



# International Journal of Fisheries and Aquatic Studies

E-ISSN: 2347-5129

P-ISSN: 2394-0506

(ICV-Poland) Impact Value: 5.62

(GIF) Impact Factor: 0.549

IJFAS 2017; 5(2): 699-711

© 2017 IJFAS

www.fisheriesjournal.com

Received: 20-01-2017

Accepted: 21-02-2017

**Deepali Rana**

Department of Zoology,  
Uttaranchal College of  
Biomedical Sciences and  
Hospital, Sewla Khurd,  
Dehradun, Uttarakhand,  
India

**S K Gupta**

Department of Zoology, D.B.S.  
(PG), College, Dehradun,  
Uttarakhand, India

## *Lepidocephalichthys* Sp. (Pisces: Cobitidae) - A taxonomic appraisal, with special reference to *Lepidocephalichthys annandalei* from Doon Valley, Dehradun, Uttarakhand

**Deepali Rana and S K Gupta**

### Abstract

The present communication deals with the taxonomic analysis and sexual dimorphic characters of *Lepidocephalichthys guntea* and *Lepidocephalichthys annandalei*. Teratological manifestation in *L. guntea*, synonymies with reference to *L. annandalei*, anomalies regarding the number of barbels, mental lobes vs. barbels and variability with reference to origin of dorsal fin are the highlights discussed. Status of *Lepidocephalus caudofurcatus* (Tilak and Husain, 1977 a) is discussed in the light of the details studied for the present material identified as *L. annandalei*. The latter is established as a valid species and found synonymous to the former. While discussing the distributional aspects, *L. annandalei* appeared of zoogeographical significance and a new addition to the fish fauna of Suswa River in Eastern Doon.

**Keywords:** *Lepidocephalichthys* sp., systematics, taxonomic variations, distribution, Doon Valley

### 1. Introduction

Loaches (Order - Cypriniformes, Family – Cobitidae, Subfamily – Cobitinae and Botinae) are widely distributed in the freshwaters of Eurasia and Morocco [28]. *Lepidocephalichthys* sp. (Subfamily – Cobitinae) are variously recorded from the streams of Western Himalayas including Doon Valley by Das [5], Lal and Chatterjee [23], Singh [33], Husain [14-16, 18], Tilak and Husain [38, 39], Husain and Tilak [19], Nautiyal [27], Uniyal and Kumar [41] and Uniyal and Mehta [42].

Tilak and Husain [37, 39, 40] in different publications discussed interrelationships of *L. guntea* (Hamilton) and *L. annandalei* Chaudhuri, systematic status of various other species, sexual dimorphism etc. Further, Tilak and Husain [38] described a new species *Lepidocephalus caudofurcatus* on the basis of the material collected from Eastern Doon, Saharanpur and Moradabad.

Arunkumar [1] has given a lucid account of the loaches of genus *Lepidocephalichthys* from Manipur. A revision of *Lepidocephalichthys* with descriptions of two new species from Thailand, Laos, Vietnam and Myanmar has recently been elaborated by Havird and Page [11]. Arunkumar and Singh [2] have very recently dealt with a systematic list of loaches from Manipur including the account of *Lepidocephalichthys* species also.

The present communication deals with the taxonomic analysis of *L. guntea* and *L. annandalei*, alongwith sexually dimorphic characters. Teratological manifestation in *L. guntea*, synonymies with reference to *L. annandalei*, anomalies regarding the number of barbels, mental lobes and variability with reference to origin of dorsal fin are other points of interest discussed in the paper. Status of *Lepidocephalus caudofurcatus* [38] is discussed in the light of the details studied for the present material identified as *Lepidocephalichthys annandalei*. The validity of the latter is discussed and found synonymous to the former.

On the basis of the distributional pattern, *L. annandalei* appeared of zoogeographical significance and is a new addition to the fish fauna of Suswa River in Eastern Doon. The present attempt is also directed towards giving firm footing to the following ideas expressed by Kottelat and Lim [22].

“Several nominal species have been reported from India as having notched, lunate or forked caudal fins (described or identified as *L. annandalei* Chaudhuri, 1912, *L. menoni* Pillai & Yazdani, 1976, *L. goalparensis* Pillai & Yazdani, 1976, *L. caudofurcatus* (Tilak & Husain, 1977a)). Some of them might possibly be synonyms of *L. micropogon*, but the existing

### Correspondence

**Deepali Rana**

Department of Zoology,  
Uttaranchal College of  
Biomedical Sciences and  
Hospital, Sewla Khurd,  
Dehradun, Uttarakhand,  
India

de-scriptions are not informative, and the illustrations accompanying several of these are crude and are not very useful. Clearly, a critical re-examination of the specimens and redescription of the Indian species in a way compatible with international standards is necessary in order to clarify their identity". The present communication is an attempt to establish *Lepidocephalichthys annandalei* as a valid species and as a new addition to the fish fauna of Suswa River.

## 2. Material and Methods

The study material was procured through drag-netting along the bottom among the pebbles, shingle, sandy and weedy thickets at Song, Suswa, Tons and Asan and their associated streams in the Eastern and Western parts of Doon Valley (April, 2008 – September, 2009). After thorough morphological, meristic and morphometric analysis in the light of the works like Day [6]; Chaudhuri [4]; Pillai and Yazdani [30]; Tilak and Husain [37-40]; Talwar and Jhingran [35]; Jayaram [21]; Menon [26]; Vishwanath *et al.*, [43]; Havird and Page [11] *etc.*, the material was found to belong to 2 species viz., *Lepidocephalichthys guntea* (Hamilton) (68 specimens, 35 – 71 mm in Total Length or TL, 29 – 60 mm in Standard Length or SL) [Tables 1 - 3] and *Lepidocephalichthys annandalei* Chaudhuri (15 specimens, 28 – 50 mm in TL and 22 – 40 mm in SL) [Tables 4 - 6]. Besides considering conventional body ratios, they were calculated on percentage (%) basis also, for ready comparison with such ratios considered by some other workers [30, 38, 39, 40] [Tables 2 and 5].

## 3. Results and Discussion

### 3.1 Taxonomical analysis:

#### Genus *Lepidocephalichthys* Bleeker

1858 *Lepidocephalus* Bleeker, *Nat. Tijdschr. Ned.- Indie*, 16 : 303 (type-species: *Cobitis macrochir* Bleeker).

1863 *Lepidocephalichthys* Bleeker, *Versl. K. Akad. Wet. Amst.*, 15 : 38, 42 (type-species : *Cobitis hasselti* Valenciennes).

1981 *Lepidocephalus* Tilak and Husain, *Occ. Paper No. 32, Rec. zool. Surv. India* : 1 - 42.

Body worm-like [Fig. 1A – 1D], compressed, sometimes giving appearance of a ‘hunch’ at the summit of head (opposite the eye orbit). Mouth sub-terminal, narrow with thick lips. Barbels 3 pairs (1 each of rostral, maxillary and mandibular) [Fig. 2A, 2C and 3B]. Mental lobes (= deeply divided, posteriorly projecting lobes at lower lip) fleshy mid-ventrally, their corrugated skinny flaps with or without digitiform projections continuous at the angle of mouth with broad-based mandibular barbel [Fig. 2A]. Eyes small, more dorsally placed, covered with transparent skin. A backwardly directed bifid suborbital spine present, outer prong being straighter, whereas, the inner one curved and only slightly longer than the outer one [Fig. 2B]. Dorsal, pectoral, pelvic and anal fin rays 9, 8, 7 and 7, respectively. Origin of dorsal fin [Fig. 1A - 1D] variable in relation to the tip of snout and base of caudal fin as well as origin of pelvic fins. Caudal fin truncate, emarginate, deeply emarginate or forked. 2 inner pectoral fin rays (7<sup>th</sup> and 8<sup>th</sup>) fused, [Fig. 2C, 2E, 2G], but more thickened and swollen (= osseous) in case of males [Fig. 2C, 2E] with a vertical osseous crest (=lamina circularis) [Fig. 2F, 3C] having maximum elevation almost at the middle of fused rays.

## 3.2 Key to Species

(Partial key, applicable to the present material only)

1. a. Caudal fin (5.14 - 6.18 in Total Length and 4.19-5.20 in Standard Length), truncate, convex or cut-square with rounded corners or slightly emarginate.....2.
- b. Caudal fin (4.50 - 5.57 in Total Length, 3.50 - 4.65 in Standard Length), notched, concavely lunate or deeply emarginate.....3
2. Body dark-brown along the dorsum, dirty yellowish-white on the sides and whitish along the belly, with dark – brown specks coalescing to form a pattern of darker and lighter longitudinal bands, that along the flank forming almost black-stripe from the tip of the snout (more prominent in males) to the base of caudal [Fig. 1A]. Light narrow stripes and interrupted wavy brown bands present above and below the lateral band, the upper one darkening towards the mid-dorsal line whereas the lower one fading into the whitish belly. Rectangular dashes (= mid-lateral black spots) absent. Caudal fin with rows of dark spots coalescing to form narrow 6 -7  $\Sigma$  – shaped bands with wider interspaces [Fig. 2H] .....*L. guntea*.
3. Body brownish on the back, silvery on sides, whitish beneath, variegated with a thin dark band along the sides (more prominent behind operculum) with 9 - 11 rectangular dashes (= mid-lateral black spots) with equal interspaces, 9 - 10 saddle shaped bands along the back. Dark stripe from tip of snout to eye present [Fig. 1C and 1D]. Caudal fin with wider 4 -5  $\Sigma$  - shaped bands with equal – sized interspaces [Fig. 3E].....*L. annandalei*.

#### *Lepidocephalichthys guntea* (Hamilton - Buchanan)

1822 *Cobitis guntea* Hamilton-Buchanan, *Fishes of Ganges*: 353, 394 (type-locality: Bengal).

1822 *Cobitis balgara* Hamilton- Buchanan, *Fishes of Ganges*: 356, 394 (type-locality: Kosi river).

1878 *Lepidocephalichthys guntea* Day, *Fishes of India*: 609, pl.155, fig. 4 (var. *balgara*) and pl.156, Fig.12.

1981 *Lepidocephalus* (*Lepidocephalichthys*) *guntea*, Tilak and Husain, *Occ. Paper No. 32, Rec. zool. Surv. India*: 7 - 12, Figs 1- 4.

1999 *Lepidocephalus guntea*, Menon, *Occ. Paper No. 175, Rec. zool. Surv. India* : 160-162.

1999 *Lepidocephalus guntea*, Jayaram, *The Freshwater Fishes of the Indian Region*: 238-242.

2007 *Lepidocephalichthys guntea*, Vishwanath *et al.*, *Fishes of North East India*, NBFGR, Lucknow: 123.

2010 *Lepidocephalichthys guntea*, Havird and Page. *Copeia* (1) : 137-159.

### 1. Diagnosis

Please refer to generic characters plus the key to the species.

### 2. Comparison

Meristic and morphometric characters of the present material in comparison to various works are given in Tables 1-3 which reveal that the present material is largely in agreement with Day [6], Tilak and Husain [40], Talwar and Jhingran [35], Jayaram [21] and Havird and Page [21].

### 3. Sexual dimorphism

The sexually dimorphic characters are well in agreement with Tilak and Husain (1975), but the characters expressed by them as ‘more than’ or ‘less than’ in terms of the length or height of pectoral, dorsal, ventral fins and that of caudal

peduncle are made more absorbing here by expressing them as ratios [Table 3] to assess the extent of 'more than' or 'less than'. With reference to caudal peduncle length in caudal peduncle height, in case of males, Tilak and Husain<sup>[14]</sup> mentioned it to be more than whereas in the present findings it is equal also. Similarly, in case of length of ventral in height of caudal peduncle, they mentioned it to be equal in females, as it is also observed to be less [Table 3]. Havird and Page<sup>[11]</sup> presented the ratios of pectoral fin of males and females in standard length (on % basis) and they are found to be as follows:

Male: 23.0 - 24.0, female : 13.33 – 18.96 vs.,  $17.5 \pm 2.4$  and  $14.0 \pm 1.5$  for male and female, respectively.

Besides the presence of a vertical crest (= lamina circularis; vide Havird and Page) on the fused and thickened 7<sup>th</sup> and 8<sup>th</sup> pectoral fin rays (generic character) in males [Fig. 2F], another interesting feature of sexual dimorphism observed, has been the presence of a wedge - shaped extension from base to the tip of rays, when the fin is viewed ventrally [Fig. 2E]. The same is not present in females whereas there is also an indication of the fusion of 7<sup>th</sup> and 8<sup>th</sup> rays but not achieving much of thickness as in males [Fig. 2G].

(The evidence of the fusion of rays in both the sexes comes out of the fact that when the fins are handled for meristic counts, often splitting occurs after six rays in both the cases [Figs. 2E and 2G]).

Hitherto not recorded earlier, the ratios of length of barbels in relation to Head Length and Snout Length [Table 3], are clearly indicating that the barbels are lengthier in males [Fig. 2C] than females [Fig. 2D].

#### 4. Teratological Manifestation:

One female specimen (71 mm in TL, 59 mm in SL) exhibited teratological manifestation in the form of bifurcated rostral barbel on the right side [Fig. 2D]. In spite of being a teratological happening, the ratios of rostral barbels of this specimen (2.7 in Head Length, 1.12 in Snout Length) did not show much difference from the ratios recorded for all specimens [Table 2]. Husain<sup>[16]</sup> also recorded a similar anomaly in the rostral barbel, but in *Noemacheilus rupecula*. Such deformities have been attributed to have been congenital, accidental or environmental<sup>[36, 29]</sup>. As far as teratological aberrations in *L. guntea* are concerned, Dhanze and Dhanze<sup>[8]</sup> reported an abnormal specimen of *L. guntea* with respect to asymmetrical aberration to the disposition, relative size predator but emphasized that disproportionate development was under the influence of some physico-chemical stress caused by some pollutant of the factory effluent in the water body during the course of its development. Hence, the congenital element, as also contemplated here, is inherent with the kind of conclusion drawn by Dhanze and Dhanze<sup>[8]</sup>.

#### *Lepidocephalichthys annandalei* Chaudhuri

1912 *Lepidocephalus annandalei* Chaudhuri, *Rec. Indian Mus.*, 7 : 442, pl.49, Figs. 3, 3a, 3b.

1937 *Lepidocephalichthys annandalei* Shaw and Shabbeare, *J. Asiat. Soc. Bengal.*, 3: 67-68

(Panchenai River, near Matighara, N. Bengal).

1977 *Lepidocephalus annandalei*, Tilak and Husain, *Newsl. zool. Surv. India*, 3(6): 408-410.

1977 *Lepidocephalus caudofurcatus*, Tilak and Husain, *Matsya*, 3: 60-63.

1981 *Lepidocephalus (Lepidocephalichthys) annandalei*,

Tilak and Husain, *Rec. zool. Sur., India, Occ. Paper No. 32*: 16, Figs. 10 - 14 (Northern India).

1991 *Lepidocephalus annandalei*, Talwar and Jhingran, *Inland Fishes of India and Adjacent Countries*, Vol. I: 522-523.

1999 *Lepidocephalus annandalei*, Menon, *Rec. zool. Surv. India, Occ. Paper No. 175*: 159.

1999 *Lepidocephalus (Lepidocephalichthys) annandalei*, Jayaram, *The Freshwater Fishes of the Indian Region* : 238-242.

2010 *Lepidocephalichthys annandalei*, Havird and Page. *Copeia* (1): 137-159.

#### 1. Diagnosis

Please refer to generic characters plus the key to the species in the foregoing.

#### 2. Comparison

As regards the meristic and morphometric characters (Tables 4 – 6) of the present material is largely in agreement with Chaudhuri<sup>[4]</sup>, Shaw and Shabbeare<sup>[32]</sup>, Pillai and Yazdani<sup>[30]</sup>, Tilak and Husain<sup>[40]</sup>, Talwar and Jhingran<sup>[35]</sup>, Jayaram<sup>[21]</sup> and Havird and Page<sup>[11]</sup> except the enlargement in range of ratios as follows :

Snout length 1.86 – 2.71 in head length vs., 3.0 – 3.50<sup>[4]</sup> [Table 5].

Interestingly, the present material also agrees with a *sp. nov.* (*L. caudofurcatus*) described earlier from Doon Valley by Tilak and Husain<sup>[38]</sup> and as discussed ahead, the latter appears synonymous with the present material.

While making comparisons, following calculation lapses have been spotted in the description of *L. caudofurcatus* and, henceforth, necessary corrections are made as under:

- i) The ratio of eye diameter has been mentioned to be 2.60 - 4.25% of interorbital width [Table 5] which is possible only when the eye diameter is about 0.005 - 0.01 mm, but that has not been the case, as in the present specimens eye diameter varies from 1.0 – 2.0 mm and interorbital width from 1.0 – 2.5 mm. Thus, after calculation the actual ratio comes out to be 80.0 - 100.0% [Table 5].
- ii) Length of maxillary barbels was reported to be 2.22 – 3.57% and 2.70-4.41% of TL and SL, respectively [Table 5]. In this case, too, such ratios will be possible when the length of maxillary barbels ranges from 0.8 - 1.6 mm, which is also not true as the said barbels are considerably longer, measuring about 2.0 – 4.5 mm (5.10 – 9.68% of TL and 6.25 – 12.0% of SL) [Table - 5].

#### 3. Sexual Dimorphism

The sexually dimorphic characters of *L. annandalei* are assessed/verified on the basis of three main sexually dimorphic characters given for *L. caudofurcatus* by Tilak and Husain<sup>[38]</sup> viz.,:

- i) "In the males, the inner rays of the pectoral fin coalesce and form a vertical osseous crest while the same is not formed in the females".

The said character cannot be the proprietary of any species as this is a 'Generic character' as also elaborated quite early by Day<sup>[6]</sup> and later on by Tilak and Husain<sup>[40]</sup> themselves; and Havird and Page<sup>[11]</sup>.

Besides, the present observations indicate that the males of *L. annandalei* can be diagnostically separated from those of *L. guntea* on the basis of the shape of the osseous crest (=lamina

circularis) on the fused 7<sup>th</sup> and 8<sup>th</sup> pectoral fin rays; the crest being shovel-like in *L. annandalei* and gradually elevating posteriorwards from behind the origin of pectoral fin rays and attaining bigger elevation (stated as “.....usually forming small dorsally projecting flange near terminus of pectoral fin”; Havird and Page) as compared to *L. guntea*. Tilak and Husain<sup>[38]</sup> and Kottelat and Lim<sup>[22]</sup> also referred, the ‘shovel-like structure’ in males of *L. caudofurcatus* and *L. furcatus*, respectively.

ii) “In the males, the length of the pectoral fin is equal to the length of the head minus the prenarial distance while in the females; it is smaller and is equal to the length of the head minus the snout”.

This character does not hold good in comparison to the present one, as the length of pectoral fin in Head Length (minus prenarial distance) said to be equal (about 1.0) in males is always observed to be more (0.70 – 0.78). In case of females, it is observed to be greater or equal (0.70 – 1.11) as against smaller [Table 6]. As far as the length of pectoral in head (minus snout) in females is concerned it is always greater (0.50 - 0.78) as against ‘equal’ [Table 6].

iii) “In the males, the height of the dorsal fin was equal to the length of the pectoral fin whereas in the females, the length of the pectoral fin was smaller than the height of the dorsal fin”.

In respect to the above, the present findings are in agreement [Table 6] as the height of dorsal fin in males was found to be almost equal (0.90 - 0.95), but in case of females the pectoral fin had never been smaller than the height of dorsal fin as evident from the ratios calculated (0.70 – 1.0) [Table 6].

In addition to the above, the present findings reveal that the ratio of maxillary barbel in snout length [Table 6] also characteristically segregates males and females.

Havird and Page<sup>[11]</sup> have given the segregating ratios of pectoral fin of males and females in standard length (on % basis) and as compared to the present findings they very well agree in case of males (*i.e.*, 17.50 – 20.83 *vs.*, 17.0 ± 1.60) but differ drastically in females (21.95 – 23.08 *vs.*, 15.5 ± 1.30).

#### 4. Remarks

**a) Synonymies of *Lepidocephalus annandalei* Chaudhuri:** Hora and Gupta<sup>[13]</sup> considered *L. annandalei* Chaudhuri and *L. guntea* (Hamilton) synonymous but proved unjustified by Tilak and Husain<sup>[40]</sup> who said that Hora and Gupta<sup>[13]</sup> had a mixture of specimens of *L. guntea* and *L. annandalei* and by mistake they considered *L. annandalei* as the young of the former because the specimens of *L. annandalei* are always smaller in size. *L. menoni sp. nov.* from Garo Hills, Meghalaya<sup>[30]</sup> has also been found synonymous with *L. annandalei*<sup>[40]</sup>, on the basis of meristics, morphometry and colour pattern, more particularly in the character of caudal fin which is notched or concavely lunate. Menon<sup>[25]</sup> also synonymized *L. guntea* (Hamilton) and *L. annandalei* Chaudhuri without giving any convincing evidences.

While discussing *Lepidocephalus caudofurcatus sp. nov.*, Tilak and Husain<sup>[38]</sup> mentioned it to be a nearest ally of *Lepidocephalus guntea* and differing with the later in the shape and depth of body, scalation on head, size of barbels, height of caudal peduncle and magnitude of sexual dimorphism. Furthermore, on the basis of ‘slightly emarginate’ caudal fin they also synonymized *L. berdmorei* (nec Blyth)<sup>[3]</sup> with *L. caudofurcatus*. Possibly for the same

reason *Lepidocephalus annandalei* of Pillai and Yazdani<sup>[30, 31]</sup> and Yazdani<sup>[44, 45]</sup> was also synonymized with *L. caudofurcatus*<sup>[38]</sup>.

With reference to the above, the following statements by Tilak and Husain<sup>[40]</sup> require thorough verification while deciding status of *Lepidocephalus berdmorei* and *Lepidocephalus annandalei* in the light of the description of *Lepidocephalus caudofurcatus*:

- “.....examples.....identified as *Lepidocephalus berdmorei* by Banarescu and Nalbant<sup>[3]</sup>, have been studied in detail by the present authors, and found them to be the same as *L. caudofurcatus* Tilak and Husain”.
- “.....*Lepidocephalus annandalei*, reported by Pillai and Yazdani<sup>[30]</sup>, has also been examined in detail and compared with a similar material from Dehradun, Saharanpur and Moradabad Districts of Uttar Pradesh. It has been observed that this material belongs to *L. caudofurcatus*”.
- “*L. annandalei*, reported by Yazdani<sup>[45]</sup> from Kaziranga Wildlife Sanctuary, Assam and *L. berdmorei*, reported by Banarescu and Nalbant<sup>[3]</sup>, are same as *L. caudofurcatus* Tilak and Husain”.

From taxonomists’ point of view, it is quite puzzling as to why Tilak and Husain<sup>[40]</sup>, while discussing the systematics of *Lepidocephalus*, included the synonymy and descriptions of *Lepidocephalus (Lepidocephalichthys) berdmorei* and *Lepidocephalus (Lepidocephalichthys) annandalei*, separately, besides also including them under the synonymy of *L. caudofurcatus*?

Kottelat and Lim<sup>[22]</sup> raised relevant question about *L. berdmorei* being equated with *L. caudofurcatus*<sup>[38]</sup> and rejected placement of *Acanthopsis micropogon* in the synonymy of *L. berdmorei* without providing any discussion. They<sup>[22]</sup> said,

“.....we do not see how this synonymy could be supported”. It is not justifiable on the part of taxonomists to ignore, ‘the law of priority’ and give justifications that the specimens, designated ‘*sp. nov.*’ [*e.g.*, *Lepidocephalus caudofurcatus*], collected, named and described on a later date are similar to those (*e.g.*, *L. berdmorei* and *L. annandalei*) described at an early date. When this is so, why could the specimens collected on a later date not identified as either of the earlier ones and that, too, as the more earlier one *i.e.*, *L. annandalei*.

The present observations are favouring the fact that giving importance to the ‘law of priority’, *Lepidocephalus annandalei* Chaudhuri be retained as a valid species and incorporating *L. berdmorei*, *L. menoni* and *L. caudofurcatus* as its synonyms after considering the variable characters like — origin of dorsal fin, length and width of caudal peduncle, colouration and shape of caudal fin.

Naming a species ‘*caudofurcatus*’ (*vide*, *L. caudofurcatus* of Tilak and Husain) clearly outlines the inherent meaning that ‘the caudal fin is furcated’. If the furcation of the caudal fin is of a different nature (taxonomically) then why the case of *L. berdmorei*, having slightly emarginate caudal fin was pleaded by Tilak and Husain<sup>[38]</sup> as equivalent to *L. caudofurcatus*? If that is so, the ‘notched or concavely lunate’ caudal fin of *L. annandalei* Chaudhuri also comes closer to *L. caudofurcatus* and to the present material, again justifying that the material collected on a later date and having slightly emarginate or notched or concavely lunate caudal fin can be safely put beside *L. annandalei* as has been done for *L. menoni* by Tilak and Husain<sup>[40]</sup>. While discussing the relationships of

*Lepidocephalus caudofurcatus* with other species, Tilak and Husain<sup>[38]</sup> stated,

“This species differs from all the known species of the genus *Lepidocephalus* Bleeker from India in having a forked tail”.

The above statement is a misleading one on the basis of the fact that Pillai and Yazdani<sup>[30]</sup> had already reported *Lepidocephalus goalparensis* sp. nov., having “free portion of caudal bifurcated into 2 lobes”. Therefore, denoting *L. caudofurcatus*<sup>[38]</sup> ‘the only species from India having forked tail’, gains no ground. The name ‘*caudofurcatus*’ also loses ground on the basis of the fact that de Beaufort<sup>[7]</sup> reported *Lepidocephalichthys furcatus* sp. nov. from the Malay Peninsula and the key character ‘caudal fin forked’ isolated it from rest of the species having ‘caudal fin rounded or truncate’<sup>[22]</sup>. From ‘Code of Zoological nomenclature’ point of view, no two species should have similar names (!).

Further, a perusal of synonymies makes it clear that when *L. annandalei* = *L. menoni* (vide 40) and *L. menoni* = *L. berdmorei* = *L. annandalei* = *L. goalparensis* = *L. caudofurcatus* (vide 26), then *L. annandalei* must be retained as a valid species on the basis of ‘law of priority’ and updating its description with variability patterns found in characters. The conclusions drawn here regarding the synonymies of *L. annandalei* largely agree with Havird and Page<sup>[11]</sup> who have said that *L. menoni* is a junior synonym of *L. annandalei*, and *L. caudofurcatus* is a synonym of *L. goalparensis*.

The validity and taxonomic history of fork-tailed species viz., *L. micropogon*, *L. annandalei*, *L. menoni*, *L. guntea* and *L. caudofurcatus*, was earlier disputed by Kottelat and Lim<sup>[22]</sup> and Arunkumar<sup>[1]</sup>. Havird and Page<sup>[11]</sup> discussed the validity of fork-tailed species in a greater detail and considered *L. menoni*, *L. annandalei*, *L. guntea* and *L. caudofurcatus* to be a synonym of *L. goalparensis*. The discussion elaborated by Havird and Page<sup>[11]</sup> is largely in agreement with the present findings. Thus, *L. caudofurcatus* be considered as a new synonym of *L. annandalei*.

#### **b) *Lepidocephalus annandalei* Chaudhuri vs. *Lepidocephalus caudofurcatus* Tilak and Husain.**

The present material (identified as *L. annandalei* Chaudhuri) agrees well with all the meristic and morphometric characters of *Lepidocephalus caudofurcatus* Tilak and Husain<sup>[38]</sup> [Tables 4 - 6].

#### **c) *Lepidocephalus annandalei* Chaudhuri vs. *Lepidocephalichthys manipurensis* Arunkumar and *Lepidocephalus caudofurcatus* Tilak and Husain :**

Recently, while discussing fishes of North East India, Vishawanath *et al.*,<sup>[43]</sup> included *Lepidocephalichthys manipurensis* in the list (a new species from Manipur reported by 1) [Fig. 1F]. A comparison of the characterizations observed in the present material (Fig. 1C and 1 D) with *L. manipurensis* has revealed that both come closer in the diagnostic characters like –

“A single distinct black spot at the base of caudal fin; caudal fin forked with 4-5 dark W – shaped bands; 8-11 mid lateral black spots; a distinct dark stripe from top of snout to anterior of eye; scales absent on vertex of head; short transverse bands from occiput to base of caudal fin”.

On the basis of the above discussion two things have become quite evident, firstly as Tilak and Husain<sup>[38]</sup> said for *L. caudofurcatus* being the only species having furcated caudal fin, it is always likely that furcated caudal fin may be reported

in any of the future observations [as by 1] [this fact also makes it clear that the character of furcation on the caudal fin cannot (or should not) be highlighted in the specific name like ‘*caudofurcatus*’]. Secondly, such individuals are not uncommon from North – East to West, as far as their distribution is concerned.

#### **d) *L. annandalei* vs. *L. guntea***

On comparison of the meristic and morphometric characters of *L. annandalei* and *L. guntea* [Tables 1 – 6] it becomes obvious that there is a considerable overlapping, but on the other hand they can be characteristically segregated on the basis of colour pattern, shape of caudal fin and  $\Sigma$  - shaped bands on it (Fig. 3E), as mentioned in the key to species given earlier (please refer to key).

Further, *L. annandalei* is also distinguished from *L. guntea* in having larger (= slightly bulging) eyes [Fig. 3A]<sup>[44]</sup>. In contrast to Yazdani<sup>[44]</sup>, the diameter of eye being greater than the interorbital width in *L. annandalei*, it is observed here to be a bit smaller or equal to the interorbital width.

#### **Common points of discussion**

In *L. guntea* and *L. annandalei*, the barbels, mental lobes and origin of dorsal fin exhibit variability, hence they are discussed here under ‘Common points of discussion’.

The discussion on the distribution of *L. annandalei* has also been elaborated.

#### **1. Barbels:** [Figs. 2A – 2D, 3A and 3B]

The present findings regard the number of barbels as to be 3 pairs *i.e.*, 1 pair rostral, 1 pair maxillary and 1 pair mandibular, corroborating with the contention of Talwar and Jhingran [1991], Jayaram<sup>[21]</sup> and Vishwanath *et al.*,<sup>[43]</sup>

Day<sup>[6]</sup> for Genus *Lepidocephalichthys* mentioned, ‘six or eight barbels, four of which belong to the mandibles’, but in the description of *L. guntea* he mentioned, ‘two rostral and a maxillary pair, all longer than the orbit: a fleshy flap from the lower surface of the mandibles on either side joins the maxillary barbel, and each has one or two barbels along its edge’. Till recently, the same was followed by Uniyal and Kumar<sup>[41]</sup>. Tilak and Husain<sup>[40]</sup> referred 6 barbels (= 3 pairs), but with a different combination, *i.e.*, 2 rostral, 2 maxillary and 2 maxillo - mandibular.

In the meantime, there were other workers who described the number of barbels as to be 8 (*i.e.*, 4 pairs; 1 pair rostral, 2 pairs maxillary and 1 pair mandibular)<sup>[4, 34, 31, 44, 38]</sup>.

For long, the mid-ventral fleshy projections at lower lip (= mental lobes) were mistaken as mandibular barbels and sometimes they have been considered joined with the maxillary barbels at the corners of mouth<sup>[6, 31, 44]</sup>, thus describing them as maxillo - mandibulars<sup>[40, 8]</sup>. In fact, the maxillary barbels having broad and fleshy bases running along upper lip and reaching upto the origin of the rostrals [Figs. 2A and 2C] were mistaken as second pair rostrals and that on the corner of the mouth as the maxillary ones. Very recently, Havird and Page<sup>[11]</sup> also described barbels as to be 3 pairs *i.e.*, 2 rostral and 1 maxillary pair at corner of mouth: pair of “flaps” on lower lip, each flap with thickened inner fold ending in a small, barbel-like projections.

#### **2. Mental Lobes**

Day<sup>[6]</sup> for, Generic character, stated “.....that on either side of the mandible is a skinny flap, ending internally in a barbel, and externally being connected to the maxillary barbel”. In

the aforesaid statement the clause, “....ending internally in a barbel....” [as also stated recently by Havird and Page] needs correction in the light of the fact that the skinny flaps along the lower mandibular surfaces are actually the fleshy, corrugated mental lobes. They are palmate mid-ventrally with 2 digitiform projections in case of *L. guntea*, where the one inner to the fleshy portion is simple and shorter than the other one outer to it, a bit longer and bifid [Fig. 2A].

In case of *L. annandalei*; the mid - ventral, fleshy, coniform part of the mental lobe (curved outwardly at the tip) is likewise continuous with the bases of mandibular barbels but on the way its free posterior margin is corrugated / frilled [Fig. 3B].

It is worth mentioning here that the projections or the frilled margins at the mental lobes should not be equated with the barbels or barbel-like structures as also stated by Tilak and Husain [40] and Jayaram [21]. It will be in the fitness of things that the following statements be regarded as abandoned in favour of fleshy projections/corrugations/frilled margins at mental lobes.

- “.....mental lobe between the mandibular barbels is simple and bears no additional barbel” [38].
- “Six barbels, one pair rostral, one or two maxillary, two pairs of barbel – like mental lobes” [20].
- “Mental lobe produced into minute, barbel-like projections” [35].

From the above-said statements it is also to be derived that when thread- like elongations on the lobes are not barbels, therefore, the elongations can also be not thread – like. More precisely, they are the projections or very fine frilled posterior borders of the mental lobes.

### 3. Variability with reference to origin of dorsal fin

The character of variability of origin of dorsal fin is equally applicable to *L. guntea* and *L. annandalei*, as in both the cases it is mostly equidistant between anterior margin of eye and

caudal base and similarly the origin of dorsal fin shows variability with reference to ventral fins as it may be slightly opposite or posterior or anterior to the origin of ventral fin as stated for *L. annandalei* by Tilak and Husain [40]. Therefore, on this basis it is quite difficult to segregate both the species [Figs. 1A – 1D].

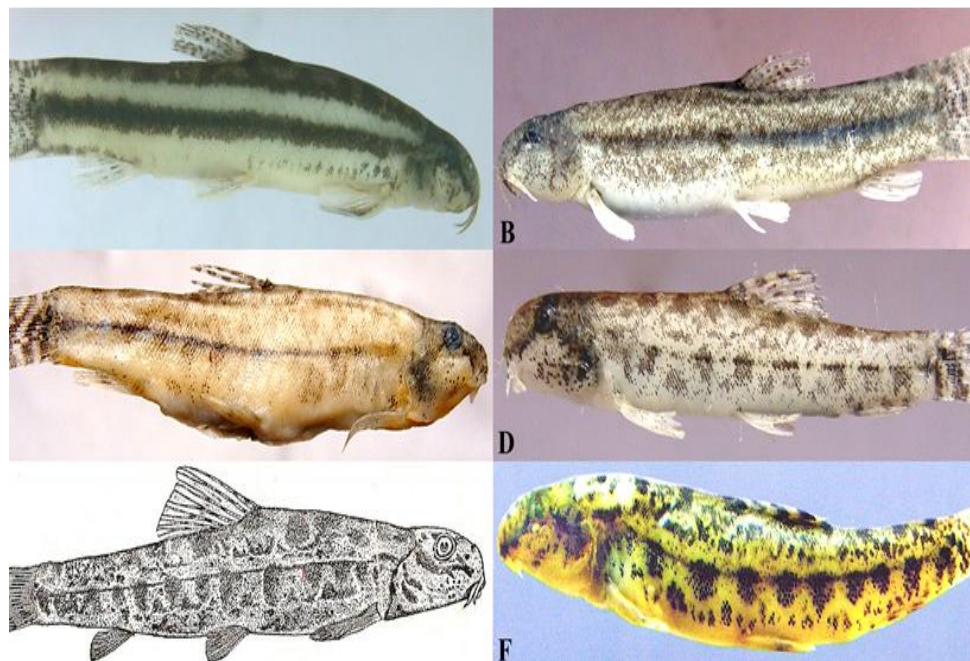
### 4. Distribution

Where *L. guntea* is widely distributed in India, Bangladesh, Nepal and Pakistan [24], *L. annandalei* for the first time was described by Chaudhuri [4] from Tista river, Jalpaiguri and Mahananda river at Siliguri (North Bengal). Shaw and Shabbear [32] reaffirmed its presence in Northern Bengal from Panchenai River near Matihara. Menon [24], while giving a distributional list of Himalayas recorded the presence of *L. annandalei* from the Brahmaputra drainage only.

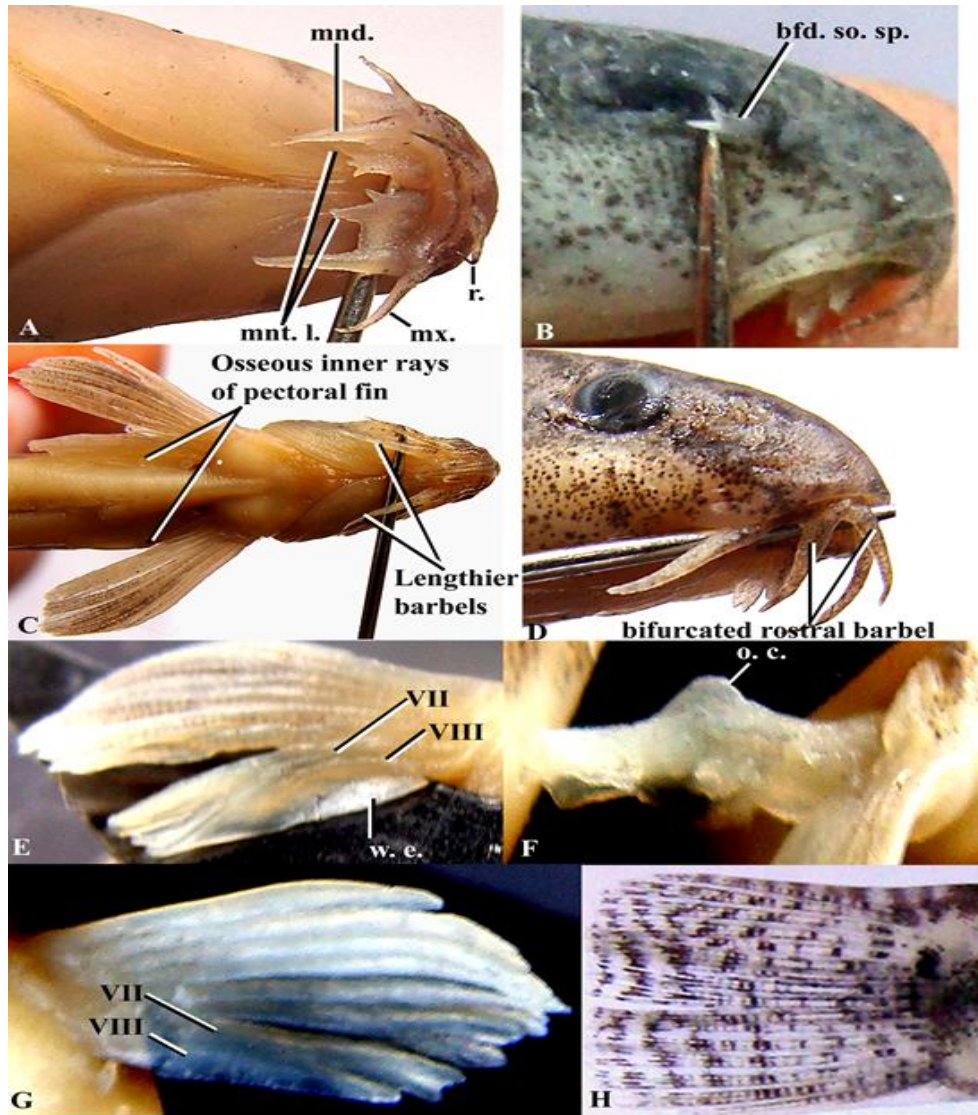
Surprisingly, *L. annandalei* does not find place in the latest list of fishes from North East India by Vishwanath *et al.*, [43], instead, *Lepidocephalichthys manipurensis sp. nov.* [1] [Fig. 1F] is included therein. As discussed earlier, the latter comes closer to the present material and needs verification so as to get it included in the synonymy of *L. annandalei* as has been done for *L. caudofurcatus* when it was synonymized with *L. menoni* [26] and the latter in turn with *L. annandalei* [40].

As far as Western Himalayas are concerned, *L. annandalei* was for the first time reported from Kalapani stream, Rishikesh (Dehradun) by Tilak and Husain [39]. Further, while updating/compiling the fish fauna of Western Himalayas, Central Highlands and Western Ghats, Husain [17] and Nautiyal [27], separately, recorded the presence of not only *L. annandalei* but also of *L. caudofurcatus* based more on secondary data, rather than actual field observations.

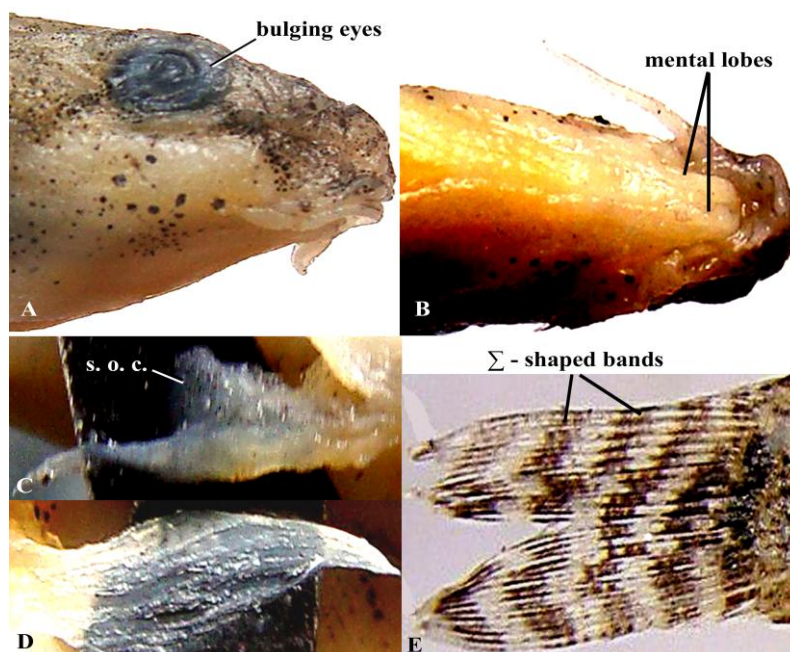
The presence of *L. annandalei* in Doon Valley streams (specially Suswa) is of ‘zoogeographical significance’ owing to the existence of fishes of Eastern Himalayas in the streams of Western Himalayas (Tilak and Husain, 1977 a and Gupta and Rana, 2009).



**Fig 1:** A - *Lepidocephalichthys guntea*, lateral view, male; B - *Lepidocephalichthys guntea*, lateral view, female; C - *Lepidocephalichthys annandalei*, lateral view, male; D - *Lepidocephalichthys annandalei*, lateral view, female; E - *Lepidocephalus caudofurcatus* (Tilak and Husain, 1977a); F - *Lepidocephalichthys manipurensis* (Arunkumar, 2000).



**Fig 2:** *Lepidocephalichthys guntea*. A - Head, ventral view showing barbels (r., rostral barbel; mx., maxillary barbel; mnd., mandibular barbel) and mental lobes (mnt. l.); B - Head, lateral view, showing bifid suborbital spine (bfd. so. sp.); C - Head and snout, ventral view, male; D - Head showing bifurcated rostral barbel, female; E - Pectoral fin of male showing wedge-shaped extension (w. e.), when viewed ventrally; F - Crest (= lamina circularis) on 7th and 8th fused pectoral fin rays in males (o. c., osseous crest); G - Pectoral fin, female; H - Caudal fin.



**Fig 3:** *Lepidocephalichthys amandalei*. A - Head, lateral view; B - Head, ventral view; C - Shovel - like osseous crest (s. o. c.) on 7th and 8th pectoral fin rays in males; D - Pectoral fin, female; E - Caudal fin.

**Table 1:** A comparative analysis of meristic characters of *L. guntea*.

S. No.	Characters (Fin Formula)	Present Specimens	Day (1878)	Tilak and Husain (1981)	Talwar and Jhingran (1991)	Havird and Page (2010)
1.	Branchiostegal Rays	iii	iii	III	-	-
2.	Dorsal Fin Rays	II / 7	8 - 9 (2 / 6 - 7)	II - III / 6 - 7	ii - iii 6 - 7	ii,6
3.	Pectoral Fin Rays	I / 7	8	I / 6 - 7	i 6 - 7	i,7
4.	Ventral Fin Rays	I / 6	7 - 8	I / 6 - 7	i 6 - 7	i,6
5.	Anal Fin Rays	II / 5	7 (2 / 5)	II - III / 5	ii - iii 5	ii,5
6.	Caudal Fin Rays	16	16	16	-	14 branched rays (each lobe i,7)
7.	Scales between anal base and back of body	25-30	25 - 30	25 - 30	25 - 30	-

**Table 2:** A comparative morphometric analysis of characters of *L. guntea*.

S. No.	Characters	Present Specimens		Day (1878) (Conv.)	Tilak and Husain (1981) (Conv.)	Talwar and Jhingran (1991) (Conv.)
		*(Conv.)	Ratios calculated on Percentage (%) basis			
1.	Head Length	4.37 - 6.90 in TL 3.62 - 5.00 in SL	16.90 - 22.86 of TL 20.0 - 27.59 of SL	6.50 - 6.75 in TL -	5.88 - 6.80 in TL -	- -
2.	Body Depth	5.60 - 7.10 in TL 4.20 - 5.80 in SL	14.28 - 19.61 of TL 17.24 - 23.81 of SL	5.75 - 6.50 in TL -	5.66 - 7.00 in TL -	5.8 - 6.8 in TL -
3.	Caudal Fin	5.14 - 6.18 in TL 4.19 - 5.20 in SL	14.70 - 21.43 of TL 18.52 - 25.86 of SL	6.0 in TL -	- -	- -
4.	Eye Diameter	4.50 - 5.0 in HL 1.0 - 1.98 on Sn. L 0.75 - 1.50 in IOW	16.67 - 28.00 of HL 27.27 - 66.67 of Sn. L 66.67 - 106.67 of IOW	5.0 in HL 1.50 in Sn. L. 1.0 in IOW	- - -	- - -
5.	Snout Length	1.86 - 2.60 in HL	37.50 - 57.14 of HL	-	-	-
6.	Rostral Barbel	1.80 - 4.80 in HL 0.80 - 2.0 in Sn. L	19.17 - 55.55 of HL 46.0 - 125.0 of Sn. L	- -	- -	- -
7.	Maxillary Barbel	1.54 - 4.0 in HL 0.77 - 1.67 in Sn.L	40.0 - 100.0 of HL 66.67 - 140.0 of Sn. L	- -	- -	- -
8.	Mandibular Barbel	1.54 - 3.33 in HL 0.77 - 1.67 in Sn.L	40.0 - 60.0 of HL 66.67 - 140.0 of Sn. L	- -	- -	- -
9.	Length of Caudal Peduncle	7.0- 9.0 in TL 5.80- 7.15 in SL	11.11- 15.71 of TL 13.33 - 17.24 of SL	- -	- -	- -
10.	Height of Caudal Peduncle	7.89 - 12.0 in TL 6.46 - 9.67 in SL 0.93 - 1.67 in Length of Caudal Peduncle	8.33 - 16.67 of TL 10.34 - 16.67 of SL 75.0 - 107.69 of Length of Caudal peduncle	- - -	- - 82.00 - 108.00% of its length	- - -
11.	Predorsal Length	2.06 - 2.40 in TL 1.70 - 2.19 in SL	41.67 - 48.57 of TL 51.72 - 58.82 of SL	- -	- -	- -
12.	Postdorsal Length	2.08 - 2.63 in TL 1.93 - 2.22 in SL	38.03 - 42.10 of TL 45.0 - 51.72 of SL	- -	- -	- -

TL = Total Length, SL = Standard Length, HL = Head Length, Sn. L. = Snout Length, IOW = Interorbital Width.

\*Conv. = Conventional Ratios.



**Table 3:** A comparative analysis of sexually dimorphic characters in *L. guntea*.

S. No.	Characters	Male		Female	
		Present Material *(Conv.)	Tilak and Husain (1975)	Present Material (Conv.)	Tilak and Husain (1975)
1.	Pectoral Fin Length in Head Length	0.87 – 1.0	More	1.0 – 1.53	Less
2.	Pectoral Fin Length in Body Height	0.87 – 1.0	More	1.12 – 1.15	Less
3.	Pectoral Fin Length in Length of Caudal Peduncle	0.64 – 0.69	More	1.0 – 1.6	Equal
4.	Height of Dorsal Fin in Length of Pectoral Fin	1.10 – 1.20	Less	0.71 – 0.89	More
5.	Length of Ventral Fin in Height of Caudal Peduncle	0.68 – 0.88	More	0.57 – 1.06	Equal
6.	Ventral to Anal Fin distance in Ventral Fin Length	0.53 – 0.68	Less than two times	0.47 – 0.82	Two times or more
7.	Longest ray of Anal Fin in Length of Ventral Fin	0.94 – 1.14	Equal	0.82 – 1.07	More
8.	Caudal Peduncle Length in its height	0.81 – 1.0	Distinctly more	0.6 – 1.06	Either equal or slightly more
9.	Rostral in Head Length	1.80 – 2.44	-	2.28 – 4.80	-
10.	Rostral in Snout Length	0.80 – 1.11	-	1.0 – 2.0	-
11.	Maxillary in Head Length	1.54 – 1.83	-	2.0 – 4.0	-
12.	Maxillary in Snout length	0.77 – 0.83	-	1.0 – 1.67	-
13.	Mandibular in Head length	1.54 – 2.0	-	2.10 – 3.33	-
14.	Mandibular in snout Length	0.77- 0.91	-	1.0 – 1.67	-
16.	Colouration	Dark – brown specks coalescing to form a pattern of darker and lighter longitudinal bands, that along the flank forming almost black-stripe from the tip of the snout to the base of caudal fin. Light narrow stripes and interrupted wavy brown bands present above and below the lateral band, the upper one darkening towards the mid- dorsal line whereas the lower one fading into the whitish.	Same as that of present material	The band is less prominent, area above and below this is festooned with dark irregular blotches.	Same as that of present material

\*Conv. = Conventional Ratios.

**Table 4:** A comparative analysis of meristic characters of *L. annandalei*.

S. No.	Characters	Present material	<i>Lepidocephalus annandalei</i>					<i>Lepidocephalus menoni</i> (Pillai and Yazdani, 1974)	<i>Lepidocephalus goalparensis</i> (Pillai and Yazdani, 1974)	<i>Lepidocephalus caudofurcatus</i> (Tilak and Husain, 1977 a)	Havird and Page (2010)
			Chaudhuri (1912)	Shaw & Shabbare (1937)	Pillai & Yazdani (1974)	Tilak & Husain (1981)	Talwar & Jhingran (1991)				
1.	Branchiostegal Rays	iii	-	-	- 2 / 7	III	-	-	-	-	-
2.	Dorsal Fin Rays	II / 7	II / 7	I / 7	- 2 / 7	I – II / 6 - 7	i - ii 6 - 7	2 - 3 / 7	3 / 6	II / 6	ii,6
3.	Pectoral Fin Rays	I / 7	7 – 8	7 – 8	8	I / 6 - 7	i 6 - 7	8	7	I / 7	i,7
4.	Ventral Fin Rays	I / 6	-	7	7	I / 6	i 6	7	7	I / 6	i,6
5.	Anal Fin Rays	II / 5	II / 5	I / 6	2 / 6	II / 5	ii 5	2 – 3 / 6	2 / 6	III / 5	ii,5
6.	Caudal Fin Rays	16	16 - 18	24 - 26	22 - 24	16 - 18	-	16 – 18	18	16	14 branched rays (each lobe i,7)
7.	Scales between anal base and back of body	27 - 29	-	-	-	28	28	-	-	25	-

**Table 5:** A comparative morphometric analysis of characters of *L. annandalei*.

S. No.	Characters	Present material		<i>Lepidocephalus annandalei</i>					<i>Lepidocephalus menoni</i> (Pillai and Yazdani, 1974)	<i>Lepidocephalus goalparensis</i> (Pillai and Yazdani, 1974)	<i>Lepidocephalus caudofurcatus</i> (Tilak and Husain, 1977a)
		† (Conv.)	Ratios calculated on Percentage (%) basis	Chaudhuri (1912) (Conv.)	Shaw & Shabbaree (1937) (Conv.)	Pillai and Yazdani (1974) (Conv.)	Tilak & Husain (1981) (Conv.)	Talwar & Jhingran (1991) (Conv.)	(%)	(%)	(%)
1.	Head Length	4.30 – 6.0 in TL 3.50 – 4.80 in SL	16.67-20.0 of TL 20.31 – 24.39 of SL	4.0-4.50 -	6.0 in TL -	- -	5.23–5.67 in TL 4.00-4.67 in SL	- -	- *23.3 (22.0 – 25.0) of SL	- 21.90 of SL	16.67 – 19.51 of TL 20.59-24.14 of SL
2.	Body Depth	5.15 – 7.89 in TL 4.0 – 6.25 in SL	15.0-19.0 of TL 18.18-23.75 of SL	5.50-6.0 -	8.0 in TL -	- -	6.90-9.00 in TL 5.50-7.25 in SL	6.9-9.0 in TL -	- 14.4 (13.3 – 16.0) of SL	- 17.20 of SL	13.55 – 18.14 of TL 17.14 – 22.94 of SL
3.	Caudal Fin	4.50 – 5.57 in TL 3.50 – 4.65 in SL	17.35-23.00 of TL 21.25-27.50 of SL	- -	5.50 in TL -	- -	- -	- -	- 20.5 (16.3 – 25.0) of SL	- 21.90 of SL	17.07-21.62 of TL 20.59 – 27.59 of SL
4.	Height of Caudal Base	8.23 – 10.20 in SL 1.60 – 2.25 in Body Depth	9.80 – 12.14 in SL 44.44 – 58.33% of Body Depth	- -	- -	- 41.70-50.00 of Body Depth	- -	- -	9.4 (8.5 – 10.4) of SL -	11.0 of SL -	- -
5.	Eye Diameter	18.23 – 30.77 in TL 14.12 – 25.55 in SL 4.0 – 6.2 in HL 1.6 – 2.5 in Sn. L 0.90 – 1.31 in IOW	3.60-6.43 of TL 5.0-7.50 of SL 16.60-25.18 of HL 37.30-63.20ofSn. L. 80.0 – 100.00 of IOW	- 4.50–5.0 in HL 1.30 – 1.50 in Sn. L 1.0 in IOW	- - - -	- - - -	- - - -	- - - -	- 25.7 (21.7 – 27.3) of HL -	- 21.40 of HL -	3.49 – 5.13 of TL 4.29 – 6.45 of SL - (?)2.60-4.25 of IOW
6.	Snout Length	9.33 – 15.0 in TL 8.15 – 11.43 in SL 1.86 – 2.71 in HL	5.10-8.33 of TL 7.69-11.36 of SL 36.87 – 53.52 of HL	- - 3.0 – 3.50 in HL	- - -	- - -	- - -	- - -	- 42.3 (38.3 – 46.7) of HL -	- 43.0 of HL -	4.84 – 8.33 of TL 6.12-10.34 of SL -
7.	Inter Orbital Width	3.51 – 6.37 in HL	15.70-28.49 of HL	-	-	-	-	-	9.1 (8.4 – 10.9) of HL	14.30 of HL	-
8.	Rostral Barbel	11.33 – 24.50 in TL 9.33 – 20.0 in SL 4.36 – 7.37 in HL 1.54 – 3.21 in Sn.L	4.08 – 8.82 of TL 5.0 – 10.71 of SL 13.47-28.49 of HL 31.15-64.56ofSn. L.	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
9.	Maxillary Barbel	10.33 – 19.60 in TL 8.33 – 16.0 in SL 1.96 – 3.69 in HL 0.80 – 1.86 in Sn. L	5.10 – 9.68 of TL 6.25 – 12.0 of SL 27.07-50.83 of HL 50.00 – 115.19 of Sn. L.	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	(?) 2.22 – 3.57 of TL (?) 2.70 – 4.41 of SL - -
10.	Mandibular Barbel	8.86 – 16.33 in TL 7.14 – 13.33 in SL 1.97 – 3.69 in HL 0.87 – 1.86 in Sn.L	6.12 – 11.29 of TL 7.5 – 14.0 of SL 27.07-50.83 of HL 53.85-115.19 of Sn. L	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -	- - - -
11.	Width of Body in depth of body	1.09 – 1.92	51.83-91.01	-	-	-	-	-	-	-	41.54 – 61.54
12.	Caudal Peduncle Length	6.67 – 12.0 in TL 5.33 – 9.67 in SL	10.20-13.33 of TL 12.82-16.67 of SL	- -	- -	- -	- -	- -	- 17.9 (17.3 – 19.2) of SL	- 15.60 of SL	9.30 – 13.00 of TL 11.76 – 15.38 of SL
13.	Caudal Peduncle	8.75 – 12.86 in	8.33 – 9.18 of TL	-	-	-	-	-	-	-	7.02 – 8.75 of TL

	Height	TL 6.87 – 10.36 in SL 0.98 – 1.10 in Length of Caudal Peduncle	8.33-11.36 of SL 65.60 – 88.50 of Length of Caudal Peduncle	- -	- -	8.8 – 11.10 in SL -	- 50.00-75.00 of Length of Caudal Peduncle	- -	9.3 (7.7 – 10.4) of SL -	9.4 of SL -	8.57 – 10.61 of SL 60.61 – 87.50 of Length of Caudal Peduncle
14.	Predorsal Length	2.05 – 2.67 in TL 1.83 – 2.06 in SL	39.58 – 43.33 of TL 48.48 – 54.54 of SL	- -	- -	- -	- -	- -	- -	- -	38.88-42.86 of TL 47.62 – 52.94 of SL
15.	Preanal Length	1.51 – 1.58 in TL 1.20- 1.29 in SL	62.50-66.67 of TL 76.92 – 83.33 of SL	- -	- -	- -	- -	- -	- -	- -	60.61-65.55 of TL 76.09-82.35 of SL
16.	Preventral Length	2.27 – 2.42 in TL 1.78 – 1.94 in SL	41.67 – 45.10 of TL 51.28-56.25 of SL	- -	- -	- -	- -	- -	- -	- -	40.35 – 45.24 of TL 50.00 – 55.88 of SL
17.	Postdorsal Length	2.45 – 2.63 in TL 1.91 – 2.10 in SL	36.73 – 42.0 of TL 47.5 – 52.27 of SL	- -	- -	- -	- -	- -	- -	- -	38.81- 42.50 of TL 47.94 – 52.38 of SL
18.	Distance between Pectoral to Pelvic	3.33 – 4.0 in TL 2.67-3.3 in SL	21.43 – 26.67 of TL 27.27 – 33.33 of SL	- -	- -	- -	- -	- -	- -	- -	20.51 – 26.19 of TL 25.81 – 32.35 of SL
19.	Distance between Ventral to Anal	4.17-4.90 in TL 3.33-4.0 in SL	20.41 – 24.0 of TL 25.0 – 30.0 of SL	- -	- -	- -	- -	- -	- -	- -	20.45 – 24.36 of TL 25.68 – 30.65 of SL
20.	Length of base of Dorsal Fin	6.67-8.17 in TL 5.33-6.67 in SL	11.20-12.50 of TL 12.50 – 16.67 of SL	- -	- -	- -	- -	- -	- -	- -	8.77 – 11.90 of TL 10.81 – 15.15 of SL
21.	Height of Dorsal Fin	4.20-4.80 in SL	20.51-23.43 of SL	-	-	-	-	-	17.2 (14.3 – 19.2) of SL	17.2 of SL	-
22.	Length of Pectoral Fin	5.55 – 7.0 in TL 4.30-6.06 in SL	12.50 – 18.0 of TL 16.50 – 23.20 of SL	- -	- -	- -	- -	- -	- 17.5 (14.0 - 19.2) of SL	- 14.0 of SL	12.82 – 16.67 of TL 16.42 – 21.21 of SL
23.	Length of Ventral Fin	6.0-8.0 in TL 4.8-6.6 in SL	12.24 – 16.67 of TL 14.54 – 18.75 of SL	- -	- -	- -	- -	- -	- -	- -	11.08 – 15.52 of TL 13.73 – 18.18 of SL
24.	Length of base of Anal Fin	9.33-12.5 in TL 7.13-10.0 in SL	6.25 – 8.93 of TL 7.5 – 11.36 of TL	- -	- -	- -	- -	- -	- -	- -	5.12 – 7.18 of TL 6.35 – 9.03 of SL

\* = Ratios outside parenthesis are the mean values, whereas inside the parenthesis are range values.

(?) = Discussed in the text.

† = Conventional ratios.

% = Ratios calculated as percentage.

**Table 6:** A comparative analysis of sexually dimorphic characters in *L. annandalei*.

S. No.	Characters	Male		Female	
		<i>L. annandalei</i> Present Material	<i>L. caudofurcatus</i> Tilak and Husain (1977 a)	<i>L. annandalei</i> Present Material	<i>L. caudofurcatus</i> Tilak and Husain (1977 a)
1.	Pectoral Fin Length in Head Length	1.0 – 1.07	-	1.0 – 1.50	-
2.	Pectoral Fin Length in Head Length minus Prenarial Distance	0.70 – 0.78	Equal <i>i.e.</i> , about 1.0	0.70 – 1.11	Smaller <i>i.e.</i> , more than 1.0
3.	Pectoral Fin Length in Head Length minus Snout Length	0.55 – 0.58	-	0.50 – 0.78	Equal
4.	Pectoral Fin Length in Length of Caudal Peduncle	0.55 – 0.62	-	0.70 – 0.83	-
5.	Height of Dorsal Fin in Length of Pectoral Fin	0.90 – 0.95	Equal	0.70 – 1.0	Smaller
6.	Maxillary barbel in Head Length	1.96 – 2.16	-	2.0 - 3.69	-
7.	Maxillary barbel in Snout length	0.80 – 0.89	-	1.0 – 1.86	-

## 5. Conclusion

The present communication concludes that *Lepidocephalichthys annandalei* is established as a valid species and is found synonymous to *Lepidocephalichthys caudofurcatus*. Also, *Lepidocephalichthys annandalei* appeared of zoogeographical significance and is a new addition to the fish fauna of Suswa River.

## 6. Acknowledgements

The authors are indebted to Uttarakhand State Council for Science and Technology (U-COST) for carrying out a Major Research Project. Thanks are due to ZSI (NRS), Dehradun for providing identification and library facilities and to D. B. S. (PG) College, Dehradun for providing necessary facilities.

## 7. References

1. Arunkumar L. Loaches of the genus *Lepidocephalichthys* (*Lepidocephalus*) from Manipur, with description of a new species. *Journal of Fish Biology*. 2000; 57(5):1093-1104.
2. Arunkumar L, Singh Th. Rajen. Systematic list and distribution of Loach fishes of Manipur, India. *Aquaculture*. 2011; 12(2):193-219.
3. Banarescu P, Nalbant TT. Cobitidae (Pisces, Cypriniformes) collected by the German – India Expedition. *Mitt. Hamburg Zoology Museum Institute*. 1968; 65:327- 51, 15 Text – Figs., pls. I – II.
4. Chaudhuri BL. Description of some new fishes of freshwater fishes from North India. *Record Indian Museum*. 1912; 7:437-444.
5. Das SM. The Fisheries of the Doon valley. *Uttarbharti*. 1960, 11-17.
6. Day F. The Fishes of India (repr. 1958). William Dawson and Sons Ltd. London. 1878; 1-2-20+778 & pls.198.
7. de Beaufort LF. On some new or rare species of Ostariophysi from Malay Peninsula and a new species of *Betta* from Borneo. *Bulletin Raffles Museum*. 1933; 8:31-36.
8. Dhanze JR, Dhanze R. Some teratological aberrations in *Lepidocephalus guntea* (Hamilton) from eutrophic water. *Journal of Environmental Biology*. 1990; 11(4):399-403.
9. Gupta SK, Rana D. On a new synonym of *Barilius tileo* Hamilton from Doon Valley (Uttarakhand) – A critical taxonomical analysis. *Aquaculture*. 2009; 10(2):231-244.
10. Gupta SK, Rana D. On *Lepidocephalichthys* sp. (Pisces : Cobitinae) - A Taxonomic Appraisal with special reference to the status of *Lepidocephalichthys annandalei* from Doon Valley, 5<sup>th</sup> Uttarakhand State Science and Technology Congress, Organised at Doon University, Uttarakhand, 2010; 01:357.
11. Havird JC, Page LM. A revision of *Lepidocephalichthys* (Teleostei: Cobitidae) with description of two new species from Thailand, Laos, Vietnam and Myanmar. *Copeia*, 2010; (1):137-159.
12. Hora SL, Mukherji DD. Fish of the Eastern Doons United Provinces. *Record Indian Museum*. 1936; 38(2):133-146.
13. Hora SL, Gupta JC. On a collection of fish from Kalimpong Duars and Siliguri Terai Northern Bengal. *Journal Royal Asiatic Society of Bengal*, 1941; 6(2):79-81.
14. Husain A. Fauna of Rajaji National Sanctuary (District Saharanpur), Uttar Pradesh 2. *Fish. Cheetal*, 1975; 16(4):55-57.
15. Husain A. Fish fauna of Corbett National Park Uttar Pradesh. *Cheetal*, 1976; 17(2):39-42.
16. Husain A. On a hillstream loach, *Noemacheilus rupecula* (McClelland) with bifurcated rostral barbel and deformed caudal fin. *Bulletin zoological Survey of India*. 1985; 7(2-3):337-339.
17. Husain A. Pisces In: Fauna of Western Himalaya, Part I, Uttar Pradesh, Himalayan Ecosystem Series: 1995; 117-150:1-63.
18. Husain A. Pisces. In: Fauna of Asan wetland. Wetland Ecosystem Series. 5 Zoological Survey of India. 2003, 23-26.
19. Husain A, Tilak R. Fishes (Pisces). Fauna of Conservation Area 5: Rajaji National Park. Zoological Survey of India Publication, Calcutta. 1994, 115-193.
20. Jayaram KC. The freshwater fishes of India, Pakistan, Bangladesh, Burma and Sri Lanka. Zoological Survey of India, Calcutta. 1981, 475.
21. Jayaram KC. The freshwater fishes of the Indian region. 2nd edition (Narendra Publishing House, Delhi). 1999; 616 1-39.
22. Kottelat M, Lim KKP. A synopsis of the Malayan species of *Lepidocephalichthys* with descriptions of two new species (Teleostei: Cobitidae). *Raffles Bulletin of Zoology*. 1992; 40(2):201-220.
23. Lal MB, Chatterjee P. Survey of Eastern Doon fishes with certain notes on their biology. *Journal zoological Society of India*. 1963; 14(2):230-243.
24. Menon AGK. A distributional list of fishes of the Himalayas. *Journal zoological Society of India*. 1962; 14(1):23-32.
25. Menon AGK. A Check list of the fishes of the Himalaya and Indo – Gangetic Plains. *Inland Fisheries Society of India, Spl. Publ.*, 1974; 1:52-53.
26. Menon AGK. Check list – fresh water fishes of India. *Record zoological Survey of India, Occasional paper Number*, 1999; 175:366.
27. Nautiyal P. Taxonomic richness in the fish fauna of the Himalaya, Central Highlands and Western Ghats (Indian Subcontinent). *International Journal of Ecology and Environmental Science*. 2005; 31(2):73-92.
28. Nelson JS. *Fishes of the World* (4rd Edition) New York, John Wiley and Sons. 2006, 624.
29. Ovais M. On the presence of a forked barbel in a cat fish *Clarias batrachus* (Linnaeus). *Current Science*. 1974; 43(4):125-126.
30. Pillai RS, Yazdani GM. Two new species and two records of *Lepidocephalichthys* Bleeker [Pisces: Cobitidae] from Assam and Meghalaya, India, with a key to the known species. *Journal zoological Society of India*. 1974; 23(1&2):11-17.
31. Pillai RS, Yazdani GM. Ichthyofauna of Garo Hills, Meghalaya (India). *Record zoological Survey of India*. 1977; 72:1-22.
32. Shaw GE and Shabbeare EO. The Fishes of Northern Bengal. *Journal Royal Asiatic Society of Bengal*. 1937; 3: 1-317.
33. Singh PP. Fishes of the Doon valley. *Ichthyologica*. 1964; 3(1-2):86-92.
34. Srivastava GJ. *Fishes of Eastern Uttar Pradesh Vishawavidyalaya Prakashan, Varanasi*. 1968, 163.
35. Talwar PK, Jhingran AG. *The Inland Fishes of India and adjacent countries*. 2 Vols. (Oxford & IBH publishing Co., New Delhi, Bombay, Calcutta. *Inland Fishes, India*).1991; 1-2, 1-17+36 unnumbered + 1 – 1158, 1

map.

36. Tandon KK, Sharma K. A specimen of *Callichrous macrothamus* (Blyth) with a forked right barbel. Current Science. 1971; 40(16):438-1.
37. Tilak R, Husain A. Further studies on the sexual dimorphism in *Lepidocephalus guntea* (Hamilton) (Family: Cobitidae). Newsletter zoological Survey of India. 1975; 1(4):74-76.
38. Tilak R, Husain A. Description of a new species of the genus *Lepidocephalus* Bleeker from Uttar Pradesh (Cobitidae: Cypriniformes). Matsya. 1977a; 3:60-63.
39. Tilak R, Husain A. On the systematic status and distribution of *Lepidocephalus annandalei* Chaudhuri in Uttar Pradesh. Newsletter zoological Survey of India. 1977b; 3(6):408-410.
40. Tilak R, Husain A. On the systematics of the Indian fishes of the genus *Lepidocephalus* Bleeker with keys to the species of the genus and genera of the subfamilies Botinae and Cobitinae (Cobitidae: Cypriniformes), Occasional Paper Number, 1981; 32:1-42.
41. Uniyal DP, Kumar A. Fish diversity in the selected streams of Chakrata and Shivalik hills (District Dehradun, Uttarakhand), India. Record zoological Survey of India, Occasional Paper Number 2006; 253:1-120.
42. Uniyal DP, Mehta HS. Faunal diversity of Western Doon Shivaliks Fishes: (Pisces). Zoological Survey of India, (Special Publication). 2007, 41-59.
43. Vishawanath W, Lakra WS, Sarkar UK. Fishes of North East India, (NBFGR, Lucknow). 2007, 264.
44. Yazdani GM. On the specific validity and distribution of the Loach, *Lepidocephalus annandalei* (Chaudhuri) (Cypriniformes: Cobitidae). Journal Bombay Natural History Society. 1976a; 73:535-537.
45. Yazdani GM. A note on the fishes of Kaziranga Wildlife Sanctuary, Assam. Newsletter zoological Survey of India. 1976b; 2(2):54-56.