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## COMMUNICATION

### ***ABORICHTHYS BARAPENSIS*, A NEW SPECIES OF RIVER LOACH (CYPRINIFORMES: NEMACHEILIDAE) FROM ARUNACHAL PRADESH, THE EASTERN HIMALAYA, INDIA**

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## INTRODUCTION

Members of the genus *Aborichthys* belonging to family Nemacheilidae, is an elongate and slender bodied bottom dwelling freshwater loach, that inhabits fast flowing water of mountain rivers, streams, drainages of Ganga-Brahmaputra River, and is endemic to the eastern Himalaya. They are characterized by having vent situated close behind pectoral girdle, dorsal fin at vertical originated slightly behind pelvic fin-origin; narrow oblique bars on body; a black ocellus at upper extremity of caudal-fin base (but here absent), and rounded or truncate caudal fin marked with concentric rings or irregular black patches, and all fins considerably separated (Chaudhuri 1913; Kosygin 2019; Shangningam 2019). So far, nine species of *Aborichthys* are recognized as valid, whose diversity is mostly confined to Brahmaputra River basins in Arunachal Pradesh, northeastern India, and its distribution extends to Bhutan and Putao in Myanmar (Chaudhuri 1913, 1919; Hora 1925; Talwar & Jhingran 1991; Shangningam et al. 2019).

The first species *Aborichthys boutanensis* (Griffith & McClelland, 1842) previously named *Cobitis boutanensis* known from the neighboring country Bhutan, when the genus was not established. Later, Thoni & Hart (2015) considered it to be a member of *Aborichthys*. The genus was first erected by Chaudhuri (1913) assigning *A. kempfi* as the type species collected by Mr. S.W. Kemp from Sirpo and Egar stream near Rottung and Renging village, Arunachal Pradesh in the east and has since remained monotypic until Hora (1921) described *A. elongatus* from the Rieng River (Brahmaputra Basin), Darjeeling (West Bengal) in the west. Thereafter, Hora (1925) further contributed another species *Aborichthys garoensis* from Tura, Garo Hills, Assam (now Meghalaya) in the southwest, followed by Barman (1984) who added *Aborichthys tikaderi* from Namdapha Wildlife Sanctuary, Changlang District in the southeastern part of Arunachal Pradesh. Over the last one decade, six more sympatric species have been described from the upper Brahmaputra River basins in Arunachal Pradesh, viz., *Aborichthys waikhomi* (Kosygin, 2012) from Bulbulia Stream near Bulbulia, a tributary of Noa-Dihing River, Namdapha, Changlang District in the east; *A. kailasi* and *A. pangensis* (Shangningam et al., 2019) from Pange River, Ziro, Lower Subansiri District in the west; and *A. iphipaniensis* (Kosygin et al., 2019) from Iphipani River, Roing, Lower Dibang Valley District in the east.

While conducting an ichthyological survey in Barap River near Lazu Village in Tirap District, southeastern

most part of the Arunachal Pradesh bordering Myanmar, we came across two adult specimens of *Aborichthys*. Later, examination revealed that it belonged to an unnamed species of *Aborichthys*, which is described herein.

## MATERIAL AND METHODS

Sampling of fishes was done by using caste net with (2 m diameter and 7 mm meshes) in a small and shallow stream (depth ca. 10–30 cm), locally known as 'Barap' (26.898 N & 95.560 E, 1,020 m). The collected specimens were freshly preserved in 10 % formaldehyde in the beginning to hold body coloration, and then transferred to 70 % ethanol after noting down its color. Measurement was made point to point with digital caliper nearest to 0.1 mm. Counts and measurements were made on the left side of specimens following Keskar et al. (2015) except self-explanatory characters, i.e., distances from: dorsal to caudal base, pectoral to pelvic, pectoral to anal, pectoral to vent, pelvic to anal, pelvic to vent, vent to anal, vent to caudal-fin base, anal to caudal base, anal-fin tip to caudal-fin base, vent to anal distance, vent to pelvic distance, mouth length, mouth width, length of medial, lateral and maxillary barbels, caudal peduncle length/caudal peduncle depth, and mouth length/mouth width. Mouth width was measured from posterior extremity of one corner to another and length medially from anterior margin of upper lip to level of posterior margin of lower lip.

Subunits of head are expressed as proportions of lateral head length. Fin rays, cephalic lateralis system, and lateral line pores were counted under a stereo-zoom transmitted light microscope (Magnus MS 24) following Kottelat (1990) except an additional: nasal pores (close to nare), antero-nasal pores (scattered pores in front of nares), pre-nasal pores (two pores situated each side between nare and outer rostral barbel base), supramaxillary pores (running along base of outer rostral barbel to posterior margin of cheek; Figure 1b). Lateral line sensory pores of three patterns – single, double (closely set), or triple (triangular and closely set), counted each pore as one (Figure 2). Three forms of oblique bars along flank (regular, bifurcated or fused). Bifurcated bars – those single bars bifurcate at the top along the dorso-lateral margin of the body, and counted as one; fused bars – those paired bars fused or joined at the top along dorso-lateral margin of the body, and counted as two. Asterisk mark (\*) after a value indicates holotype.

The holotype and paratype are deposited in Estuarine Biology Research Centre (EBRC), ZSI, Gopalpur, India and Dera Natung Government College (DNGC) Itanagar, respectively for future reference.

## RESULTS

### *Aborichthys barapensis* sp. nov.

(Images 1,3; Figures 1,2)

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### Type material

Holotype: EBRC/ZSI/F-12608, 08.iii.2020, 97mm SL, from small diverted course of Barap Stream (Brahmaputra River basin) near Lazu Village, Arunachal Pradesh, 26.898758 N & 95.560656E, 1,020 m, coll. P. Nanda & Nali Kholia Rangsong.

Paratypes: DNGC F-02, 1 specimen, 91 mm SL, same information as in holotype.

### Diagnosis

The new species is diagnosed from its congeners in having a narrow black basicaudal bar without a black ocellus on the upper end (vs. present); and in having a very low dorsal and ventral adipose crests (vs. prominent; absent in *A. waikhomi*). The new species is further distinguished from its congeners by the following combination of characters: body with 24–26 oblique bars along the flank; interspace mostly narrower than bars on body; moderately rounded caudal fin with five distinct black to brown cross bars; vent closer to the caudal-fin base (44.1–45.1 % SL) than to snout tip.

### Description

For general appearance see Image 1. Morphometric

data are presented in Table 1. Body elongate and slender, body between pectoral fin and posterior tip of dorsal fin cylindrical in cross section and thereafter compressed posteriorly. Body deepest at dorsal-fin origin, depth equal its width. Dorsal profile evenly rising from snout tip to occiput, then horizontal up to point at vertical through tip of anal fin, there after very gently radiating away, due to very low and short dorsal adipose crest, confluent with caudal fin. Ventral profile almost horizontal to anal-fin origin, then gently rising up to its posterior end, thereafter very gently radiating away due to ventral adipose crest, confluent with caudal fin, ventral adipose crest much lower than dorsal, adipose crests much lower in paratype (Image 1a, 2).

Head triangular when viewed dorsally and depressed, longer than caudal fin, width greater than height, length 5.1\*–5.2 times its standard length, but almost equal to pectoral and pelvic fin length, and depth almost equal to length of dorsal-fin base, lateral head length longer than dorsal, dorsal profile evenly slope, and ventral flattened. Snout obtusely pointed in dorsal view. Eyes moderate (11.2–12.4 % HL), dorsally situated, closer to tip of snout than to posterior extremity of opercle, not visible from ventral, 2.1\*–2.8 times smaller than inter-orbital space. Nostril closer to eye than to tip of snout, nares separated by triangular membrane flap dividing it into two parts; anterior nare tubular, attached with membrane flap, membrane flap raised up and slightly twisted postero-laterally, and posterior nare roughly triangular. Three pairs of barbels; one pair maxillary and two pairs of rostral, longer than eye, medial and maxillary barbel almost equal, lateral barbel slightly longer. Medial rostral barbel extending anterior margin of knob on lower lip in holotype, whereas reaching posterior margin of knob in paratype, adpressed lateral rostral barbel reaching or closer to maxillary barbel base, maxillary barbel at

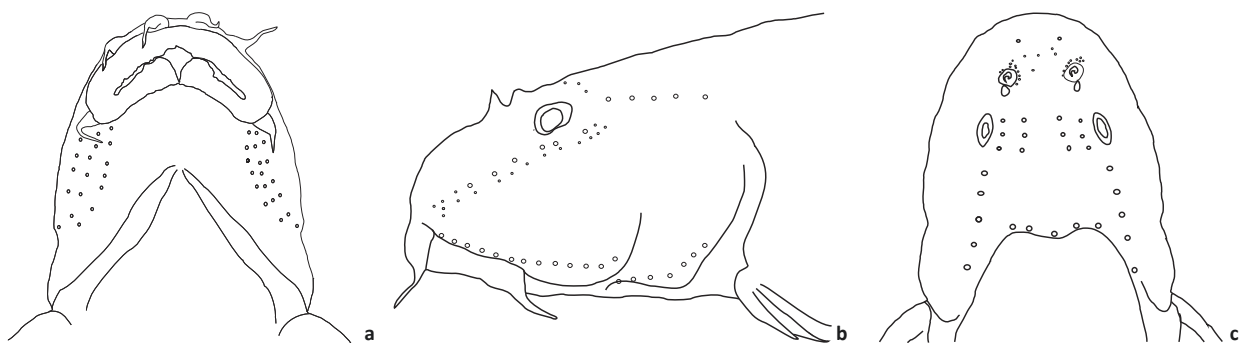


Figure 1. Sketch diagram of *Aborichthys barapensis* sp. nov., EBRC/ZSI/F-12608, holotype, 97.0mm SL, ventral, lateral and dorsal views, showing sensory pores on cephalic lateralis system: a—preoperculo-mandibular | b—infraorbital, suprapremaxillary, subopercular | c—pre-nasal, antero-nasal, nasal, supraorbital, temporal, and supratemporal.





Image 1. *Aborichthys barapensis* sp. nov., EBRC/ZSI/F-12608, holotype, 97.0mm SL, India, Arunachal Pradesh: a—lateral | b—dorsal | c—ventral views. © L. Tamang.



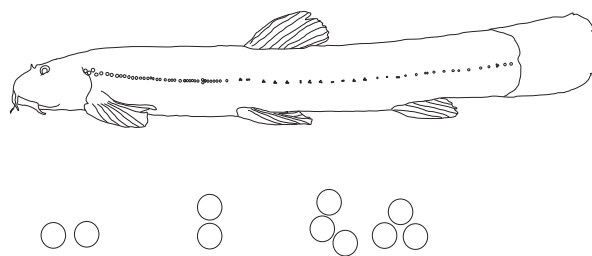
Image 2. *Aborichthys barapensis* sp. nov., DNGC/F- 02, paratype, 91.0mm SL, India, Arunachal Pradesh, lateral view; showing caudal fin with dark grayish-brown bars and somewhat irregular medial bars.. © L. Tamang.

vertical almost reaching to posterior margin of orbit. Mouth inferior and widely arched, 2.7–2.9\* times wider than long. Lips soft, thick, fleshy & pleated, continuous

all around with a deep furrow behind, upper lip broader than lower, with a small incision in the middle. Lower lip with two large roughly triangular pads or knobs

Table 1. Biometric data of *Aborichthys barapensis* sp. nov.

	Holotype	Paratype
Standard length (mm)	97	91
% Standard Length		
Head length	19.1	19.7
Head width	14.4	14.1
Dorsal head length	16.0	16.5
Head depth at nape	10.2	9.7
Body depth at dorsal-fin origin	13.4	12.7
Body width at dorsal-fin origin	12.2	11.6
Predorsal length	47.7	48.2
Pre-pectoral length	18.0	18.1
Pre-pelvic length	46.4	46.0
Pre-anal length	76.3	77.0
Pre-anus length	53.7	53.8
Pectoral-fin length	14.4	14.4
Pectoral-fin base length	5.2	4.4
Dorsal-fin length	13.5	15.4
Dorsal-fin base length	9.8	9.3
Pelvic-fin length	14.4	15.4
Pelvic-fin base length	3.6	3.4
Anal-fin length	13.6	13.3
Anal-fin base length	6.4	6.1
Caudal-fin length	17.0	17.7
Caudal peduncle length	18.0	17.5
Caudal peduncle depth	11.4	11.0
Distances from:		
Dorsal to caudal base	52.8	51.9
Pectoral to pelvic	30.4	28.9
Pectoral to anal	59.7	59.7
Pectoral to vent	40.7	38.7
Pelvic to anal	29.9	30.5
Pelvic to vent	10.4	9.9
Vent to anal	19.5	20.9
Vent to caudal-fin base	44.1	45.1
Anal to caudal base	25.8	24.5
Anal fin tip to caudal-fin base	11.3	10.8
% of Pelvic to anal fin origin		
Vent to anal distance	65.2	68.3
vent to pelvic distance	34.8	32.6
% of head length		
Head depth	44.7	53.5
Head width	71.5	75.7
Snout length	41.9	44.9
Eye diameter	11.2	12.4
Inter-orbital width	26.5	30.7
Mouth width	50.3	44.7
Mouth length	17.3	16.8
Inner rostral barbel length	17.8	21.8
Outer rostral barbel length	21.6	22.3
Maxillary barbel length	17.3	21.2
Ratio		
Caudal peduncle length/ caudal peduncle depth	1.6	1.6
Mouth width/mouth length	2.9	2.7

Figure 2. Sketch diagram of *Aborichthys barapensis* sp. nov., EBRC/ZSI/F-12608, holotype, 97.0mm SL, lateral view, showing three patterns of lateral line sensory pores (single, double, and triple).Image 3. *Aborichthys barapensis* sp. nov., EBRC/ZSI/F-12608, holotype, 97.0 mm SL: a—dorsum showing more grayish dusky background and unclear spots, blotches or marks | b—ventral mottled with minute grayish-brown color. © L. Tamang.

separated by extremely narrow median interruption. Processus dentiformis prominent, situated in the middle on upper jaw, its anterior margin arched (Image 3b).

Dorsal fin with two simple and 7½ branched rays, situated at vertical almost in between pectoral-fin and anal-fin origins, at vertical slightly posterior to pelvic-fin origin, slightly closer to snout tip than to caudal-fin base, tip of last ray at vertical exceed to anal-fin tip, anterior margins slightly arched towards tip and distal arched, second or third branched ray the longest, length of dorsal and anal fins almost equal. Pectoral fin broadly leaf-shaped, tip obtusely rounded, with one simple, 11 branched rays, fourth or fifth branched ray the longest, anterior margin slightly convex, distal obtusely rounded and tip extending to middle of pectoral- and pelvic-fin origins. Ventral surface of first and second branched ray plain padded. Pelvic fin shape similar to pectoral fin, with 1 simple and 6\* or 7 branched rays, surpassing considerably beyond vent, situated at vertical slightly anterior to dorsal-fin origin, inserted almost middle of pectoral- and anal-fin origins. A small prominent and fleshy axillary pelvic-fin lobe present. Anal-fin with 2\*–3 simple and 5½ branched rays, anterior margin slightly convex and posterior straight. Caudal fin rounded and



deepest at posterior end, with first one unbranched ray, 17 branched rays and last one unbranched ray, distal margin moderately arched. Caudal peduncle length 1.6 times its depth. Caudal peduncle equal prepectoral length. Vent situated very closer to pelvic-fin origin (32.6–34.8 % of pelvic to anal-fin origin) than anal-fin origin (65.2–68.3 % of pelvic to anal-fin origin).

Body embedded with minute cycloid scales, more deeply embedded along abdominal mid region that extend up to posterior half of pectoral fin bases. No scales on dorsal and ventral surface of head. Lateral line complete, with 92\*–95 pores, arranged in three patterns as single, double or triple (Figure 2). Pores aligned before pectoral fin origin slightly bulgy, prominent and closely set, causing distinct lateral line, pores beyond pectoral-fin origin very small, not bulgy, distantly placed and indistinct, causing poor lateral line which mostly consist of double and triple pores. Cephalic lateralis system comprises of 7+6+6\* or 9+6+7 preoperculo-mandibular, 8\* or 9 subopercular, 13\*–14 suprapremaxillary, 10+12\* or 9+12 infraorbital, 3+3\* supraorbital, 5 temporal, 5 supratemporal, 11\* or 10 nasal, 5\* or 7 antero-nasal, and 2 pre-nasal (Figure 1).

#### Color in preservative

In live, body and head background dusky white with dark brown saddles, spots, irregular marks on body and head. Ventral and lateral region of head mottled with minute brown spots, over all seems brown patch. Cheek, isthmus, chest creamy and beyond up to level of anus dirty white. Dorsum of head darker than body in holotype (Image 3a). Three forms of oblique bars on flank—regular, bifurcate or fuse. Flanks with 24\*–26 (6 pairs fused, 11\*–13 regular, 1 bifurcate) dark brown oblique bars directed backwards, fused bars mostly appear on anterior part of body and one almost below middle of dorsal-fin base; regular and bifurcate bars mostly occur beyond dorsal fin; bars mostly broader than interspace. All fins background semi-transparent. Dorsal fin with 5\*–6 rows of brown spots existing on each radial and one dark brown ocellus at its origin. Pectoral fin with 4–5 rows of brown spots, distinctiveness decreasing posteriorly. Pelvic fin with 3 rows of indistinct brown spots, and anal fin with few brown spots on distal half. Holotype: Caudal fin intense pinkish with five prominent black cross bars, first bar, broadest and moderately arched, situated at subdistal margin, second and third bars widely stretched W-shaped and complete, former slightly broader than later, fourth and fifth bar incomplete extending up to middle, almost of equal width, some part visible on lower edge after interruption,

size of interspaces between bars decreasing towards caudal base, interspace between first and second bars broadest which appears to be caterpillar like (Image 1a). Paratype: Caudal fin light pinkish with five dark brown cross bars, first two outer bars distinct and moderately arched but proximal three bars indistinct, feebly arched and irregular without W-shaped pattern (Image 2).

In 70 % ethanol, body and head background grayish-dusky white. Bars, saddles, spots, irregular marks on body and head dark grayish-brown. All fins grayish and semi-transparent, proximal dorsal surface dusky. Caudal fin light pinkish (disappearing) with five dark grayish-brown cross bars in holotype, whereas pinkish color disappeared with five grayish-brown cross bars in paratype. Proximal region of caudal fin more grayish in paratype than holotype.

Remarks: Live holotype exhibits prominent black cross bars on caudal fin with deep pinkish background, whereas dark brown, light pink, and irregular proximal bars in paratype (may be former male and later female).

**Comparison.** *Aborichthys barapensis* is easily distinguished from all its congeners in lacking a black ocellus on the upper end of the basicaudal bar (vs. present). It can be further differentiated from *A. kempi*, *A. tikaderi*, *A. elongatus*, *A. garoensis*, *A. iphipaniensis*, *A. kailashi*, *A. waikhomi* and *A. pangensis* by the presence of five cross bars on caudal fin (vs. usually two concentric bars in *A. kempi*, *A. tikaderi*, *A. elongatus*, *A. garoensis*, *A. iphipaniensis* and *A. kailashi*; cluster of spots in *A. pangensis*; irregular black blotches in *A. waikhomi*). Moreover, distal margin of the caudal fin moderately rounded (vs. almost circularly rounded in *A. elongatus* and *A. tikaderi*; U-shaped in *A. garoensis*; truncate in *A. waikhomi* and *A. pangensis*; and obliquely rounded in *A. kempi*, *A. iphipaniensis*, and *A. kailashi* (compare Image 1a with Kosygin 2012; Figure 4a,b,c,e,f for *A. elongatus*, *A. tikaderi*, *A. garoensis*, *A. waikhomi* and *A. kempi*; Kosygin et al., 2019; Figure 1b for *A. iphipaniensis*; Shangningam et al., 2019; Figure 1 for *A. kailashi*). Further, from *A. boutanensis*, *A. kempi*, *A. elongatus*, *A. garoensis*, *A. tikaderi*, *A. waikhomi*, *A. iphipaniensis*, *A. kailashi*, and *A. pangensis* in having very low and short (vs. prominent) dorsal and ventral adipose crests, but absent in *A. waikhomi*.

The genus *Aborichthys* exhibits three different positions of vent (Hora 1925): (1) closer to snout tip than to caudal-fin base (Kosygin et al. 2019: *A. garoensis*, *A. tikaderi*, *A. iphipaniensis*), (2) closer to caudal-fin base than to tip of snout (Kosygin et al. 2019; Chaudhuri 1913; Shangningam et al. 2019: *A. boutanensis*, *A. elongatus*, *A. waikhomi*; *A. kempi*, *A. kailashi*, and *A.*



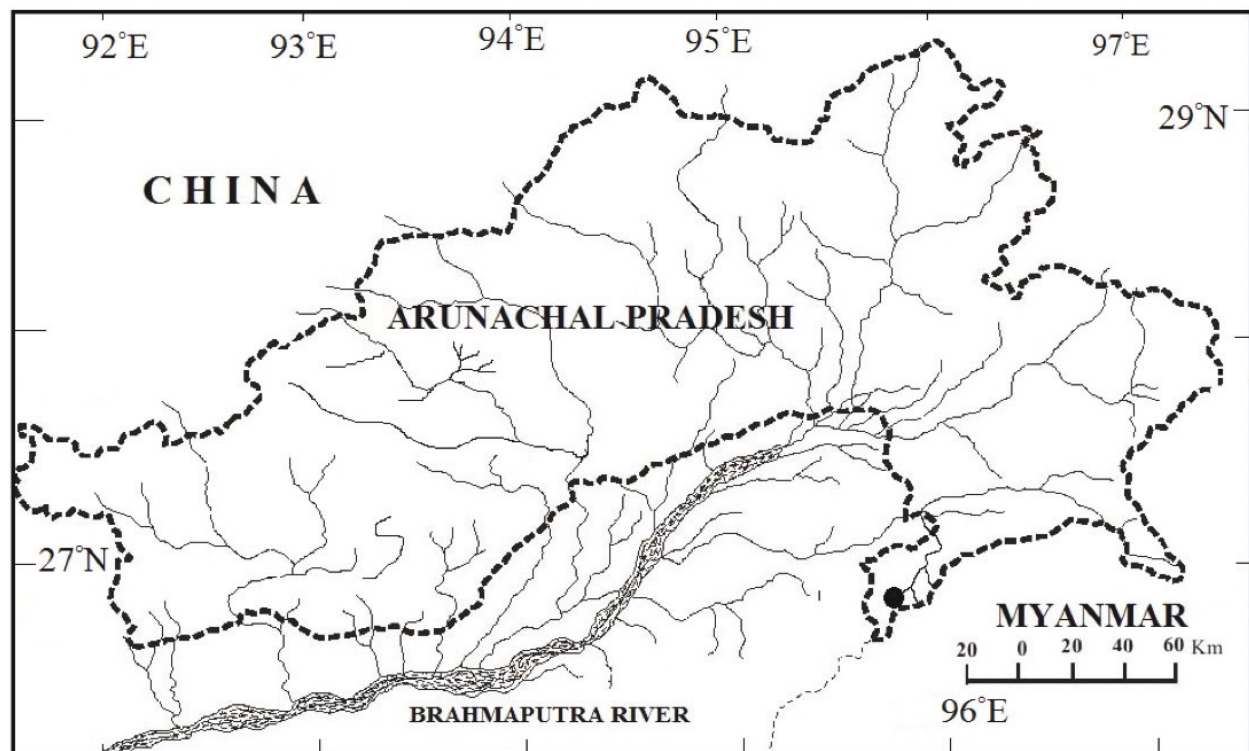


Figure 3. Map of Arunachal Pradesh, showing Barap Stream (filled circle), the type locality of *Aborichthys barapensis* sp. nov., India.

*pangensis*), (3) almost in the middle between snout tip and caudal-fin base, which is used as generic character to differentiate other nemacheilid genera and among species as well (Kottelat 1990). As per the recent study (Kosygin et al. 2019), the third condition is not fulfilled to any *Aborichthys* species. *Aborichthys barapensis* belongs to the above second condition and hence, can be further distinguished from *A. garoensis*, *A. tikaderi*, *A. iphipaniensis* by having the vent closer to caudal-fin base than to snout tip (vs. closer to snout tip than to caudal-fin base); furthermore, it can be differentiated from *A. garoensis*, *A. iphipaniensis*, *A. kailashi*, and *A. pangensis* by having a fewer oblique bars on flank (24–26 vs. 28–29 in *A. garoensis*; 33–35 in *A. iphipaniensis*; 28–36 in *A. kailashi*, and 34–38 in *A. pangensis*) and from *A. elongatus*, *A. kempi*, *A. tidakeri*, and *A. waikhomi* by having more oblique bars on flank (24–26 vs. 17–22 in *A. elongatus*; 18–19 in *A. kempi*; 16–20 in *A. tikaderi*; and 12–16 in *A. waikhomi*). It is further distinguished from *A. iphipaniensis*, *A. garoensis*, *A. kempi*, and *A. waikhomi* in having oblique bars mostly broader than interspace (vs. narrower) along body.

*Aborichthys barapensis* can be further differentiated from *A. boutanensis* in having shorter pre-anus length (53.7–53.8 % SL vs. 70.9), longer predorsal length (47.7–48.2 % SL vs. 45.7), shallow caudal peduncle (11.0–11.4



Image 4. Type locality (Barap Stream) of *Aborichthys barapensis* sp. nov., near Lazu Village, Tirap District, Arunachal Pradesh.

% SL vs. 12.3) and shorter caudal peduncle (17.5–18.0 % SL vs. 19) and from *A. iphipaniensis* by having a higher body (12.7–13.4 % SL vs. 8.9–9.9); a longer predorsal (47.7–48.2 % SL vs. 42.4–44.4), prepelvic (46.0–46.4 % SL vs. 39.4–42.0), and pelvic fin (14.4–15.4 % SL vs. 10.3–12.7); and a shorter distance between vent and



anal-fin origin (19.5–20.9 % SL vs. 24.1–27.5).

### Distribution and habitat

The new species were collected from the Barap Stream in shallow water (ca 10–30 cm depth) near Lazu Village in the southeastern part of Arunachal Pradesh (Figure 3). The substrate comprises mostly medium-sized boulders, and mixture of pebbles, cobbles, small stones and large boulders somewhere of light to dark grayish colors (Image 4). The water in the stream was cool, clear and moderately flowing due to considerable decrease in water volume in dry season. Riparian vegetation comprises grasses, shrubs and small to medium sized trees along the banks and larger trees uphill. The Barap Stream originates from the hills and deep forest near Raho Village, about 10 km from Lazu Village towards south and flows downward and forms Tirap River in the lower reach, further moves towards north and north-east through Changlang Town and meet with Noa-dihing River, which eventually confluences with Brahmaputra River in the state of Assam towards the west. Other associated fish collected belongs to genus *Schizothorax richardsonii*, *Garra* sp., *Amblyceps* sp., *Psilorhynchus balitora*, *Devario aequipinnatus*, and *Exostoma labiatum*.

### Etymology

The specific name is derived from the name of the river Barap from where the present new species was obtained.

### DISCUSSION

The description of the new species based on two specimens, indeed is challenging in the field of taxonomy. The present new species, however, is set forth for description is based chiefly on an important generic character of *Aborichthys*, i.e., the absence of a black ocellus on the upper end of the basicaudal bar, whereas it's present in all congeners. Apart from this, following secondary additional significant external characters also support in being distinct from its congeners, i.e., the presence of very low dorsal and ventral adipose crests on caudal peduncle except *A. waikhomi* and considerably to some extent, head and body in preservative being more grayish dusky white causing respective bars, saddles, spots or irregular marks on the body and head indistinct, whereas usually exhibit creamy to yellowish light background that gives distinctiveness in rest of the congeners, the caudal fin moderately arched with a slight

oblique distal margin. Moreover, from the geographically point of view, the type locality of the new species is situated southeastern most part of the state, bordering Myanmar, where no any species of *Aborichthys* have so far been reported. As far as cephalic lateralis system is concerned, the presence of nasal, antero-nasal, pre-nasal, triple rows of preoperculo-mandibular, and three patterns of lateral line sensory pores (single, double and triple) deserve an additional information, may be used as an essential comparative characters in future course of study? Besides, the present study also exposed and well-defined the reason hidden behind the occurrence of distinct or indistinct lateral line. Close observation showed that little bit elevated and closely set sensory pores reflects distinct lateral line that can be seen by naked eye, restricted just before the pelvic-fin origin, whereas small and distantly placed pores fail to show lateral line up to the base of caudal fin.

A perusal of literature revealed that there are two more names *Aborichthys cataracta* and *A. verticauda* published in a predatory journal (Raghavan et al. 2014) which is against the policy of JoTT (Raghavan et al. 2015). Hence, these two species have not been taken into consideration.

### Comparative material

*Aborichthys waikhomi*, V/APRC/ZSI/P-519, 05.xi.2009, paratypes, 3 specimens, 61.0–66.5 mm SL, a stream of Noa-Dihing River near Hornbill camp, Namdapha, Arunachal Pradesh, India, Coll. J.K. De & party.

*A. iphipaniensis*, ZSI/V/APRC/P-1659, 4.iv.2016, paratypes, 3 specimens, 107.5–120.8 mm SL, Iphipani River at Roing, Lower Dibang Valley, Brahmaputra River basin, Arunachal Pradesh, India, coll. S. Devi and party.

Data for *A. boutanensis*, *A. kempji*, *A. elongatus*, *A. tikaderi*, *A. garoensis*; *A. kailashi* and *A. pangensis* accessed from Chaudhuri 1913; Shangningam et al. 2019; Thoni & Hart 2015.

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