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Acrossocheilus longipinnis (Wu 1939), a senior synonym of *Acrossocheilus stenotaeniatus* Chu & Cui 1989 from the Pearl River basin (Teleostei: Cyprinidae)

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Abstract

A detailed morphological comparison of the currently recognized subspecies, *Acrossocheilus iridescens longipinnis* and *A. i. iridescens*, shows that there are differences in body coloration of juveniles and some osteological characters, in addition to the structure of the first branched dorsal-fin ray and the shape of the distal edge of the dorsal fin which are currently used to distinguish them. These differences support the taxonomic elevation of the two subspecies to species. Based on examination of the type specimens of *Acrossocheilus stenotaeniatus*, and comparison with *A. longipinnis*, it is concluded that *A. longipinnis* is a senior synonym of *A. stenotaeniatus*. *Acrossocheilus longipinnis* is redescribed. The current generic classification of the two species is discussed based on the body coloration of juveniles and ontogenetic color change.

Key words: Morphology, ontogenetic changes, subspecies

Introduction

Acrossocheilus iridescens (Nichols & Pope 1927) is regarded as including three subspecies: *A. i. iridescens* from Hainan Island, *A. i. yuanjiangensis* Wu & Lin 1977 from the Red River (= Yuan-Jiang in Chinese) basin, and *A. i. longipinnis* Wu 1939 from the Pearl River (= Zhu-Jiang basin in Chinese) (Yue 2000). Taxonomic status of these subspecies requires re-evaluation because there is no subspecific category under the phylogenetic species concept, which is widely accepted by fish taxonomists. Kottelat (2001a) commented that whatever specific or subspecific status *A. i. yuanjiangensis* merits, it is a junior synonym of *Cyclocheilichthys microstoma* Pellegrin & Chevey 1936, but he preferred to regard the materials from the Red River basin and the Nam Xan and Nam Ma basins as identical to *A. iridescens*. *Acrossocheilus i. longipinnis* was first described in *Lissochilus* Weber & de Beaufort 1916 (which is preoccupied by *Lissochilus* Zittel 1882 by Wu (1939) based on three specimens of 185–380 mm SL caught from Yangso (= Yangshuo), Li Kiang (= Li-Jiang of the Zhu-Jiang basin in Guangxi Province), southern China. It was transferred by Wu *et al.* (1977) to *Acrossocheilus* Oshima 1919. This species is characterized by the presence of a filament-like extension to the first branched dorsal-fin ray (Fig. 1a). However, subsequent authors did not assign diagnostic value at the species level to the character. As a result, the specimens from the Zhu-Jiang basin have until now been identified as a subspecies of *A. iridescens* (Chen *et al*. 1991; Yue 2000). The goal of this study is to provide evidence in favor of full species status for *A. longipinnis*.

Although *A. stenotaeniatus* Chu & Cui 1989 is currently considered as valid, its taxonomic status needs to be re-evaluated. This species was originally described by Chu & Cui (1989) based on four 53.0–59.5 mm SL specimens caught from the You-Jiang of the Zhu-Jiang basin at Bo'ai Town, Fu'ning County, Yunnan Province, South China. In the original description, it was established without a broad comparison to existing species. Yue (2000), in a recent monograph of Chinese freshwater fishes, considered *A. stenotaeniatus* as valid, and recorded it from Hainan Island and the Zhu-Jiang basin in Guangxi Province, South China. Unfortunately, no comparison was made with the sympatrically occurring *A. i. longipinnis*. The presence of a filament-like extension to the first

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branched dorsal-fin ray, which is typical for the subspecies, was observed in the type material of *A. stenotaeniatus* (Fig. lb) by us during a visit to the Kunming Institute of Zoology, Chinese Academy of Sciences (KIZ); however, the character was not mentioned in the original description of this taxon. It appears to us that the type material of *A. stenotaeniatus* is likely identical to *A. iridescens longipinnis*. Thus, the other goal of this study to examine the validity of *A. stenotaeniatus* by comparing the type material of this species to a broad sample of Chinese barred species of *Acrossocheilus*.

FIGURE 1. Lateral views of: (A) *A. i. longipinnis*, IHB 20080900039, 126.2 mm SL, male, Baise, Guangxi Province; (B) *A. stenotaeniatus*, KIZ 805283, holotype, 53.9 mm SL, Bo'ai, Yunnan Province. (C) *A. i. longipinnis*, IHB 81XI4694, 65.2 mm SL, with a filament-like extension to first branched dorsal-fin ray missing, Baise, Guangxi Province. Scale bars = 10 mm.

Material and methods

Measurements were taken with digital calipers point to point to the nearest 0.1 mm. Counts and measurements, made on the left side of individuals whenever possible, follow those of Kottelat (2001b), with the following four additional measurements: predorsal, prepectoral, prepelvic and preanal lengths. These lengths were taken from the anteriormost tip of the snout to, respectively, the dorsal-, pectoral-, pelvic- and anal-fin origins. The pharyngeal teeth are counted and given in a formula using Hubbs & Lagler's (1947) method; e.g. the formula 2, 3, 5-5, 3, 2 indicates that the pharyngeal bones of both left and right sides bear three rows, with two teeth in the outer row, three in the middle, and five in the inner. The number of specimens with a given meristic count is indicated in brackets after the count. Measurements of parts of the head are expressed as percentages of the head length. The head length and measurements of other parts of the body are presented as percentages of the standard length. Statistics 5.0 (Wilkinson *et al*. 1992) was utilized for the basic statistical analysis on morphometric data and for the principal component analysis that was conducted on the variance-covariance matrix of the log-transformed measurements. Osteological characters were examined in the cleared and double-stained specimens that were prepared by using the modified methods of Dingerkus & Uhler (1977) and Taylor & Van Dyke (1985).

The local Chinese toponymy is utilized for descriptions of distributions, and the international English toponymy, if available, is also provided in parentheses following the local Chinese river name when it first appears in the paper. The examined specimens are stored in the collections at the Institute of Hydrobiology (IHB), and the Kunming Institute of Zoology (KIZ), Chinese Academy of Sciences. Abbreviations here used are: HL, head length and SL, standard length.

FIGURE 2. Underwater photographs of *A. i. iridescens* by Bosco Chan. (A) juvenile; (B) adult.

Results

Comparison between *A. i. longipinnis* and *A. i. iridescens* in body coloration. These two subspecies undergo ontogenetic alternation in body coloration. In formalin-preserved juvenile individuals of less than 80 mm SL, both exhibit a similar color pattern including five or six narrow black vertical bars, each one or two scales in width, on each side of the body, but with yellow interspaces (Figs. 1c & 2a). This number is fewer than that of juveniles in all other congeneric barred species (excluding *A. stenotaeniatus*), with seven or eight narrow black vertical bars on the flank (Yuan *et al*. 2006; Yuan & Zhang 2010a; Yuan & Zhang 2010b). The two subspecies differ in the width of black vertical bars on the flank; *A. i. longipinnis* develops narrower bars on the flank of juveniles than does *A. i. iridescens* (Figs. 1c & 2a). In adult individuals of more than 110 mm SL, *A. i. longipinnis* and *A. i. iridescens* share a common body coloration including five or six wide black vertical bars, each five to eight scales in width, on the flank, alternating with narrow yellow interspaces (Figs. 1a & 2b).

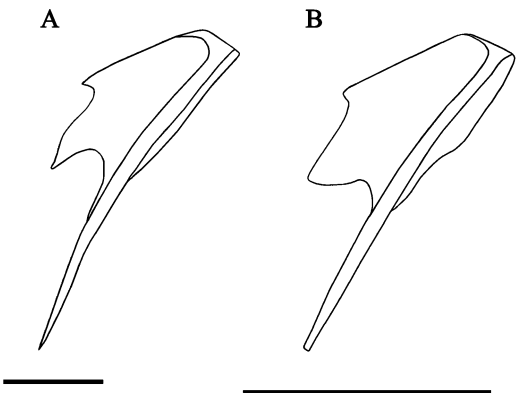

FIGURE 3. Left lateral view of the first dorsal-fin pterygiophore in: (A) *A. i. longipinnis*, IHB 73V2022, 118.3 mm SL, Rong' an County, Guangxi Province; (B) *A. i. iridescens*, IHB 602248, 116.6 mm SL, Wuzhishan, Hainan Island. Scales bars = 5 mm.

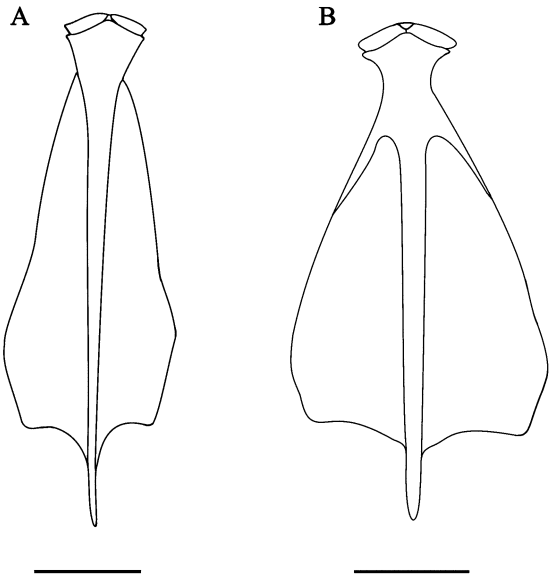

FIGURE 4. Left lateral view of the basihyal ventral plate in: (A) *A. i. longipinnis*, IHB 73V2022, 118.3 mm SL, Rong' an County, Guangxi Province; (B) *A. i. iridescens*, IHB 602248, 116.6 mm SL, Wuzhishan, Hainan Island. Scales bars = 5 mm.

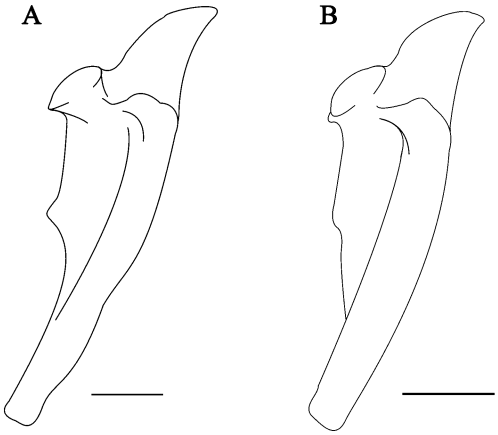

FIGURE 5. Left lateral view of the hyomandibular in: (A) *A. i. longipinnis*, IHB 73V2022, 118.3 mm SL, Rong' an County, Guangxi Province; (B) *A. i. iridescens*, IHB 602248, 116.6 mm SL, Wuzhishan, Hainan Island. Scales bars = 5 mm.

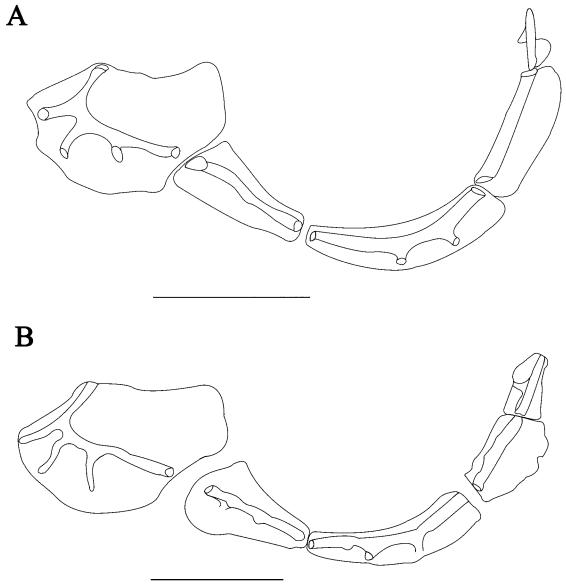

FIGURE 6. Left lateral view of circumorbital bones in: (A) *A. i. longipinnis*, IHB 73V2022, 118.3 mm SL, Rong' an County, Guangxi Province; (B) *A.i. iridescens*, IHB 602248, 116.6 mm SL, Wuzhishan, Hainan Island. Scales bars = 5 mm.

Osteological differences between *A. i. longipinnis* and *A. i. iridescens*. Both taxa exhibit osteological variations in the following five characters: (1) the first dorsal-fin pterygiophore develops a more prominent, fowards-pointed precumbent spine on its anterior-superior edge in *A. i. longipinnis* than in *A. i. iridescens* (Fig. 3); (2) the ventral plate of the basihyal possesses a wider posterior part in *A. i. longipinnis* than in *A. i. iridescens* (Fig. 4); (3) the hyomandibular has a triangular projection on its anterior-middle margin in *A. i. longipinnis*, but this triangular projection is missing in *A. i. iridescens* (Fig. 5); (4) the fourth infraorbital bone is longer in *A. i. longipinnis* than in *A. i. iridescens* (Fig. 6); and (5) the fifth infraorbital bone is thinner in *A. i. longipinnis* than in *A. i. iridescens* (Fig. 6).

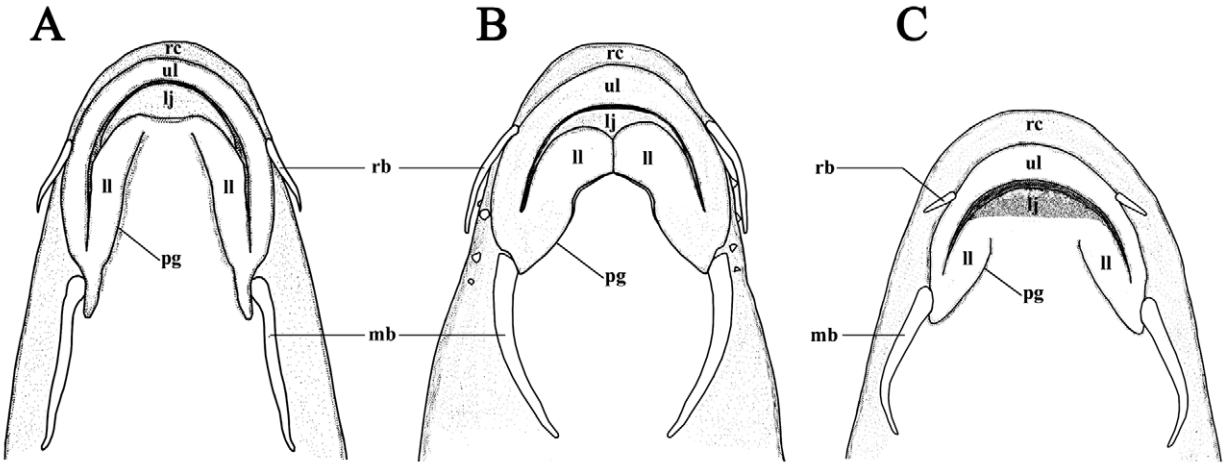

FIGURE 7. Diagrammatic illustrations of oromandibular structures in: (A) *A. i. longipinnis*, (B) *A. wuyiensis*, and (C) *A. monticola*. ll = lateral lobe of lower lip; lj = lower jaw; mb = maxillary barbel; rb = rostral barbel; rc = rostral cap; pg = postlabial groove; ul = upper lip.

Characters that *A. stenotaeniatus* shares with *A. i. longipinnis* and *A. i. iridescens*. Five narrow black vertical bars, each two scales in width, on the flank of the type specimens of *A. stenotaeniatus* are present in juveniles (less than 80 mm SL) of *A. i. longipinnis* (Figs. 1b–c). Juveniles (less than 80 mm SL) of *A. i. iridescens* have the same number of black vertical bars, but the bars are wider, each spanning three or four scales (Fig. 2a).

The type material of *A. stenotaeniatus* has the same pattern of oromandibular structures as in *A. i. longipinnis* and *A. i. iridescens*. The following three characters typical for *A. i. longipinnis* and *A. i. iridescens* are also present in *A. stenotaeniatus*, but absent in all other congeneric barred species.

Mouth gape. The type specimens of *A. stenotaeniatus* have a narrow, horse-shoe shaped mouth gape typical for *A. i. longipinnis* and *A. i. iridescens* (Fig. 7a). The mouth gape is wide and arched in all other congeneric barred species (Figs. 7b–c).

Position of rostral barbels. The rostral barbels of *A. i. longipinnis* and *A. i. iridescens* are placed posterior to a horizontal line through the anteriormost margin of the lower jaw (Fig. 7a); that is the case with the type material of *A. stenotaeniatus*. Whereas the rostral barbels of all other congeneric barred species are rooted nearly at the same level as a horizontal line through the anteriormost margin of the lower jaw (Figs. 7b–c).

Lower lip. The lower lip of the two subspecies possesses two long, thin lateral lobes, with two postlabial grooves extending anteromedially beyond a horizontal line through the root of the maxillary barbels, and terminating with each other in a gap wider than one-third of the mouth gape (Fig. 7a); that is the case with the type specimens of *A. stenotaeniatus*. All other barred species of this genus exclusive of *A. monticola* (Günther 1888) and *A. clivosius* (Lin 1935) have a lower lip that has two thick lateral lobes, with a slightly anteriorly enlarged anterior portion (Fig. 7b); two postlabial grooves extending anteromedially away from a horizontal line through the root of the maxillary barbels. The lower lip of the two species is short, confined to the side of the lower jaw (Fig. 7c).

TABLE 1. Morphometric data for the four type specimens of *A. stenotaeniatus* and 33 specimens of *A. i. longipinnis*.

	A. stenotaeniatus	*A.i. longipinnis*
Standard length (mm)	51.5–56.5	67.6–213.5
% SL		
Body depth	28.6–31.6	30.0–36.3
Head length	26.9–27.9	20.7–27.9
Head depth	18.1–19.1	16.3–20.5
Head width	8.1–8.7	7.4–9.0
Dorsal-fin length	27.2–28.5	22.6–28.7
Pectoral-fin length	20.1–22.6	17.3–23.3
Pelvic-fin length	21.1–22.0	17.0–23.8
Anal-fin length	19.0–20.1	16.6–23.0
Caudal-peduncle length	12.0–12.6	13.2–20.0
Caudal-peduncle depth	11.0–11.4	9.7–11.7
Predorsal length	54.0–55.9	43.6–54.7
Prepectoral length	27.6–29.8	21.7–30.8
Prepelvic length	53.8–55.9	47.4–57.3
Preanal length	78.3–83.0	73.9–85.9
% HL		
Snout length	33.1–37.8	32.9–43.5
Eye diameter	24.4–28.1	16.2–32.7
Interorbital width	29.0–31.4	31.2–39.9

TABLE 2. Meristic data for the four type specimens of *A. stenotaeniatus* and thirty-three specimens of *A.i. longipinnis*.

	A. stenotaeniatus	*A. i. longipinnis*
Branched dorsal-fin rays	8	8
Branched anal-fin rays	5	5
Branched pelvic-fin rays	6	6
Branched pectoral-fin rays	15 (2), 16 (1) or 17 (1)	15 (21), 16 (8) or 17 (4)
Lateral-line scales	40 (1), 42(2) or 43 (1)	41 (3), 42 (16) or 43 (14)
Scale rows above lateral line	6	6
Scale rows below lateral line	4	4
Circumpeduncular scales,	16	16
Predorsal midline scales	14 (2) or 15 (2)	13 (16), 14 (9) or 15 (8)

Measurements and counts for *A. stenotaeniatus* and *A. i. longipinnis*. Morphometric and meristic data for the type specimens of *A. stenotaeniatus* and specimens examined of *A. i. longipinnis* are given in Tables 1 and 2. Three meristic characters have variable counts, namely branched pectoral-fin rays, lateral-line scales, and predorsal midline scales; but their variations between taxa are not significant ($p > 0.05$). Counts of all other seven meristic characters are invariant between the type specimens of *A. stenotaeniatus* and specimens examined of *A. i. longipinnis*. In a principal component analysis (PCA) performed for 18 log10-transformed morphometric characters, the loadings of the variables on the first principal component (PC1) were positive and of similar magnitude (0.204–0.290) (Table 3), indicating that the axis can be interpreted as a proxy for general size. And the PC2 and PC3 scores largely overlapped between the type specimens of *A. stenotaeniatus* and specimens examined of *A. longipinnis* (Fig. 8), indicating that they are indistinguishable.

TABLE 3. Loadings on the first three principal components extracted from morphometric data for *A. stenotaeniatus* and *A. longipinnis*.

	PC1	PC2	PC3
Standard length	0.252	-0.093	0.085
Body depth	0.270	-0.087	0.267
Head length	0.204	0.004	-0.024
Head depth	0.240	0.095	0.007
Head width	0.254	0.005	0.132
Snout length	0.227	0.191	-0.223
Eye diameter	0.243	0.042	-0.817
Interorbital width	0.241	-0.148	0.045
Dorsal-fin length	0.241	0.104	0.186
Pectoral-fin length	0.224	0.185	-0.013
Pelvic-fin length	0.229	0.277	-0.113
Anal-fin length	0.237	0.095	-0.065
Caudal-peduncle length	0.290	-0.839	-0.162
Caudal-peduncle depth	0.252	-0.042	0.290
Predorsal length	0.226	0.242	0.051
Prepectoral length	0.208	0.083	-0.122
Prepelvic length	0.233	0.069	0.026
Preanal length	0.242	0.090	0.060

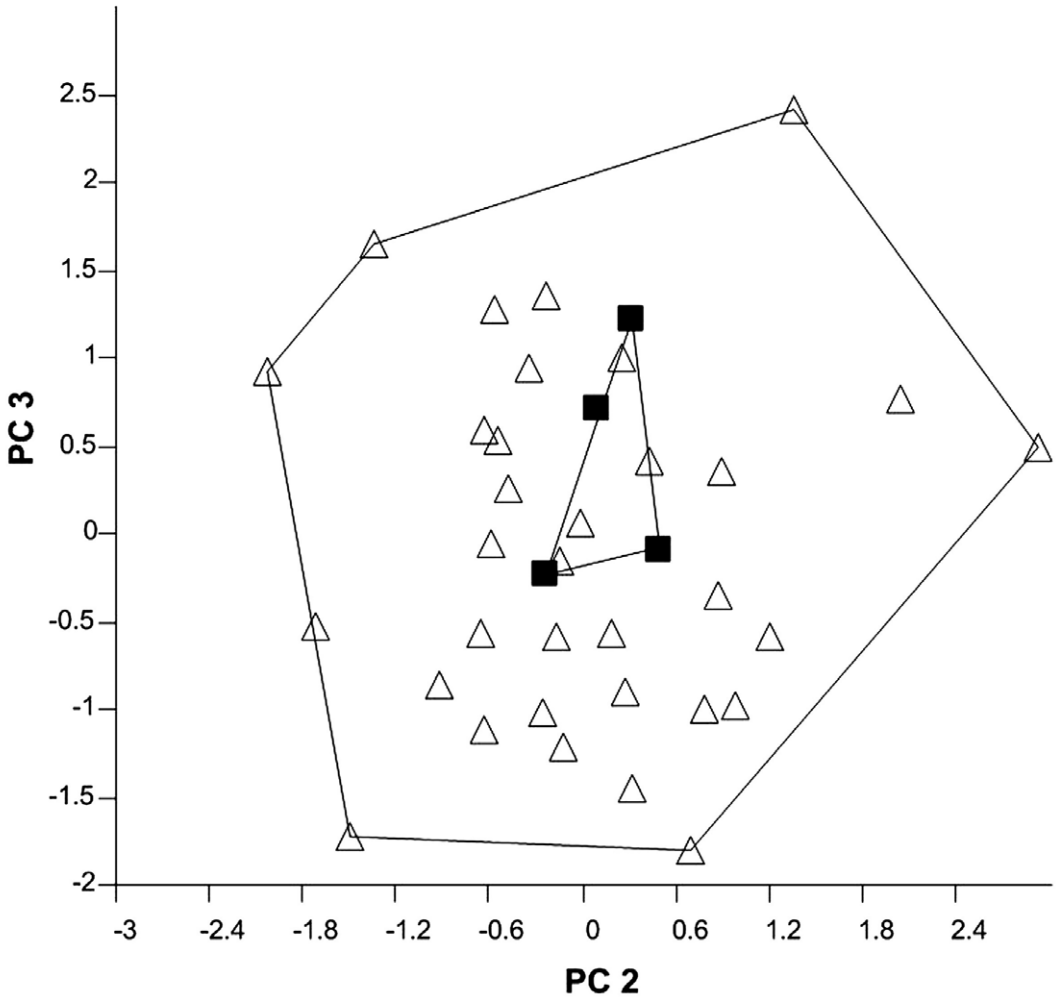

FIGURE 8. Scatter plot of the 2nd and 3rd principal components (PC2 against PC3) extracted from morphometric data for *A. stenotaeniatus* (■) and *A. i. longipinnis* (△).

Discussion

The currently recognized subspecies, *A. i. longipinnis* and *A. i. iridescens*, according to Yue (2000), can be distinguished by the presence or absence of a filament-like extension to the first branched ray of the dorsal fin, and the presence of a deeply or shallowly concave distal margin on the dorsal fin. However, this filament-like extension is sometimes broken off or missing in some collection specimens. For this reason, its taxonomic value at the species level has been underestimated by subsequent authors since Wu *et al*. (1977). The present study indicates that aside from these two characters, the width of black vertical bars on the flank also differs between juvenile individuals (less than 80 mm SL) of the two subspecies (Figs. 1c & 2a). These external morphological differences coincide with osteological characters, i.e., the shape of the precumbent spine on the anterior-superior margin of the first pterygiophore of the dorsal fin (Fig. 3), the shape of the ventral plate of the basihyal (Fig. 4), the presence or absence of a triangular projection on the anterior-middle margin of the hyomandibular (Fig. 5), and the length and size of the fourth and fifth intraorbital bone (Fig. 6). All of these differences support the taxonomic recognition of *A. i. iridescens* and *A. i. longipinnis* as distinct species, *A. longipinnis* and *A. iridescens*.

Parts of the original description of *A. stenotaeniatus* by Chu & Cui (1989) are imprecise. A filament-like extension to the first branched dorsal-fin ray was not mentioned in their text or shown in their illustration (fig. 192) of this species. Our observation showed that this character is present in the holotype (Fig. lb). Information is also conflicting about the type locality of *A. stenotaeniatus*. Chu & Cui (1989) stated that the type material was captured from Bo'ai town, Fu'ning County, Yunnan Province. This town, as illustrated in their distributional map (fig. 191), is actually in the You-Jiang of the Zhu-Jiang basin. However, for unknown reasons, their text indicated that the type material came from the Nanpan-Jiang of the Zhu-Jiang basin. Bo'ai Town was originally situated on the side of the upper You-Jiang of the Zhu-Jiang basin. It has been inundated forever by surface water of a reservoir formed by the construction of a hydropower dam across the You-Jiang in Baise City, Guangxi Province. The present site of Bo'ai Town, where the last author of this study visited in April, 2008, is placed on the top of a hill about twenty kilometers south of its original site.

The type specimens of *A. stenotaeniatus* share with *A. longipinnis* and *A. iridesens* the same pattern of oromandibular structures (Fig. 7a). These specimens have the first branched dorsal-fin ray extended as a filament as is typical for *A. longipinnis*. None of morphometric and meristic characters examined differ significantly between the type specimens of *A. stenotaeniatus* and specimens of *A. longipinnis* (Tables 1 & 2). In adult specimens (more than 110 mm SL) of *A. longipinnis*, there are five wide vertical black bars, each five to eight scales in width, on the flank (Fig. la). Five narrow black vertical bars on the flank are exhibited by the type material of *A. stenotaeniatus* (Fig. 1b). Such coloration is typical of small specimens (less than 80 mm SL) of *A. longipinnis* (Fig.1c). Apparently, the type specimens of *A. stenotaeniatus* are misidentified juveniles of *A. longipinnis*. According to the principle of priority of the 1999 edition ICZN, *A. stenotaeniatus* is a junior synonym of *A. longipinnis*.

Shan *et al.* (2000) also recognized small specimens (less than 80 mm SL) from Hainnan Island as *A. stenotaeniatus*. Their identification of this species followed Chu & Cui (1989). Small specimens (less than 80 mm SL) from the Hainan Island have relatively wider vertical bars on the flank than those from the Zhu-Jiang basin of the same range in length; each bar spans three or four scales. Moreover, specimens examined from Hainan Island, either small or large ones, possess no filament-like extension on the first branched dorsal-fin ray (Figs. 2a–b). Clearly, Shan *et al.*'s specimens from Hainan Island are not *A. stenotaeniatus*. They are misidentified juveniles of *A. iridescens*.

Results of this study reveal that *A. longipinnis* and *A. iridescens* have ontogenetic changes in their body coloration. This is congruent with observations of Kottelat (2001b) and Nguyen & Ngo (2005) for *A. iridescens* from Vietnam and Laos. Ontogenetic color change in these two species has taxonomic implication for their generic designation. Although the number of black vertical bars on the flank remains constant during growth in *A. longipinnis* and *A. iridescens*, there is a marked difference in the vertical-bar width between juveniles and adults (Figs. 1 & 2). Juveniles possess five narrow black vertical bars, each two scales in width, on the flank, with wider yellow interspaces (Figs. 1b & 2a). With the increase in size, these black vertical bars fade away, and their wide interspaces concurrently become darkened, eventually resulting in an adult body coloration of five wide black vertical bars, each five to eight scales in width, on the flank, with alternating narrow yellow interspaces (Figs. 1a & 2b). There are two categories of ontogenetic color changes for these two species: the deletion of five narrow black

vertical bars in juveniles, and the addition of five wide black vertical bars in adults. This ontogenetic change contrasts with what has been observed for *A. hemispinus* (Nichols 1925) and *A. kreyenbergii* (Regan 1928) (Yuan & Zhang 2010a, b), which have seven narrow black vertical bars on the flank in juveniles. These vertical bars are deleted in male and female adults of *A. hemispinus*. In *A. kreyenbergii*, a longitudinal black stripe extending along the lateral line on the flank is added in both sexes of adults, and the seven black vertical bars are truncated below the longitudinal black stripe in female adults, and deleted in male adults. The main difference in ontogenetic color alternation between these two pairs of species is the addition of five wider black vertical bars on the flank in adults of *A. longipinnis* and *A. iridescens* vs. the addition of a longitudinal black stripe along the lateral line on the flank in adults of *A. kreyenbergii*, and no addition of this stripe for *A. hemispinus*. It is likely that *A. longipinnis* and *A. iridescens* do not share the same ancestral body coloration as *A. kreyenbergii* and *A. hemispinus*, given the differences in ontogenetic color change and the number of black vertical bars on the flank in juveniles of the latter pair. This means that *A. longipinnis* and *A. iridescens* are possibly not congeneric with *A. hemispinus* and *A. kreyenbergii*. Since *A. hemispinus* and *A. kreyenbergii* have a common body coloration of juveniles with the majority of barred species of this genus, the current generic designation of *A. longipinnis* and *A. iridescens* requires re-evaluation under phylogenetic scrutiny in the future.

Acrossocheilus longipinnis (Wu 1939)

(Figs. 1a–c)

Lissocheilus longipinnis Wu 1939, 10 (1–6): 101 (Yangshuo, Guangxi).
Masticbarbus pentafasciatus Tang 1942, 20 (2–4): 158 (Guiyang, Guizhou).
Acrossocheilus (*Acrossocheilus*) *longipinnis*: Wu *et al.* 1977:286 (Yangshuo, Guangxi).
Acrossocheilus iridescens zhujiangensis Wu & Lin in Wu *et al.* 1977: 291 (Baise, Liuzhou, Longzhou, and Rong'an in Guangxi; Yangshan, Liangxian, Lechang and Yingde in Guangdong).
Acrossocheilus iridescens: Fang 1981:78 (Yangshuo, Zhaoping, Longsheng, Sanjiang, Rong'an, Rongshui, Sirong, Liucheng, Fengshan, Yishan, Xiangzhou, Xiling, Baise, Pingguo, Qingxi , Jingxi, Longzhou, Bama, and Dongxing in Guangxi); Li in Wu *et al.* 1989: 139 (Rong-Jiang, Cong-Jiang, Libo and Ceheng in Guangzhou)
Acrossocheilus longipinnis: Lin in Zheng 1989:184 (Rong-Shui in Guangxi and Cong-Jiang in Guizhou).
Acrossocheilus iridescens longipinnis: Chen *et al.* 1991:153 (Lechang, Liangxian, Yangshan and Yingde in Guangdong); Shan *et al.* 2000:121 (Rongshui, Yangshuo, Longsheng, and Longjiang in Guangxi).
Acrossocheilus stenotaeniatus Chu & Cui 1989:205 (Bo'ai in Yunnan)
Acrossocheilus stenotaeniatus: Shan *et al.* 2000:105 (Rong'an in Guangxi).

Diagnosis. *Acrossocheilus longipinnis*, along with *A. iridescens*, can be distinguished from all other barred species of *Acrossocheilus* by possessing wider (vs. narrower) black vertical bars, each five to eight (vs. no more than four) scales in width, on the flank of adults, a horse-shoe shaped (vs. arched) mouth gape; rostral barbel placed posterior (vs. anterior) to a horizontal line through the anteriormost margin of the lower jaw, and two postlabial grooves extending anteromedially beyond (vs. away from) a horizontal line through the roots of the rostral barbels. *Acrossocheilus longipinnis* is distinct from *A. iridescens* in having the first branched dorsal-fin ray extended (vs. not extended) as a filament, and a deeply concave (vs. slightly concave or straight) distal margin of the dorsal fin (Figs. 1& 2). This species has relatively narrower vertical black bars on the flank of juveniles than *A. iridescens* (Figs. 1b–c & 2a).

Description. Morphometric and meristic data are provided in Tables 1 and 2, and see Fig. 1a–c for body appearance. Body elongate, compressed laterally, with greatest body depth anterior to dorsal-fin origin, least caudal-peduncle depth closer to caudal-fin base than to posterior end of anal-fin base. Dorsal profile of head straight, body convex from supraoccipital to base of caudal fin. Ventral profile rounded from anteriormost tip of snout to anal-fin origin, straight or slightly concave to caudal-fin base. Head moderately large; interorbital space slightly convex. Eye large, almost equal to snout length, laterodorsal. Snout pointed, protruding, with shallow lateral groove extending along anteroventral margin of lachrymal, confluent with postlabial groove. Tubercles on snout tip and anterior part of lachrymal in males more than 110 mm SL. Mouth subterminal, horse-shoe shaped with its opening smaller than eye diameter.

Rostral fold present, overlying base of upper lip, laterally ending at base of rostal barbel. Upper lip completely adnate to upper jaw, continuous with lower lip around corners of mouth. Lower lip anteriorly separated from lower jaw by groove running along full length of lower jaw, modified to form two long, thin lateral lobes on lower jaw; lateral lobes separated by median interruption. Postlabial grooves extending anteromedially, ending almost at same horizontal line through root of maxillary barbels or slightly beyond, interrupted from each other with gap wider than one-third of mouth gape. Lower jaw with thick, flexible horny sheath on its cutting edge not covered by lower lip. Two pairs of barbels well developed: rostral pair not extending beyond maxillary barbel base, rooted posterior to horizontal line through anteriormost margin of lower jaw (Fig. 7a); maxillary pair not extending beyond midpoint of eye. Gas bladder bipartite, anterior chamber round, posterior chamber elongate and oval, twice as long as anterior one.

Dorsal fin with three simple and eight (37) branched rays, last one split to base; last simple ray stout with serrations along posterior margin, first branched ray extended as filament at distal tip; distal edge deeply concave; origin closer to anteriormost tip of snout than to base of caudal fin. Pectoral fin with one simple and 15 (23), 16 (9) or 17 (5) branched rays; tip of adpressed fin extending midway to pelvic-fin insertion. Pelvic fin with one simple and eight (37) branched rays, inserted opposite to base of first branched dorsal-fin ray; tip of adpressed fin extending beyond halfway to anal-fin origin, but not as far as anus. Pelvic axillary scale long, extending beyond base of last ray. Anal fin with three simple and five (37) branched rays; distal margin obliquely straight; origin equidistant between pelvic-fin insertion and caudal-fin base. Anus located immediately anterior to anal-fin origin. Caudal fin deeply forked, longest ray three times as long as shortest ray.

Body scales moderately large dorsally and laterally, slightly reduced ventrally. Lateral line complete, with 37 (1), 38 (3), 39 (18) or 40 (15) pored scales plus three pored scales on base of caudal fin; $6^{1}/_{2}$ (37) scale rows above lateral line, $4^{1}/_{2}$ (37) below; 16 circumpeduncular scales; 13 (16), 14 (11) or 15 (10) predorsal midline scales, nearly same size as those on flank, not embedded beneath skin. Pharyngeal teeth triserial, tooth pattern 2, 3, 5/5, 3, 2 (KIZ 805283, holotype, 54.5 mm SL) with pointed, slightly curved, compressed tips. Gas bladder bipartite; anterior chamber oval and posterior chamber oblong, twice as long as anterior chamber.

Coloration in preservative. In juveniles of less than 80.0 mm SL, five narrow black vertical bars, each one or two scales in width, on flank. In adults of more than 110 mm SL, ground color of body yellowish with five wide black vertical bars, each five to eight scales in width, on flank; each bar extending vertically beyond fourth row directly below lateral line. First bar placed posterior to head or above pectoral-fin base; second bar anterior to dorsal-fin origin, or with its posterior edge vertically through dorsal-fin origin; third bar below dorsal-fin base, with its posterior margin vertically through posterior end of dorsal-fin base; fourth bar posterior to vertical through tip of adpressed pelvic fin, with its posterior margin anterior to vertical through posterior end of anal-fin base; and fifth bar nearly spanning caudal-peduncle length, its anterior edge separated from the anal-fin origin by two scales. Dorsal fin light orange with black leading and distal margins, pectoral and pelvic fins white and pink; anal fin light yellowish; caudal fin yellowish or orange, with blackish upper, lower and distal margins. Each scale on back and flank with dark chromatophores along exposed part of its posterior edge forming a faint, dusky, crescentic mark.

Distribution. *Acrossocheilus longipinnis* is currently known from the Zhu-Jiang basin.

Remark. *Masticbarbus pentafasciatus* Tang 1942 and *Acrossocheilus iridescens zhujiangensis* Wu & Lin in Wu *et al.* 1977 are here considered to be synonyms of *A. longipinnis* following the recent revision of this genus by Shan *et al*. (2000).

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Materials examined.

Acrossocheilis stenotaeniatus—KIZ 805283-5, 805293, type series, 4 specimens, 51.5–56.5 mm SL, Tuoniang-Jiang, a tributary flowing to the You-Jiang of the Zhu-Jiang basin at Bo'ai town of Funing County, Yunnan Province.

A. longipinnis—KIZ 20050705001–7, 20050709032, 8 specimens, 88.0–175.0 mm SL, Zhang-Jiang in Libo County, Guizhou Province; KIZ 20050828167, 20050826028, 2 specimens, 78.4–93.9 mm SL, Tuoniang-Jiang in Funing County, Yunnan Province; IHB 87V921–7, 83V0650–1, 83V0735, 87V976, 11 specimens, 85.0–193.2 mm SL, Liu-Jiang in Rong-Jiang County, Guangxi Province; IHB 814695–9, 81X0202, 81X1683, 81X4686, 81X4690–3, 73 V2022 (cleared and stained, 118.3 mm SL), 13 specimens, 67.6–213.5 mm SL, Liu-Jiang in Rong'an County, Guangxi Province; Liu-Jiang in Rong'an County, Guangxi Province.

A. iridescens—IHB 76V8589–90, 76V9126–9, 76V9133, 76V9219, 76V9338, 76V9352, 76V9345, 11 specimens, 67.2–134.2 mm SL, Wan-quan River in Qiong-zhong County, Hainan Province; IHB 602235–6, 602238–9, 602242–3, 602246–7, 602248 (cleared and stained, 116.6 mm SL), 602250–4, 14 specimens, 105.1–167.3 mm SL, Wan-quan River in Wu-zhi shan City, Hainan Province; IHB 6440286, 6440580–1, 6450645, 4 specimens, 107.4–195.3 mm SL, Yuan Jiang in Hekou, Yunnan Province.

A. kreyenbergii —BMNH 1907112612101–2, 2 type specimens, 71.1–132.9 mm SL, Gan Jiang (a tributary of the Poyang Lake system) in Nankancho, near Tinghsiang (= Pingxiang city), Jiangxi Province; IHB 0605421–27, 7, 89.7–127.4 mm SL, Gan Jiang (a tributary of the Poyang Lake system) in Yiyang, Jiangxi Province; IHB 902152–53, 2 specimens, 80.1–123.4 mm SL, Chang Jiang (not Yangtze River, but a tributary of the Poyang Lake) in Jingdezhen, Jiangxi Province; IHB 901940 –41, 901943–47, 7 specimens, 104.1–145.3 mm SL, Le'an Jiang (a tributary of to the Poyang Lake) in Wuyuan, Jiangxi Province; IHB 74V2459–61, 3 specimens, 61.0–106.9 mm SL, Gui jiang (a tributary of the Xi Jiang) in Xiuren, Guangxi Province; IHB 86X114, 86X116, 86X110–2, 86X118–9, 86X123–126 , 11 specimens, 91.3–125.3 mm SL, Yu Jiang (a tributary of the Xi Jiang) in Nanning, Guangxi Province; IHB 81X- 0126 , 81X0161, 2 specimens, 95.9–110.8 mm SL, Gui Jiang in Yangshuo, Guangxi Province; IHB 75IV2614–6, 3 specimens, 81.6–153.1 mm SL, Gui jiang in Lipu, Guangxi Province; IHB 83V0531–2, 75V2403, 75V2406, 4 specimens, 49.4–55.8 mm SL, Xi Jiang in Jinxiu, Guangxi Province; IHB 539413, 539431, 539435, 539448, 539475, 539481, 539505, 539682, 539534 –5, 539781, 11 specimens, 9.5–131.6 mm SL, Gui Jiang in Guilin, Guangxi Province; IHB 20080500001–03, 3 specimens, 94.1–128.3 mm SL, Liu Jiang (a tributary of the Xi Jiang) in Rongshui, Guangxi Province.

A. hemispinus—IHB 74VI1359, 74VI1370–2, 74VI374, 74VI1401, 74VI1403–6, 10 specimens, 87.9– 157.3 mm SL, Sha Xi (a tributary of the Min Jiang) in Ninghua, Fujian Province; IHB 74VI2552, 74VI2555, 74VI2557, 74VI2559, 74VI2562–3, 74VI2740, 661230–31, 9 specimens, 88.0–102.2 mm SL, Sha Xi in Shaxian, Fujian Province; IHB 74VI1448, 1 specimen, 146.1 mm SL, Jian Xi (a tributary of the Min Jiang) in Jianning, Fujian Province; IHB 20070500081–84, 20050500086, 5 specimens, 56.1–124.6 mm SL, Huotong Xi (a stream emptying into the east sea) in Huotong, Fujian Province; IHB 20070500092–94, 20070500097, 4 specimens, 80.9–109.9 mm SL, Min Jiang in Shaowu, Fujian Province; IHB 20070500144–46, 20070500151–57, 20070500159–61, 20070500165, 20070500173, 20070500175, 20070500167–68, 18 specimens, 84.2–107.9 mm SL, Dazhang Xi (a tributary of the Min Jiang) in Yongtai, Fujian Province; IHB 20050600187, 70.4 mm SL, Min Jiang in Jian'ou, Fujian Province; IHB 20070500193–94, 20070500196, 20070500198–99, 20070500201, 20070500204, 20070500210, 20070500212, 9 specimens, 85.1–115.6 mm SL, Min Jiang in Wuyishan, Fujian Province.

A. jishouensis—IHB 79VI111, 1 specimen, 169.4 mm SL, Yuan Jiang (a tributary of the Dongting Lake system) in Songtao, Guizhou Province; IHB 8840946–8, 3 specimens, 79.1–129.6 mm SL, Yuan Jiang in Tongren, Guizhou Province; IHB 831089, 83IV1079–81, 831086–7, 6 specimens, 55.1–84.0 mm SL, Qingshui Jiang (a tributary draining to the Yuan Jiang) in Leishan, Guizhou Province; IHB 87VI212–5, 4 specimens, 109.3–130.7 mm SL, Qingshui Jiang in Kaiyang, Guizhou Province; IHB 87V076–9, 4 specimens, 112.4–160.5 mm SL , Qingshui Jiang in Jinping, Guizhou Province; IHB 87V180–2, 3 specimens, 97.3–145.8 mm SL, Qingshui Jiang in Kaili, Guizhou Province;

A. parallens—IHB 76IV7301, 76IV7303, 76IV7313, 3 specimens, 85.0–154.0 mm SL, Bei Jiang of the Pearl River drainage in Lianping, Guangdong Province; IHB 76IV6941–3, 3 specimens, 74.9– 112.6 mm SL, Bei Jiang in Lianshan, Guangdong Province; IHB 72IV6201, 76IV6203, 2 specimens, 106.6–117.0 mm SL, Bei Jiang in

Lechang, Guangdong Province; IHB 2008090026–30, 5 specimens, 84.9–113.5 mm SL, Bei Jiang in Lianzhou, Guangdong Province; IHB 620670–5, 6 specimens, 68.3– 79.8 mm SL, Xi Jiang in Gaoyao, Guangdong Province; IHB 76III163, 76III7311, 76III434, 3 specimens, 63.7–80.1 mm SL, Bei Jiang in Heping, Guangdong Province; IHB 74VI1185–6, 74VI1182, 74VI1188–90, 74VI1193, 7 specimens, 84.3–131.9 mm SL, Ting Jiang in Changting, Fujian Province; IHB 2005050005–6, 2 specimens, 54.8–70.1 mm SL, Gan Jiang in Guanshan, Jiangxi Province. IHB 20070500076, 1 specimen, 86.8 mm SL, Min Jiang in Nanping, Fujian Province.

A. wenchowensis—IHB 640674–6, 3 specimens, 80.5–106.9 mm SL, Ou Jiang in Wenzhou, Zhejiang Province; IHB 74IX3477–80, 4 specimens, 75.4–107.4 mm SL, Ou Jiang in Jinyun, Zhejiang Province; IHB 74IX4241–46, 0605346–66, 0605368–70, 0605372–74, 0605376–79, 0605383–84, 0605391, 0605394, 0605398–99, 0605401, 0605403, 0605406, 0605409–12, 50 specimens, 92.0–123.0 mm SL, Ou Jiang in Lishui, Zhejiang Province; IHB 74IX3540–6, 7 specimens, 73.5–140.2 mm SL, Ou Jiang in Longquan, Zhejiang Province.

A. fasciatus—IHB 59VII001, 59VII004–7, 5 specimens, 67.4–106.6 mm SL, Xin'an Jiang (upper Qiantang Jiang drainage) in Tianmushan, Zhejiang Province; IHB 74IX3101–10, 74IX3295–302, 74IX3303–5, 74IX3307–13, 74IX4106–9, 74IX4480, 74IX4544–6, 74IX4548–50, 74IX4552–3, 38 specimens, 64.4–191.6 mm SL, Ling Jiang ing Tiantai, Linhai and Xianju, Zhejiang Province; IHB 74IX3701–02, 74IX3704, 74IX3707–11, 74IX3719, 74IX3727, 10 specimens, 73.2–123.4 mm SL, Yong Jiang in Fenghua, Zhejiang Province; IHB 0605319–43, 25 specimens, 76.5–113.8 mm SL, Xin'an Jiang in Tunxi, Anhui Province; IHB 0605573–85, 0605594, 0605600–2, 0605606, 0605615, 0605624–40, 36 specimens, 62.6–156.3 mm SL, Xin'an Jiang in Jiande; Zhejiang Province.

A. beijiangensis—IHB 76IV8266–7, 76 IV 8304, 3 specimens, 77.5–104.9 mm SL, Xi Xi in Haifeng, Guangdong Province; IHB 76IV7432, 1 specimen, 84.1 mm SL, Bei Jiang in Lianping, Guangdong Province; IHB 76IV6202, 1 specimen, 94.9 mm SL, Dong Jiang in Lechang, Guangdong Province; IHB 76IV7991–2, 2 specimens, 82.6–126.3 mm SL, Bei Jiang in Wengyuan, Guangdong Province; IHB 660026, 660028, 660091–2, 660153, 76IV6538–9, 76 IV6544, 20080900035–36, 10 specimens, 58.1–123.1 mm SL, Bei Jiang in Lianzhou, Guangdong Province; IHB 73X2181–2, 74XI1458–9, 4 specimens, 102.8–107.4 mm SL, Liu Jiang in Rong'an, Guangxi Province; IHB 75IV1727–30, 4 specimens, 80.3–140.9 mm SL, Rong Jiang (a tributary of the Xi Jiang) in Longsheng, Guangxi Province; IHB 87IV706–13, 8 specimens, 66.7–125.6 mm SL, Rong Jiang in Sandu, Guizhou Province; IHB 87IV476–84, 1 specimen, 89.2–146.0 mm SL, Long Jiang (a tributary of the Xi Jiang) in Libo, Guizhou Province; IHB 87IV935–7, 3 specimens, 125.0–147.8 mm SL, Rong Jiang in Rongjian, Guizhou Province.

A. spinifer—IHB 74VI0816, holotype, female, 115.4 mm SL, Jiulong Jiang in Longyan, Fujian Province; IHB 74VI1018–9, 74VI1124–5, 74VI1125, 74VI1127–8, 74VI1061, 7 specimens, 78.4–141.4 mm SL, Ting Jiang in Shanghang, Fujian Province; IHB 825077, 1 specimen, 99.1 mm SL, Min Jiang in Chong'an, Fujian Province; IHB 74VI1183–4, 74VI1191–2, 4 specimens, 133.1–152.9 mm SL, Ting Jiang in Changting, Fujian Province.

A. paradoxus—BMNH 1865.5.2.20–23 (1), type specimen, 156.6 mm SL, Formosa, Taiwan; BMNH 1908.5.27.6–10, 1909.4.28.26, 5 specimens, 70.1–118.5 mm SL, Lake Candidius in Formosa, Taiwan; IHB 750665–9, 5 specimens, 56.1–130.0 mm SL, Pinglin, Taiwan; IHB 070257–58, 2 specimens, 51.7–84.5 mm SL, Taiwan.

A. wuyiensis—IHB 20070500310–11, 20070500314–15, 20070500318–19, 6 specimens, 62.6 –127.8 mm SL, Min Jiang in Shaowu, Fujian Province; IHB 20070600214–29, 16 specimens, 84.6–143.5 mm SL, Min Jiang in Jianyang, Fujian Province; IHB 825218, 825219, 825220, 3 specimens, 107.5–133.3 mm SL, somewhere in Fujian Province; IHB 20070600234, 20070600230–31, 20070600236–46, 16 specimens, 67.2–126.1 mm SL, Min Jiang in Wuyishan, Fujian Province; AO17682, 174590, 17670–71, 17693, 17695, 17743–4, 17771, 9 specimens, 52.5–82.1 mm SL, Min Jiang in Wuyishan, Fujian Province.

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