Available online at www.ijpab.com

ISSN: 2320 – 7051
Int. J. Pure App. Biosci. **2 (3):** 258-264 (2014)

Research Article

INTERNATIONAL JOURNAL OF PURE & APPLIED BIOSCIENCE

Loaches of Darjeeling Himalaya and Adjoining areas of West Bengal: their Prospects as Ornamental Fish and Constraints

M. L. Acharjee[1]* and S. Barat[2]

[1]Department of Zoology, Kalimpong College, Darjeeling, West Bengal, 734301, India

[2]Aquaculture & Limnology Research Unit, Department of Zoology,
University of North Bengal, District- Darjeeling, West Bengal, 734013, India

*Corresponding Author E-mail: manik_kpg@rediffmail.com

ABSTRACT

The loaches form an important group of having good potential to be classified aquarium fish due to their small size, bright bands, blotches, colouration, peaceful nature, hardiness, compatibility, and the ability to be reared in aquarium throughout the life span. In the present communication, The Darjeeling Himalaya and its adjoining plain land Terai and Dooars of the Indian state of West Bengal were surveyed for four years (March 2007 to February 2011) in order to examine the diversity of loaches. A total of 20 species of loaches were recorded from the study area belonging to 4 families and 9 genera. Percentage compositions of families were Balitoridae (5%), Nemacheilidae (55%), Cobitidae (20%) and Botiidae (20%). Amongst them more than 50 percent species belong to threatened category. The region with rich ichthyodiversity and high level of endemism is under immediate threat of species decline and habitat destruction mainly due to tremendous pressure from demotechnic growth and also because of natural environmental changes. Thus, there should be a term planning, conservation and judicious use of the germplasm, the highly priced native ornamental fish resources especially loaches to provide this region an ample scope for foreign exchange earnings.

Keywords: *Darjeeling Himalaya, Loaches, Ornamental fish.*

INTRODUCTION

The fishes of the superfamily Cobitoidea (suborder Cobitoidei minus Catostomidae) are popularly called “Loaches” which form an important group having good potential as a classified aquarium fish due to their small size, bright bands, blotches, colouration, peaceful nature, hardiness, compatibility, and which can be reared in aquarium throughout their life span. Fishes of the suborder Cobitoidei, are small benthic fishes known throughout Eurasia, with two named species in Africa[1]. The suborder Cobitoidei derives its name from *Cobitis*, a genus established by Linnaeus[2]. *Cobitis* means 'like the gudgeon'. Kottelat[1] has reviewed the suborder and recognised 1043 valid species in 111 valid genera. Earlier, approximately 85 genera and 770 species of loaches have been reported[3]. The general body pattern is oblong, elongate, compressed or cylindrical but not depressed. Snout and lips are fleshy. Small, inferior mouth is with thick pendulous barbels. Six to eight, rarely 10 barbels are present. The fishes are usually scaleless; scales when present, small and cycloid. A suborbital or preorbital spine is present or absent. Lateral line is nearly straight. Vertical fins are spineless. Dorsal fin is with varying number of rays (8-30), anal with few (7-8) rays. Pelvics are present or absent. Darjeeling Himalaya, as it popularly known, is the hilly Himalayan part of the northern most Darjeeling district of Indian state of West Bengal. The district lies between 27º13' 05" and 26º17'10" North latitude and between 88º 53' 00" and 87º 59' 30" East longitude. Being an integral part of the eastern Himalaya the region is regarded as freshwater biodiversity hotspot[4]. Goswami *et al.*, [5] have reported a total of 67 species of loaches from North-East India, inclusive Himalayan and Indo Burma biodiversity hotspot s zones. Blyth[6] had collected *Botia nebulosa* (=*Nemacheilus botia*) from

Darjeeling. Choudhury[7] described a new species *Lepidocephalichthyes annandalei* obtained from the river Tista near Jalpaiguri and the river Mahananda at Siliguri. Shaw and Shebbeare[8] had listed 17 species from North Bengal. Hora and Gupta[9] collected fish from Kalimpong Duars and Siliguri Terai of North Bengal and mentioned ten species under the family Cobitidae. Very recently a total of 13 species were reported from Teesta river[10]. Some species are already popular among the traders and hobbyists both locally and globally by specific trade name. The present study was therefore carried out in order to examine the diversity of loaches in the Darjeeling Himalaya and its adjoining plain land Terai and Dooars of the Indian state of West Bengal. The elucidation of the distribution patterns of loaches will provide substantial geographical and biological information as a starting basis for the formation and implementation of conservation policy.

MATERIALS AND METHODS

Darjeeling Himalaya, as it popularly known, is the hilly Himalayan part of the northern most Darjeeling district of Indian state of West Bengal. The region has a pronounced seasonal climate and lies north of the tropical belt (The district lies between 27º13' 05" and 26º17'10"North latitudes and between 88º 53' 00" and 87º 59' 30" East longitudes). The wavy plain lying in the foot of Darjeeling Himalaya is known as the Terai and Duars. The Western part of the river Teesta is known as Terai and Eastern part is called Duars (Fig-1). Collection of fish were made from River Teesta and Rangeet, hill stream Relli and Riyang in Darjeeling Himalaya, river Mahananda and Sevok khola in Terai, Ghish in Duars, Teesta barrage at Gajoldoba, ponds and ditches from March 2007 to February 2011. Fish sampling was carried out following fishermen or local people who used to catch fish in this region. Gears and methods used in fish sampling were cast net (*Bhureli jal*), rock-striking, scoop net, gill-net, hook and line, various traps (*Dhadiya, tip, thokre and thali trap*), electro-fishing and water diversion. The fishes caught were examined for their morphological features, colour bands or spots present on the body and these were recorded in the field along with their length and weight. Photographs were taken by digital compact camera (Nikon, coolpix L10). Two specimens of each species were taken for identification. The specimens were transported to the laboratory after wrapping them in cotton soaked in 10% formalin solution and packed in polythene bag. Before identification these were washed in running tap water for half an hour and then the species were ascertained on the basis of their morphometric characters and meristic counts following the criteria given by Shaw and Shebbeare[8]**,** Menon[11], Talwar and Jhingran[12], Menon[13], Tekriwal and Rao[14], Nath and Dey[15], and Jayaram[16]. Valid scientific names were taken from *Fish Base*[17]. Current conservation status as evaluated by Conservation Assessment and Management Plan (CAMP) workshop held at NBFGR[18] is indicted and IUCN[19].

RESULTS AND DISCUSSION

A total of 20 species of loaches were recorded from the study area and these belong to 4 families and 9 genera (Table- I). The percentage composition of families of loaches representing Darjeeling Himalaya and adjacent areas is depicted in Fig.1. Shaw and Shebbeare[8], Hora and Gupta[9] and Sen[20] reported 17, 10 and 20 species of Loaches respectively from this region. Single species, *Balitora bruce*i belonging to the family Balitoridae (hill-stream loach) was found in the bottom of swift river like Teesta, stream like Riyang. The loach does well in aquaria but is not popular because of its drab appearance[21]. A total of 11 species of loaches belongs to the family Nemacheilidae (Cylindrical Loaches) were found among the stones and pebbles at the bottom of shallow, clear and swift streams like Teesta, Rangeet, Riyang, Relli, Mahananda, Sevok khola and Ghish. Environmental conditions tend to produce similar characters and it is probable that the great resemblance between the various species of Nemacheilids is due to a similarity in their environment[21]. Single specimen each of *Nemacheilus botia aureus* and *Schistura Savona* was caught in Teesta and Teesta barrage area respectively. *Acanthocobitis botia* and *Nemacheilus botia aureus* are synonymous[22] but Jhingran and Sehgal[23] and Srivastava[24] treated them separately. *Nemacheilus mooreh* (Sykes, 1839) is synonym of *Nemacheilus botia aureus*[17]. Earlier, Shaw and Shebbeare[8] and Hora and Gupta[9] have also reported *Schistura Savona* from this area. The family Cobitidae is popularly known as 'Spined Loaches'. They are bottom dwellers, mostly of small sizes and are found mainly in streams,

rivers and lakes of hilly areas[14]. The family Cobitidae is popularly known as 'Spined Loaches'. They are bottom dwellers, mostly of small sizes and are found mainly in streams, rivers and lakes of hilly areas[14]. Four species of 'True Loaches' which belong to the family Cobitidae were found in this region. Characterstics of Cobitid genera like *Lepidocephalichthys, Pangio and Canthophrys* were compared[25]. These Cobitid genera did not form a monophyletic group and were referred to as the 'southern lineages'[26]. *Lepidocephalichthys guntea* (Air Breathing Loach) was found in muddy bottom of pool zone of streams, rivers and ditches. They appear to prefer a sandy or fine gravel bottom into which they are able to burrow and quickly disappear if alarmed or frightened. The spinous first pectoral ray helps with the digging in[14]. *Pangio pangia* (Coolie Loach) inhabit standing or slow flowing waters of pool zones of stream and rivers of submontane regions. The fish is quite popular with aquarist. Another species *Pangio apoda* (Snake Loach) was also found in Teesta barrage area. Shaw and Shebbeare[8] mentioned that Hora found a form of *Pangio pangia* without pelvices among the debris at the bottom of still pools. He therefore suggests that the form may be correlated with its habitat. But recently the form was described by Britz and Maclaine[27] from Teesta barrage area and the new species status was supported by Kottelat[1]. *Canthophrys gongota* (Jaguar or Moose Faced Loach) is a very odd-looking fish which inhabit the sandy or muddy bottom of streams. Four species of family Botiidae (Point Faced Loaches) were found in the study area and found to inhabit in the benthos of running water. They have a large bifid suborbital spine which can be erected and set in a position perpendicular to the cheek, must be of material value in discouraging attacks by snakes and fish, somewhat similar to the tusks of a wild boar[21]. Spines are also used for shifting the sand for blood worms and other worms[14]. Shaw and Shebbeare[8] found *Botia dayi* and Sen[20] recorded *Botia rostrata* in this region. *Botia.dayi* and *Botia.rostrata* are synonyms of *B.almorhae*[13]. But, Kottelat[1] treated them separately. Some species like *Lepidocephalus annandalei, Nemacheilus zonatus and Balitora maculata* were not found in this survey which was earlier reported by Shaw and Shebbeare[8] and Sen[20]. *Lepidocephalus annandalei* and *Lepidocephalichthys guntea* was regarded as conspecific[9] though treated separately by Kottelat[1].

Conservation status of the loaches of Darjeeling Himalaya and adjoining areas of West Bengal evaluated on the basis of CAMP report have shown that out of 20 species, 5 are Endangered (EN), 2 are Vulnerable (Vu), 5are Lower Risk Near Threatened (LR-nt) and rest 8 are Not Evaluated (NE). But recent update by NBFGR[28] included species like *Schistura multifasciata, Pangio pangia* and *Botia dario* under vulnerable (Vu) category. Two species *Balitora brucei and Nemacheilus devdevi* belong to Near Threatened category and *Botia rostrata* is vulnerable[19]. Thus, more than 50% species of loaches belong to threatened category. This categorization may be useful for planning conservation strategies for genetic resources of loach and policy development for the benefit of people and industries concerned.

The people of this region generally do not consider loaches as food fish, so are neglected but these fishes fetch good price in the ornamental fish market. Ornamental fishes, popularly known as 'aquarium fish', or 'live jewel', are exported to 27 countries, which amounted to 2568 mt (0.86 per cent of the total marine export) in terms of quantity and US$14 million (0.50 per cent of total marine export) in terms of value[29]. The entire supply of Indian ornamental fish is primarily dependent on wild catch (85 per cent) and a few artificially bred varieties (15 per cent) of exotic fish. Among the wild catch fishes exported from the country, West Bengal and the North-Eastern states are the major contributors[30]. Capture based export is not sustainable in ornamental fish trade because species are being harvested at greater volumes and fetching higher rates, threatening the viability or sustainability of this fishery across various parts of the world [31, 32, 33].Moreover, the fishes are collected from the wild habitat by local fishermen and then marketed by traders who actually control the activities. This could be improved by providing pertinent training to the interested farmers on captive breeding and rearing of ornamental fishes and providing incentives and assistance to them to create basic infrastructure for a fishery unit[34]. Breeding and farming of ornamental fish requires very little space, the same can be done even in the backyard of houses. This would enable even women to look after the culture and involve them in this business.

Table I: Loaches of Darjeeling Himalaya and adjoining areas of West Bengal

Name of the Species/ Length (L) in cm. / English (E), Nepali (N), Bengali (B) Name.	Distribution	Conservation Status CAMP / IUCN
Order – Cypriniformes **Sub-order- Cobitoidei** **Super-family – Cobitoidea**		
Family – Balitoridae Swainson,1838		
1. *Balitora brucei* Gray, 1830. L=7; Gray's stone loach (E); Tita Kabre (N).	Teesta, Riyang, Teesta barrage	**LR-nt/ NT**
Family – Nemacheilidae Regan, 1911		
2. *Aborichthys elongatus* Hora, 1921 L=8; Bami gadela (N); Wedge tail Loach (E)	Relli, Rangeet, Teesta, Riyang.	**EN/LC**
3. *Acanthocobitis botia* (Hamilton, 1822) L=8; Mottled loach, Leopard loach (E); Bilturi, Poia(B); Pate Gadela (N)	Relli, Teesta, Sevok, Mahananda.	**LR-nt/LC**
4. *Schistura beavani* (Günther, 1868) L=4; Creek loach or Banded loach (E); Gadero (N);Poia (B).	Relli, Rangeet, Teesta, Riyang, Mahanada.	**NE/ LC**
5. *Schistura multifasciata* (Day, 1878) L=7; Many banded loach (E); Gadela (N); Poia(B).	Relli, Teesta	**EN/LC**
6. *Schistura rupecula* McClelland, 1838 L=4; Banded loach (E); Gadela (N); Poia (B).	Relli, Rangeet,Teesta, Riyang.	**LR-nt/ LC**
7. *Schistura scaturigina* McClelland, 1839 L=6 ; Victory Loach (E); Gadela (N); Dari, Poia(B).	Relli, Rangeet,Teesta, Riyang.	**Vu/ LC**
8. *Schistura shebbearei* (Hora, 1935) **L= 4**; Gadela (N); Khorkey/Kharika or Poia (B).	Teesta, Teesta barrage	**NE/ NEF**
9. *Schistura savona* (Hamilton, 1822) L=2.3; Half-banded loach (E); Khorka (B)	Teesta Barrage	**NE/LC**
10. *Nemacheilus devdevi* (Hora, 1935) L=3; Olivaceous loach (E); Gadela (N); Poia(B).	Relli, Rangeet, Teesta, Riyang, Mahananda.	**EN/NT**
11. *Nemacheilus botia aureus* (Day, 1878) L=6; Loach; Gadela (N);Poia (B).	Teesta	**NE/NEF**
12. *Nemacheilus corica* (Hamilton, 1822) Polka dotted loach (E), Gadela (N); Kharika (B).	Teesta barrage	**LR-nt/LC**
Family – Cobitidae Swainson,1838		
13. *Lepidocephalichthys guntea* (Hamilton, 1822) L=8; Guntea loach (E); Lata or Gethu (N); Gunte Poia or Gutum (B)	Teesta, Ghish, Sevok, Mahananda, ditch, ponds.	**NE/ LC**
14. *Pangio pangia* (Hamilton, 1822) L=5; Coolie loach (E); Pangya or Daria (B)	Teesta and Sevok	**Vu/ LC**
15. *Pangio apoda* Britz and Maclaine, 2007 L=3.2; Eel loach (E); Pangya or Daria (B)	Teesta barrage	**NE/DD**
16. *Canthophrys gongota* (Hamilton, 1822) L=8; Gongota loach, Jaguar loach (E); Poia (B); Latai (N).	Relli, Teesta, Sevok, Ghish, Mahananda.	**LR-nt/ LC**
Family –Botiidae Berg, 1940		
17. *Botia lohachata* Chaudhuri, 1912 L=10; Y-loach (E); Baghi (N)	Teesta, Teesta barrage	**EN/ LC**
18. *Botia dario* (Hamilton, 1822)L= 11; Golden banded loach or Rani loach (E); Baghi (N)	Ghish, Sevok, Ditch	**NE/LC**
19. *Botia almorhae* Gray, 1831 L=9; Almorah loach (E); Baghuwa (N)	Teesta barrage	**EN/ LC**
20. *Botia rostrata* Gunther, 1868 L=8; Gangetic loach or twin banded loach (E); Rani mach (B).	Mahananda, Teesta barrage	**NE/Vu**

*** EN- Endangered, Vu-Vulnerable, LR-nt-Low risk near threatened, NE-Not evaluated, NT- Near Threatened, LC- Least Concern, NEF- No Entry Found, DD-Data deficient.**

Fig.1: Study area showing sampling sites (Courtesy- Google earth)

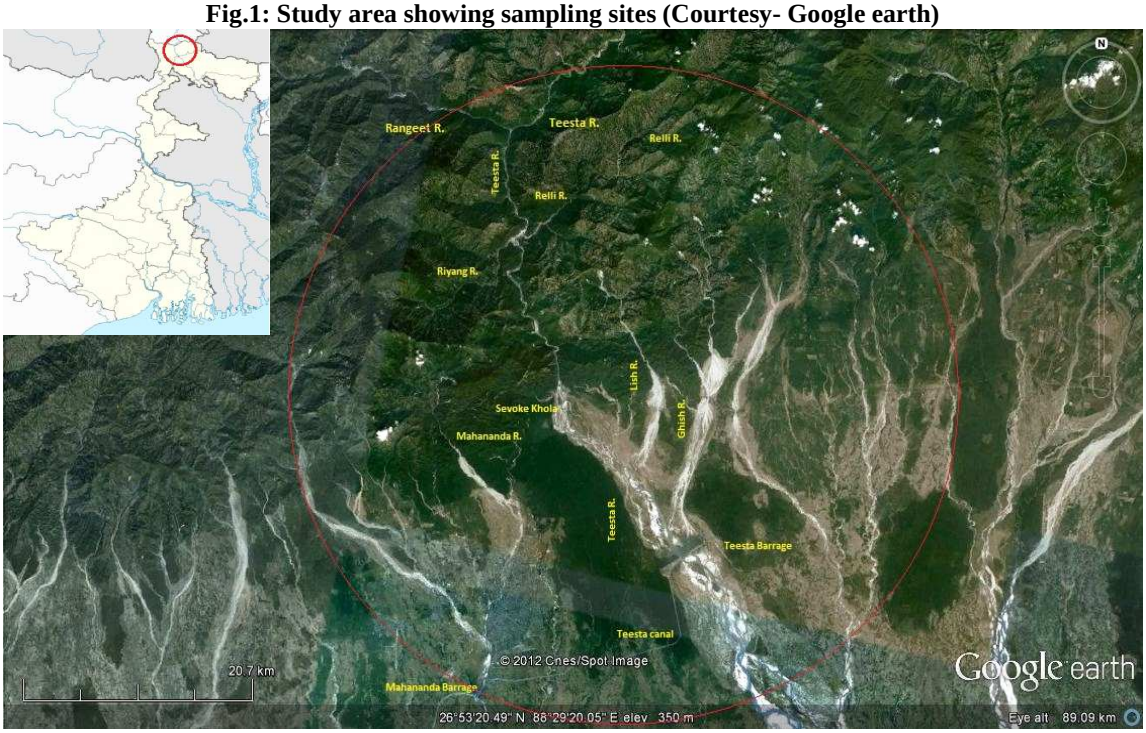
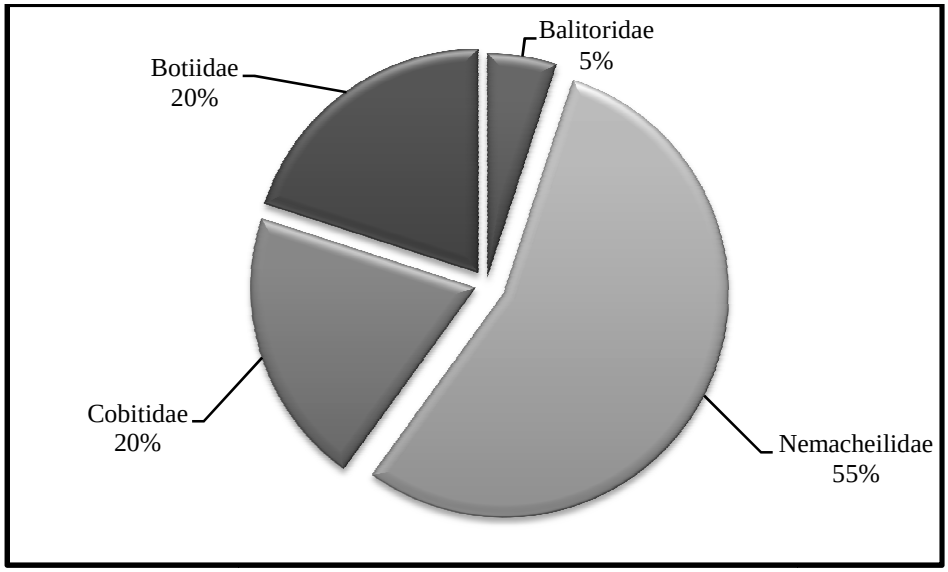


Fig.2: Percentage composition of families of loaches in the study area



CONCLUSION

The region with rich *ichthyodiversity is* under immediate threat of species decline and habitat destruction due to tremendous pressure from demotechnic growth and natural environmental changes. All the rivers, streams and other water bodies are more or less impacted because of high population growth, construction of highways, roads, bridges, dams, destruction of riparian vegetation and watershed forest cover, denudation causing high siltation, boulder and sand lifting, landslides, disposal of untreated sewages, indiscriminate use of pesticides and fertilizer in agricultural practices, altered land use pattern, rampant fishing and so on. Several workers [23, 35] have mentioned that illegal fishing methods used in the Himalayan rivers cause a decline in the fish population.

It may be concluded, that gene pool of unique ichthyofauna in Darjeeling Himalaya and adjoining areas is a valuable endowment of nature. The aquatic resources and fish germplasm are our national wealth which

has co-evolved during the course of evolution. Any species getting extinct would upset the ecological balance resulting in dangerous imbalance of the system. Thus, the use of destructive methods of fishing calls for formation of task force, strict vigilance, stopping illegal fishing and effective enforcement of legislative measures such as, closed season, mesh size regulation and awareness of the local people residing along the river bank. The involvement of voluntary organizations, local clubs, self-help groups, is urgently needed in an effort to maintain fish stocks at a healthy level. Cornish and McKellar[36] opined, educating the local communities on the destructive effects of the practices and making them more vigilant and responsible for controlling them would be more effective. The stocks should be enhanced through regular release of hatchery produced fingerling especially of fishes with ornamental value and having endangered and vulnerable status. Thus, through long term planning, conservation and judicious use of the germplasm, the highly priced native ornamental fish resources especially loaches may provide the region an ample scope for foreign exchange earnings.

Acknowledgements

The authors are grateful to the Head, Department of Zoology, University of North Bengal; Principal, Kalimpong College for providing necessary laboratory facilities for the present work. We are also grateful to Mr. S. Rai and Mr. G. Chhetri, Mr. K. Monger, Mr. N. Gupta, Mr. K. Pradhan, Mr. S. Rai, Mr. B. B. Chhetri, Mr. S. Sherpa, Mr. P. B. Rai, Mr. S. Sarkar and Mr. P. Das for their help and assistance during sampling.

REFERENCES

1. Kottelat, M., Conspectus cobitidum: an inventory of the loaches of the world (Teleostei: Cypriniformes: Cobitoidei). *The Raffles Bulletin of Zoology, Suppl.* **26**: 1-199 (2012)
2. Linnaeus, C., *Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis. Tomus I. Editio decima, reformata*. Salvius, Holmiae. 824 pp (1758)
3. Nelson, J.S., *Fishes of the world*, 4th ed. *Wiley, New York* (2006)
4. Kottelat, M. and Whitten, T., Freshwater Biodiversity in Asia with special reference to Fish: World Bank Tech. Paper No. 343. The World Bank, Washington, DC. Pp.17-22 (1996)
5. Goswami, U. C., Basistha, S. K., Bora, D., Shyamkumar, K., Saikia, B. and Changsan, K., Fish diversity of North East India, inclusive of the Himalayan and Indo Burma biodiversity hotspots zones: A checklist on their taxonomic status, economic importance, geographical distribution, present status and prevailing threats. *International Journal of Biodiversity and Conservation,* **4(15)**: 592-613(2012)
6. Blyth, E., Report on some fishes received chiefly from the Sitang river and its tributary streams, Tenasserim Provinces. *Journal of the Asiatic Society of Bengal*, **29** (2): 138–174 (1860)
7. Chaudhuri, B. L., Descriptions of some new species of freshwater fishes from North India, Rec. Indian Mus., **7**: 437-444 (1912)
8. Shaw, G. E. and Shebbeare E. O., 1937. The fishes of Northern Bengal. *Journal Royal Asiatic Society of Bengal. Science*. **3(1)**: 137 (1992)
9. Hora, S. L. and Gupta, J. C., On a Collection of Fish from Kalimpong Duars and Siliguri Terai, Northern Bengal. Journal Royal Asiatic Society of Bengal. Science. **6(8)**: 77-83 (1940)
10. Acharjee, M. L. and Barat, S., Ichthyofaunal Diversity of Teesta River in Darjeeling Himalaya of West Bengal, India. *Asian J. Exp. Biol. Sci.* **4 (1)**:112-122 (2013)
11. Menon, A. G. K., *Fauna of India and Adjacent Countries.* Pisces Vol. IV. Teleostei-Cobitoidea, Pt. I,Homalopteridae. ZSI Calcutta. Pp. X+259, pls. 1-XV (1987)
12. Talwar, P.K. and Jhingran A. G., Inland *Fishes of India and adjacent countries*. In 2 vols. Oxford & IBH Publishing House, New Delhi. Pp. xx+1158 (1991)
13. Menon, A. G. K., *Fauna of India and Adjacent Countries.* Pisces Vol. IV. Teleostei-Cobitoidea, Pt. 2, Cobitidae. ZSI Calcutta. Pp. 113+Plate1-10 (1992)

14. Tekriwal, K. L. and Rao A. A., Ornamental Aquarium Fish of India. Waterlooville, Kingdom Books. Pp. 144 (1999)
15. Nath, P. and Dey, S. C., *Fish and Fisheries of Northeastern India (Arunachal Pradesh)*. Narendra Publishing House. Delhi (India). Pp. xviii + 217 (2000)
16. Jayaram, K. C., *The Freshwater Fishes of the Indian Region.* 2nd edition. Narendra Publishing House. Delhi (India). Pp. 616 (2010)
17. Froese R. and Pauly D., (Eds.). *FishBase*. World Wide Web electronic publication.www.fishbase.org, version (08/2012)
18. Molur, S. and Walker, S. (eds.). Report of the Workshop "Conservation Assessment and Management Plan (CAMP) for Freshwater Fishes of India". Report # 18. Zoo Outreach Organisation/Conservation Breeding Specialist Group, India, Coimbatore, India, and NBFGR, Lucknow, India (1998)
19. IUCN., IUCN Red List of Threatened Species. Version 2012.2. <www.iucnredlist.org>Downloaded on 18. 12. 2012
20. Sen, T. K., *Freshwater Fish.* State Fauna Series 3: Fauna of West Bengal, Part 2, Zoological Survey of India: 101-242.
21. Rao, A.A., Indigenous cold water fish potential for ornamental fish exports. In: Proceedings of State Level Seminar on *Prospects and Potentialities of Cold Water Fisheries in West Bengal.* Jointly organized by Department of Fisheries, Aquaculture, Aquatic resources and Fishing harbours, Government of West Bengal and Department of Zoology, University of North Bengal, Siliguri. pp. 50-54 (2006)
22. Jayaram, K.C., *Freshwater fishes of India; A hand book.* Zoological Survey of India, Calcutta (1981)
23. Jhingran, V. G. and Sehgal, K. L., *Cold water Fisheries of India.* 1st edition. Inland Fisheries Society of India, Barrackpore, West Bengal, India. Pp. ix+239 (1978)
24. Srivastava, G., *Fishes of U.P. and Bihar*. 13th edition. Viswhavidyalaya Prakashan. Varanasi, India. Pp. 207
25. Havird, J. C. Page, L. M. Tangjitjareon, W. Vidthaynon, C. Grudpan, C. and Udduang, S., A new species of *Lepidocephalichthys* (Teleostei: Cobitidae) with distinctive sexual dimorphism and comments on relationships in southern lineages of Cobitidae. *Zootaxa* **2557**: 1–18 (2010)
26. Havird, J.C. and Page, L.M., A revision of *Lepidocephalichthys* (Teleostei: Cobitidae) with descriptions of two new species from Thailand and Myanmar. *Copeia*, 137–159 (2010).
27. Britz, R. and Maclaine, J., A review of the eel-loaches, genus *Pangio*, from Myanmar (Teleostei: Cypriniformes: Cobitidae). *Ichthyological Exploration of Freshwaters*, **18**(1): 17–30 (2007)
28. Lakra W. S., Sarkar U. K., Gopalkrishnan A. and Kathirvelpandian A., *Threatened Freshwater Fishes of India.* National Bureau of Fish Genetic Resources, Lucknow. Pp, 1-20 (2010)
29. MPEDA., Export Performance of Marine Products during 2005-06, http:// www.mpeda.com (2007)
30. Mahapatra, B.K. Vinod, K. Mandal, B.K. and Bujarbaruah, K.M., Ornamental Fisheries in North Eastern India, Research Bulletin No. 49, ICAR Research Complex for NEH Region, Umroi Road, Umiam, Meghalaya (2006)
31. Vagelli, A.A. and Erdmann, M.V., First comprehensive ecological survey of the Banggai cardinalfish, *Pterapogon kauderni*. *Environmental Biology of Fishes*, **63**: 1-8 (2002)
32. Cato, J.C. and Brown, C.L., *Marine Ornamental Species: Collection, Culture, and Conservation.* Ames, IA: Iowa State Press (2003)
33. Lunn, K.E. and Moreau, M. A., Unmonitored trade in marine ornamental fishes: The case of Indonesia's Banggai cardinal fish (*Pterapogon kauderni*), *Coral Reefs*, **23**:344-351 (2004)
34. Mandal, S. Mahapatra, B. K. Tripathi, A. K. Verma, M. R. Datta, K.K. and Ngachan, S. V., Agribusiness Opportunities of Ornamental Fisheries in North-Eastern Region of India. Agricultural Economics Research Review Vol. 20 (Conference Issue). Pp 471-488 (2008)
35. Acharjee, M. L. and Barat, S., Impact of fishing methods on conservation of ichthyofauna of river Relli in Darjeeling Himalaya of West Bengal. *Jour. of Environ. Biol,* July, **31**: 431-434 (2010)
36. Cornish, A.S. and McKellar, D., A history of fishing with explosives and poisons in Hong Kong waters. Naga, the Iclarm Quarterly, **21**: 4-9 (1998)