is minimum hence recorded population of entire biota is more. pH also has significant effect as it is low in monsoon when population is also low and high in winters when population is also high. Similar results were shown by Dobriyal and Singh (1981,1988, 1989) and Nautiyal (1985).

Table 5: Level of dominance of fishes in the river Pinder (1981-82)

SN	Fish species	Level of dominance
	Family-Cyprinidae	
1.	*Schizothorax* sps (3)	Abundance
2.	*Schizothoraichthys* sps (1)	Common
3.	*Tor* sps (2)	Common
4.	*Garra* sps (2)	Common
5.	*Crossocheilus* sps (1)	Common
6.	*Puntius* sps (2)	Rare
7.	*Barilius* sps (3)	Common
	Family: Sissoridae	
8.	*Glyptothorax* sps (4)	Common
9.	*Pseudecheneis* sps (1)	Common
	Family- Cobitidae	
10	*Noemacheilus* sps (5)	Rare (Common in side waters)

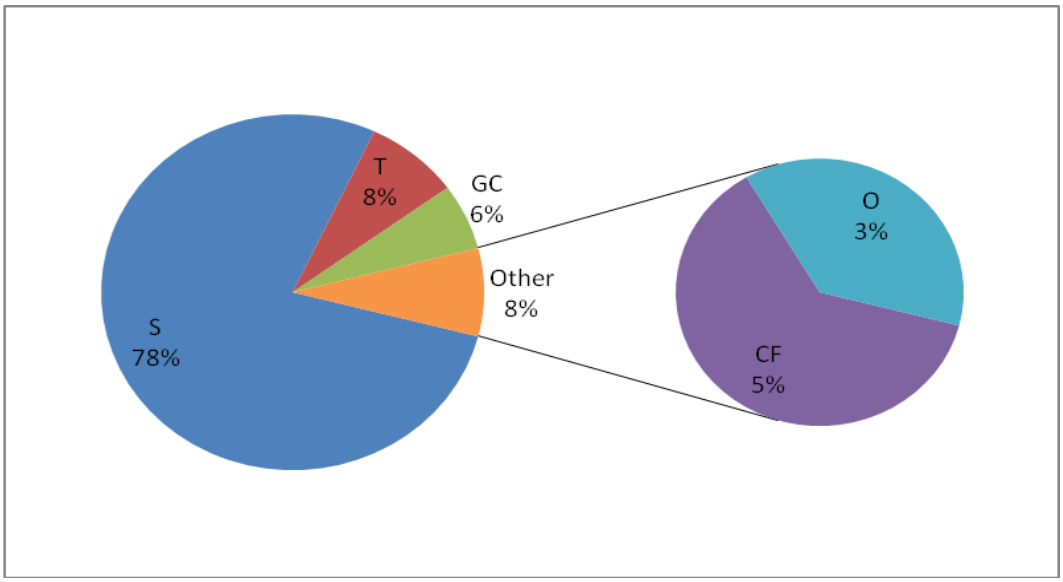

Fig 2: Average Fish catch composition in river Pinder during 1981-82 (S= Schizothoracids, T= *Tor* sps, GC= *Garra-Crossocheilus* sps, CF Catfishes, O= minor carps and loaches in side waters

Like other hillstreams, the fishery of Pinder is also influenced negatively by various anthropogenic activities. One of the important reasons for depletion in fishery is unscientific fishing techniques used by the village folk. The use of dynamite, ichthyo-toxic plants and electric fishing is highly disastrous. Conservation strategies must be enhanced to conserve fishery here by creating ecological awareness and safeguard of river banks through afforestation. Pinder is the best habitat to establish snow trout hatchery in Uttarakhand.

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