

# CURRENT STATUS OF FISH DIVERSITY, PRODUCTION AND THEIR ABUNDANCE IN RAMGANGA RESERVOIR AT KALAGARH, UTTARAKHAND

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## ABSTRACT

The present study aimed to the current status of fish diversity, production and abundance of selected fish species in Ram-Ganga reservoir at Kalagarh. During the present study, a total of 31 fish species belonging to 7 families were reported. *Cyprinius carpio* and *Tor* fish species (Cyprinidae family) were the dominant species (>50 % of total fish catch) in the impoundment segment of Ramganga reservoir. Few other fish species of *Barilius*, *Garra*, and *Glyptothorax* etc. also have been recorded during the study. The comparison of present result with earlier reports delighted that endemic fish fauna has to be diminished with the progression of time in the Ramganga reservoir, which may because of debasement and fracture of riverine natural habitats caused by various natural and anthropogenic activities. The environmental change in the natural water flow pattern of river and hydrological characteristics including indiscriminate fishing practices and other natural calamities are the main factors for decline the fishery resources in Ramganga reservoir.

**Keywords:** Fish diversity, abundance, Ram-Ganga reservoir, Uttarakhand.

## INTRODUCTION

The diversity of fishes based on the geographical position, varied aquatic ecological conditions, health of aquatic bodies, optimum exploitation of the commercial fish species, enforcement of laws, rules and regulations, and their implementation and fish habitat restoration programs. Fish diversity represents the fish faunal varieties, occurrence, distribution, abundance and conservation of species (Burton et al, 1992). Fishes are not only important indicators of ecological health and the abundance, but also maintain a balance in the food chain by consuming plankton and small animals and form food for many animals. This balance in food chain may be affected due to pollution in aquatic system (Ramanjaneya et al., 2016). In India, there are about 2,500 species of fishes, of which 930 freshwater and 1,570 marine, are estimated (Kar., 2003). Fishes have been found to exhibit enormous diversity in their morphology, habitat and their biology. They live in almost all conceivable aquatic habitats. India is one of the mega-biodiversity countries in the world and occupying ninth position in terms of freshwater

biodiversity (Mitemeir., 1997). Fish is sensitive to changes in water chemistry due to different anthropogenic activities from their catchments. Fish responses to environmental disturbances, including hydro-morphological factors are different in time and space in comparison to simpler organisms, as they tend to be integrated over larger intervals. Fish has been identified as suitable for biological assessment due to its easy identification and economic value (Siligato and Bohmer.2001). Fish assemblages have widely been used as ecological indicators to assess and evaluate the level of degradation and health of water bodies at various spatial scales (Zampella et al., 2006; Vijaylaxmi et al., 2010). The low fish yield from the reservoirs may be largely due to total lack of understanding of physico-chemical nature and biodiversity of the ecosystem, fitful efforts of management totally unrelated to ecosystem requirements as well as inadequate understanding of the complex relationship between food-chain organisms leading to a characteristic nature of energy flow through communities (Schiemer et al., 1987). Ichthyofauna of Garhwal region have been carried out by many workers (Badola, 1975; Dobriyal, 1983; Tilak and Baloni, 1983; Sharma, 1984; Singh *et al.*, 1987; Lakra *et al.*,1987; Dobriyal 1991; Khanna and Badola, 1991, Singh *et al.*, 1993; Agarwal *et al.*, 2005, 2011; Bisht *et al.*, 2009; Sharma *et al.*, 2018., Kumar *et al.*, 2018). Construction of dam and barrages on rivers for hydroelectric power generation, irrigation, and navigation purposes have interfered with the riverine environment, inevitably affecting the fishery resources of the rivers. The existing dam or barrages are an alarming threat to food and feeding habit, spawning biology and fish migration. They are altering magnitude, chronology, quality of streams flows below dams and affecting fish stock. Dam and reservoir is regarded as one of the most critical ecological factors contributing to changes in river ecosystem (Malik and Tyagi, 2014).

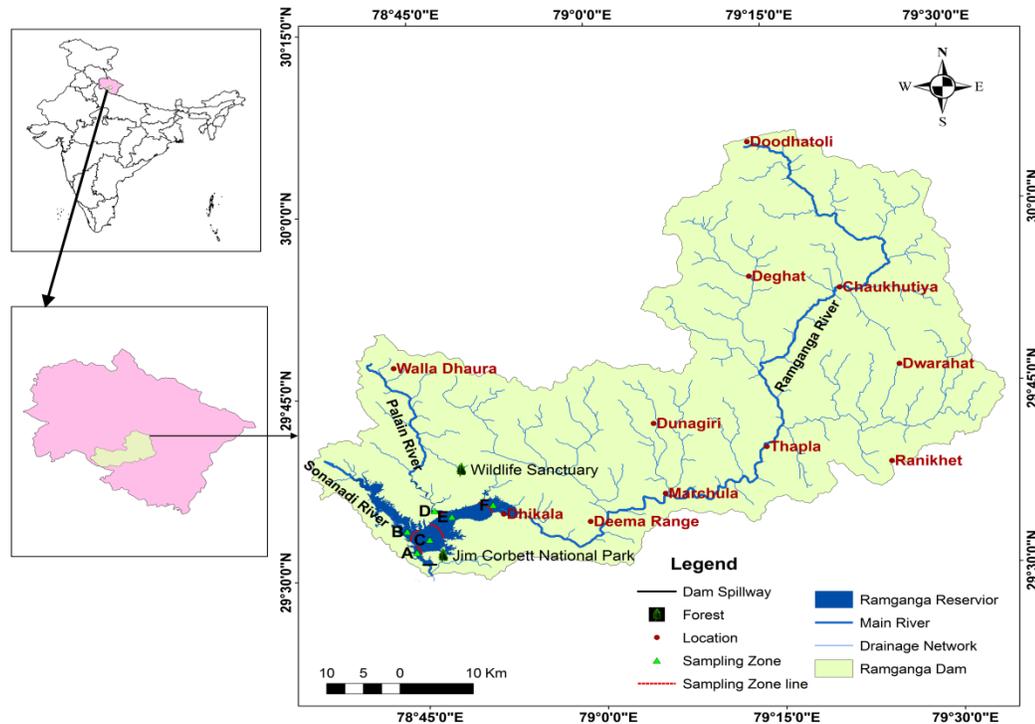
## STUDY AREA

The present study was carried during the period of one year from August 2016 to August 2017. Six sampling (Z1, Z2, Z3, Z4, Z5 and Z6) zones were selected on upstream and dam site of the Ramganga reservoir. The Sub- Himalayan region where the dam is situated is known by the name of Shiwalik Ranges. Ramganga dam is situated about 3 km upstream of Kalagarh villages in district Pauri Garhwal of Uttar Pradesh. It is about 110 km to the North-East of Moradabad. The exact location of the Dam site is latitude 29° 31' 13" North and longitude 78° 45' 35" East.

## Materials and Methods

Experimental fishing was carried out in all sampling zones with the help of locally hired professional fisherman. Fish species were collected with gill nets (mesh size 2.5 × 2.5cm; 3 × 3cm; 7 × 7cm; length × breadth = 75 × 1.3m; 50 × 1m), cast nets (mesh size 0.6 × 0.6 cm), drag nets or locally called mahajal and indigenous nets using nylon mosquito nets tied with the bamboo in both ends. At all zones, all the gears except cast nets were used at least ten times

during each sampling occasion. The cast nets (5.5 m<sup>2</sup>) were operated 20 times at each zone covering about 100<sup>2</sup> meter of river segment allowing 3-5 minutes settled times in each cast. The relative abundance (percent of catch) of fish across different zone was calculated. Relative abundance of individual species was calculated by the following formula.



**Figure 1: Index Map of Selected sampling zones in Ram-Ganga reservoir**

$$RA = \frac{\text{Number of sample of particular species} \times 100}{\text{Total number of samples}}$$

The catch composition and catch per unit effort were estimated applying following method.

$$\text{Catch per unit effort (CPUE)} = \frac{\text{total weight of catch}}{\text{Number of persons} \times \text{hrs. of fishing}}$$

Captured fish samples were released after recording the data except for a few individuals which needed to confirm species identifications in the laboratory. The fish caught were collected and preserved in 10% formalin solution and transferred to laboratory and stored in specimen jars. All the specimens were identified in laboratory using standard references like Day (1875-78), Talwar

and Jhingran (1991), Jayaram (1999) and scientific names were verified using <http://www.fishbase.org>. The colour spot, if any, maximum size and other characters (morphometric and meristics) of the fish sample caught were measured. The Fish finder model-GARMIN -160C was also operated in the reservoir area, which is helpful to found fish species in different depth of the reservoir.

## RESULTS

Total 31 fish species belonging to seven families were recorded from six zones of Ram-Ganga reservoir. Cyprinidae was represented by the *Cyprinus carpio* var. *specularis* (Linnaeus), *Hypophthalmichthys molitrix* (Valenciennes), *Ctenopharyngodon idella* (Valenciennes), *Puntius conchonius* (Hamilton), *Puntius ticto* (Hamilton), *Puntius sophare* (Hamilton), *Tor-tor* (Hamilton), *Tor-putitora* (Hamilton), *Tor-chelynooides* (Hamilton) *Cirrhinus mrigala* (Hamilton), *Catla catla* (Hamilton), *Labeo gonius* (Hamilton), *Barilius bendelisis* (Hamilton), *Barilius vagra* (Hamilton), *Gara gotyla gotyla*, *Crossochelius latius*, *Brachydanio rerio*, *Danio devario* other families consisted of *Nemacheilus montanus* (McClelland), *Nemacheilus rupicola* (McClelland), (Balitoridae), *Nemacheilus bevani* (McClelland), *Nemacheilus botia* (McClelland), *Channa gauthua* (Bloch (Channidae), *Channa orirntalis* (Bloch), *Channa punctatus* (Bloch), *Channa maruilius* (Hamilton), *Gadusia chapra* (Hamilton), (Clupeidae), *Bagarius bagarius*, *Glyptothorax pectinopteraus* (Sisoridae), *Mystus vittatus* (Bagridae), *Lapidocephalus guntea* (Hamilton) respectively (Table 1).

The relative abundance of forage species was calculated and *Tor putitora* was found maximum (6.70%) at zone F and minimum (8.87%) at zone E. *Tor-tor* was recorded maximum (7.94%) in zone E and minimum (10.89%) at zone F. Sharma et. al., 2018 observed similar abundance o Tor sepecies by study on fish diversity of Bhagirathi river. *Puntius ticto* was observed higher (2.48%) at zone B and lower (2.02%) at zone F. *Hypophthalmichthys molitrix* was recorded maximum (2.98%) at zone E and minimum (2.82%) at zone F. *Labeo gonius* was found maximum (10.08%) at zone F and minimum (7.44%) at zone E. *Barilius bendelisis* was recorded maximum (6.85%) at zone F and minimum (5.46%) was observed at zone E. *Nemacheilus rupicola* was observed maximum (1.47%) at zone A and minimum (0.81%) at zone F (Table 2).

Fish production was maximum in summer (29.82 Kg) and minimum in winter (26.27 Kg) while weed species fish production was maximum in monsoon (4.10 Kg) and minimum in summer (3.18 Kg) in zone B. In zone C, fish Fish production was maximum in summer (59.23 Kg) and minimum in monsoon (53.48 Kg) while weed species fish production was maximum in summer (25.26 Kg) and minimum in monsoon (6.86 Kg). In zone D, fish Fish production was maximum in summer (29.54 Kg) and minimum in winter (25.23 Kg) while weed species fish production was maximum in monsoon (6.18 Kg) and minimum in winter (2.98 Kg). In zone E, Fish

production was maximum in summer (56.33 Kg) and minimum in winter (51.69 Kg) while weed species fish production was maximum in monsoon (25.18 Kg) and minimum in winter (23.82Kg). In zone F, fish production was maximum in summer (42.99 Kg) and minimum in winter (37.49 Kg) while weed species fish production was maximum in winter (15.48 Kg) and minimum in summer (12.47 Kg). Major carp contributed maximum production in all selected sampling zone while minimum production was contributed by forge carp (weed species). The fish production contributed by fish group was in order Major > Minor > Weed species (Table 3).

**Table 1: Major fish species recorded from Ram-Ganga reservoir during 2016-17.**

S.No.	Family	Species
A.	Cyprinidae	1. <i>Cyprinus carpio</i> var. <i>specularis</i> (Linnaeus)
		2. <i>Hypophthalmichthys molitrix</i> (Valenciennes)
		3. <i>Ctenopharyngodon idella</i> (Valenciennes)
		4. <i>Puntius conchonius</i> (Hamilton)
		5. <i>Puntius ticto</i> (Hamilton)
		6. <i>Puntius sophare</i> (Hamilton)
		7. <i>Tor-tor</i> (Hamilton)
		8. <i>Tor putitora</i> (Hamilton)
		9. <i>Tor-chelynoides</i> (Hamilton)
		10. <i>Cirrhinus mrigala</i> (hamilton)
		11. <i>Catla catla</i> (Hamilton)
		12. <i>Labeo gonius</i> (Hamilton)
		13. <i>Barilius bendelisis</i> (Hamilton)
		14. <i>Barilius Vagra</i> (Hamilton)
		15. <i>Gara gotyala gotyala</i>
		16. <i>Crossocheliu latius</i>
		18. <i>Danio devario</i>
B.	Balitoridae	19. <i>Nemacheilus montanus</i> (McClelland)
		20. <i>Nemacheilus rupicola</i> (McClelland)
		21. <i>Nemacheilus bevani</i> (McClelland)
		22. <i>Nemacheilus botia</i> (McClelland)
C.	Channidae	23. <i>Channa orientalis</i> (Bloch)
		24. <i>Channa gechua</i> (Bloch)
		25. <i>Channa punctatus</i> (Bloch)
		26. <i>Channa marulius</i> (Hamilton)
D.	Clupeidae	27. <i>Gadusia chapra</i> (Hamilton)
E.	Sisoridae	28. <i>Bagarius-bagarius</i>
		29. <i>Glythorax pectinopteraus</i>
F.	Bagridae	30. <i>Mystus vittatus</i>
G.	Cobitidae	31. <i>Lapidocephalus guntea</i> (Hamilton)

**Table 2: Relative abundance of fish species in selected zones of Ram-Ganga reservoir during 2016-17.**

S.No.	Family	Species	RA (%)					
			ZONE A	ZONE B	ZONE C	ZONE D	ZONE E	ZONE F
A.	Cyprinidae	1. <i>Cyprinus carpio</i> var. <i>specularis</i> (Linnaeus)	10.22	11.13	11.79	9.39	8.68	12.44
		2. <i>Hypophthalmichthys molitrix</i> (Valenciennes)	2.59	2.74	2.47	2.4	2.23	1.95
		3. <i>Ctenopharyngodon idella</i> (Valenciennes)	2.01	2.1	1.75	1.86	1.73	1.15
		4. <i>Puntius conchoni</i> (Hamilton)	1.71	1.78	1.39	1.59	1.48	0.74
		5. <i>Puntius ticto</i> (Hamilton)	2.01	2.1	1.75	1.86	1.73	1.15
		6. <i>Puntius sophore</i> (Hamilton)	2.3	2.42	2.11	2.13	1.98	1.55
		7. <i>Tor-tor</i> (Hamilton)	8.46	9.19	9.64	7.77	7.19	10.02
		8. <i>Tor putitora</i> (Hamilton)	6.99	7.58	7.84	6.43	5.95	8
		9. <i>Tor chelynoide</i> (Hamilton)	3.77	4.03	3.9	3.47	3.22	3.57
		10. <i>Cirrhinus mrigala</i> (Hamilton)	6.11	6.61	6.77	5.62	5.21	6.79
		11. <i>Catla catla</i> (Hamilton)	6.99	7.58	7.84	6.43	5.95	8
		12. <i>Labeo gonius</i> (Hamilton)	7.87	8.55	8.92	7.24	6.69	9.21
		13. <i>Barilius bendelisis</i> (Hamilton)	5.53	5.97	6.05	5.09	4.71	5.98

		14. <i>Barilius Vagra</i> (Hamilton)	3.77	4.03	3.9	3.47	3.22	3.57
		15. <i>Gara gotyala</i> <i>gotyala</i>	2.3	2.42	2.11	2.13	1.98	1.55
		16. <i>Crossocheilus</i> <i>latius</i>	2.01	2.1	1.75	1.86	1.73	1.15
		17. <i>Brachydanio rerio</i>	1.13	1.13	0.68	1.05	0.99	0.06
		18. <i>Danio devario</i>	0.83	0.81	0.32	0.78	0.74	0.47
B.	Balitoridae	19. <i>Nemacheilus</i> <i>montanus</i> (McClelland)	1.42	1.45	1.03	1.32	1.24	0.34
		20. <i>Nemacheilus</i> <i>rupicola</i> (McClelland)	1.13	1.13	0.68	1.05	0.99	0.06
		21. <i>Nemacheilus</i> <i>bevani</i> (McClelland)	0.83	0.81	0.32	0.78	0.74	0.47
		22. <i>Nemacheilus botia</i> (McClelland)	1.13	1.13	0.68	1.05	0.99	0.06
C.	Channidae	23. <i>Channa orientalis</i> (Bloch)	0.54	0.49	-0.04	0.52	0.49	0.87
		24. <i>Channa gechua</i> (Bloch)	0.83	0.81	0.32	0.78	0.74	0.47
		25. <i>Channa punctatus</i> (Bloch)	1.13	1.13	0.68	1.05	0.99	0.06
		26. <i>Channa marulius</i> (Hamilton)	0.54	0.49	0.04	0.52	0.49	0.87
D.	Clupeidae	27. <i>Gadusia chapra</i> (Hamilton)	1.13	1.13	0.68	1.05	0.99	0.06
E.	Sisoridae	28. <i>Bagarius-bagarius</i>	0.83	0.81	0.32	0.78	0.74	0.47
		29. <i>Glytothorax</i> <i>pectinopteraus</i>	1.42	1.45	1.03	1.32	1.24	0.34
F.	Bagridae	30. <i>Mystus vittatus</i>	0.83	0.81	0.32	0.78	0.74	0.47
G.	Cobitidae	31. <i>Lapidocephalus</i> <i>guntea</i> (Hamilton)	1.13	1.13	0.68	1.05	0.99	0.06

**Table 4: Season wise fish production (kg) of selected sampling zones of Ram-Ganga reservoir during 2016-17**

	Zone A			Zone B			Zone C			Zone D			Zone E			Zone F			Total Production
	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon	Winter	Summer	Monsoon	
<b>Major Carp</b>	Fishing not allowed			26.27	29.82	27.10	53.48	59.23	55.89	25.23	29.54	28.32	51.69	56.33	53.98	37.49	42.99	42.15	619.51
<b>Minor Carp</b>				6.87	13.29	4.74	31.19	38.36	32.15	7.69	11.36	3.98	30.24	37.24	33.23	18.58	25.39	16.24	310.55
<b>Forge Group (Weed species)</b>				4.10	3.18	3.24	22.34	25.26	6.86	2.98	3.27	6.18	23.82	24.18	25.18	15.48	12.47	14.49	193.03

## Reference

- Agarwal, N.K., Khanna, D.R., Thapliyal, B.L. and Rawat, U.S., 2005. *Resources assessment and Potential of Hill Fisheries in Garhwal Himalaya Region of Uttranchal: A Perspective* In. D.R. Khanna, A.K. Chopra and G. Prasad (eds.), *Aquaculture Biodiversity, Present Scenario*, Daya Publishing House, New Delhi. pp: 81-97.
- Badola, S.P., 1975. Fish fauna of Garhwal hills, part II ( Pauri Garhwal-U.P.). *Ind. J. Zoot.*, XVI (1): 57-70.
- Bisht, B., Badoni, A.K. and Bahuguna, S.N., 2009. Seasonal Distribution and Relative Abundance of Fish Fauna of a Small Hill Stream Dangchaura (Takoli) Gad, along with River Alaknanda. *Our nature*, 7: 182-186.
- Dobriyal, A.K., 1991. *An appraisal of the fishery resources of riverine ecosystem of Garhwal Central Himalaya* In. S.D. Bhatt and R.K. Pande (eds.), *Ecology of the Mountain Water*, Ashish Publ. House, New Delhi. pp: 306-312.
- Burton, P.J., Balisky, A.E., Coward, L.P., Cumming, S. Gand Kneeshaw, D.D., 1992. The value of managing biodiversity. *The forestry Chronicle* 68(2):225-237.
- Day, F., 1878. *The fishes of India: being a natural history of the fishes known to inhabit the seas and freshwater of India, Burma and Ceylon*. Text and Atlas in two parts. London XX+778, 195. Reprinted in 1994 by Jagmander Book Agency, New Delhi.
- Jayaram, K.C., 2010. *The fresh water fishes of the Indian region*. Narendra Publishing House, Delhi.
- Khanna, D.R. and Badola, S.P., 1991. Fish fauna of the river Ganga at Haridwar. *Aquatic Environment*, Ashish Publishing House. 8/81, Punjab Bagh, New Delhi, 90-93
- Kar D. (2003): In *Environment Pollution and Management* APH Publishing Corporation, New Delhi (Kumar A., Bohra C., Sing L.K. eds.), 203-211.
- Kumar. V, Malik. D.S., Sharma. A.K., (2018). Study On Distribution Pattern Of Benthic Diversity In Relation To Water Quality Of River Ganga And Its Tributaries., *Journal of Emerging Technologies and Innovative Research (JETIR)*. 5(5): 88-103.
- Lakra, W.S., Agarwal, N.K. and Singh, H.R., 1987. Present status of Snow trout in Garhwal Himalaya. *U.P.J. Zoology*, 7 (1): 85-88.
- Mittermeier R.A., Mitemeir C.G. (1997): In *Global freshwater biodiversity sea wind cemex Mexico City* (Mc Allister D.E., Lttamiltion A., Harvery B. eds.), 1-140.
- Malik, D.S. and Negi, K.S.(2007). *Mahseer fish: Bionomics and population*. Daya Publishing House, Delhi. 231p
- Malik, D.S. (2011). Population dynamics and conservation management of Himalayan mahseer(*Tor* species) in riverine aquatic ecosystem in Garhwal region of uttarakhand(India). *Journal of Applied and Natural Science*. 3(1): 9-101.

- Malik, D.S. and Tyagi, D. (2014). A preliminary assessment of biodiversity and ecological services of Ramganga reservoir at Kalagarh (Uttarakhand). *Journal of Sustainable Environmental Research*, 3 (2): 195-201 (2014).
- Malik. D.S., Sharma. A.K., Bargali. H., (2018) Status of phytoplankton diversity in relation to water quality of Bhagirathi riverine system in Garhwal Himalaya. *International Journal of Advanced Science and Research*. 3 (1): 30-37.
- Ramanjaneya and Ganesh C. B., (2016): Fish faunal diversity in Tungabhadra Reservoir, Hosapete, Ballari District, Karnataka. *International Journal of Research in Fisheries and Aquaculture*
- Schiemer F and Duncan A (1987) The significance of the ecosystem approach for reservoir management. In: Proceedings of a workshop on reservoir fishery management and development in Asia, Nepal, IDRC 264 C 183–194
- Sharma, R.C., 1984. Ichthyofauna of the snowfed river Bhagirathi of Garhwal Himalaya. *Utter Pradesh J. Zool.*, 4(2): 208-212.
- Singh, H.R., Badola, S.P. and Dobriyal, A.K., 1987. Geographical distribution list of Ichthyofauna of Garhwal Himalaya with some new records. *J. Bombay Nat. Hist. Soc.*, 84(1): 126-132
- Singh, N., Bahuguna, S.N. and Bhatt K.C., 1993. The profile of river ecosystem, food and feeding habits of hill stream fishes and consequences of recent environmental degradation in Garhwal Himalaya. *ACTA Ichthyologica et. Piscatorial*, XXIII Fasc.1.
- Sharma.A.K., Malik.D.S., Bargali.H., (2018).Present status o fish diversity and population abundance of selected fish species in Bhagirathi river at Uttarakhand. *International journal of creative research thught (IJCRT)*.6(1):432-438
- Sharma. A.K., Malik. D.S., Bargali. H., (2018). Food and Feeding Habits of Schizothorox Richardsonii (Gray, 1832) Inhabiting Bhagirathi River, Tehri Garhwal, India., *Int. J. Recent Sci. Res.* 9(4); 25562-25565.
- Siligato S & Bohmer J .2001. Using indicators of fish health at multiple levels of biological organization to assess effects of stream pollution in southwest Germany. *J. aquat. ecosyst. stress recovery*, 8: 371-386.
- Sugunan VV (1997) Guidelines for management of small reservoirs in India. *Fishing Chimes* 17: 23-27.
- Vijaylaxmi C, M Rajshekhar & K Vijaykumar. 2010. Freshwater fishes distribution and diversity status of Mullameri River, a minor tributary of Bheema River of Gulbarga District, Karnataka. *Int J of Syst Biol.*, 2: 1-9.
- Tilak, R. and Baloni, S.P., 1983. *On the food and feeding habits of hill stream fishes of Tehri-Garhwal*, Uttar Pradesh 4th All India Seminar Ichthyol; Dehradun. 68 (Abstract).
- Talwar, P.K. and Jhingran, A.G., 1991. *Inland fishes of India and adjacent countries*. Vols. 1 and 2, Oxford & IBH Publishing house, New Delhi.