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# *SINIBRAMA LONGIANALIS*, A NEW CYPRINID SPECIES (PISCES: TELEOSTEI) FROM THE UPPER YANGTZE RIVER BASIN IN GUIZHOU, CHINA

**Zhong-Gui Xie**
*Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan 430072, Hubei, Peoples' Republic of China; Fisheries College, Huazhong Agricultural University, Wuhan 430070, Hubei, Peoples' Republic of China*

**Cong-Xin Xie**
*Fisheries College, Huazhong Agricultural University, Wuhan 430070, Hubei, Peoples' Republic of China*

**E Zhang**
*Institute of Hydrobiology, Chinese Academy of Sciences, Wuhan 430072, Hubei, Peoples' Republic of China*
*Fax: 86-27-87875132; E-mail: zhange@ihb.ac.cn (All correspondence to E Zhang)*

***ABSTRACT.* –** *Sinibrama longianalis*, a new cyprinid species from the Wu Jiang (upper Yangtze River basin) in Guizhou, China is distinguished from other congeners in having the following combination of characters: last simple dorsal-fin ray well-ossified; a snout shorter than eye diameter; eye diameter 27.1-31.6% HL; lateral line scales 56-64 (mean 59.5); circumpeduncular scales 18-21; anal fin with 24-28 (mean 25.2) branched rays, originating opposite to or slightly in advance of posterior end of dorsal-fin base, basal length 27.0-31.1% SL; pectoral fin reaching to or slightly beyond pelvic-fin insertion.

***KEY WORDS.* –** *Sinibrama*, Cyprinidae, new species, China.

## INTRODUCTION

The cyprinid genus *Sinibrama* was proposed by Wu (1939) using *Chanodichthys wui* as the type species. Currently, it consists of four nominal species, namely *S. affinis*, *S. macrops*, *S. taeniatus* and *S. wui*, known from South China (including Hainan and Taiwan Islands), Vietnam and Laos (Luo & Chen, 1998; Kottelat, 2001a, b). Among them, *S. wui* is the most widely distributed species occurring in the Min Jiang, Ling Jiang, Ou Jiang, Cao'e Jiang, Qiantang Jiang, and upper and middle Yangtze River basins. While *S. taeniatus* is restricted to the upper Yangtze River basin in Sichuan, *S. affinis* occupies the Red River basin in Laos, North Vietnam and South China, and Hainan Island. *S. macrops* has its distribution in the Pearl River and Wu Jiang (upper Yangtze River) basins as well as Taiwan Island.

*Sinibrama*, presently placed in the subfamily Cultrinae by both Luo & Chen (1998) and Rainboth (1991), is superficially similar to *Parabramis* and *Megalobrama*, but distinguished from them in having a unique combination of two characters: air bladder bipartite and abdominal keel present between the pelvic fin and anus. The two characters, not unique to *Sinibrama*, are also shared with *Ancherythroculter* and *Metzia*. *Sinibrama* is distinct from *Ancherythroculter* in having a terminal (vs. superior or subsuperior) mouth and more gill rakers on the first gill arch (9-15 vs. 15-22), and from *Metzia* in having more branched anal-fin rays (18-26 vs.12-17) and a well-ossified (vs. non-ossified) last simple dorsal-fin ray. Luo et al. (1985) described *S. barbatula* as a new species based on material from the Qing Jiang (Pearl River basin) in Guangxi. This species was later utilized by Luo (1995) as the type species to propose *Pogobrama*. This monotypic genus is distinguished from *Sinibrama* in having a pair of maxillary barbels (vs. absent) and fewer branched anal-fin rays (14-16 vs.18-26).

There remains a controversy over identification of *S. macrops* and *S. wui*. The material from the upper Yangtze River in Kiating (=Leshan) and Suifu (=Yibin), Sichuan was originally described by Wu (1930) as an unnamed *Chanodichthys* species. It was subsequently named by Rendahl (1932) as *Chanodichthys wui* based on the material from the same river in Szetschwan (=Sichuan). Lin (1932) recorded *Chanodichthys wui* from Kweichow (now Guizhou), with no precise locality. Wu (1939) identified the material from the Li Jiang (Pearl River basin) as *Chanodichthys wui* and established *Sinibrama* as a new genus for this species. A review of the Chinese *Sinibrama* species

was provided by Yih & Wu (1964), who referred the materials from the Pearl River and Yangtze River basins to as *S. wui* and those from the Qiantang Jiang, Min Jiang and Ou Jiang basins to as *S. macrops*, a species that was originally described by Günther (1868) as *Chanodichthys* from Taiwan Island. This opinion was challenged by Zhuang (1981), who held that the material from the Pearl River basin is conspecific with *S. macrops* and those from the Qiantang Jiang, Ou Jiang, Ling Jiang, Min Jiang and Yangtze River basins is identical to *S. wui*. Luo & Chen (1998) followed Zhuang to identify the material from the Qiantang Jiang, Cao'e Jiang, Ling Jiang, Ou Jiang, Min Jiang and Yangtz River basins as *S. wui* and the material from the PearlRiver and Wu Jiang basins as *S. macrops*. However, Luo's identification of these two species is questionable. It is unbelievable that *S. macrops* has a disjunct distribution, occurring in the mainland of China (Pearl River and Wu Jiang basin) and Taiwan Island, and that the gap is occupied by its most similar species *S. wui*. Additionally, Luo & Chen (1998) noted that the Pearl River and Wu Jiang basin materials differ in the size of the eye diameter and the number of gill rakers, but they arbitrarily attributed these differences to geographic variation and thus referred them to *S. macrops*.

The present paper is part of a systematic revision of the Chinese *Sinibrama* species, and described the material formerly identified by Luo & Chen (1998) as *S. macrops* from the Wu Jiang basin as a new species *S. longianalis*.

## MATERIALS AND METHODS

Measurements and counts were made on the left side of individuals whenever possible. Each measurement was taken point to point with digital caliper and data was recorded to 0.1 mm. 31 measurements were made as shown in Fig. 1. Among them, there were 18 truss network measurements (Fig. 1B) and they were taken with the protocol suggested by Bookstein et al., (1985). Other measurements (Fig. 1A), along with six counts, were made utilizing the method of Kottelat (2001b) with the addition of the anal-fin basal length that was taken from the base of the first simple ray to the base of the posteriormost ray in the anal fin. All measurements were expressed as percentages of the standard length, except for those relating to the head, such as snout length, eye diameter, interoribtal width and distance from the snout tip to the posterior point of the neurocranium. These measurements were given as proportions of the head length. Statistics 5.0 (Wilkinson et al., 1992) was employed for the basic statistic analysis on meristic and morphometirc data and the principal component analysis (PCA) that was performed on the correlation matrix of the $\log_{10}$–transformed measurements.

Toponymy utilized for distribution data in the present paper follows local Chinese usage, except for three: the Red, Pearl and Yangtze Rivers which are referred to by their English names. The Chinese portion of the Red River is known locally as the Yuan Jiang.

The description is based on formalin-preserved specimens. All examined specimens are deposited in the collection of the Freshwater fish Museum of Institute of Hydrobiology (IHB), Chinese Academy of Sciences and in the Zoological Reference Collection (ZRC) of the Raffles Museum of Biodiversity Research, National University of Singapore. Abbreviations used herein are: HL, head length and SL, standard length.

## TAXONOMY

### *Sinibrama longianalis*, new species
(Fig. 2)

*Sinibrama macrops* – Luo & Chen, 1998: 145 (Wu Jiang in Guizhou, China)(not Günther, 1868).

***Material examined.*** – Holotype – (IHB 6650583) 134.3 mm SL; Xiang Jiang (a stream tributary flowing to the Wu Jiang of the upper Yangtze River basin) in Zunyi, Guizhou, China, coll. R. D. Lin, P. Q. Yue & W. Chen, May.1966.

Paratypes – 24 ex. (IHB 6650559, 650554, 6650587, 6650572-5, 6650561, 6650577-9, 6650600, 6650596-7, 6650602-03, 6650566-7, 6650589-94) 110.6- 171.6 mm SL, 1 ex. (ZRC 6650601), 111.9 mm SL, all data same as holotype; 2 ex. (IHB 87VI225, 87VI256), 119.6-128.6 mm SL, Qingshui Jiang (a stream tributary flowing to the Wu Jiang of the upper Yangtze River basin) in Kaiyang, Guizhou, coll. D. Z. Wang, Jun.1987.

***Diagnosis.*** – *Sinibrama longianalis* is distinguished from all other congeners by possessing the following combination of characters: last simple dorsal-fin ray well-ossified; a snout shorter than eye diameter; lateral line scales 56-64 (mean 59.5); circumpeduncular scales 18-21; eye diameter 27.1-31.6 % HL; anal fin with 24-28 (mean 25.2) branched rays, originating opposite to or slightly in advance of posterior end of dorsal-fin base, basal length 27.0-31.1% SL; pectoral fin reaching to or slightly beyond pelvic-fin insertion.

***Description.*** – Meristic and morphometric data of 28 specimens, 110.6-171.6 mm SL in Tables 1-2 and general appearance in Fig. 2.

Body strongly compressed and moderately deep, dorsal profile convex with a slight hump posterior to nape and ventral profile somewhat round. Head roughly triangular, longer than deep, dorsally straight, with a slightly convex interorbital space. Snout blunt, shorter than eye diameter. Eye large, laterally positioned in anterior half of head, diameter equal to interobital width. Mouth terminal, oblique, no small knob at lower jaw symphysis. Maxillary reaching somewhat beyond nostril, but not to anterior margin of orbital. No barbel. Abdominal keel present between pelvic-fin and anus.

Dorsal fin with 3 simple and 7-8 branched rays, last branched ray split to base and last simple ray well-ossified and shorter than HL, origin in halfway between snout tip and caudal-fin base or slightly moved forwards, distal margin slightly

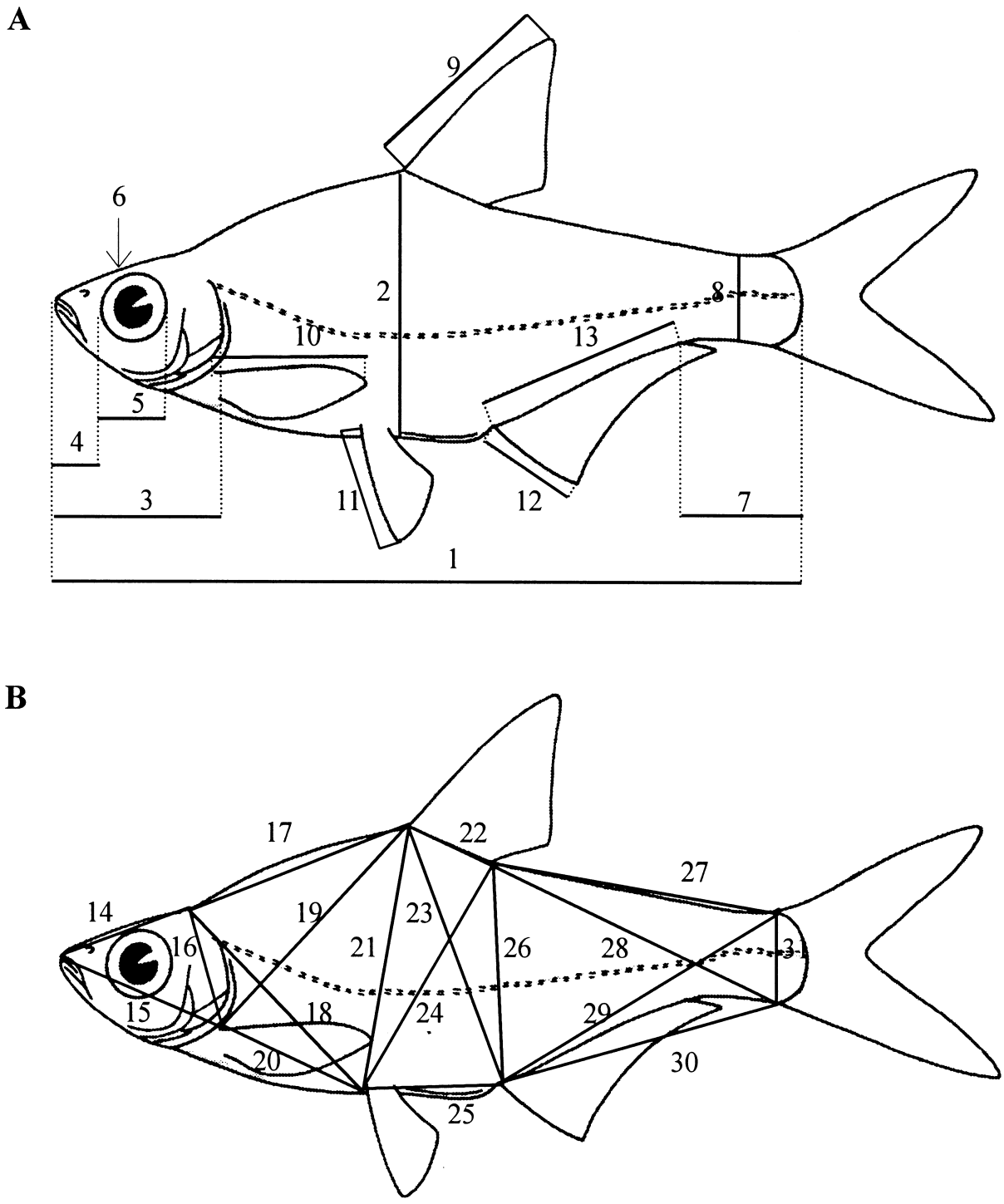


Fig. 1. Measurements taken on *Sinibrama* species. A: 1-13; B: 14-31: 1: standard length (SL); 2: body depth; 3: head length (HL); 4: snout length; 5: eye diameter; 6: interorbital width (impossible to be shown here); 7: length of caudal peduncle; 8; depth of caudal peduncle; 9: dorsal-fin length; 10: pectoral-fin length; 11: pelvic-fin length; 12: anal-fin length; 13: anal-fin basal length; 14: distance from anterior tip of snout to posterior point of neurocranium; 15: distance from anterior tip of snout to pectoral-fin insertion; 16; distance from posterior point of neurocranium to pectoral-fin insertion; 17: distance from posterior point of neurocranium to dorsal-fin origin; 18: distance from posterior point of neurocranium to pelvic-fin insertion; 19: distance from pectoral-fin insertion to dorsal-fin origin; 20: distance from pectoral- to pelvic-fin insertion; 21: distance from pelvic-fin insertion to dorsal-fin origin; 22: dorsal-fin basal length; 23: distance from dorsal- to anal-fin origin; 24: distance from pelvic-fin insertion to posterior end of dorsal-fin base; 25: distance from pelvic-fin insertion to anal-fin origin; 26: distance from posterior end of dorsal-fin base to anal-fin origin; 27: distance from posterior end of dorsal-fin base to dorsal origin of caudal fin; 28: distance from posterior end of dorsal-fin base to ventral origin of caudal fin; 29: distance from anal-fin origin to dorsal origin of caudal fin; 30: distance anal-fin origin to ventral origin of caudal fin; 31: distance from dorsal to ventral origin of caudal fin.

Table 1. Variation of six meristic characters in three Chinese species of *Sinibrama*. Parameters of each character distribution as follows: range/means ± standard deviation.

| | *S. macrops* (n=26) | *S. wui* (n=112) | *S. longianalis* (n=28) |
|---|---|---|---|
| Lateral line scales | 55-61<br>57.7±1.7 | 55-61<br>57.7±1.5 | 56-64<br>59.5±2.4 |
| Scale rows above lateral line | 9-10<br>9.5±0.5 | 9-11<br>10.1±0.6 | 11-12<br>11.3±0.5 |
| Scale rows below lateral line | 5-6<br>5.3±0.5 | 5-6<br>5.6±0.5 | 6-7<br>6.2±0.4 |
| Circumpeduncular scales | 19-21<br>20.2±0.6 | 18-23<br>20.1±0.9 | 18-21<br>19.2±0.8 |
| Branched pectoral-fin rays. | 13-16<br>14.5±0.7 | 14-16<br>14.8±0.6 | 13-16<br>14.9±0.7 |
| Branched anal-fin rays | 20-25<br>22.6±1.1 | 18-24<br>21.3±1.2 | 24-28<br>25.2±1.1 |

concave or truncate. Pectoral fin falcate, with 1 simple ray and 13-16 branched rays, shorter than HL, reaching slightly beyond pelvic-fin origin when depressed. Pelvic fin broadly pointed, with 1 simple ray and 8 branched rays, shorter than HL, inserted midway between pectoral- to anal-fin origin, not reaching anal-fin origin when depressed. Anal fin with 3 simple and 24-28 branched rays, last one split to base, origin vertically opposite to or somewhat in advance of posterior end of dorsal-fin base, distal margin concave. Caudal fin forked, longest rays more than 2 times as long as shortest rays.

Lateral line complete, with 56-64 perforated scales, bent ventrally before pelvic-fin origin and running parallel with ventral margin to anal-fin origin, then increasingly directed dorsally and finally extended mid-laterally along caudal peduncle. Scale rows above lateral line 11-12 and below 6-7. Predorsal scales irregularly arranged; circumpeduncular scales 18-21. Axillary scale long, reaching beyond base of last ray. First gill arch on left side of body with 12-15 short, small and sparsely-set gill rakers. Pharyngeal teeth triserial, somewhat compressed with pointed and curved tips. Gas bladder bipartite, anterior chamber elliptical, posterior chamber slender with a round distal end, 1.5 times as long as anterior chamber.

***Coloration.* –** In formalin-stored specimens, body yellowish, somewhat darker above, a streak of very minute black dots above lateral line to base of caudal fin.

***Distribution.* –** *Sinibrama longianalis* is so far known only from the Xiang Jiang in Zunyi and the Qingshui Jiang in Kaiyang, two stream tributaries flowing to the Wu Jiang (upper Yangtze River basin) in Guizhou Province, China (Fig.3).

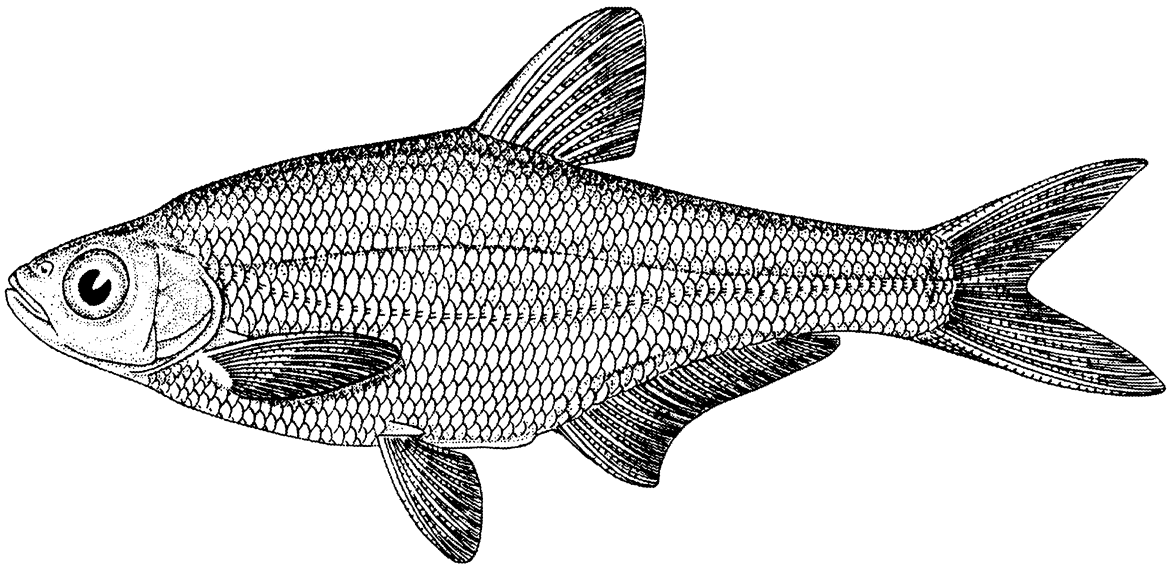

Fig. 2. *Sinibrama longianalis*, holotype, IHB 6650583, 134.3 mm SL; China: Guizhou: Zunyi, Lateral view.

Table 2. The range for measurements taken on three Chinese species of *Sinibrama* followed by means ± standard deviation in the bracket. Measurements relating to the head were expressed as percentages of individual specimen's head length, and head length itself, body parts and fins were presented as proportions of that specimen's standard length.

| Characters | *S. macrops* (n=26) | *S. wui* (n=112) | *S. longianalis* (n=28) |
|---|---|---|---|
| SL(mm) | 89.2-160.2 (123.4±15.9) | 70.5-166.5 (114.3±19.1) | 110.6-171.6 (133.5±37.9) |
| HL(mm) | 22.7-37.0 (29.8±3.5) | 19.2-40.9 (27.8±4.1) | 26.5-38.3 (31.1±3.0) |
| 2 | 30.4-37.8 (34.8±2.0) | 27.4-38.5 (32.0±2.5) | 32.1-40.0 (34.5±1.6) |
| 3 | 22.9-25.5 (24.0±0.7) | 22.2-27.3 (24.4±1.0) | 22.3-24.3 (23.4±0.5) |
| 4 | 27.6-33.8 (30.1±1.5) | 23.8-32.6 (29.0±1.7) | 22.5-30.8) (27.2±2.0) |
| 5 | 33.7-37.0 (35.4±0.9) | 32.1-39.4 (34.5±1.7) | **27.1-31.6 (30.2±1.1)** |
| 6 | 32.4-37.2 (35.1±1.5) | 28.5-38.7 (33.4±1.9) | 30.7-36.9 (33.0±1.6) |
| 7 | 10.2-14.7 (12.2±1.1) | 9.5-14.1 (12.2±0.9) | 10.7-15.0 (13.2±1.0) |
| 8 | 9.4-11.6 (10.7±0.5) | 9.5-12.2 (10.6±0.5) | 10.1-12.1 (10.8±0.4) |
| 9 | 21.6-25.7 (23.6±1.2) | 19.2-26.9 (23.6±1.6) | 23.4-27.9 (25.0±1.0) |
| 10 | 18.7-22.3 (20.2±0.9) | 17.5-23.1 (20.1±1.2) | 19.7-22.5 (21.1±0.7) |
| 11 | 14.2-17.4 (15.6±0.7) | 13.7-18.1 (15.8±1.0) | 15.6-17.9 (16.7±0.5) |
| 12 | 11.3-14.6 (13.0±0.8) | 11.5-15.9 (13.7±1.0) | 12.2-16.2 (13.6±0.9) |
| 13 | 22.9-26.7 (25.6±1.2) | 21.3-26.8 (23.8±1.3) | **27.0-31.1 (29.1±1.1)** |
| 14 | 70.7-82.3 (74.5±2.7) | 69.3-81.4 (74.1±2.2) | 71.2-77.6 (74.3±1.6) |
| 15 | 24.1-28.0 (25.3±0.9) | 23.3-28.5 (25.5±1.0) | 23.1-25.8 (24.4±0.6) |
| 16 | 17.8-20.3 (19.1±0.6) | 16.6-19.8 (18.3±0.7) | 15.9-18.2 (17.1±0.4) |
| 17 | 31.2-36.1 (34.0±1.0) | 31.7-37.9 (34.7±1.3) | 34.0-37.0 (35.4±0.8) |
| 18 | 34.8-39.6 (37.3±1.3) | 34.5-40.8 (36.7±1.2) | 32.2-37.6 (33.9±1.1) |
| 19 | 34.9-39.8 (37.8±1.4) | 34.1-41.9 (37.0±1.5) | 37.0-40.9 (38.7±1.0) |
| 20 | 21.7-27.0 (24.0±1.4) | 20.9-28.4 (24.1±1.4) | **20.1-24.1 (21.5±1.1)** |
| 21 | 29.3-37.1 (33.6±2.1) | 26.4—37.7 (30.8±2.6) | 31.6-40.6 (34.2±1.9) |
| 22 | 11.4-13.7 (12.6±0.6) | 10.2-13.6 (12.1±0.6) | 10.6-13.0 (11.6±0.6) |
| 23 | 31.2-36.7 (34.7±1.4) | 28.7-37.7 (32.5±2.1) | 30.8-37.1 (33.3±1.1) |
| 24 | 29.1-35.8 (33.2±1.9) | 27.1-37.2 (31.2±2.2) | 32.9-41.2 (35.1±1.7) |
| 25 | 17.2-21.2 (19.4±1.0) | 16.9-23.2 (20.3±1.3) | 17.8-20.6 (19.1±0.8) |
| 26 | 24.6-29.3 (27.1±1.4) | 21.6-30.1 (25.2±2.0) | 25.4-31.1 (27.6±1.1) |
| 27 | 37.3-42.8 (40.7±1.3) | 36.1-42.1 (39.0±1.5) | 36.6-41.1 (39.3±1.0) |
| 28 | 39.7-44.2 (42.7±1.1) | 37.8-44.1 (40.8±1.2) | 39.6-42.4 (41.0±0.7) |
| 29 | 37.6-43.7(40.8±1.0) | 35.7-43.1 (39.1±1.4) | **43.1-46.5 (45.0±0.8)** |
| 30 | 32.6-38.7 (36.2±1.0) | 31.1-38.3 (34.6±1.6) | **37.7-42.6 (40.5±1.0)** |
| 31 | 10.6-12.2 (11.5±0.4) | 10.3-12.5 (11.3±0.5) | 10.8-13.0 (11.5±0.5) |

***Etymology.* –** The name is made from the Latin *longus* (long) and *analis* (anal fin), meaning a long anal-fin base.

***Remarks.* –** *Sinibrama longianalis* is closely associated with *S. macrops* and *S. wui* by having a snout shorter than eye diameter, a well-ossified last simple ray of dorsal fin, lateral line scales 56-64 and circumpeduncular scales18-21. As mentioned above, the taxonomy of *S. macrops* and *S. wui* is still controversial and in need of revision. But this is not the place to address this problem in depth. For convenience of comparison, we provisionally retain both as two valid species, as currently understood by Chinese authors. *Sinibrama longianalis* differed from *S. macrops* and *S. wui* in six meristic characters studied (Table 1). Although these differences were highly significant (*t*-test, $p < 0.05$), there were no gaps in the distributions of characters from *S. longianalis* compared with *S. macrops* and *S. wui* when the distribution of each character was examined. Therefore, there is no single character that discriminates *S. longianalis* from both *S. macrops* and *S. wui*.

Two characters displaying the least amount of overlap between *S. longianalis* and *S. wui* or *S. macrops* were the numbers of the branched anal-fin rays and scale rows above the lateral line. *Sinibrama longianalis* had 24–28 branched anal-fin rays in the studied specimens. Four specimens with 24 and one specimen with 25 branched anal-fin rays were found in twenty-six studied specimens of *S. macrops*, however. These five specimens had 10 scale rows above the lateral line and 20-21 circumpeduncular scales, both typical of *S. macrops*. Among one hundred and twelve studied specimens of *S. wui*, there were two specimens having 24 branched anal-fin rays, but the values of other meristic characters in these two specimens were characteristic of *S. wui* and not of *S. longianalis*: 57 lateral line scales and 10 scale rows above the lateral line. All studied specimens of *S. longianalis* had 11-12 scale rows above the lateral line. In contrast, three specimens having 11 scale rows above the lateral line were found in *S. macrops*, but they had 22-23 branched anal-fin rays typical of *S. macrops* and not of *S. longianalis*. While most studied specimens from *S. wui* had

9-10 scale rows above the lateral line, there were twenty-two (19.8 % of the total) specimens whose scale rows above the lateral line are 11, falling within the range of the same meristic character in *S. longianalis*. These specimens had 18-22 branched anal-fin rays characteristic of *S. wui*. When the numbers of the branched anal-fin rays, lateral line scales and scale rows above the lateral line were graphed as a three-dimensional distribution (Fig. 4), there was a distinct separation between the studied specimens of *S. longianalis* and those so far identified as *S. wui* and *S. macrops*. Furthermore, this separation was displayed by the principal component analysis (PCA) that was performed on 31 measurements that were made from 165 studied specimens.

The studied specimens of *S. longianalis*, *S. wui* and *S. macrops* were analyzed with PCA on the correlation matrix of $\log_{10}$-transformed measurements (Table 2 and Fig. 5). PC1 (the first principal component) is considered as a general size axis (Marcus, 1990; Schaefer, 1991). The similarity of character loadings on PC1 (Table 3) confirmed this interpretation for our data set. PC2, the main shape axis (James & McCulloch, 1990) in our analysis, separates S. *longianalis* from both *S. wui* and *S. macrops* (Fig. 5). PC3, another shape axis, doesn't allow separation of *S. longianalis* from *S. wui* and *S. macrops.*

There are six characters with main loadings on PC2: snout length, eye diameter, anal-fin basal length, distance from the pectoral- to pelvic-fin origin, distance from the anal-fin origin to the dorsal origin of the caudal fin, and distance from the anal-fin origin to the ventral origin of the caudal fin (characters 4, 5, 13, 20, 29 and 30 in Table 3). In order to estimate the importance of the measurements for species identification, we conducted a univariate analysis of these six measurements expressed as percentages of SL or HL (characters 4 and 5 of HL and others of SL) comparing *S. longianalis* with each of *S. macrops* and *S. wui*. All of them showed significant differences (t-test) in mean values of the indexes. However, only two characters (5 and 13) in *S. longianalis* were found to have a gap in their distributions of indexes compared with *S. wui* and *S. macrops*. Apparently, both are useful characters for identification of *S. longianalis*. It is distinct from *S. macrops* and *S. wui* in having a smaller eye (diameter 27.1-31.6 % of HL vs. 32.1-39.4) and a longer anal-fin base (length 27.0- 31.1% SL vs. 21.3-26.8). Three other characters (20, 29 and 30) in *S. longianalis* overlapped in their distributions of indexes compared with *S. macrops* and *S. wui*. Nevertheless, the mean value of the index was shorter in *S. longianalis* for character 20. This means that *S. longianalis* has a shorter distance from the pectoral- to pelvic-fin insertion than both *S. macrops* and *S. wui*. Our examination showed that *S. longianalis* has a depressed pectoral fin reaching to or slightly beyond the pelvic-fin insertion (vs. not reaching), by which it can be distinguish from both *S. wui* and *S. macrops*. The mean values of the indexes were higher in *S. longianalis* for characters 29 and 30, indicating that it has a more forward positioned anal-fin origin compared with both *S. macrops* and *S. wui*. Our observation confirmed that the anal-fin origin in *S. longianalis* is vertically opposite to or slightly in advance of the posterior end of dorsal-fin base (vs. far behind), a character easily used to distinguish it from *S. wui* and *S. macrops*.

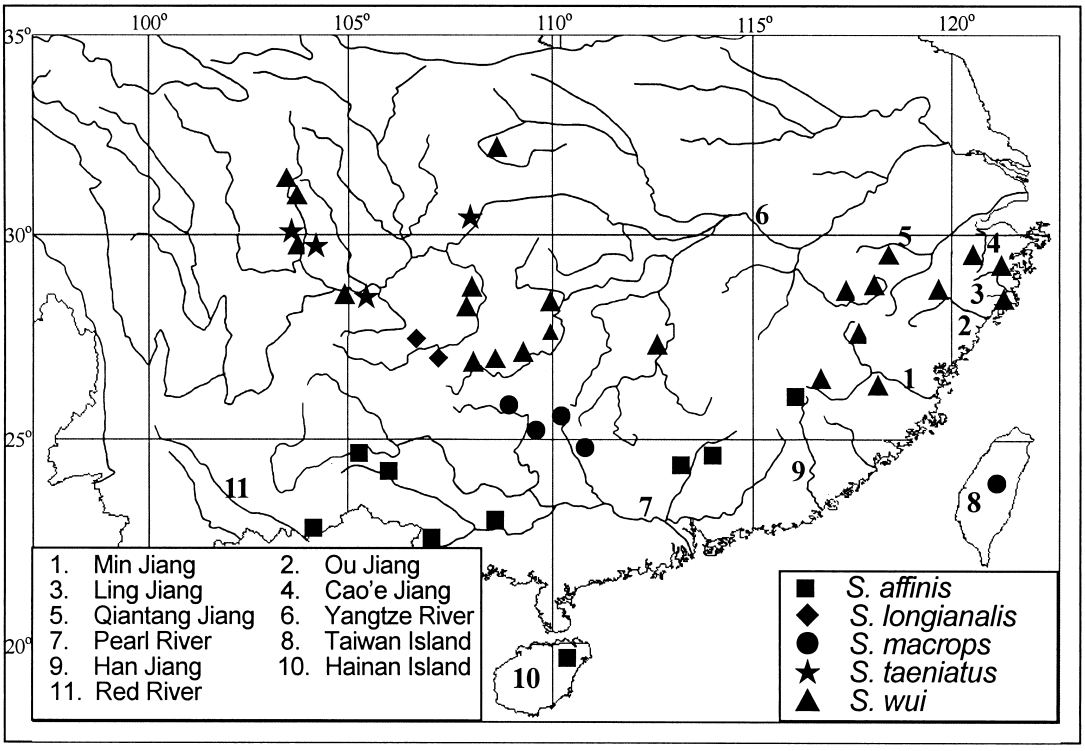


Fig. 3. Map showing the distribution of the Chinese *Sinibrama* species.

Table 3. Loadings for each morphometric measurement on the first three principal components.

| Characters | PC1 | PC2 | PC3 |
|---|---|---|---|
| 1 | .993 | .046 | .028 |
| 2 | .955 | -.158 | -.201 |
| 3 | .972 | .160 | .117 |
| 4 | .903 | **.331** | .067 |
| 5 | .916 | **.476** | .078 |
| 6 | .946 | .132 | -.021 |
| 7 | .918 | -.119 | .183 |
| 8 | .976 | -.029 | -.052 |
| 9 | .936 | -.214 | .149 |
| 10 | .954 | -.091 | .209 |
| 11 | .948 | -.134 | .204 |
| 12 | .921 | -.064 | .243 |
| 13 | .929 | **-.307** | .031 |
| 14 | .950 | .176 | .174 |
| 15 | .971 | .153 | .104 |
| 16 | .964 | .179 | -.095 |
| 17 | .976 | .016 | .005 |
| 18 | .961 | .201 | -.138 |
| 19 | .989 | -.049 | -.082 |
| 20 | .905 | **.265** | -.184 |
| 21 | .951 | -.190 | -.193 |
| 22 | .952 | .094 | -.084 |
| 23 | .973 | -.064 | -.186 |
| 24 | .959 | -.204 | -.145 |
| 25 | .920 | .159 | -.080 |
| 26 | .949 | -.185 | -.197 |
| 27 | .969 | .012 | -.024 |
| 28 | .980 | .010 | -.043 |
| 29 | .961 | **-.246** | .051 |
| 30 | .942 | **-.272** | .083 |
| 31 | .975 | .006 | .035 |
| Proportion of total variance explained | 89.7% | 3.5% | 1.7% |

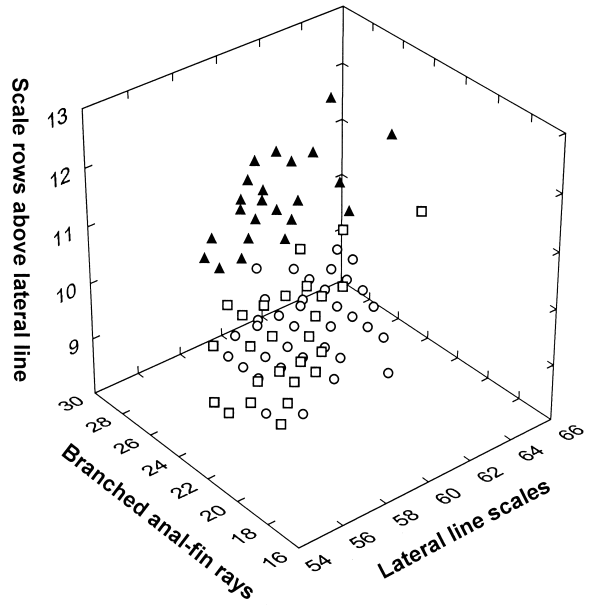


Fig. 4. Three-dimensional distribution of the numbers of lateral line scales, scale rows above lateral line and branched rays in the anal fin of three species in *Sinibrama*. *S. longianalis* (▲); *S. macrops* (□); *S. wui* (O).

***Comparative material.*** **–** *Sinibrama wui*: IHB 74VI1396-9, 74VI1340-5, 10 ex., 92.9-146.2 mm SL, Min Jiang in Ninghua, Fujian. IHB 74VI2726, 74VI723-4, 3 ex., 101.9-109.4 mm SL, Min Jiang in Jian'ou, Fujiang. IHB 825185, 825042, 2 ex., 107.7-136.4, Min Jiang, Fujian. IHB 574181-2, 2 ex.,110.0-116.4 mm SL, Min Jiang in Nanping, Fujian. IHB 74VI2459-62, 4 ex., 79.5-132.0 mm SL, Min Jiang in Jianyan, Fujian. IHB 74IX4201-4, 74IX 4206-13, 12 ex., 91.6 -127.4 mm SL, Ou Jiang in Lishui, Zhejiang. IHB 74IX4111, 74IX4113-9, 8 ex., 112.5-157.2 mm SL, Ling Jiang in Linhai, Zhejiang. IHB 74IX3946-8, 74IX3964-8, 74IX3950, 9 ex., 81.2- 124.0 mm SL, Cao'e Jiang in Chenxian, Zhejiang. IHB 74IX3502-4, 3 ex., 70.5 -79.5 mm SL, Ou Jiang in Jingyun, Zhejiang. IHB 74IX4644, 74IX 4482-3, 74IX4485-9, 8 ex., 100.2-166.5 mm SL, Ling Jiang in Xianju, Zhejiang. IHB 74IX3285-6, 2 ex., 130.8-132.4 mm SL, Ling Jiang in Tiantai, Zhejiang. IHB 90IV1635-6, 90IV1632, 3 ex., 98.4-127.2 mm SL, Xin Jiang in Guangfeng, Jiangxi. IHB 90IV0192-3, 90IV0197, 90IV0201, 90IV0204, 5 ex., 94.4- 129.8 mm SL, Xin Jiang in Yujiang, Jiangxi. IHB 90IV0658-9, 2 ex., 102.6-107.2 mm SL, Xin Jiang in Guiqi Jiangxi. IHB 90IV0776-8, 3 ex., 112.7-125.6 mm SL, Xin Jiang in Yiyang, Jiangxi. IHB 8840938, 8840940-4, 5 ex.,102.6 -140. 6 mm SL, Yuan Jiang in Tongren, Guizhou. IHB 89VII2089-90, 593885, 593742, 593735, 5 ex., 119.7 -166.0 mm SL, Yuan Jiang in Yuanling, Hunan. IHB 89VII337-8, 89VII2335, 3 ex., 94.1-105.2 mm SL, Yuan Jiang in Luxi, Hunan. IHB 8840232-3, 8840235, 3

ex., 95.6-118. 7 mm SL, Yuan Jiang in Mayang, Hunan. IHB 8840007-9, 8840015, 8840013, 5 ex., 86.0- 102.7 mm SL, Yuan Jiang in Jishou, Hunan. IHB 800754, 1 ex., 54.5 mm SL, Wu Jiang in Sinan, Guizhou. IHB 0209001, 0209005-6, 0209009, 0209012-7, 0209019, 0209021-2, 0209025, 14 ex., 103.5- 124.6 mm SL, Xin'an Jiang in Tunxi, Anhui.

*Sinibrama macrops*: uncatalogued, 3 ex., 104.6 -144.4 mm SL, Taiwan. IHB 73IV2025, 73X2151, 74 XII1445-7, 754961, 81X0581, 81XI4732-5, 11 ex., 89.2 - 160.2 mm SL, Pearl River in Rong'an, Guangxi. IHB 87V881-2, 87V871-9, 11 ex., 108.5-130.9 mm SL, Pearl River in Yongjiang, Guizhou. IHB 83V0583, 1 ex., 121.3 mm SL, Pearl River in Rongshui, Guangxi.

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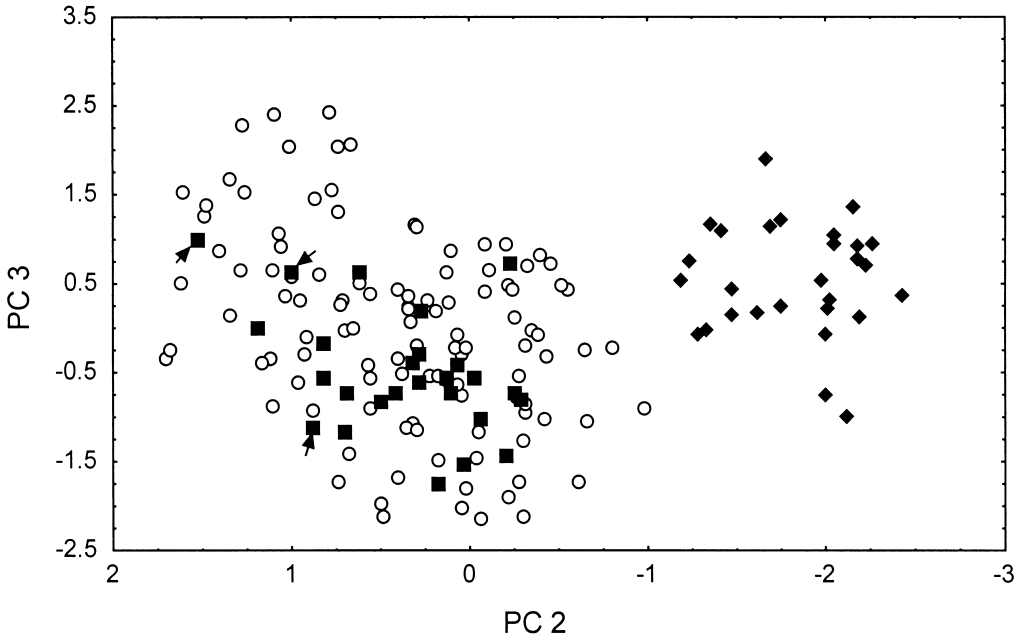


Fig. 5. Scatterplots on scores of the first and second principal component for all specimens of three species in *Sinibrama*: *S. longianalis* (▲); *S. macrops* (■); *S. wui* (O). Arrow indicating the specimens from Taiwan.

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