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A NEW FISH SPECIES OF THE GENUS *BARILIUS* (CYPRINIDAE : RASBORINAE), FROM RIVER SIANG, D'ERING MEMORIAL WILDLIFE SANCTUARY, ARUNACHAL PRADESH, INDIA

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INTRODUCTION

Arunachal Pradesh is known as global biodiversity hotspot in Eastern Himalaya and located in the transition zone between the Himalayan and Indo-Burmese region. The total geographical area of the Arunachal Pradesh is 83,743 km^2, which is predominantly hilly and mountainous, and largely covered with extremely varied and dense vegetation/ forests, crisscrossed by six major rivers and their tributaries (Kaul and Haridasan, 1987; FSI 2000; Kalita and Haridasan, 2001). These habitats carry fairly large populations of faunal elements belonging to various groups of invertebrates and vertebrates (Editor-Director 2006 a&b; Kumar and Ramakrishna 2009). During last one decade several new species of vertebrates and invertebrates have been discovered from the state (Borang *et al.* 2005; Datta *et al.* 2008; Kumar and Ramakrishna, 2009; Kumar *et al.*, 2005; Mishra and Datta, 2007). As per records of Zoological Survey of India (ZSI), fish fauna of Arunachal Pradesh comprises of 143 species under 61 genera, 21 families and 8 orders (Editor-Director, 2006a). It includes 50 new records from the state. The family *Cyprinidae* forms the largest group with 65 species followed by *Homolopteridae* (17 species), *Sissoridae* (12 species), *Bagridae* (7 species), *Channidae* and *Cobitidae* (6 species each) and the rest with one, two or three species. Of the 50 new records, 12 fish species are recorded exclusively from the state of Arunachal Pradesh.

Most of the fishes of hill streams belong to the Genus *Barilius*. Review of the literature reveals that in most cases the information on systematics of these taxa was provided only up to generic level. Howes (1980) reported the details of lateral line as complete, incomplete or absent. Nevertheless all the species either reported from India or adjoining countries has complete lateral line but none reported the absence or presence of interrupted lateral line at the species level. Similarly all seven species reported from the State of Arunachal Pradesh (Nath and Dey 2000; Sen 2006) showed the presence of complete lateral line.

In the present investigation we are reporting a new species of fish of genus *Barilius* from D'Ering Memorial Wildlife Sanctuary, Eastern Arunachal Pradesh. (Fig. 1) In this regard it may be mentioned that the support for the new species has been thoroughly investigated with all known species (including all synonymies) of the genus *Barilius* so far reported from the region and adjoining areas. Further, it may be mentioned that Tilak *et al.* (1984) and Talwar & Jhingran (1991) reported of sexual dimorphism pertaining to few characters like coloration of the body, fan shaped paired fins, body size in synonymies of *B. bendelisis*. When compared with the reported species, *B. arunachalensis* it revealed many interesting and new characters which were found sufficient to authenticate the reported species as new to science particularly in respect of barbels (totally absent), lateral line (incomplete, ceases at the 35th scale),

lateral line scales (with single large spots and a few bilobed spots), dorsal fin (fan shaped enclosed in a sheath with strong rays), snout (deeply humped), 'V' shaped band one on each side of gill opening, caudal fin (unequal).

STUDY AREA AND HABITAT

D'Ering Memorial Wildlife Sanctuary (hereafter DWS) is located in the eastern Arunachal Pradesh and one of the bio-diversity rich areas of the state. It was notified as Lali Wildlife Sanctuary in 1978 vide notification no. FOR/284/78/2 dated 23-08-1978. Later on it was named as Daying Ering Memorial Wildlife Sanctuary vide notification no. CWL/37/83/D/T/4524-54 dt. 27-10-1986. The total area of sanctuary is about 190 km^2 including aquatic area of Siang River. The sanctuary located between 95°22' to 95°29' E and 27°51' to 28°05' N, and divided into three ranges namely Anchalghat, Namsing and Borguli.

The sanctuary area mainly consists of two types of habitats. (i) Most of the land area (about 75%) is alluvial grassland and semi evergreen forest patches covering the rest (ii) While the aquatic area covering the sanctuary proper comprises of two major islands *i.e.* Jopong and Balun formed between Siang River and its tributary Sibya River (Fig. 2 and Fig. 3). Both the rivers are divided into streams, which intersect the sanctuary and form several smaller islands also. The topography of these islands changes from time to time depending upon the season, rainfall and flooded water. The surrounding area of the sanctuary is mainly composed of agriculture fields and thick forests. The main agriculture crop is paddy, while thick forest composed of mixed vegetation such as *Bombax ceiba*, *Albizzia procera*, *Dipteria wallichii*, *Talauma hodgsonii*, *Daubanga grandiflora*, *Solanum torvum* and *Ficus dumosa* etc. The sanctuary support a large number of endangered, rare aquatic and terrestrial species of animals such as White-winged Duck, Bengal Florican, Gangetic Dolphin, Tiger, Hispid Hare and some rare species of invertebrates (Kumar, 2009).

MATERIALS AND METHODS

The fauna of the sanctuary has not been documented properly. With reference to the ongoing research project of the Zoological Survey of India for the documentation of fish fauna of Arunachal Pradesh, a field survey was undertaken *w.e.f.* 03.10.2006 to 23.10.2006. During the survey different localities of DWS and surrounding areas were visited. Some fish specimens were also collected for identification and photographs were taken, from outside the sanctuary areas. During the survey on 07.10.2008, an interesting species was seen in the shallow water of Agari River mouth (Fig. 2). Few specimens were collected (about 8 of them) with the help of a local fishing person and photographed with scale (Fig. 4). Preliminary identification revealed that this species had some peculiar features and assumed that it may be new to science. On 08.10.2008, while surveying the southwest side of Jopong Island, the same species was seen in the shallow water streams in good number (about 11 individuals were seen). For confirmation and identification two of them were trapped, photographed and released immediately at the same place of trapping. Morphometric measurements and counts were made with dial calipers and recorded. The measurements of head length and body parts has been presented as proportion of standard length (SL).The subunits of head are presented as proportion of head length (HL). Counts and measurements were made on the left side of the specimen whenever possible. The system of classification of fish followed is after Jayaram (1999).

Type Material : *Holotype* : Reg. No.APFS/ZSI/P-502 dt. 8th October 2006, 16.5 cm. TL, O^-, Agari river mouth, D'Ering Memorial Wildlife Sanctuary, near Pasighat, East Siang District, Arunachal Pradesh, India.

Paratypes : Reg. No. APFS/ZSI/P-503 dt. 8th October 2006, 11.5-16.8 cm TL, 4 ex., O^-, 7 ex., O_+; other details as of holotype.

RESULTS

This new species differs from the other reported species of the Genus *Barilius* on various scores viz. (1) On the numbers of fin rays (D.i.7, P.ii.11,V.i.8, A.ii.8, C.18); shape of dorsal fins, fan like supported by strong and robust branched rays embedded in a muscular tough skin like pad. (2) Snout and lower lip beset with rough, prominent tubercles. (3) Snout deeply humped. Nostrils with prominent nares. (4) Mouth upturned, lips unequal and gape of mouth does not reach the orbit.

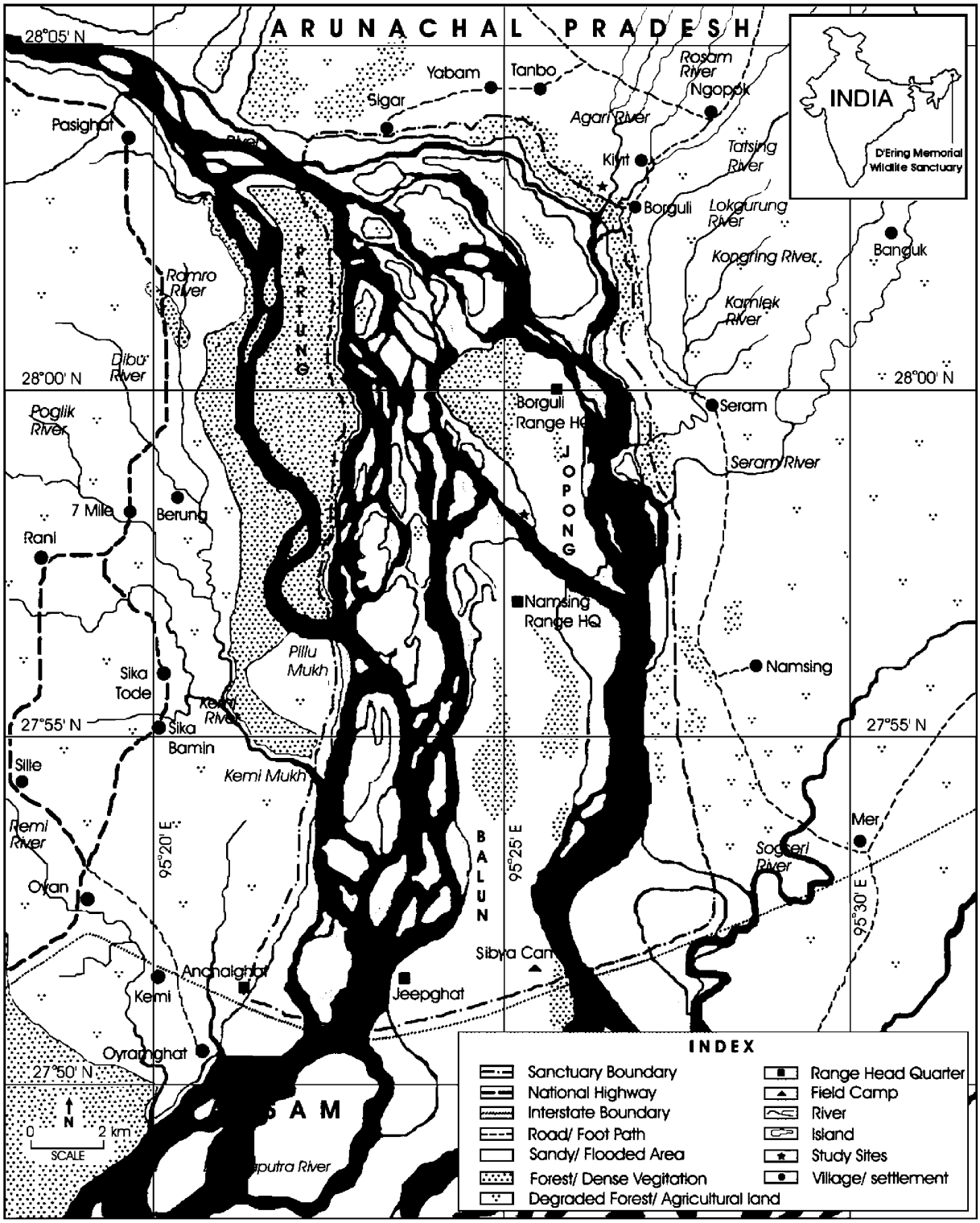

Figure 1 : Map of the D'Ering Memorial Wildlife Sanctuary, showing the study sites.

Figure 2 : Photograph is showing the confluence of Siang River and its tributary Agari River near Borguli village in north-east peripheral area of the sanctuary.

Figure 3 : Photograph is showing the general topography and habitat of the fish at Jopong island inside the sanctuary area.

Figure 4 : Indigenous method of the fishing in study area. Tribes of the area, mostly use bamboo made conical baskets (as shown in photo) for fish trapping in the minor rivers/ streams for livelihood.

(5) Pectoral tip reaches the base of ventral fin. (6) Caudal fin unequal, lower longer than upper. (7) Barbels totally absent. (8) Lateral line interrupted at the 35th scale. (9) Scales with oval shaped spot at the dorsal side and diamond shaped spots at its tip below the lateral line and lateral line scales with single large spots and a few bilobed spots. (10) Dorsal fin inserted nearer to caudal base. (11) Two longitudinal bands giving a 'V' shaped on each side behind gill opening. (12) Caudal fin with a prominent streak at the bifurcation of caudal lobes.

On account of the above mentioned specific characteristics, the species has therefore been described as a new species of the Genus *Barilius*. However while describing the new species, an attempt has been made for providing the key to identification of the available valid species (Menon 1999) of the Genus *Barilius* in the text.

KEY TO THE SPECIES OF THE GENUS BARILIUS

1. Lateral line complete, snout smooth. Barbels maybe present or absent ..... (2)

   Lateral line incomplete, ceases at the 35th scale. Snout deeply humped. Barbels absent .... *Barilius arunachalensis*. Sp. Nov

2. Barbels present ..... (3)

   Barbels absent ..... (14)

3. Barbels 2 pairs ..... (4)

   Barbels 1 pair ..... (10)

4. Vertical bars on the body absent .... *Barilius radiolatus* (Gunther)

   Vertical bars on the body present ..... (5)

5. Anal Fin short (A.ii.iii.7-8) ..... (6)

   Anal Fin long (A.ii.iii.10-12) ..... (7)

6. Maxillary barbel longer than rostral pair. Two black spots at the base of lateral line .... *Barilius bendelisis* (Hamilton-Buchanan)

   Maxillary barbels shorter than rostral pair. Black spots at the base of lateral line absent .... *Barilius shacra* (Hamilton-Buchanan)

7. Vertical bars extends to lateral line. Mascular pad at he base of pectoral. Pre-dorsal scales not less than 22 ..... (8)

Vertical bars does not reach lateral line. Mascular pad at pectoral absent. Pre-dorsal scale either more or less than 22 ..... (9)

8. Body shallow, its depth 4.6-4.8 in SL. Lateral line scales more than 43. Caudal unequal, lower lobe longer ..... *Barilius barila* (Hamilton-Buchanan)

Body deep, its depth 3-3.3 times in SL. Scales not less than 43. Caudal equal .... *Barilius ngawa* Vishwanath & Manoj Kumar

9. Pre-dorsal scales 21-26. Tubercles on snout and lower jaw. Rostral shorter than eye diameter .... *Barilius vagra* (Hamilton-Buchanan)

Pre-dorsal scales 19-21, Tubercles on head. Rostral about one third eye diameter .... *Barilius barnoides* Vinciguerra

10. Barbels –a maxillary pair rudimentary. Lateral line scales 60-75.Mouth gape wide extends beyond middle of orbit ..... (11)

Barbels –a rostral pair may be short or fairly long. Mouth gape extends to orbit or middle of orbit. Lateral line scales 39-43 ..... (12)

11. Upper jaw longer. Lateral line scales 65-75. Body with two-three irregular rows of spots..... ..... *Barilius tileo* (Hamilton-Buchanan)

Lower jaw slightly longer. Lateral line scales 60-66. Body with 2-4 rows of irregular spots .... *Barilius dimorphicus* Tilak & Hussain

12. Pre-dorsal scales not below 15. Dorsal extends to the third anal rays or does not reach anal fin. Lateral line scales 40 or more ..... (13)

Pre-dorsal scales more than 15. Dorsal fin inserted over half of anal fin. Lateral line scales less than 40 ..... *Barilius dogarsinghi* Hora

13. Vertical bars present Lateral line scales 39-40 .... *Barilius gatensis* (Valenciennes)

Vertical bars absent. Lateral line scales 42-43 .... *Barilius modestus* Day

14. Anal rays not more than 14 (A ii. iii 12-14) ... (15)

Lateral line scales 37-38 Anal rays less than 14 (A ii. iii. 10-13) Lateral line scales 40-42 ..... (16)

15. Body with a single row of spots. Dorsal fin nearer to caudal base. Pre-dorsal scale 16. .... *Barilius bakeri* Day

Body with a double row of spots, Dorsal fin midway between caudal base and snout tip. Pre-dorsal scales 15 .... *Barilius canarensis* (Jerdon)

16. Body with vertical bars 11, last ray of dorsal extends to caudal base .... *Barilius barna* (Hamilton- Buchanan)

Figure 5 : Photograph of the head region of the fish, showing the absence of barbels.

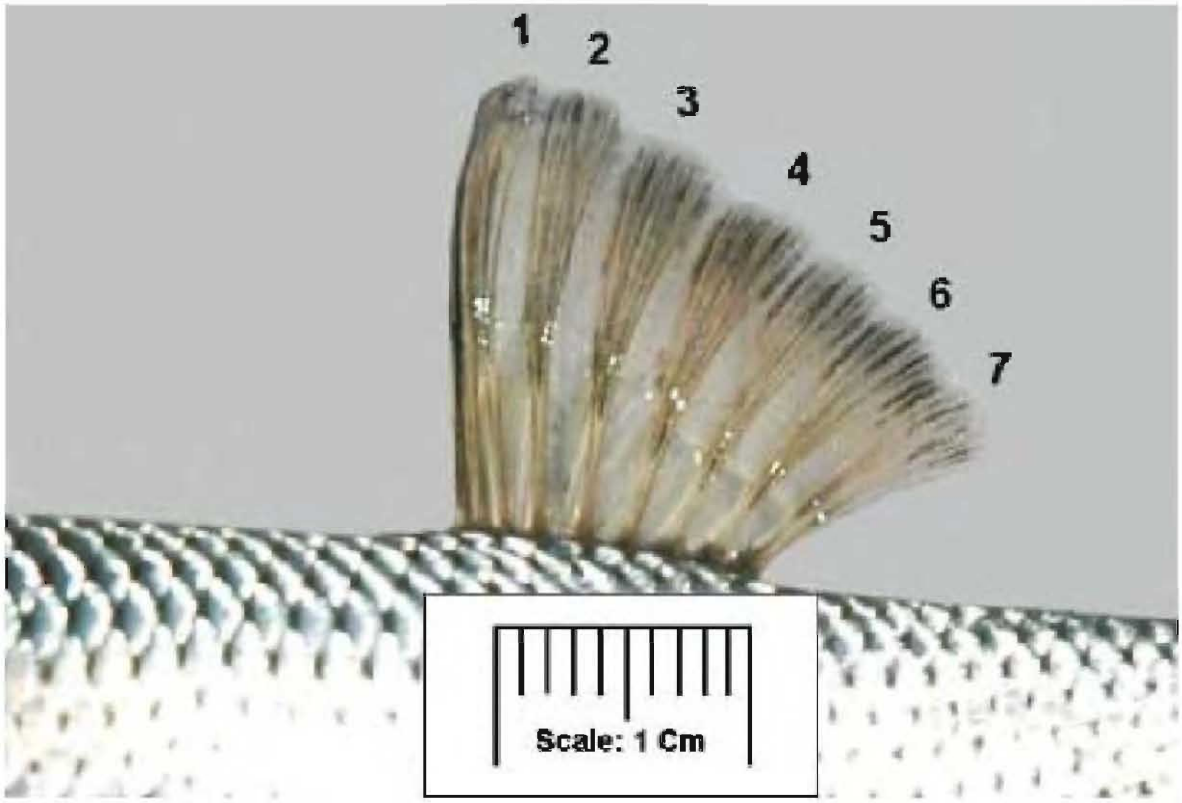

Figure 6 : Showing the physical structure and number of dorsal fin rays.

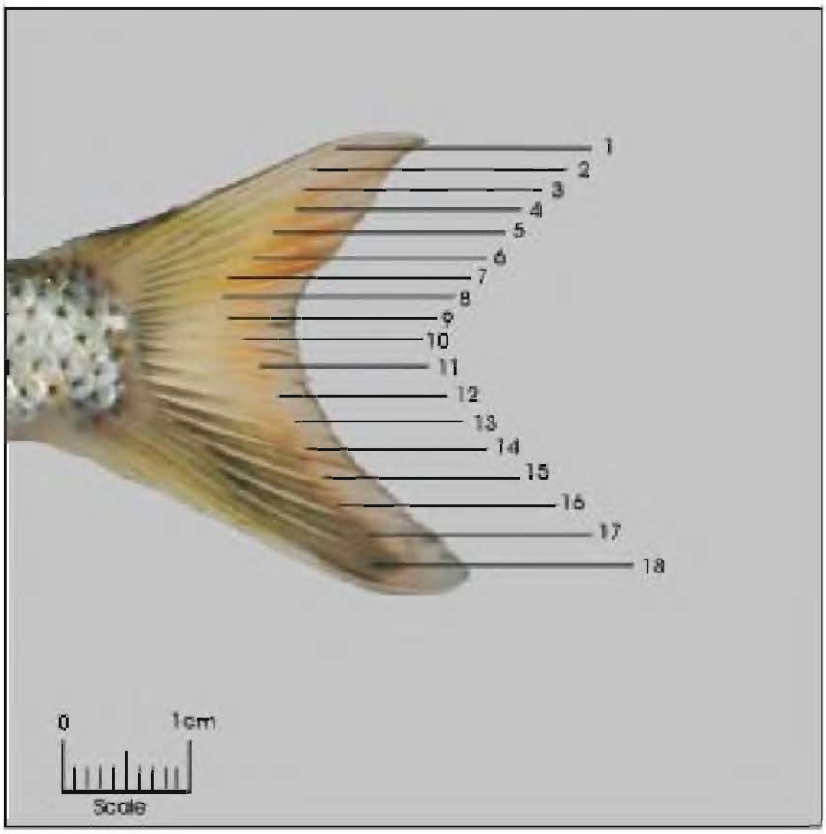

Figure 7 : Showing the physical structure and number of caudal fin rays.

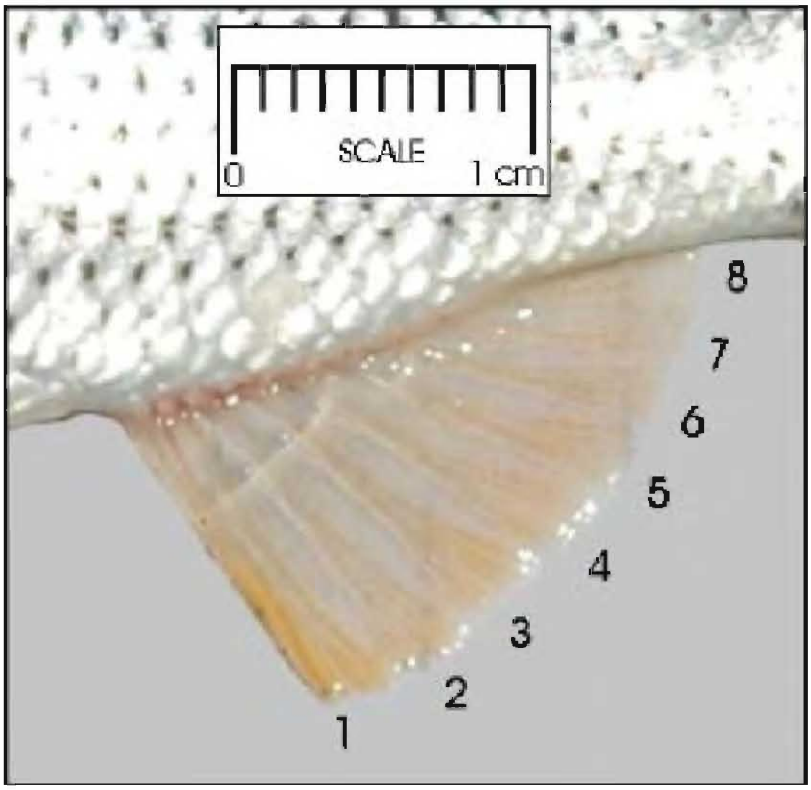

Figure 8 : Showing the physical structure and number of anal fin rays.

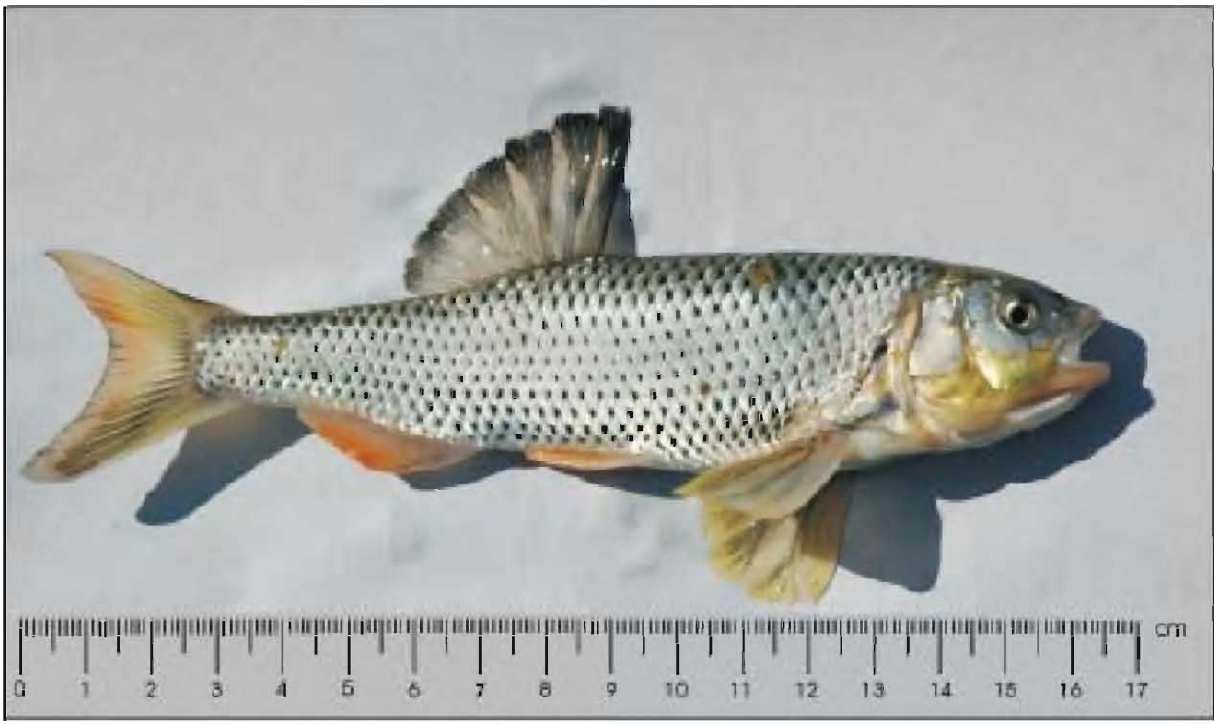

Figure 9 : Photograph of the fresh fish specimen *Barilius arunachalensis* sp. nov.

Body with a band, vertical bar absent, Dorsal fin extends to 4th ray of anal .... *Barilius evezardi* Day

Fin Formula : Barbels absent, Dorsal i.7, Pectoral ii. 11, Ventral i.8, Anal ii.8, Caudal 18

DIAGNOSIS

Body broad & deep, its depth 4.8-4.9 times in standard length (SL). Head long & broad, its length 3.7-4.0 in SL, its maximum width 1.2-1.3 times and inter nostril distance 4.0-4.1 times in HL, gill opening almost at the base of pectoral fins. Eyes fairly large, its diameter 5.0-6.1 times in HL; inter orbital distance 2.27-2.46 times in H.L. Snout deeply humped and tip with rough, prominent tubercles. Mouth moderate in size, up turned and its gape far away from orbit. Lips thick, sub-equal, lower lip with tubercles and longer than upper. Barbels absent (Fig. 5) Paired fins, well built dorsal fin nearer to caudal base. Dorsal fin fan like supported by strong and branched rays, robust in nature & embedded in a skin-like sheath (Fig. 6). Its posterior end extends to 3rd ray of anal. Anal fin also supported by strong, cartilaginous branched rays & looks like a reed of a harmonium or piano (Fig. 8). Caudal fin unequal, lower lobe longer (Fig. 7). Scales cycloid fairly large; lateral line ceases at the 35th scale. Body color silvery, dorsal fin with a streak of longitudinal band; scales with oval spots at the dorsal side and almost diamond shaped at

Table-1 : Morphometric data for *Barilius arunachalensis* Sp. nov. (n = 8). Measurements are in cm (mean ± SE).

Sl. No.	Morphological Characters	Measurements (Ranges in parenthesis)
I	**Head length (HL)**	3.17 ± 0.27 (2.5-3.7)
1	Snout length	0.75 ± 0.07 (0.65-0.9)
2	Eye diameter	0.59 ± 0.03 (0.5-0.65)
3	Inter-orbital distance	1.27 + 0.09 (1.1-1.5)
4	Post-orbital distance	1.27 ± 0.09 (1.1-1.5)
II	**Body measurements**	
1	Total length	14.12 ± 1.38 (11.5-16.8)
2	Standard length	11.9 ± 1.33 (9.4-14.4)
3	Body depth	2.43 ± 0.29 (1.9-3.0)
4	Pre-dorsal length	6.4 ± 0.66 (5.2-7.6)
5	Post dorsal length	4.3 + 0.13 (4.0-4.6)
6	Pre-pectoral length	3.18 + 0.38 (2.5-3.9)
7	Post-pectoral length	8.49 + 0.96 (6.8-10.2)
8	Pre-ventral length	5.9 + 0.66 (4.7-7.1)
9	Post-ventral length	5.71 + 0.74 (4.4-7.0)
10	Pre-anal length	8.1 + 0.89 (6.5-9.7)
11	Post-anal length	3.6 + 0.44 (2.8-4.5)
12	Caudal fin length (upper)	2.34 ± 0.05 (2.2-2.4)
13	Caudal fin length (lower)	2.65 ± 0.06 (2.5-2.8)
14	Dorsal fin base length	1.45 + 0.17 (1.1-1.8)
15	Dorsal fin height	1.86 + 0.12 (1.6-2.15)
16	Pectoral fin base length	0.7 ± 0.09 (0.6-0.9)
17	Pectoral fin height	1.8 + 0.06 (1.7-1.95)
18	Ventral fin base length	0.58 ± 0.1 (0.4-0.8)
19	Ventral fin height	1.58 + 0.12 (1.35-1.8)
20	Anal fin base length	2.0 + 0.25 (1.6-2.5)
21	Anal fin height	0.9 + 0.03 (0.9-1.05)
22	Length of caudal peduncle	1.14 ± 0.05 (1-1.25)
23	Depth of least height of caudal peduncle	1.02 ± 0.11 (0.8-1.3)

the ventral surface & abdomen and lateral line scales with single large spots and a few with bilobed spots; caudal with a blue strip at the bifurcation of its lobe, two 'V' shaped bands on each side behind gill openings. Fins yellowish, tinged with pink. The morphometric measurements depicted at Table-1.

Besides, the species under report (*B. arunachalensis*) has also been compared with the valid species of the Genus *Barilius* and has been shown in Table-2. The distinguishing features in regard to the *Barilius arunachalensis* strongly supports for the establishment as a new species. From the comparative chart it could also be revealed that the *Barilius arunachalensis* Sp. nov. has a close affinity with *Barilius bendelisis* except for the absence of barbels, body coloration, lateral line incomplete, lips unequal, dorsal fin fan shaped supported with strong rays enclosed in a sheath, cleft of mouth does not reach orbit, snout deeply humped, lateral line scales with single large spots and a few bilobed spots, 'V' shaped band on each side of gill opening, caudal lobe unequal justify for the separation of the reported fish as a new species.

DISTRIBUTION

The fish samples were collected from the Agari River mouth just outside the D'Ering Memorial Wild Life Sanctuary through which passes river Sibya forming one of the tributaries of a major river Siang. The fish specimens were also seen inside the sanctuary at the south west of Jopong Island. The Sanctuary is located adjacent to the Pasighat town, the Headquarters of East Siang district of Arunachal Pradesh. The location of the collection centre is at an altitude of 160 m (msl).

ETYMOLOGY

The species *Barilius arunachalensis* is named after the state of Arunachal Pradesh. One of the authors namely Anil Kumar collected the fish specimens during his field survey to D'Ering Memorial Wildlife Sanctuary & its adjacent areas.

DISCUSSION

The new species *Barilius arunachalensis* to some extent has a close resemblance with *Barilius bendelisis*: (i) Presence of prominent tubercles on snout & lower lip (*versus* tubercles small and poorly developed in *Barilius bendelisis*) (ii) Dorsal fin ray (i.7), Pectoral (ii. 11), Ventral (i.8), Anal (ii.8) (*versus* D. ii.7, A.ii.iii. 7-8, P.i.14, V.i 8 in *Barilus bendelisis*) (iii) Lateral line incomplete and ceases at 35th scale (*versus* Lateral line scales 40-45 in *B. bendelisis*); (iv) Dorsal fin fan like (*versus* dorsal fin not fan like in *B. bendelisis* of Day, 1878; Tilak *et al.*,1984; Talwar & Jhingran,1991). (v) Each scales with oval spots at dorsal side and diamond shaped at the ventral, and lateral line scales with large single spots and a few bilobed spots ((*versus* lateral line scales with two spots in *B bendelisis* of Day, 1878; Tilak *et al.*, 1984; Talwar & Jhingran, 1991).

Tilak *et al*. (1984) and Talwar & Jhingran (1991) reported of sexual dimorphism pertaining to coloration of the body, fan shaped paired fins, body size of synonymies of *B. bendelisis*. When compared with the reported species, *B.arunachalensis* it was found to vary in all respect as pointed out in paragraph (1) as above, i.e. barbels totally absent, lateral line incomplete, lateral line scales with single large spots and a few bilobed spots, 'V' shaped band on each side of gill opening, caudal fin with a prominent streak at the bifurcation of caudal lobe and caudal fin unequal.

The diagnostic features purported in Table-1 also distinctly shows that the species under report, *Barilius arunachalensis* could be readily separated from all the reported species as well as the synonymies of the Genus *Barilius* (Day, 1878; Talwar & Jhingran, 1991; Menon, 1999; Jayaram, 1999; Vishwanath & Manoj Kumar, 2002).

The discovery of the new species (*Barilius arunachalensis*) from the D'Ering wildlife Sanctuary of Arunachal Pradesh has thrown a new light that the sanctuary offers a safe habitat and in no way the fish stands threatened from external interferences. Thus the sanctuary is one of the noble examples of in-situ conservation of fauna and flora of the region. The collection of live species within the sanctuary is not legally permitted hence only a few samples of the present species were collected from outside the sanctuary. However, the continuity of the studies shall be kept in progress so that any variability of the new species could be further observed, if any.

Table 2 : Comparative account is showing the distinction between *Barilius arunachalensis* and the allied genera/ species of the sub-family Rasborinae.

Sl. No.	Name of the Species	Characteristic features	Diagnostic features
A.	**Species with 2 pairs of barbels**		
1	*Barilius radiolatus*	D.ii 7-8, A.ii.iii 10-11, P.i.16, V.i.8	Tubercles small, poorly developed on snout and lower jaw. Lateral line (L.L) scales 56-62. Vertical bars absent. Dorsal fin inserted anterior to anal fin. Pre-dorsal scales 24.
2	*Barilius shacra*	D.ii 7, A. ii. iii. 8, P.ii 14, V.i.8	Tubercles small and poorly developed on snout & lower jaw. Lateral line scales 59-70. Vertical bars 12, rarely absent. Dorsal inserted advance of Anal. Dorsal fin with black band along its upper third. Pre-dorsal scale 22-25. The fish attains a length of 12.5 cm.
3	*Barilius bendelisis*	D.ii 7, A.ii. iii. 7-8, P.i. 14, V.i.8	(i) Tubercles small and poorly developed on snout & lower jaw. Lateral line scales 40-45. Vertical bands 8-12 numbers descending towards lateral line, often becomes indistinct (as spots) in adults. Lateral line scales with two black spots at their base. Dorsal fin ahead of anal nearer to caudal base than snout tip. Pre-dorsal scale 18-20. The species attains a length of 15.5 cm.
	Sub–species of *Barilius bendelisis* (Synonyms of *Barilius bendelisis* of Menon, 1990)		
3 i.*	*chedra* (male)		(i) Males are well built.Paired fins enlarged and fan like. Pectoral fin base muscular and robust Three pectoral rays extends beyond ventral. Dorsal & anal fins are expanded.
3 ii.*	*cocsa* (Female)		(ii) Tip of snout, sides and lower jaw with thick layer of spiny tubercles. Body with fine tubercles on scales. Vertical bands disappear with growth. (iii) Females lack all characters as in sl ii. Fish attains a length of 15.5 cm.
4	*Barilius vagra vagra*	D.i.ii.7, A.ii. iii. 10-12, P.i.14-15, V. 8	Tubercles poorly developed on snout & lower jaw. Lateral line scales 33-44. Vertical bars 10-14 above lateral line. Dorsal inserted anterior to anal. Dorsal & caudal fin grey edged. Pre-dorsal scales 21-26. Body depth 5.5-7.4 times S.L. Vertical bars reaching lateral line.

Table 2 : *Cont'd.*

Sl. No.	Name of the Species	Characteristic features	Diagnostic features
4.i	*Barilius vagra pakistanicus* (synonym of *Barilius vagra* of Talwar & Jhigran 1991)		
5	*Barilius ornatus* (A synonym of *Barilius barnoides* of Talwar & Jhingran, 1991)	D. iii.7-8, A.iii.10-11 P.i.13-14, V.i.8	Lateral Line scales 38 – 41, Pre-dorsal scales 14–20
6	*Barilius barilia*	D.ii.7, A.iii.10-11, P.i.12, V.i.8	Tubercles poorly developed on lower jaw. Lateral Line scales 43-46. Vertical bars 14 or 15 extends up to lateral line. Dorsal placed advance to anal. Fins pinkish, Pre-dorsal scales 22. The Fish attains a length of 10 cm.
7	*Barilius barnoides*	D.ii.iii.7-8, A. ii. iii.10-11, P.i.13, V.i.8	Tubercles on head poorly developed. Lateral Line scales 42-45. Vertical bars 14-15 above lateral line. Dorsal fin advance of Anal. Fins hayline. Pre-dorsal scale 19-21. The fish attains a length of 8.0 cm.
8	*Barilius ngawa*	D.ii.iii.7 – 8, A.ii.iii.10-11 P.i.12-13,V.i.7	Lower jaw with a symphysis & upper jaw with a notch Lateral Line scales 42-43. Vertical bars 13-14 extends to lateral line. Dorsal fin with a dark band and caudal with dark margins.
B.	**Species with 1 pair of Barbels :**		
9	*Barilius gatensis*	D.ii.iii 8 – 9, A.iii.12-14, P.i.14, V.i.8	Rostral pair minute. Tubercles large and well developed on snout and lower jaw. L.L scales 39-40, Pre-dorsal scale 15, Vertical bars 13-15, often as oblong spots, become almost broken in adults, Dorsal fin a ahead of anal, extending to 3rd Anal ray. Dorsal fin & anal with dark base. The fish attains 15 cm in length.
10	*Barilius modestus*	D. ii. 7, A.ii. 10 – 11, P.i.14, V.i.8	Rostral pair fairly long. Tubercles well developed on snout & lower jaw. L.L scales 42-43, Pre-dorsal scales 15. Body silvery with dark band on dorsal fin. Fins yellowish. The fish attains a length of 12.5 cm.
11	*Barilius tileo*	D. ii.7, A.iii.10, P.i.13, V.i.8	Maxillary pairs, often absent. Tubercles well developed on snout & lower jaw. L.L scales 65-75. Pre-dorsal scales 28-30. Body with two-three rows of spots & blotches. Dorsal fin advance to Anal. Dorsal fin dark grey with pinkish edge others yellow. The fish attains a length of 15 cm.

Table 2 : *Cont'd.*

Sl. No.	Name of the Species	Characteristic features	Diagnostic features
12	*Barilius dogarsinghi*	D.ii.7, A.iii.9, P.i.12, V.i.8	Short Rostral pair. Tubercles large and well developed on snout & lower jaw and sides of head. L.L scales 38-39. Pre-dorsal scales 20. Transverse bands 9 extending to lateral line. Dorsal inserted nearer to caudal and extending over half of Anal fin. Fins hyaline. The fish attains a length of 8.5 cm.
13	*Barilius dimorphicus*	—	Lateral line scales 60-66. Lower jaw slightly longer. Pectoral fin longer than head. Body with 2-4 irregular rows of spot.
C.	**Barbels absent :**		
14	*Barilius evezardi*	D.ii.7, A.ii.12 – 13, P.i.12., V.i.8	Tubercles large & well developed on head. Lateral line scales 40. A silvery band on flanks. Dorsal fin ahead of anal, its posterior half above anal. Dorsal and caudal fins edges black. Fins yellowish. Pre-dorsal scales 14. The fish attains a length of 11 cm.
15	*Barilius bakeri*	D.ii.iii.10, A.i.iii.14, P.i.14, V.i.8	Tubercles large and well developed on snout & lower jaw.L.L scales 37-38, Body with a row of large bluish spots along the flanks. Dorsal fin ahead of Anal, extending to 4th Anal ray. Dorsal, anal and pectoral fins with dark grey bases, edges white. Pre-dorsal scales 16. The fish attains a length of 15 cm.
16	*Barilius barna*	D.ii.7, A.iii. 10-11, P.i.14, V.i.8	Tubercles large and well developed on snout & lower jaw. L.L scales 39-42. Vertical bars11. Dorsal advance of Anal fin, often last ray extending to caudal. Dorsal & caudal fin edges black. Pre-dorsal scales 15-16. The fish attains a length of 7.5 cm.
17	*Barilius canarensis*	D.ii.10-11, A.ii.12-14, P.i.14, V.i.8	Tubercles large on head. L.L scales 37-38. Dorsal with rows of large vertical green spots along body. Fins grey with white margin. Pre-dorsal scales 15. Fish attains a length of 15 cm.
18	*Barilius auropurpureus* (separated & placed under Genus *Inlecypris*, Howes, 1980a)	D.ii.7, A.iii.15, P.i. 11, V.i.6	L.L scales 39 – 41. Vertical bars 14 with rows of minute dots. Dorsal inserted above anal fin. Ventral keeled.
19	*Barilius lairokensis* (of Arun Kumar and Tombi Singh, 2000)	—	Dorsal & Anal fins with spines. Body with 14-16 dark lateral bands.(No *Barilius* species so far reported with spines thus needs to be separated).

Table 2 : *Cont'd.*

Sl. No.	Name of the Species	Characteristic features	Diagnostic features
20	*Barilius nelsoni* (of Barman, 1989, a synonym of *Barilius radiolatus* of Talwar & Jhingran, 1991)		Hence not described.
21	*Barilius bola/guttatus* (Separated under the genus Raiamus of Howes, 1980)		Hence not described.
22	*Barilius arunachalensis*	D.i.7, A.i.8, P.ii.11, V.i.8,C.18	Rough tubercles, prominent on snout & lower jaw. Barbels absent. Snout deeply humped. Mouth upturned, gape not reaching orbit. Lips unequal, lower lip slightly longer. Lateral line scales incomplete, ceases at the 35th scale. Dorsal inserted ahead of anal, but nearer to caudal base. Dorsal fin extends to 3rd ray of Anal. Scales large, cycloid and with oval spots at the dorsal side & diamond shaped spots at the ventral surface and lateral line scales with single large spots and a few bilobed spots. Pectoral tip just reaching ventral fin base. Two broad band almost 'V' shaped on each side behind gill opening. Caudal fin with prominent streak at the bifurcation of the caudal lobe. Longitudinal streak at the dorsal fin and prominent streak at the bifurcation of caudal. Caudal unequal, lower lobe longer. The length of fish recorded upto 16.8 cm.

*Sub-species

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REFERENCES

Borang, A., Bhatt, B.B., Chaudhury, S.B., Borkotoki, A. and Bhutia, P.T. (2005). Checklist of the snakes of Arunachal Pradesh, Northeast India. *J. Bombay Nat. Hist. Soc.*, **102**(1) : 19-26.

Borang, A. (2001). Mammalian fauna of Arunachal Pradesh (checklist & distribution in protected areas). *Arunachal Forest News*, **19** (1&2) : 43-82.

Choudhury, A.U. (2003). *The Mammals of Arunachal Pradesh*. Regency Publications, New Delhi.

Datta, A., Naniwadekar, R. and Anand, M.O. (2008). Hornbills, hoolocks and hog badgers : long term monitoring of threatened wildlife with local communities in Arunachal Pradesh, north east India. Final report to the Rufford Small Grants Program (UK). Nature Conservation Foundation, Mysore, India. pp. 80.

Day, F. (1878). The Fishes of India; being a natural history of the fishes known to inhabit the seas and fresh waters of India, Burma and Ceylon.

Editor-Director, (2006a). *Fauna of Arunachal Pradesh*, *State Fauna series*, **13**(Part-I) : 317-396.

Editor-Director, (2006b). *Fauna of Arunachal Pradesh. State Fauna Series*, **13**(Part-2) : 1-518. (Published by Director, *Zool Surv. India*, Kolkata).

Forest Survey of India (2000). The State Forest Report, 1999. FSI, Govt. of India Press, Dehradun, 133.

Howes, G.J. (1980a). The taxonomy, phylogeny and classification of the Bariline cyprinid fishes. *Bull. Br. Mus. Nat. Hist (Zool)*, **37**(3) : 129-198.

Jayaram, K.C. (1999). *The Freshwater Fishes of the Indian Region.* Narendra Publishing House, Delhi, India, xxiii. Pp. 551.

Kalita, S.N. and Haridasan K. (2001). Forest and wildlife management in Arunachal Pradesh. *Arunachal Forest News*, **19**(1&2): 26-31.

Kaul, R.N. and Haridasan, K. (1987). Forest types of Arunachal Pradesh-A preliminary study. *J. Econ. Tax. Bot.*, **9**(2) : 397-389.

Kumar, A. (2009). Occurrence of mammals in D'Ering Memorial Wildlife Sanctuary and adjacent areas, Arunachal Pradesh, India. *J. Env. Bio-sci.* vol. **23**(1), 107-111.

Kumar, A. and Ramakrishna (2010). A review of vertebrate and invertebrate fauna of Arunachal Pradesh. *State Gazetteer of Arunachal Pradesh.* (in Press)

Kumar, R.S., Mishra, C. and Sinha, A. (2005). Discovery of the Tibatan macaque Macaca thibetana in Arunachal Pradesh, India. *Curr. Sci.* **88**(9) : 1387-1388.

Mishra, C. and Datta, A. (2007). A new bird species from Eastern Himalayan Arunachal Pradesh- India's biological frontier. *Curr. Sci.* **92**(9) : 1205-1206.

Menon A.G.K., (1999). Checklist Freshwater Fishes of India. *Rec. Zool. Surv. India*, *Occasional Paper* **175** : 1-366.

Nath, P. & Dey, S.C. (2000). *Fish and Fisheries of North Eastern India (Arunachal Pradesh).* Narendra Publishing House, Delhi : 200 pp.

Talwar, P.K. and Jhingran, A. (1991). *Inland Fishes of India and adjacent countries*, Oxford and IBH publishing Co. Pvt. Ltd., New Delhi, 2 Volumes : xix-1158 pp.

Tilak, R., Jaffer, Z. and Hussain, A. (1984). Systematic status of *Barilius bendelisis*,Hamilton (Cyprinidae : Pisces). *Rec. Zool. Surv. India*, **81**(3&4) : 279-290.

Vishwanath and Manoj Kumar, B. (2002). A New Bariliine Cyprinid Fish of the Genus *Barilius* Hamilton from Manipur, India. *Journal of Bombay Natural History Society*, **99**(i) : 86-89.