Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Archives of Applied Science Research, 2014, 6 (1):223-228
(http://scholarsresearchlibrary.com/archive.html)

ISSN 0975-508X
CODEN (USA) AASRC9

Report of IUCN Red Listed *Pillaia indica* Yazdani, 1972 from Lakhimpur District of Assam, Northeast India with a note on its habitat ecology

Bikramaditya Bakalial[1*]; Shyama Prashad Biswas [2]; Debojit Baruah[3]

[1,2] Department of Life Sciences, Dibrugarh University, Dibrugarh, Assam 786604, India
[3]Department of Botany, Lakhimpur Girls' College, North Lakhimpur, Assam 787031, India

---

ABSTRACT

Pillaia indica Yazdani,an endangered hill stream spineless eelhas been detected for the first time in a streamof upper Assam after its first discovery in Meghalaya in the year 1972.Information on the eco-biology, population structure, distribution pattern, and threats to this endangered fish is least known. In this paper, attempt has been made to provide some data on certain morphometric characters, habitat ecology and feeding behavior. A brief discussion on the potential threats and steps taken for its conservation is also included.

Keywords: *Pillaia indica*, Northeast India, habitat-ecology, conservation.

INTRODUCTION

Earthworm eels of the family Chaudhuriidae are small, very elongated, spine-less percomorphs that live among dense aquatic vegetation and leaf litter in standing or slowly flowing waters of small streams, lakes and ponds in India, Indonesia and the Sunda Iislands [1] [2] [3].Currently, the family comprises ten species of which three genera *Chaudhuria*, *Pillaia* and *Garo*are found in India. The only species of *Pillaia* found in India i.e. *P. indica* was first described by Yazdani in 1972 fromSumer stream of Khasi and Jayantia Hills of Meghalaya of Northeast India [4]. Meghalaya was included in Assam till 1972 and established as separate state later on.Thisfishwas described under the genus *Chaudhuria*andthrough a journey of frequent changes in taxonomic positions [5][6][7][8] [9] it was finally validated as *Pillaia indica* by Kottelat& Lim [2].Britz &Chaudhry[10] considered *Pillaia indica* as a Endangered fish of IUCN based on criteria - B1ab(iii). After its original description, it was reported from Arunachal Pradesh [11]but without including much detail about it while Bagraand coworker [12] did not include the same in their checklist of fish of Arunachal Pradesh prepared based on field collections and literature reviews.

During thefield visits operated (2010 – 2013) to inventorize the fish fauna of Subansiri sub-basin, Lakhimpur District of Assam, Northeast India few individuals of *Pillaiaindica* was collected from a low altitude ephemeral stream in the winter months of 2010.Some aspects on body morphometry, habitat ecology, feeding biology, potential threat and conservation measures taken for the fish are discussed herein along with the geographical range extension report of the fish.

MATERIALS AND METHODS

This hill stream, locally called *Baghijan*originates from the foothills of Arunachal Pradesh and enters Lakhimpur district, Assam of Northeast India (Fig. 1). Fishing in the stream was done with the help of a very fine meshed scoop net (2 X 2 foot).Collected specimen werepreserved

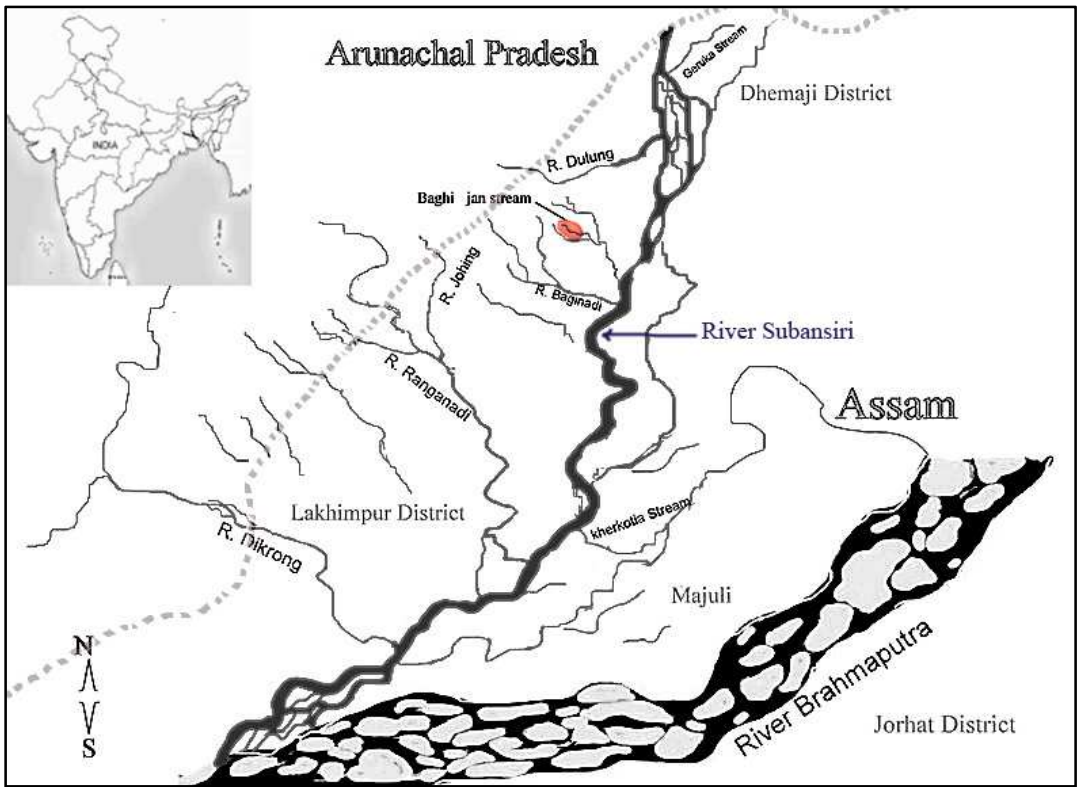


Fig. 1 Schematic map of Lakhimpur Distict with major drainage system
(red area indicates Baghijan stream, N 27°25' E 094°11')

in 10% formalin and deposited in Lakhimpur Girls' College Museum of Fishes. Identification of the fisheswere done following [13],[14]and scientific names followed that of CAS Ichthyology- Catalog of Fishes. Conservation status for the fish was determined following web database of - The IUCN Red List of Threatened Species. Photographs were taken with digital camera (Model: Cannon IXUS 95 IS, SONY DSC W35). Morphometric measurements of the fish were done using digital vernier calipers following[3]. Gut content of two mature individuals were analyzed under compound microscope to evaluate nature of food material only.Nature of the stream was evaluated following [15],water temperature by using mercury thermometer, pH by pen type digital pH meter, current flow were recorded according to [16], DO by Winkler's modified method [17] and FCO_2following[18].Potentialthreats to the fish were determined by visual observation and information provided by the native people.

RESULTS

Table 1.Selected morphometric proportions (in %) of 5 specimens of *P. indica*.

Parameters	*Average*	*SD*	*SE*	*RANGE*	*% SL*
Total Length	5.86	± 2.03	0.83	4.22 - 9.60	
Standard Length	5.47	± 1.98	0.81	3.90 - 9.10	
Gape Width	0.32	± 0.13	0.05	0.20 - 0.54	5.85
Head Depth (at eye)	0.31	± 0.16	0.07	0.19 - 0.62	5.70
Head Width (at eye)	0.30	± 0.16	0.06	0.18 - 0.60	5.49
Body Depth (max)	0.35	± 0.16	0.07	0.22 - 0.66	6.46
Body Width	0.39	± 0.12	0.05	0.30 - 0.60	7.13
Anal Length	3.03	± 1.02	0.42	2.20 - 4.90	54.54
Pectoral fin length	0.20	± 0.10	0.04	0.12 - 0.40	3.72
Dorsal fin base	2.26	± 0.79	0.32	1.72 - 3.80	41.40
Anal fin Base	2.56	± 0.92	0.37	1.70 - 3.78	48.54
Pre Dorsal Length	3.29	± 1.09	0.45	2.4 0- 5.30	60.12
Pre Pectoral Length	0.84	± 0.36	0.15	0.54 - 1.50	15.37
Pre Anal Length	3.12	± 1.07	0.44	2.25 - 5.10	55.46

SD – standard deviation; SE-standard error

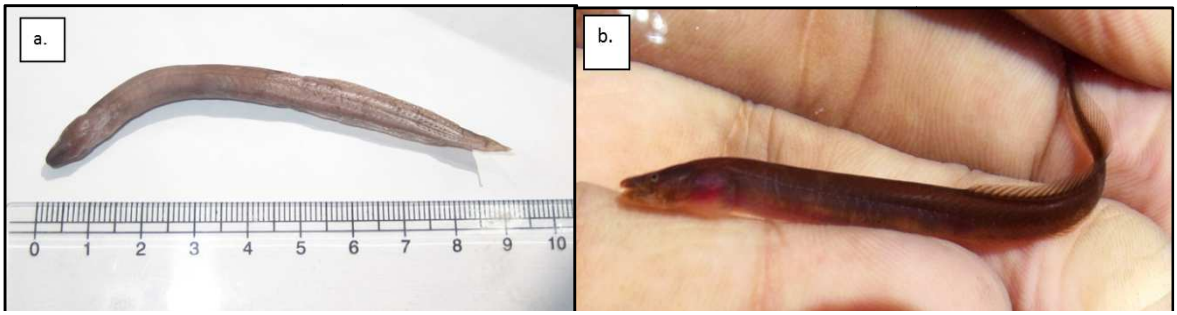
Brief description of the Fish:
Certain Morphometricmeasurementsof 5 specimens of *P.indica* are given in Table1. Head is dorsally depressed, laterally compressed and 15% of SL. Head depth and width at eye is almost equal, snout conical, mouth wide and

terminal. Gape width 39% of HL, narrow bands of small teeth on jaws, cleft of mouth reaches eye. Jaws with rows of small teeth. Eyes are minute.

Body elongated,anterior half of the body almost cylindrical,posterior portion develop lateral compression and tapering to the end,dorsal fin originates at posterior half of body, well developed and devoid of spines;anal fin also well developed,the starting fin rays of both dorsal and anal fin are short lengthen and gradually increasing its length toward posterior;caudal fin tapering, short and confluent with dorsal and anal fin;pectoral fins small, about 1/4 of head length.Ventral fin absent.Lateral line complete.Branchiostegal rays- six. The counted finrays are: Dorsal: 35-36, Pectoral: 8-9, Anal: 34-35, Caudal: 9-10.

The colour of the body varies and depending upon maturity stages. Adult individual dark reddish brown, while young are light purple reddish in colouration both in dorsal and flanks. Young fishes are more or less transparent. Ventral side is whitish through which pinkish gill and gut can be seen. Some arrow head shaped or 'v' shaped lines pointing towards head are found on the flanks with a light dark line running through them. In preserved specimens, a furrow arises in the longitudinal dark line. Fins are dusky white.

The depressed head, union of caudal fin with dorsal and anal fin, 8-9 pectoral fin ray and 9-10 caudal fin ray confirms the identity of the fish as *Pillaia indica.*(Fig 2 a&b)



Fig, 2: a. A mature preserved specimen. b. Sub-adult live specimen

Gut content:
Gut content of the fish mainly composed of small unknown aquatic insects, beetles and crustaceans. Small amount of plant debris, and sand particle were also observed in the gut content. Thus the fish seem to be a carnivorous fish or insectivorous fish.

Habitat Ecology:
The stream has a longitudinal connectivity between up and downstream during rainy period (April to October) and looses the surface water connectivity from November to March. The longitudinal connectivity and discharge of water mainly depends on local precipitation. The seasonal variation of water environment is depicted in Table 2and stream bed composition in Table 3.

Table 2: Certain physico-chemical parameter of the Baghijan stream

Season	Water Temp. (^{0}C)	Water Velocity (m/sec)	DO (mg/L)	FCO_2 (mg/L)	pH
Pre monsoon (Mar.-May)	26.78±0.81 (0.305)	1.06±0.08 (0.030)	10.98±0.98 (0.371)	4.13±0.51 (0.191)	7.71±0.14 (0.051)
Monsoon (June-Aug.)	28.34±1.27 (0.48)	1.44±0.23 (0.086)	8.19±0.66 (0.248)	4.03±0.55 (0.207)	7.63±0.05 (0.018)
Post Monsoon (Sept. – Nov.)	24.13±1.73(0.652)	0.56±0.11 (0.042)	8.46±0.45 (0.171)	7.57±0.34 (0.506)	7.64±0.39 (0.149)
Winter (Dec.–Feb.)	19.21±0.89(0.336)	0.19±0.04 (0.016)	9.61±1.17 (0.434)	4.30±1.28 (0.484)	7.40±0.16 (0.062)

value in parenthesis indicates standards error

Table 3: Stream bed composition of Baghijan stream

Sl no	Substrate materials	Percent composition
1.	Boulder (Larger than 256 mm in diameter)	12%
2.	Graval: (diameter greater than 2 mm-256 mm) a. Cobble: (64-256 mm in diameter) b. Pebble: (2-64 mm in diameter)	 21% 27%
3.	Sand (0.06 to 2 mm)	30%
4.	Silt (3 to 60 µm)	09%
5.	Clay (less than 3 µm or less than 0.003 mm)	01%

The fishmainly lives inrootwad habitatof the stream (Fig. 3a-f). However, it was also found in undercut banks, stable debris jams and overhanging vegetationin certain cases. The species is found to be confined in a length of 150 m stretch of the stream and during the dry period,

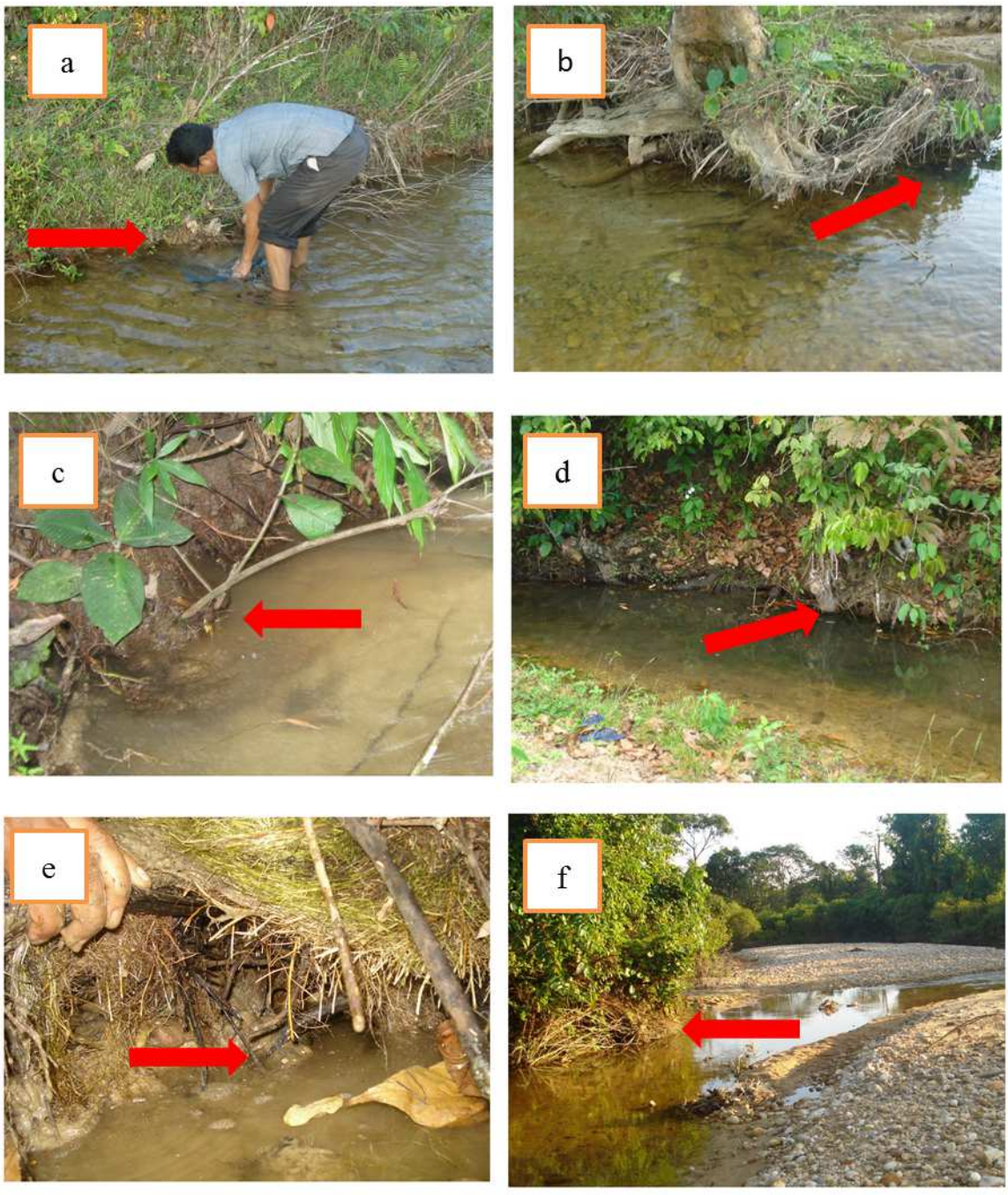


Fig 3a-f: Rootwad habitat at different part of the stream where *P. indica* occurred.

they prefer to stay in the rootwad composedof growing small roots and root hairs of *Dileniaindica (*a tropical evergreen tree),*Melastomamalabathricum*(a dominant riparian shrub) andsoft roots ofsome amphiphytic herbs. The rootwad habitat was found associated with a marginal stream pools (38-85 cm maximum depth during winter) where water saturation is found throughout the year.Bottom of the pools becomes muddy with decaying plant leaves. It avoids areas of rootwad where stream water hits directly or having fast water current. The riparian zone of the stream is covered with forest. Further, the twenty twofish species that occurred in the same stream along with *P. indica* are *Barilius barila, B. bendelensis, Chela cachius,Brachydaniorerio, Danio dangila,Devario aequipinnatus,D.devario, Puntius chola, P.ticto* (Cyprinidae)*; Nemacheilus botia* (Nemacheilidae); *Lepidocephalichthysguntea, Canthophrys gongota* (Cobitidae);*Amblyceps mangois, A.apangi* (Amblycipitidae);

Olyra longicaudata(Olyridae); *Badisbadis, B.singenensis* (Badidae);*Trichogaster chuna* (Osphronemidae);*Channa gachua,C. stewartii* (Channidae); *Pterocryptis sp.*(Siluridae) and *Mastacembelus armatus* (Mastacembellidae).

DISCUSSION

Yazdani (1972)described *P. indica*from Sumer stream of Meghalayawith oneparatype at Umsingat an altitude of 1524 m. But we have recorded the same species in a lower altitudinal level i.e.74 m after a long thirty years from its original discovery. Further, the maximum length known so far for the fish was8 cm while the present study reveals that the fish grows upto 9.1 cm of standard length.The other body descriptions also match with that of [4].

Rainfall is the major factor in controlling the hydrology and hydrobiology in this ephemeral stream.The exact duration of the dry phase varies according to the local hydrologic conditions.Flood events are unforeseeable and violent due to the heavy downpour of rains.During rainy period, the water discharge is almost bankful and the current flow is very high particularly in the months of July and August. From September onwards the discharge is quite moderate and last part of November onwards it looses longitudinal surface water connectivity with its upstream and becomes dry by leaving out some water saturations in the form of shallow pools along alond its sides. [19] advocated that ephemeral channels differ in the duration of their surface flow and show evidence of fluvial processes but have flows only during and shortly after precipitation events whereas in perennial streams, flow over the stream bed is usually maintained throughout the year.

Habitat complexity is a composite of cover elements which partition the available stream space. Rootwad habitat type was mainly found in intermediate small forest streams. Rootwads are considered as a part of large woody debris by some authors[20] [21] while other regarded it to be a unique habitat [15]. Number of rootwad present in a stream determines the species composition to a large extend [22] [23] [24]. Rootwadmay armor banks and provide important fish habitats [25] [26], act as refuge from predation and foraging substrate [27] [28]. In present study, *Pillaia indica*was found in rootwad habitat whichmay be for breeding or to avoid the damage, drift of eggs and spawnsfrom fast water current or sand particle therein. Stream invertebrates often take shelter in rootwad to avoid fast water current which serves as food for different fishes [29]. *P. indica*, as a carnivorous fish seem to take advantage of such food resource and also avoids competition for food and shelter with other fish species.

The main threat to the fish is anthropogenic in origin. Some native people use to practice fishing in the stream despite the absence of any larger sized fish or higher abundance of small fish. They use some native bamboo seines through which smaller individuals of *P. indica* easily passes away. However, larger reproducing adults often get caught which is dangerous for the survival of the species in the stream. Sometimes, rootwad habitat created by bankside shrub *Melastoma* sp. were also cleared completely in search of *P. indica* andother edible fish (e.g. sheltering *Channa stewartii, Danio dangila or Devario aequipinnatus*). We are also informed that agricultural pesticides of tea gardens have also been used by few native people to capture the Silurid fish -*Pterocryptis*sp. which results mortality of other non target fish species in the stream.

As a step to conserve the fish species, we havecreated and displayed few hoardings along the stream bank. The finding and importance of *P. indica* is written in local language (Assamese) assisted with a photograph of the fish and anappeal has been made to the native people to participate in the conservation of this endangered fish. Further interactions are also made with local inhabitants with an attempt to aware them about the species. It seems impossible to conserve a species without informing and involving the native people, especially in the cases like *Pillaia indica* where geographical distribution very restricted and the population is gradually declining. As the local population density is low and people seldom depends on the water of Baghijan Stream, a temporary declaration as 'No Disturbance Stream Zone' can also be proposed as a conservation step till more details of the species comes out from other regions of Northeast India.

CONCLUSION

Taxonomic diversity of fishes in Northeastern region of India is very rich. Every year, several new fish species are being described from this region. Due to different anthropogenic pressures, existences of these fishes are threatened. On the other hand, information on geographical distribution, habitat or different biological aspects are least known. The finding of such a fish, theEndangered hill stream spineless eel *Pillaiaindica* Yazdani, 1972 in an extended geographical location and information on the habitat ecology will help conserving the species in near future.

Acknowledgement
Authors acknowledge University Grants Commission, Govt. of India for the fund under their Major Research Project Scheme.

REFERENCES

[1] N Annandale. *Records of the Indian Museum*, **1918**, 14: 33–64.
[2]M Kottelat; KKP LIM. *Ichthyological Exploration of Freshwaters*, **1994**, 5(2):181-190.
[3] S Kullander;R Britz; F. Fang. *Ichthyological Exploration of Freshwaters*, **2000**, 11: 327–334.
[4] GM Yazdani. *Journal of the Bombay Natural History Society*, **1972**, 69:134–135.
[5] GM Yazdani. *Journal of the Bombay Natural History Society*, **1976**, 73: 166–170.
[6] PK Talwar; GM Yazdani; DK Kundu. *Proceedings of the Indian Academy of Sciences* **1977**, 85B: 53–56.
[7] GM Yazdani; PK Talwar.*Bulletin of the Zoological Survey of India*, **1981**, 4: 287–288.
[8] RA Travers. *Bulletin of British Museum (Natural History) Zoology*, **1984**, **6**(11):1-133.
[9] GD Johnson; C Patterson.*Bulletin of Marine Science*, **1993**, 52: 554–626.
[10] R Britz; S Chaudhry. IUCN Red List of Threatened Species.**2010Version 2013**.2.<www.iucnredlist.org>
[11] N Sen. *Records of the Zoological Survey of India*, **1999**, 97 (2): 189-204.
[12] K Bagra; K Kadu; K Nebeshwar-Sharma; BA Laskar; UK Sarkar; DN Das.*Check List*, **2009**, 5(2): 330-350.
[13] PK Talwar; AGJhingran. *Inland Fishes of Indian and adjacent countries*. Pvt. Ltd. I & II, New Delhi.**1991**, 1158 pp.
[14] KC Jayaram. *The freshwater Fishes of the Indian region*.Narendra Publishing House, New Delhi. **1999**, 551 pp.
[15]NB Armantrout.*Aquatic habitat inventory terminology glossary*.American Fisheries Society,Bethesda,Maryland.**1998**, 136 pp.
[16] PK Trivedy; K Goel; CLTrishal. *Practical Methods in Zoology and Environmental Science*.Enviro Media Publication, Karad (India) **1987**, 340pp.
[17] APHA. *Standard Methods for the Examination of Water and Wastewater.*17th Edition American Public Health Association, Washington D.C., **1989**, 1268 pp.
[18] PS Welch. *Limnology*, McGrew Hill Book Company, Inc., New York. **1952**, 538pp.
[19] KL Halwas; M Church; JS Richardson.*Journal of the North American Biotechnological Society* **2005**, **24**:478–494.
[20] ME Harmon; JF Franklin; FJ Swanson; P Sollins; SV Gregory; JD Lattin; NH Anderson; SP Cline; NG Aumen; JR Sedell; GW Lienkaemper; KCromack Jr.; KW Cummins. *Advances in Ecological Research*, **1986**, 15:133–302.
[21] PA Bisson; K Sullivan; JL Nielsen. *Transactions of American Fisheries Society*, **1988**, 117:262-273.
[22] DR Bustard; DW Narver.*Journal of Fisheries Research Board of Canada*, **1975**, 32:667-680.
[23] CS Shirvell. *Canadian Journal of Fisheries and Aquatic Sciences*, **1990** 47:852-861.
[24] RM Lehtinen; ND Mundahl; JCMadejczyk.*Environmental Biology of Fishes*, **1997**, 49:7-19.
[25] DD Magoulick.*Aquatic Ecology*, **2000**, 34:29–41.
[26] S Sutin; M Jaroensutasinee; K Jaroensutasinee. *World Academi of Scinece, Engineering and Technology*, **2007**, 36:28-31.
[27] P Roni; T P Quinn. *Transactions of the American Fisheries Society*,**2001**, 130:675–685.
[28] SM Boss; JS Richardson.*Canadian Journal of Fish Aquatic Science*, **2002**, **59**:1044–1053.
[29] JB Stribling; BK Jessup; JS White; D Boward; M Hurd. Report # CBWP-EA-98-3. Tetra-Tech, Owings Mills, Maryland, and Maryland Department of Natural Resources, Annapolis, Maryland.**1998**, 62p.