

# Article

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## A new species of *Metzia* (Cypriniformes: Cyprinidae) from Northern Laos

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### Abstract

A new cyprinid fish, *Metzia bounthobi*, is described on the basis of 18 specimens (including 10 specimens in type series) from the Mekong River basin in Phongsaly and Luang Prabang Provinces, northern Laos. The species is distinguished from congeners by having the following diagnostic traits: 18–20 branched anal-fin rays (vs. 10–18 in the others); 49–55 lateral-line scale rows (vs. 35–48); 33–36 predorsal scale rows (vs. 15–20); 20–22 circumpeduncular scale rows (vs. 14–18); 8–10 gill rakers on outer surface of first gill arch (vs. 12–18). The new species also resembles species of *Hemiculterella*, *Ischikauia* and at least some species of *Anabarilius*, in sharing a sharp keel developed only between the base of the pelvic fin and anus, soft last unbranched dorsal-fin ray, and air bladder composed of two chambers; however, *M. bounthobi* differs in having a considerably rounded snout (vs. pointed in *Hemiculterella*, *Ischikauia* and *Anabarilius*), 18–20 branched anal-fin rays (vs. 8–17 in *Hemiculterella*, *Ischikauia* and *Anabarilius*), 49–55 lateral-line scale rows (vs. more than 58 in *Ischikauia* and *Anabarilius*, except for *A. transmontana* with 54–57), air bladder with rounded posterior end (vs. posterior end with a small lobe at least in *Hemiculterella*) and 39–40 vertebrae (vs. 40–43, 42–43 and 43–48 in *Hemiculterella*, *Ischikauia* and *Anabarilius*, respectively).

**Key words:** Cypriniformes, Cyprinidae, *Metzia bounthobi*, new species, Laos

### Introduction

Fishes of the cyprinid genus *Metzia* Jordan and Thompson are small to medium-sized (up to about 15 cm in standard length), dull colored or silvery species, known from freshwater streams of southern China, Taiwan and northern Vietnam; one species, *M. lineata* (Pellegrin), has been recently introduced into northern Laos from China (Kottelat 2001a; Welcomme & Vidthayanon 2003). Recently Gan *et al.* (2009) revised the genus, and recognized the following six species: *M. alba* (Nguyen); *M. formosae* (Oshima); *M. hautus* (Nguyen); *M. lineata*; *M. longinasus* Gan, Lan and Zhang; *M. mesembrinum* (Jordan and Evermann). Species of *Metzia* share a sharp keel restricted to the vent between the pelvic-fin base and anus, an air bladder composed of two chambers, and last unbranched dorsal-fin ray being soft (not spinous). These characters are also shared by some other cyprinid genera, i.e., *Hemiculterella* Warpachowski, *Ischikauia* Jordan and Snyder and some species of *Anabarilius* Cockerell. These latter genera are separated from *Metzia* by the scale counts and some other morphological details in their osteology and air bladder (Luo & Chen in Chen *et al.* 1998; Chen & Fang 2002; Gan *et al.* 2009; Takeuchi & Hosoya 2011). Although the monophyly and the limits of the genus are still open to debate (Gan *et al.* 2009; Tang *et al.* 2010), we tentatively follow Kottelat (2001b) and Gan *et al.* (2009), who consider *Rasborinus* Oshima as a junior synonym of *Metzia*.

On 2007–2010, the Nagao Natural Environment Foundation, Tokyo (NEF), and the National University of Laos, Vientiane (NUOL), conducted extensive field surveys of the fishes of Laos. During a course of the surveys, Bounthob Praxaysombath and his colleagues in the NUOL (including the third author) collected eight specimens of

unidentified cyprinid fish (Figs. 1–2) from the Mekong basin in Luang Prabang Province, northern Laos. The second and fourth authors of this paper also collected 10 specimens of the same species, many of which were juveniles or young, from Phongsaly and Luang Prabang provinces. We have thus joined together for clarifying the taxonomic status of these fish samples. This investigation, based on our specimens, has revealed that the characteristics of the species are consistent with the diagnosis of *Metzia* or the allied genera by possessing the sharp keel along the ventral midline between the pelvic-fin base and the anus, air bladder composed of two chambers with rounded posterior end, and the last unbranched ray of the dorsal fin being soft. None of the described species of these genera are identical with this species, and thus it is herein described as new.

## Materials and methods

Specimens examined are deposited in the following institutions: National Museum of Nature and Science, Tokyo (NSMT); Faculty of Science, National University of Laos, Vientiane (NUOL); Faculty of Agriculture, National University of Laos, Vientiane (NULFA); National Inland Fisheries Institute, Fish Taxonomy Division, Bangkok (NIFI). All fish lengths given are standard length (SL), taken from snout tip to midlateral point of posterior margin of hypural plates. Measurements were taken point to point with digital calipers and data recorded to hundredths of a millimeter (but rounded to a tenth of a millimeter in the descriptions here). The methods for counts and measurements follow those of Gan *et al.* (2009), with some additional details identified here: snout tip refers to anteriormost midpoint of upper jaw; body depth was greatest depth of body; head length was taken from snout tip to posteriormost point of operculum including branchiostegal membrane; head depth was middorsal posteriormost point of exposed neurocranium (neurocranium not covered by epaxial musculature); interorbital width was taken at narrowest point of bony interorbital space; caudal-peduncle length was taken from posteriormost point of anal-fin base to midlateral point of posterior margin of hypural plates; caudal-peduncle depth was least depth of caudal peduncle; transverse scales above lateral line was number of scales in forwardly-inclined oblique scale row above lateral line, containing scale on predorsal area just in front of dorsal-fin origin (if scale was on predorsal midline and unpaired, it was counted as 1 scale, not 1/2 as in Kottelat 2001a); transverse scales below lateral line was number of scales in forwardly-inclined oblique (or almost vertical) row below lateral line and not including scale closest to anal-fin origin (but 1–2 series of scales covering anal fin were not included); both transverse scale counts do not contain lateral-line scale; predorsal scales were not always regularly arranged in the new species, and thus the count is represented here as the approximate number of all transverse scale rows (actually the forwardly-inclined oblique rows) across the predorsal midline. Scales were observed on the specimens stained with cyanine blue (see Saruwatari *et al.* 1997). Osteological features were observed from radiographs and three specimens cleared and counter stained for bones and cartilages, following the method of Potthoff (1984); the terminology follows that of Takeuchi and Hosoya (2011).

### *Metzia bounthobi*, new species

New Laotian name: Pa tep thob

(Figs. 1–3)

**Holotype.** NIFI 4680 (previously NUOL-P 4060), 57.0 mm SL, Mekong basin in Sopvan, Nyoi District, Luang Prabang Province, Lao PDR ( $20^{\circ}36.5'N$ ,  $102^{\circ}39.1'E$ ), 23 June 2010, collected by B. Praxaysombath and party.

**Paratypes.** Total 9 specimens, 40.5–61.0 mm SL: NSMT-P 105977, 2 specimens, 53.4–58.4 mm SL, collected with holotype; NULFA-P 715, 1 specimen (cleared and stained), 41.9 mm SL, Nam Pok River (a tributary of Ou River, Samphan District, Phongsaly Province, Lao PDR, 19 October 2009, collected by P. Phousavanh; NULFA-P 716, 1 specimen, 57.1 mm SL, Ou River, Na, Samphan District, Phongsaly, 20 September 2007, collected by P. Phousavanh; NUOL-P 4034, 2 specimens, 40.5–61.0 mm SL, collected with holotype; NUOL-P 4074, 1 specimen, 58.0 mm SL, collected with holotype; NUOL-P 4902, 2 specimens (cleared and stained), 55.1–55.9 mm SL, collected with holotype.

**Non-type specimens.** Total 8 specimens, 33.0–40.1 mm SL: NULFA-P 717, 1 specimen, 34.2 mm SL, Ou River, Tay, Gnot Ou District, Phongsaly Province, Lao PDR, 25 August 2007, collected by P. Phousavanh; NULFA-P 718, 1 specimen, 33.0 mm SL, Huay Tom River (a tributary of Ou River), Pak Bak, Ngoy District,

Luang Prabang Province, Lao PDR, 15 August 2008, collected by P. Phousavanh; NULFA-P 719, 1 specimen, 33.1 mm SL, Ou River, Pak Bak, Ngoy District, Luang Prabang Province, Lao PDR., 16 August 2008, collected by A. Iwata and P. Phousavanh; NULFA-P 720, 1 specimen, 40.1 mm SL, Ou River, Hat Sa, Phongsaly District, Phongsaly Province, 19 September 2007, collected by P. Phousavanh; NULFA-P 721, 1 specimen, 38.7 mm SL, collected with NULFA-P 720; NULFA-P 722, 1 specimen, 38.3 mm SL, Nam Pok River (a tributary of Ou River), Samphan District, Phongsaly Province, Lao PDR, 19 October 2009, collected by P. Phousavanh; NULFA-P 723, 1 specimen, 36.4 mm SL, collected with NULFA-P 722; NULFA-P 724, 1 specimen, 35.9 mm SL, collected with NULFA-P 722.



**FIGURE 1.** Freshly collected specimen of *Metzia bounthobi* (holotype, 57.0 mm SL, NIFI 4680), Mekong Basin in Sopvan, Nyoi District, Luang Prabang Province, Lao PDR ( $20^{\circ}36.5'N$ ,  $102^{\circ}39.1'E$ ), 23 June 2010. Same specimen above and below but on different backgrounds to provide full view of characters of the species. Photographed by T. Phommavong.

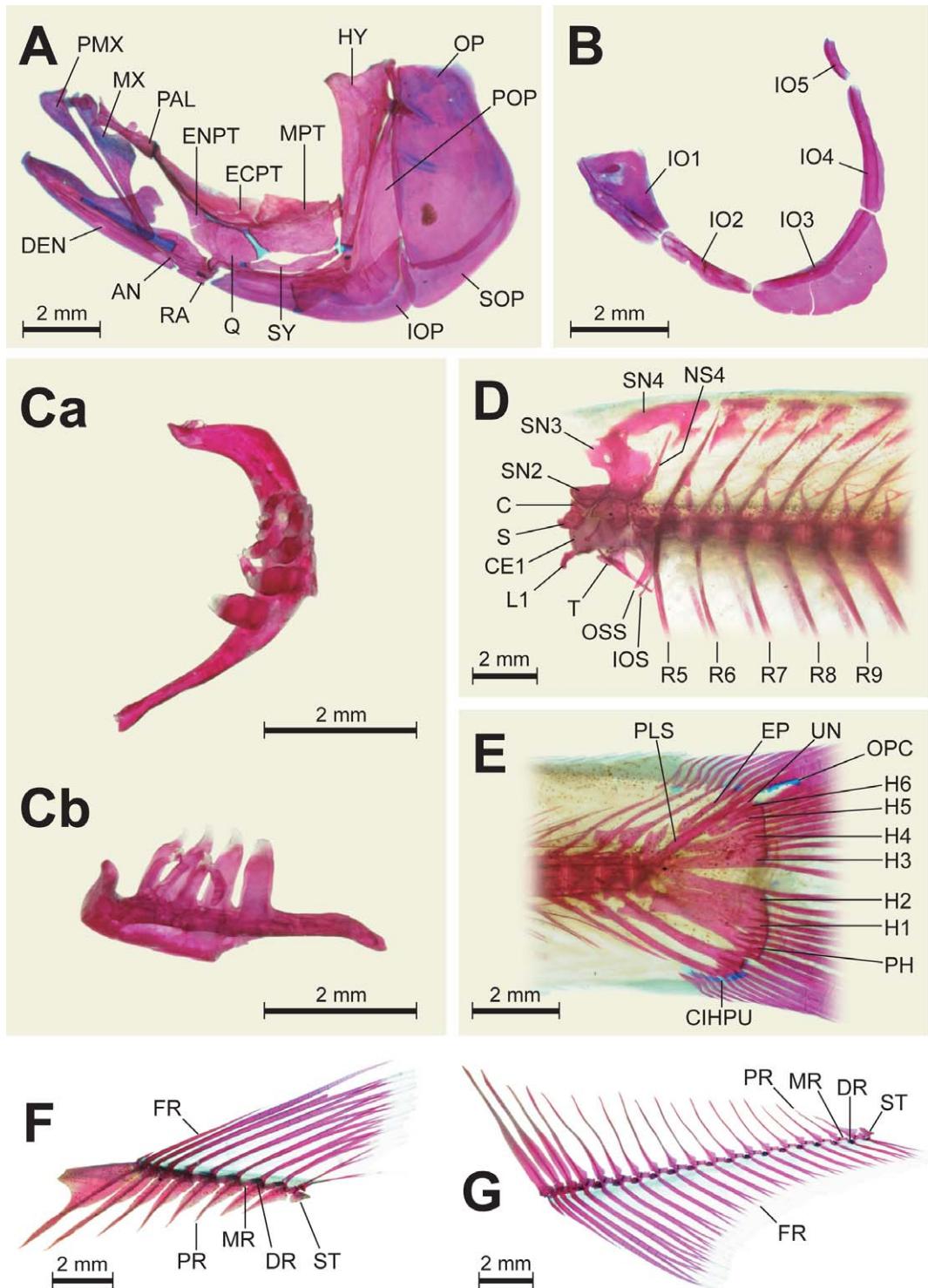
**Diagnosis.** *Metzia bounthobi* is distinguished from its congeners in having the following characters: 18–20 branched anal-fin rays (vs. 10–18 in the others); 49–55 lateral-line scale rows (vs. 35–48); 33–36 predorsal scale rows (vs. 15–20); 20–22 circumpeduncular scale rows (vs. 14–18); 8–10 gill rakers on outer surface of first gill arch (vs. 12–18). The new species also resembles species of *Hemiculterella*, *Ischikauia* and at least a part of *Anabarilius* in sharing a sharp keel restricted in development to the area between pelvic-fin base and anus, last unbranched dorsal-fin ray being soft, and an air bladder composed of two chambers. However, *M. bounthobi* differs in having a notably rounded snout (vs. pointed in *Hemiculterella*, *Ischikauia* and *Anabarilius*), 18–20 branched anal-fin rays (vs. 8–17 in *Hemiculterella*, *Ischikauia* and *Anabarilius*), 49–55 lateral-line scales (vs. more than 58 in *Ischikauia* and *Anabarilius*, except for *A. transmontana* with 54–57), air bladder with rounded posterior end (vs. posterior end with a small lobe at least in *Hemiculterella*) and 39–40 vertebrae (vs. 40–43, 42–43 and 43–48 in *Hemiculterella*, *Ischikauia* and *Anabarilius*, respectively). The new species is fairly similar to the sympatric *Paralaubuca barroni* (Fig. 4) in counts of scales and the other general features, and can be possibly confused; however, *P. barroni* (Fowler 1934) is readily distinguished from the former by having more anal-fin rays (24–29 vs. 18–20 in the new species) and gill rakers (19–24 vs. 8–10) and a distinct, complete abdominal keel extending from anus to isthmus (Bănărescu 1971; Luo & Chen in Chen *et al.* 1998; Kottelat 2001a).



**FIGURE 2.** Preserved specimen of *Meztia bounthobi*, new species (holotype, 57.0 mm SL, NIFI 4680). (A) lateral, (B) dorsal and (C) ventral views. Photographed by K. Phongsaa.

**Description.** In the following description, the counts of the holotype are asterisked, and the frequency or each count is given in parentheses following the relevant count. Dorsal-fin rays 3 unbranched and 7\* (10) branched rays, last one split to base; anal-fin rays 3 unbranched and 18\* (4), 19 (2) or 20 (3) branched rays, last one split to base; total pectoral-fin rays 12\* (7) or 13\* (13), including uppermost 1\* (20) and lowermost 1 (8) or 2\* (12) unbranched rays; total pelvic-fin rays 8\* (18), including anteriormost 1\* (20) and innermost 1\* (20) unbranched rays; branched caudal-fin rays 9+8\* (10); lateral-line scales 49 (1), 50 (2), 51\* (4), 52 (3), 53 (5), 54 (1) or 55\* (2), followed by 2\* (8), 3\* (9) or 4 (1) pored scales on caudal fin; transverse scale rows above lateral line 9 (4), 10\* (13) o:r 11\* (1); transverse scale rows below lateral line 4\* (16) or 5 (2); predorsal scale rows 33 (3), 34\* (3) or 36 (2); circumpeduncular scale rows 20 (2), 21 (4) or 22\* (3); gill rakers on outer surface of first gill arch 0+8 (1), 1+7 (2), 1+8\* (3), 1+9 (2), 2+7 (1) or 2+8 (1).

Body compressed and moderately deep, with greatest body depth slightly anterior to pelvic-fin insertion. Caudal peduncle moderately deep (its depth 69.4–74.9% of its length), with narrowest part of caudal peduncle located nearer the posterior base of anal fin than to base of caudal fin. Ventral profile of head and body almost as arched as much as, or a slightly more arched than, dorsal profile. Distinct keel between anus and a vertical through posterior end of pelvic-fin base; keel preceded by a very weak midventral, blunt ridge extending anteriorly to a vertical through posterior half of pectoral fin. Snout rounded and short, shorter than eye diameter (snout length 69.4–80.3% of eye diameter). Eye large, midlaterally positioned at slightly anterior to middle of head. Interorbital width subequal or less than (89.5–99.1% of) eye diameter. Adipose eyelid weakly developed, covering half and less than one fourth of iris anteriorly and posteriorly, respectively. Mouth terminal, gape oblique, about 45 degrees relative to longitudinal axis of body. Maxillary extending beyond a vertical through anterior margin of eye, but not to anterior margin of pupil. Symphyseal knob of lower jaw not developed. Barbels absent. Nares closely positioned, with anterior naris as a short tube. Dorsal-fin origin nearer caudal-fin base than to tip of snout; its origin slightly nearer to vertical through pelvic-fin insertion than to anal-fin origin. Last unbranched ray of dorsal fin soft and nonossified. Pectoral fin short, not reaching to a vertical through pelvic-fin insertion. Pelvic fin short, its length 67.0–74.6% of length of pectoral fin; pelvic-fin insertion nearer snout tip than to caudal-fin base. Anal-fin base greater than dorsal-fin base (its length 188.8–220.0% of the latter). Caudal fin moderately forked, with rounded (not pointed) tips of lobes.



**FIGURE 3.** Selected osteological features of *Metzia bounthobi*, new species. Features from one paratype (55.1 mm SL) of NUOL-P 4902: (A) lateral view of jaws, suspensorium and opercular bones; (B) lateral view of infraorbital bones; (C) mesial (a) and anterior (b) views of fifth ceratobranchial; (D) lateral view of anterior part of axial skeletal complex; (E) lateral view of caudal skeletal complex; (F) dorsal fin and its supports; (G) anal fin and its supports. Bars indicate 2 mm. Abbreviations: AN, anguloarticular; C, claustrum; CE, centrum; CIHPU, interhaemal spine cartilage; DEN, dentary; DR, distal radial; ECPT, ectopterygoid; ENPT, endopterygoid; EP, epural; FR, fin ray; H, hypural; HY, hyomandibular; IO, infraorbital; IOP, interopercle; IOS, inner arm of os suspensorium; L, lateral process of vertebral centrum; MPT, metapterygoid; MR, medial radial; MX, maxilla; NS, neural spine; OP, opercle; OPC, opisthural cartilage; OSS, outer arm of os suspensorium; PAL, palatine; PH, parhypural; PLS, pleurostyle; PMX, premaxilla; POP, preopercle; PR, proximal radial; Q, quadrate; R, rib; RA, retroarticular; S, scaphium; SN, supraneurale; SOP, subopercle; ST, stay; SY, symplectic; T, tripus; UN, uroneural. Photographed and retouched by K. Phongsaa and K. Shibukawa, respectively.

Scales cycloid. Lateral line complete, gradually bent ventrally anterior to pelvic-fin insertion, then running parallel with ventral profile and ending midlaterally at basal part of caudal fin; 2–3 lateral-line scales basally at midlateral caudal fin; pectoral and pelvic fin axillary scales long, extending slightly beyond a vertical through base of last ray of each fin. No scales on fins, except for 2–3 and 1–2 scale rows basally on caudal and anal fins, respectively. Air bladder with two chambers; anterior chamber elliptical, posterior chamber elongate (longer than anterior chamber) and with rounded posterior end.

**Selective osteology.** (Fig. 3). Frontal transversely convex; lateral ethmoid bearing a truncate wing with pointed ventral corner laterally; vomer extending anteriorly slightly beyond ethmoid; parasphenoid laterally compressed at interorbital region, followed by a narrow, outwardly curved ascending process; elongate foramen between parasphenoid and basisphenoid; supraorbital reduced and narrow, not attached with infraorbital series; third infraorbital with broad posteroventral lamella; ventral margin of coracoids feebly serrate; two rows of pharyngeal teeth on fifth ceratobranchial, pattern 4, 5–4, 4 (1 specimen), 4, 4–5, 4 (1 specimen) or 3, 4–5, 4 (1 specimen), with pointed and slightly curved tips. Vertebrae  $18+21 = 39^*$  (8) or  $18+22 = 40$  (2); anteriormost 4\* (8) vertebrae modified into the Weberian apparatus.

**Freshly-fixed coloration.** Coloration of freshly-fixed specimen shown in Figure 1. Dorsum of head and body dull greenish yellow, turning to plain silvery ventrally; iris silvery; fins hyaline.

**Coloration in alcohol.** Coloration after preservation in alcohol shown in Figure 2. Ground color of head and body pale brown, with a dusky midlateral stripe from slightly behind posterodorsal end of operculum to caudal-fin base; midlateral stripe usually paler in specimens less than ca. 40 mm SL; opercular and infraorbital areas silvery; occipital area blackish brown in some specimens; fins subtranslucent.

**Distribution and habitat.** *Metzia bounthobi* is hitherto known only from the Ou River basin (a tributary of the Mekong) in Phongsaly and Luang Prabang provinces of northern Laos. This species was found in upland clear streams with moderate or slow current.

**Etymology.** The specific name, *bounthobi*, is in honour of Bounthob Praxaysombath (NUOL), who was the leading researcher performing the field surveys throughout the NUOL-NEF project on 2007–2010. Eight of all 10 type series of the new species were brought from the project surveys.



**FIGURE 4.** *Paralaubuca barroni*, NUOL-P 4038, 75.4 mm SL, Nyoi District, Luang Prabang Province, Lao PDR. Photographed by T. Phommavong.

## Discussion

The supra-generic classification of the cyprinid fishes is still in state of flux through several large-scale analyses of Cypriniformes and more local area studies of groups of genera (e.g., Howes, 1991; Chen *et al.* 1998; Saitoh *et al.* 2006, 2011; Mayden *et al.* 2009). Gan *et al.* (2009) placed *Metzia* in the subfamily Cultrinae, presumably following the concept of Luo and Chen in Chen *et al.* (1998). Following the system of Howes (1991), however, the genus

appears to have been assigned to his Alburninae (rather than his Cultrinae). Likewise, following the definition of subfamilies of cyprinid fishes in the Cambodian Mekong by Rainboth (1996), *Metzia* can be placed in his Alburninae. Recent molecular analyses including many more species and in a phylogenetic context versus the previous studies, casts serious doubt to these morphology-based classifications. Tang *et al.* (2010) showed that the fishes previously placed in Cultrinae and/or Alburninae are paraphyletic. However, if species of Squaliobarbinae and Xenocypridinae were included, these might form a monophyletic assemblage. We here hesitate to assign *Metzia* in any subfamily with the current focus on the order, elevation of some subfamilies to families, and the current flux of subfamilies and superfamilies of the Cyprinidae.

Using the key to subfamilies of cyprinids in China of Chen *et al.* (1998), the new species can be assigned to their Cultrinae. In the same book, Luo and Chen in Chen *et al.* (1998) included 18 genera in the Cultrinae: *Anabarilius*; *Ancherythrocutter* Yih and Wu; *Culter* Basilewsky; *Cultrichthys* Smith; *Hainania* Koller; *Hemiculter* Bleeker; *Hemiculterella*; *Ischikauia* (known only from Japan); *Macrochirichthys* Bleeker; *Megalobrama* Dybowski; *Metzia* (as *Rasborinus*); *Parabramis* Bleeker; *Paralaubuca* Bleeker; *Pogobrama* Luo; *Pseudohemiculter* Nichols and Pope; *Pseudolaubuca* Bleeker; *Sinibrama* Wu; *Toxobrama* Günther. Of these 18 genera, only nine (*Anabarilius*, *Ancherythrocutter*, *Hainania*, *Hemiculterella*, *Ischikauia*, *Metzia*, *Pogobrama*, *Pseudohemiculter* and *Sinibrama*) possess a unique combination of the following characters: 1) air bladder composed of two chambers and 2) incomplete abdominal keel, ridge well developed only between pelvic-fin insertion and anus (Luo & Chen in Chen *et al.* 1998; Gan *et al.* 2009). The new species is more similar to fishes of *Metzia* than the other eight genera by having: last unbranched ray of dorsal fin being soft (vs. hard, pungent and spinous in *Ancherythrocutter*, *Hainania*, *Pogobrama*, *Pseudohemiculter*, *Sinibrama* and many species of *Anabarilius*), air bladder with rounded posterior end (vs. end of air bladder with a small lobe at least in *Hainania*, *Hemiculterella* and *Pseudohemiculter*), and 39–40 vertebrae (35–41 in *Metzia* vs. 42–43 and 43–48 in *Ischikauia* and *Anabarilius*, respectively). Note that keys to genera of cyprinids and cultrines of Chen *et al.* (1998) and Luo and Chen in Chen *et al.* (1998), respectively, were based merely on the fishes found in China (including the upper Mekong), and this coverage does not include many cyprinid fishes found outside China. However, as far as we know, this new species cannot be assigned to any other cyprinid genus from other geographic regions (i.e., outside China and the Indochinese countries).

Morphological characters of the new species agree well with those of the current diagnosis of *Metzia* as refined by Gan *et al.* (2009), except for its 18–20 anal-fin rays (vs. 10–18 in purported congeners) and 49–55 lateral-line scales (vs. 35–48). We prefer to regard these discrepancies as intra-generic variations, rather than establish a new monotypic genus. However, in addition to these characters, *Metzia bounthobi* differs from the other species of *Metzia* by having two rows of pharyngeal teeth (vs. three in all congeners, except for *M. alba* and *M. hautus* with no information about the osteological characters), third infraorbital enlarged and much wider than fourth infraorbital (vs. not enlarged and subequal to fourth infraorbital in width) and considerably more rounded snout (vs. more or less pointed) (Luo & Chen in Chen *et al.* 1998; Gan *et al.* 2009). The present allocation of the new species to *Metzia* is merely provisional. The monophyly of *Metzia* as currently recognized has been questioned, based on phylogenetic analysis of both morphological and molecular data (Gan *et al.* 2009; Tang *et al.* 2010). We argue that in order to clarify the taxonomic status of this new species and the genus, as well as species of the above listed genera similar to *Metzia*, they need to be included in broad-based phylogenetic studies (also including several cultrine genera sensu Luo & Chen in Chen *et al.* 1998). These analyses should also include *Hemigrammocyparis* Fowler (see Tang *et al.* 2010).

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