

Diversity of fish species in the lakes of Kumaon Himalya Uttarakhand, India

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Abstract: During the present investigation, a total of 9 species belonging to 6 genera, 2 families and 2 orders were reported from the Nainital lake. Out of 6 genera, genus *Puntius* (48.46%) was the most dominant genera followed by *Schizothorax richardsonii* (12.90%), *Gambusia* (8.87%), *Labeo rohita* (4.83%), *Cyprinus* (4.03%) and *Catla* (2.41%). From Bhimtal lake, 15 species belonging to 10 genera, 3 families and 2 orders were recorded. Out of these, *Tor tor* (16.93%), *Puntius ticto* (15.30%), *Nemachilus montanus* (14.75%) and *Tor putitora* (13.11%) were the dominant fish species. The maximum fish diversity was reported in Bhimtal lake, (H' 2.359) followed by the Nainital lake (H' 1.978). From the above findings, it may be conferred that water quality of Bhimtal lake is more conducive for fish production as evident from the diversity of fishes.

[Ram Krishan Negi and Vishal Rajput. **Diversity of fish species in the lakes of Kumaon Himalya Uttarakhand, India.** *Academ Arena* 2014;6(10):67-70]. (ISSN 1553-992X). <http://www.sciencepub.net/academia>. 8

Keywords: Fish diversity, Kumaon Himalaya, lake, *Puntius*

1. Introduction:

Extensive stress has been laid on fish communities of Himalayan water bodies. The main reason for using fish monitor biodiversity is that we know more about them than about other aquatic organisms. Fishes are enormously diverse, with different species reflecting different conditions. Fishes often have major impacts on distribution and abundance of other organisms in water, they inhabit and display the characteristics of the ecosystem of water body. The structure of fish community and their distribution has been reported by various workers in the different lakes and reservoirs (Pant and Sharma, 1978; Srivastava, 1978; Vass and Raina, 1979; Das and Pande, 1979; Pant and Bisht, 1980; Johri *et al.*, 1989; Joshi *et al.*, 1989; Raina, 1999; Kaushal, 2000; Nagdali and Gupta, 2002; and Kantoussan *et al.*, 2007). In the present study attempt has been made to find out the fish diversity in the lakes of Nainital and Bhimtal.

2. Material And Methods

For the collection of fishes, cast net of 1-2 m diameter with mesh size of 0.05cm knot to knot with heavy sinkers which allow rapid settling of the net at the bottom is used. In addition scoop net (mesh size 0.25cm), cast net of varying mesh size, gill net (mesh size 0.25cm, 0.50cm, 1.0 cm) were also employed. At the each study site, at a time 10-15 throws were casted at different sites of the lake between mid morning and late afternoon on a fixed day every month. Representative specimens of different fish species were preserved in 10% formaldehyde solution and identified

in the laboratory using standard references like Day (1875-1878), Talwar and Jhingran (1991) and Jayaram (1999).

3. Results

During the present investigation, a total of 9 species belonging to 6 genera, 2 families and 2 orders were reported from the Nainital lake. Out of 6 genera, genus *Puntius* (48.46%) was the most dominant fish followed by *Schizothorax richardsonii*, *S. plagiostomus* (12.90%, 8.87%), *Gambusia affinis* (8.87%), *Labeo rohita* (4.83%), *Cyprinus carpio* (4.03%) and *Catla catla* (2.41%) (**Tables 1,3 & Fig. 1**).

From Bhimtal lake, 15 species belonging to 10 genera, 3 families and 2 orders were recorded. Out of these, *Tor tor* (16.93%), *Puntius ticto* (15.30%), *Nemachilus montanus* (14.75%) and *Tor putitora* (13.11%) were the dominant fish species. In addition, other species like *Puntius conchoni* (9.83%), *Nemachilus chanide* (6.55%), *Labeo rohita* (6.01%), *Barilius bendelesis* (4.37%), *Cirrhina mrigala* (3.27%), *Schizothorax richardsonii* (2.18%), *Catla catla* (2.18%), *Schizothorax plagiostomus* (1.63%), *Chanda ranga* (1.63%), *Chanda nama* (1.09%) and *Channa gechua* (1.09%) were also reported (**Table 2 & Fig. 2**). The maximum fish diversity was reported in Bhimtal lake, (H' 2.359) followed by the Nainital lake (H' 1.978). From the above findings, it may be conferred that water quality of Bhimtal lake is more conducive for fish production as evident from the diversity of fishes.

Table 1. Fish species reported from Nainital and Bhimtal lakes

	Fish	Nainital lake	Bhimtal lake
Order: Cypriniformes			
Family: Cyprinidae			
Genus:	<i>Puntius ticto</i> (Ham.)	+++	+++
	<i>Puntius conchoni</i> (Ham.)	++	++
	<i>Puntius sarana</i> (Ham.)	+	---
	<i>Schizothorax plagiostomus</i> (Gray.)	+	+
	<i>Schizothorax richardsonii</i> (Gray.)	+	+
	<i>Labeo rohita</i> (Ham.)	+	+
	<i>Catla catla</i> (Ham.)	+	+
	<i>Cyprinus carpio</i> (Linn.)	+	---
	<i>Tor tor</i> (Ham.)	---	+++
	<i>Tor putitora</i> (Ham.)	---	+++
	<i>Barilius bendelesis</i> (Ham.)	---	++
	<i>Cirrhina mrigala</i> (Ham.)	---	+
Family: Balitoridae			
Genus:	<i>Nemacheilus montanus</i> (McClelland)	---	++
	<i>Nemacheilus chanide</i> (Day)	---	++
Order: Perciformes			
Family: Channidae			
Genus:	<i>Channa gechua</i> (Bloch.)	---	+
	<i>Chanda nama</i> (Ham.)	---	+
	<i>Chanda ranga</i> (Ham.)	---	+
Order: Cyprinodontiformes			
Family: Poeciliidae			
Genus:	<i>Gambusia affinis</i> (Poey)	++	---

Dominant (+++), Reported (++) , Rare (+), Absent (---)

Table 2. Diversity index, Frequency and Percentage composition of fishes in Bhimtal lake.

	Fish Species	Frequency	(%)	Shannon-Wiener (H')
1	<i>Puntius ticto</i>	28	15.30	2.3595
2	<i>Puntius conchoni</i>	18	9.83	
3	<i>Schizothorax plagiostomus</i>	3	1.63	
4	<i>Schizothorax richardsonii</i>	4	2.18	
5	<i>Labeo rohita</i>	11	6.01	
6	<i>Catla catla</i>	4	2.18	
7	<i>Tor tor</i>	31	16.93	
8	<i>Tor putitora</i>	24	13.11	
9	<i>Barilius bendelesis</i>	8	4.37	
10	<i>Cirrhina mrigala</i>	6	3.27	
11	<i>Nemachilus montanus</i>	27	14.75	
12	<i>Nemachilus chanide</i>	12	6.55	
13	<i>Chanda nama</i>	2	1.09	
14	<i>Chanda ranga</i>	3	1.63	
15	<i>Channa gechua</i>	2	1.09	
	Total	183	100	

Table 3. Diversity index, Frequency and Percentage composition of fishes in Nainital lake

	Fish Species	Frequency	(%)	Shannon-Wiener(H')
1	<i>Puntius ticto</i>	32	25.80	1.9782
2	<i>Puntius conchoni</i>	21	16.93	
3	<i>Puntius sarana</i>	8	6.45	
4	<i>Schizothorax plagiostomus</i>	11	8.87	
5	<i>Schizothorax richardsonii</i>	16	12.90	
6	<i>Labeo rohita</i>	6	4.83	
7	<i>Catla catla</i>	3	2.41	
8	<i>Cyprinus carpio</i>	5	4.03	
9	<i>Gambusia affinis</i>	11	8.87	
	Total	124	100	

4. Discussion

Mass mortality of fishes in Nainital lake has been observed (Pant and Sharma, 1978; Das and Pande, 1979) during the winter season due to low DO content (3.6 mg/l). During the present study, such type of observation was not reported because of installation of artificial aeration in the lake which has increased the DO content up to 10.0 mg/l at surface water.

Pant and Bisht (1980) has reported 13 fish species viz. *Labeo* spp., *Tort tor*, *Tor putitora*, *Cyprinus carpio*, *Schizothorax* spp., *Puntius* spp., *Catla catla*,

Cirrhina spp. from the Nainital lake and reported that low diversity of fishes may be due the changing environmental factors. During the present investigation, a total of 9 fish species were reported.

Vass *et al.* (1989) studied twelve high altitude lakes of Jammu and Kashmir to obtain information on the status of their limnology and fish stocks and reported the dominance of *Puntius* genus among all the fish population. Similar observations were reported from Nainital and Bhimtal lakes where genus *Puntius* was the dominant fish among the total fish population.

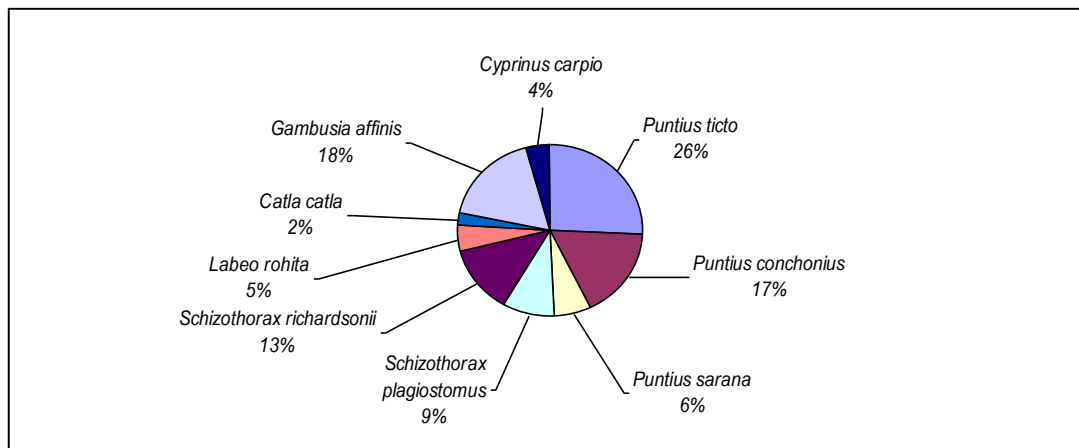


Fig. 1. Percentage composition of fishes in Nainital lake

Nagdali and Gupta (2002) have reported the mass mortality of a mosquito fish, *Gambusia affinis* in Nainital lake due to depletion of oxygen and oxidative and anaerobic decay of bottom deposits, causing high concentration of CO₂ and ammonia-N considered as cause of fish mortality. During the present investigation, it has been reported that *Gambusia affinis* has been eradicated from the lake water as very few samples of *Gambusia affinis* have been collected

from the Nainital lake, whereas, it was found completely absent from the Bhimtal lake.

Shukla *et al.* (2007) opined that the diversity of fish species in the lake mainly depends upon the health, ecological factors and various anthropogenic activities happening in and around the lake water. Similar results have been observed in Nainital lake where various types of anthropogenic activities has led to decline in fish diversity, but in the Bhimtal lake water quality and other factors were found to be in satisfactory condition.

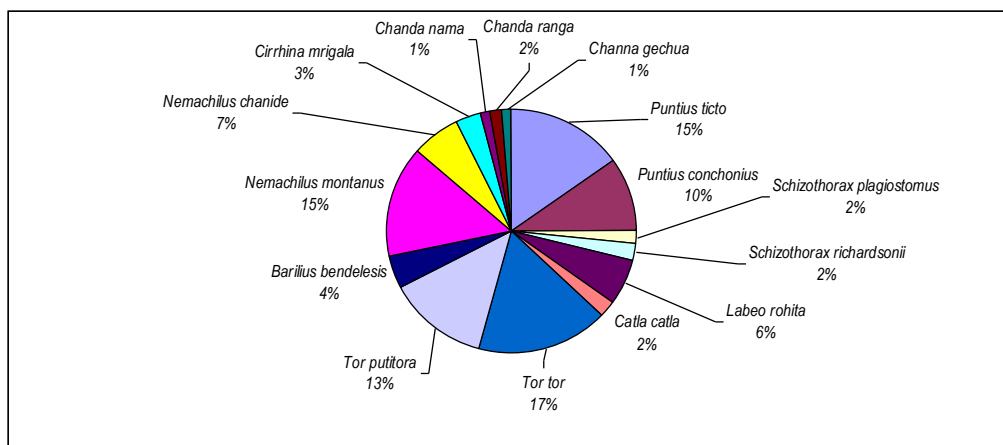


Fig. 2. Percentage composition of fishes in Bhimtal lake

Kantoussan *et al.* (2008) studied the relevance of species-based indicators as a tool for evaluating the health of lake in two tropical lakes in Mali, West Africa and reported that there was complete eradication of fish species from the polluted lake as compared to the non-polluted lake. Similar observations have been made during the present study where maximum fish diversity was reported from Bhimtal lake as compared to Nainital lake. From the present investigations, it has been observed that Bhimtal lake maintains the oligotrophic status whereas, lake Nainital is changing to eutrophic one.

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1/11/2014