

***Schistura megalodon* species nova, a new river loach from the Irrawaddy basin in Dehong, Yunnan, China (Teleostei: Cypriniformes: Nemacheilidae)**

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Abstract: A new species of river loach, *Schistura megalodon* sp. nov., is described from the Irrawaddy basin in Yingjiang County, Dehong Autonomous Prefecture, Yunnan Province, China. The following combination of diagnostic characters serve to distinguish it from all other congeners in the given zoogeographical region: a large processus dentiformes in the upper jaw, a short pre-anus length of 65.4%–66.3% of SL, long paired fins (pectoral: 20.8%–24.2% of SL; pelvic: 17.9%–20.6% of SL), a wide body of 9.7%–11.3% of SL at anal fin origin, an incomplete lateral line, the absence of an orbital lobe, and a broad and distinct basicaudal bar with forward extensions.

Keywords: *Schistura megalodon*; Irrawaddy; Dehong; Yunnan

The Dehong Dai and Jingpo Autonomous Prefecture is situated at the westernmost corner of China's Yunnan Province and shares a border with Myanmar's Kachin State. This area is quasi-solely drained by the Irrawaddy River, also known as Ayeyarwady River, except for its southeastern corner which lies in the watershed of the Salween River. Yingjiang County as the largest of five counties stretches over the northern half of the prefecture. It has various climatic zones from temperate to tropical with altitudes ranging from 210 to 3 404 m (Wikipedia, 2014). The region along its border with Myanmar is inhabited by people of the ethnic minorities Jingpo and Lisu.

Examination of a jar of fishes in the collection room of the Kunming Institute of Zoology (KIZ), Chinese Academy of Science, from rivers around Tongbiguan town in Yingjiang County prompted an ichthyofaunistic survey to western Dehong. The survey yielded inter alia a lot of four specimens of a *Schistura* species that was compared with all congeners reported from the Irrawaddy. Nemacheilid loaches reported from the northeastern Irrawaddy are *Schistura sikmaiensis* (Hora, 1921), *S. vinciguerrae* (Hora, 1935), *S. polytaenia* (Zhu, 1982), *S. yingjiangensis* (Zhu, 1982), and *S. malaisei*

Kottelat, 1990. The taxon *Nemacheilus putaoensis* Rendahl, (1948) is considered a junior synonym of *S. sikmaiensis* (see Kottelat, 1990:208; 2012:118). In addition, the concerned lot was compared with affine species from neighboring watersheds. The concerned specimens turned out to be a distinct species which is, scientifically described herein.

MATERIALS AND METHODS

Meristics, morphometrics and related terminology follow explanations given in Kottelat (1990). Terminology of cephalic sensory system differs in otic canal for 'infraorbital canal A1'. Lateral head length excludes opercular membrane. Eye diameter is measured horizontally. Ultimate and penultimate rays of the dorsal and anal fin that share the same pterygiophore are counted as one. Principal caudal rays are counted upper lobe plus lower lobe including unbranched rays. The widely used term 'suborbital flap' for the protuberance of the lateral ethmoid in some species of nemacheilid loach is

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misleading. This feature is neither located exactly suborbital - anteroinferior would be a better fit - nor it is proved movable as the term 'flap' anticipates. It is therefore herein replaced by the term 'orbital lobe'.

Measurements are taken point to point with a caliper and recorded to nearest 0.1 mm. Regional squamation densities and scale types were examined using a monocular Fenglin XSP-06 (50–200 times magnification).

Lateral and abdominal radiographs (x-rays) of the specimen were taken by a Kubtec Xpert 80 and used to count vertebrae and fin rays. Vertebral counts and associated terminology follow Clothier (1950) and Arratia et al (2010); the terminal compound centrum supporting the hypural series is counted as one vertebra. In addition, radiographs were used to noninvasively measure the width of the Weberian apparatus. It is measured radially at the center of the gas bladders over the entire complex.

Location coordinates including altitudes were determined using a Global Positioning System (GPS) Garmin handheld device.

Type series material was preserved in the field using a 10% formalin solution and after eight days transferred into 90% industrial ethanol. It is placed in the Kunming Institute of Zoology (KIZ), Chinese Academy of Sciences, Kunming, China.

Morphometrics and meristics of comparative species are from Kottelat (1990) and Zhu (1989).

Schistura megalodon species nova (Figures 1–6)



Figure 1 *Schistura megalodon* sp. nov.
Holotype, KIZ 2014001456, 40.7 mm SL, lateral, dorsal, ventral view.



Figure 2 *Schistura megalodon* sp. nov.
Holotype, KIZ 2014001456, life coloration.

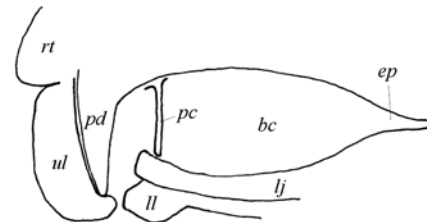


Figure 3 *Schistura megalodon* sp. nov.

Buccal enclosure, mouth closed, schematic depiction: bc, buccal cavity; ep, esophagus; lj, lower jaw; ll, lower lip; pc, palatal curtain; pd, processus dentiformes; rt, rostrum; ul, upper lip.



Figure 4 *Schistura megalodon* sp. nov.
Holotype, KIZ 2014001456, head, ventral view, scale bar: 1 mm.

Type series material

Holotype: KIZ 2014001456, 40.7 mm SL; Erganyahe River, Jieyanghe River subbasin, Irrawaddy basin, close to Erganya village, East of Tongbiguan Nature National Reserve, West of Tongbiguan town, Yingjiang County, Dehong Autonomous Prefecture, Yunnan, China; N24°36', E97°36', 1323 m above sea level; collected by M. Endruweit & ZY. Sha, 2014-01-28.

Paratypes: KIZ 2014001457, 3 ex., 33–41.7 mm SL; KIZ 2014001458 with an opened visceral cavity; paratypes collected with the holotype.

Diagnosis

Key diagnostic characters of *Schistura megalodon* are a large processus dentiformes in the upper jaw, a

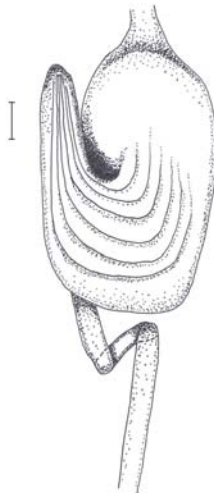


Figure 5 *Schistura megalodon* sp. nov.

Paratype, KIZ 2014001458, gastrointestinal tract, ventral view, scale bar: 1 mm.

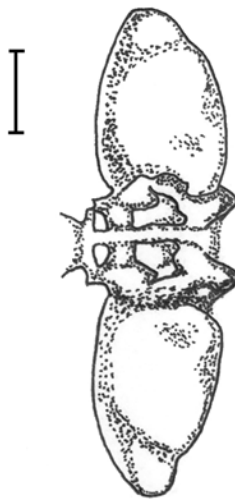


Figure 6 *Schistura megalodon* sp. nov.

Holotype, KIZ 2014001456, gas bladder complex, ventral view, scale bar: 1 mm.

short pre-anus length of 65.4%–66.3% of SL, long paired fins (pectoral: 20.8%–24.2% of SL; pelvic: 17.9%–20.6% of SL), a wide body of 9.7%–11.3% of SL at anal fin origin, an incomplete lateral line, the absence of an orbital lobe, and a broad and distinct basicaudal bar with forward extensions.

Description

Body compact, cylindrical, posteriorly compressed with a short pre-pelvic length (51.3%–52.1% of SL), a short pre-anus length (65.4%–66.3% of SL), and a short pre-anal length (75.5%–78.2% of SL); body height nearly constant from nape to caudal fin base, slightly

deeper in front of dorsal fin (14.7%–16.7% of SL); body wide (at dorsal fin origin 13.2%–15.3% of SL; at A origin 9.7%–11.3%). Caudal peduncle deep (13%–14% of SL) and long (16.4%–17.5% of SL), its length-depth ratio being 1.23–1.33; crests absent.

Head moderately wide (max. 16.1%–17.5% of SL, at nares 10.3%–11.5%: 68.8%–71.6% of lateral HL) and slightly depressed (height at eye 11.1%–11.8% of SL; at nape 12.6%–14.4% of SL, 91.7%–107% of lateral HL). Eye located dorso-laterally, in large specimens (KIZ 2014001456, 40.7 mm SL; KIZ 2014001457, 41.7 mm SL) conspicuously more dorsally; eye small (18.1%–18.8% of dorsal HL); interorbital width moderate (31%–40% of dorsal HL); ratio interorbital width in eye diameter large (1.69–2.12); eyes not visible when viewed ventrally. Orbital lobe absent. Nares situated anterodorsally to eye, immediately next to each other; anterior nostril is located at the outlet of a valve-like tube. Snout blunt; its dorsal profile convex. Two pairs of rostral and one pair of maxillary barbels, singly rooted. When stretched inner rostral barbel does not reach anterior rim of eye, outer rostral barbel reaches midline through eye, maxillary barbel exceeds posterior rim of eye. Mouth inferior and moderately arched (ratio width to length: 1.71–2); upper jaw with large, pointed processus dentiformes at symphysis; lower jaw gutter shaped and notched at symphysis when viewed ventrally. Processus dentiformes reaches over lower jaw when mouth is closed. A thin, vertical palatal curtain (Figure 3) shortly posterior to the tip of the lower jaw arranges a buccal enclosure, its distal edge is gutter shaped following the shape of lower jaw at the given position. Lips moderately thick, furrowed; upper lip axially vertically enlarged to muffle processus dentiformes, axially slightly notched; lower lip notched centrally, not forming lateral triangular pads, each side medially with about four lobes separated by furrows (Figure 4). Rostral, labial groove continuous and very deep; labial groove centrally discontinuous around lower lip.

Body densely scaled, between pectoral fin bases sparsely scaled with naked patches. Scales minute, cycloid, imbricate. Head not scaled. Lateral line incomplete, to below D base; approximately 35–40 pored scales. Cephalic sensory system well developed; supra-temporal and otic canals with three pores each, preo-perculo-mandibular canal with 10 pores, supraorbital canal with 8–9 pores, and infraorbital canal with 10–11 pores. An additional, well visible, short canal

of seven pores commences from the upper lip and runs nearly parallel to the infraorbital canal before they merge at the anterior rim of the eye. Infraorbital canal from rostrum to posterior rim of eye and anteriormost three pores of preoperculo-mandibular canal situated on (fixation-induced) elevated ridges.

A short esophagus leads into a comparatively large stomach; stomach simple, sac-like, u-shaped, multiply ridged, nearly horizontally arranged, its posterior wall does not reach tip of pectoral fin, ventrally fully muffled by a thin layer of spleen, outlet located anteriorly on the right side. Intestine straight with two loops in the central section; upper loop does not reach wall of stomach (Figure 5). Peritoneum hyaline with plenty of silver speckles accumulated at visceral arch.

Vertebral column with 4+(13–14) abdominal and 19 caudal vertebrae. Weberian apparatus spreads over from the atlas to the fourth vertebra; gas bladder complex (Figure 6) manubrium shaped with a slight median commissure, massive, transversely arranged, located superior to the second and third vertebra, wide (ratio to interorbital width is 1.2–1.46); gas bladders paired, isodiametric, ovoid, ossified; secondary gas bladder absent. Urostyletic centrum with three lower hypural plates directly detached and three upper hypural plates detached via a long pleurostylus. All principal caudal fin rays are supported via this structure. Dorsally there are 6–7 rudimentary rays along the posterior part of the caudal peduncle associated to neural spines of preural centra 2 to 4 and one epural; ventrally 4–5 rudimentary rays are associated to hemal spines of preural centra 2 and 3.

Fin formula: D iii, 7; P i, 9; V i, 6–7; A iii, 5; C i, 9+8, i. Paired fins comparatively long (P: 20.8%–24.2% of SL; V: 17.9%–20.6% of SL). Pectoral fin horizontally inserted, falcate; tip reaches anteriormost tip of ligaments of pelvic girdle, but does not reach origin of pelvic fin; in KIZ 2014001457 first ray of pectoral fin thickened and ventrally flattened. Pelvic fin rays surpass anus by far, but do not reach origin of anal fin; origin of pelvic fin at vertebra 4+11; suprapelvic lobe well developed, posteriorly free. Origin of anal fin at vertebra 4+21. Distal margin of dorsal fin slightly convex; insertion of dorsal fin at vertebra 4+11; insertion in larger specimens (KIZ 2014001456–7, 40.7–41.7 mm SL) slightly behind pelvic fin origin, in smaller specimens (KIZ 2014001458–9, 33–34.1 mm SL) slightly in front of pelvic fin origin. Caudal fin slightly emarginated, almost truncate, lobes equally long, tips widely rounded.

An overview of selected comparative morphometrics is given in Table 1.

Coloration of preserved specimens

Body with 10–12 dark brown bars on light brown ground coloration; usually four predorsal, 2–3 subdorsal, and 4–5 postdorsal bars; predorsal bars 2–3 times wider, more irregular and inconspicuous than subdorsal and postdorsal bars. Humeral spot inconspicuous, superimposed to first and second bar. Predorsal bars more conspicuous in smaller specimens (KIZ 2014001458–9). All bars interconnected over dorsum, not connected at ventral extremity, except last bar between anal fin and basicaudal bar. Basicaudal bar conspicuously black, wide, straight, with forward directed extensions at both extremities; in some specimens (KIZ 2014001457) additionally with backward directed extensions. Interspace between last body bar and basicaudal bar conspicuously light gray. Abdomen in front of anus light beige; posterior to anus light gray. Top of head with dark gray markings on light gray ground coloration; head ventrally light beige. Tip of anterior nostril tube black. Lower lip with a peculiar, dark gray mark on each side in larger specimens (see Figure 3).

Dorsal fin with large black anterobasal spot reaching onto membrane between first and second branched fin ray followed by a dark brown basal band over the entire length of the fin base; a median band along rays; membranes hyaline. Caudal fin basally with black bar as described ranging far onto the fin; a transverse gray band at around halfway and another slightly lighter band submarginally. Pectoral, pelvic and anal fins hyaline with a whitish-yellowish hue.

Life coloration

Basically identical to the coloration of preserved specimens with differences as follows: ground coloration light brown to purple; the first four pectoral fin rays yellow; unbranched and first two unbranched dorsal fin rays red distally; unbranched and uppermost two unbranched caudal fin rays of the upper lobe distally red.

Etymology

The specific epithet *megalodon* is a compound word borrowed from ancient Greek: μέγας for 'big' and 'οδούς for 'tooth'; an allusion to the large processus dentiformes of the upper jaw; a noun in nominative, indeclinable.

Table 1 Comparative morphometrics of *Schistura megalodon* sp. nov. and of related species (values from Kottelat, 1990)

	<i>Schistura megalodon</i> sp. nov.					<i>S. malaisei</i>	<i>S. vinciguerrae</i>					<i>S. sikmaiensis</i>
	types series; n=4						n=10					
	Holotype	Mean	Min	Max	SD		Holotype	Mean	Min	Max	SD	
SL [mm]	40.7		33.0	41.7		45.9		40.3	65.2		58.7	
In % of SL												
Dorsal HL	22.1	21.6	21.1	22.1	0.41	20	19.5	18.0	20.3	0.76	21.1	
Lateral HL	24.8	23.9	22.4	24.8	1.13	24.6	20.3	18.3	21.3	0.87	24.5	
Pre-dorsal length	53.6	53.2	52.1	54.2	0.90	52.3	51.4	48.9	52.6	1.09	53.5	
Pre-pelvic length	51.4	51.7	51.3	52.1	0.43	57.1	51.5	49.7	52.6	0.95	58.8	
Pre-anal length	75.7	76.6	75.5	78.2	1.23	79.5	76.1	74.1	77.7	1.00	80.8	
Pre-anus length	66.3	65.9	65.4	66.3	0.39	74.7	68.8	66.8	71.3	1.30	77.8	
Head depth (at eye)	11.3	11.4	11.1	11.8	0.26	11.1	9.9	8.9	10.7	0.50	12.8	
Head depth (at nape)	14.3	13.5	12.6	14.4	0.96	12.6	11.9	10.7	13.0	0.61	14.7	
Body depth	16.7	15.6	14.7	16.7	0.92	16.1	18.4	16.1	21.3	1.69	17.6	
Depth caudal peduncle	14.0	13.4	13.0	14.0	0.43	13.5	12.2	11.6	12.6	0.39	12.3	
Length caudal peduncle	17.2	17.0	16.4	17.5	0.48	13.3	15.6	14.6	16.2	0.51	12.6	
Snout length	9.3	8.9	8.2	9.4	0.57	8.7	8.9	8.2	9.7	0.45	9.9	
Head width (at nares)	11.5	10.8	10.3	11.5	0.66	10.7	9.4	8.2	10.1	0.50	11.1	
Maximum head width	17.4	16.8	16.1	17.5	0.80	15.0	14.1	13.1	14.9	0.48	15.0	
Body width (dorsal origin)	14.7	14.2	13.2	15.3	0.99	12.9	13.7	12.3	15.3	0.99	14.0	
Body width (anal origin)	10.8	10.4	9.7	11.3	0.73	8.9	8.7	7.6	9.7	0.64	9.0	
Eye diameter	4.2	4.0	3.8	4.2	0.16	4.6	4.0	3.2	4.5	0.38	3.9	
Interorbital width	8.8	7.8	6.7	8.8	1.10	6.5	7.0	6.3	7.9	0.39	6.1	
Length pelvic fin	17.9	19.2	17.9	20.6	1.20	16.6	18.7	16.9	20.7	1.02	17.2	
Length pectoral fin	21.4	21.9	20.8	24.2	1.59	18.1	22.3	19.6	24.2	1.32	19.3	

Ecology

The type series was obtained from the Erganyahe River (Figure 7). A montane, subtropical biome predominates this region. At the time of visit (late January, 2014, dry season) the stream was approximately 8–10 m wide and 0.3–0.5 m deep over riffles. Water parameter: 12 °C, 20 µs/cm, pH 5.9. The water was clear and running moderately to fast over boulders, rocks, pebbles, sand, and twigs. Aquatic macrophytes were absent. Aside *Schistura megalodon*, there were *Schizothorax malacanthus*, *Devario kakhienensis*, *Exostoma labiatum*, *Misgurnus anguillicaudatus*, and *Channa gachua*.

A full day of fishing just yielded the four specimens that compose the type series. *Schistura megalodon* is regarded as rare. This is in compliance with the statements of locals and Shuwei Liu (KIZ), who spend a



Figure 7 Erganyahe River, type locality of *Schistura megalodon* sp. nov., view northwards, downstream.

full spend a full day fishing at the Erganyahe River close to Erganya village in June 2013. He collected just one specimen that was identified conspecific basing on

photographs. The specimen concerned was not preserved (SW. Liu, pers. comm.).

The large processus dentiformes may be a trophic adaptation. It is hypothesized that it may be used as a tool to detach eggs and other food items from the substratum or it may be used for efficient digging. It is equally well developed in the type specimens and therefore most likely not a sexual dimorphic character.

The dorsal fin migrates backwards during ontogeny in *Schistura megalodon*. Its position relatively to the pelvic fin, thus, proves unsuitable as a diagnostic character. Smaller specimens of *S. megalodon* have the dorsal fin inserted slightly in front of the pelvic fin, while larger specimens have it inserted slightly behind the pelvic fin origin. This is manifested by the predorsal length: the two smaller paratypes (KIZ 2014001458–9, 33–34.1 mm SL) have a predorsal length of 52.1%–52.8 mm SL, the holotype (KIZ 2014001456, 40.7 mm SL) and the largest paratype (KIZ 2014001457, 41.7 mm SL) have a predorsal length of 53.6%–54.2% of SL.

Distribution

Schistura megalodon is only known from the type locality (Figure 8). A few kilometers downstream of the type locality the Erganyahe River marks the borderline between China and Myanmar flowing northwards prior to its influx in the Jieyanghe River. The new species is, thus, expected to occur on Burmese territory as well.

DISCUSSION

Certainly *Schistura megalodon* has been hitherto overlooked by taxonomists working on this group of fishes due to its diminutive size, its rather limited distributional range, its occurrence close in the politically sensitive border region of China and Myanmar and the therefore restricted accessibility, and its absolute scarcity in the habitat.

The palatal curtain in *Schistura megalodon* separates the pharynx into an anteriorly located prebuccal cavity and a posteriorly located buccal chamber. The buccal chamber is quasi sealed by the palatal curtain when the mouth is closed. This morphology reminds of the condition found in member of the genus *Neonoemacheilus* Zhu & Guo, 1985. However, in *Neonoemacheilus* the prebuccal cavity is formed by hypertrophied lips which is not the case in *S. megalodon*. Furthermore, *S. megalodon* does not possess characters diagnostic of *Neonoemacheilus* such as an orbital lobe in males and a

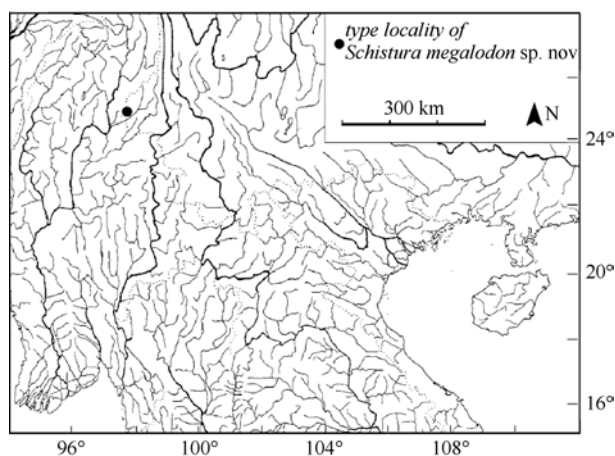


Figure 8 *Schistura megalodon* sp. nov., type locality

complete lateral line. It perfectly fits into the generic description of *Schistura* as provided by Kottelat (1990: 24) and is therefore herein treated as a member thereof.

Phenotypically close to *Schistura megalodon* is *S. cincticauda* (Blyth, 1860) from the Salween basin in Thailand. *Schistura megalodon* differs from *S. cincticauda* in having a smaller size (41.7 mm SL vs. 50 mm SL); a shorter pre-dorsal length (52.1%–54.2% of SL vs. 54.7%–58.8%); a longer caudal peduncle (16.4%–17.5% of SL vs. 12.2%–16.4%); a wider body at anal fin origin (9.7%–11.3% of SL vs. 7.7%–9.4%; 45.1%–52.2% of dorsal HL vs. 34%–45%); a smaller eye diameter (3.8%–4.2% of SL vs. 4.6%–5.7%; 18.1%–18.9% of dorsal HL vs. 21%–27%); suprapelvic lobe present vs. absent; and further differences in the color pattern.

Schistura megalodon is distinguished from *S. malaisei* by a shorter pre-pelvic length (51.3%–52.1% of SL vs. 57.1% of SL in *S. malaisei*); a shorter pre-anus length (65.4%–66.3% of SL vs. 71.1%–74.7%); a longer caudal peduncle (16.4%–17.5% of SL vs. 11.8%–13.3%), a wider head (16.1%–17.5% of SL vs. 15%–15.1%); a wider body (at dorsal fin origin: 13.2%–15.3% of SL vs. 12.9%; at anal fin origin: 9.7%–11.3% of SL vs. 8.9%–9.6%); a longer pelvic fin (17.9%–20.6% of SL vs. 14.7%–16.6%); a longer pectoral fin (20.8%–24.2% of SL vs. 17.6%–18.1%); and a different color pattern. *Schistura malaisei* was described from Putao in northern Myanmar.

Another similar nemacheilid loach described from the Irrawaddy basin in the Manipur State in India is *S. sikmaiensis*. *Schistura megalodon* is readily distinguishable from *S. sikmaiensis* by having iii, 7 dorsal fin rays vs. iv, 8; i, 9 pectoral fin rays vs. 11; lateral incomplete

with 35–40 pored scales vs. complete with 100–110 pored scales; a shorter pre-pelvic length (51.3%–52.1% vs. 58.8%); a shorter pre-anus length (65.4%–66.3% of SL vs. 77.8%); a shorter pre-anal fin (75.5%–78.2% vs. 80.8%); a less deep head (at eye: 11.1%–11.8% vs. 12.8%; at nape: 12.6%–14.4% vs. 14.7%); a less deep body (14.7%–16.7% vs. 17.6%); a deeper and longer caudal peduncle (depth: 13%–14% vs. 12.3%; length: 16.4%–17.5% vs. 12.6%); a shorter snout (8.2%–9.2% vs. 9.9%); a wider head (16.1%–17.5% vs. 15%); a wider body at anal fin origin (9.7%–11.3% vs. 9%); a wider interorbital distance (6.7%–8.8% vs. 6.1%); longer paired fins (pelvic fin: 17.9%–20.6% vs. 17.2%; pectoral fin: 20.8%–24.2% vs. 19.3%); processus dentiformes present vs. absent; and significant differences in color pattern. Kottelat (1990:210) designates the holotype of *Nemacheilus putaoensis* as neotype of *S. sikmaiensis* which makes *N. putaoensis* an objective junior synonym to *S. sikmaiensis*. Zhu (1989:62, Figure 42) lists one specimen of *N. putaoensis* from the Dayingjiang River in Yingjiang County and gives the species' distributional range as Jieyanghe River, the same subbasin from which *S. megalodon* is described. This river is an independent tier one tributary to the Irrawaddy itself and does not belong to the Dayingjiang subbasin. Zhu places *putaoensis* in *Nemacheilus* which actually implies the presence of an orbital lobe in males according to his generic diagnosis (1989:60). Both, the description and the accompanying figure, however, are lacking an orbital lobe. Zhu does not mention a processus dentiformes which fits well to the species' diagnosis.

Schistura vinciguerrae (Figure 9a) was described from Meekalan within the Tenasserim mountain range in southern Myanmar and is reported from the Irrawaddy basin Yingjiang County in Dehong by Kottelat (1990:219) and Zhu (1989:52). *Schistura megalodon* is distinguished from *S. vinciguerrae* by having iii, 7 dorsal fin rays vs. iv, 8–9; i, 9 pectoral fin rays vs. 11–12 in total; lateral incomplete with 35–40 pored scales vs. complete with 84–90 pored scales; a longer head length (dorsally: 21.1%–22.1% of SL vs. 18%–20.3%; laterally: 22.4%–24.8% vs. 18.3%–21.3%); a deeper and wider head (depth at eye: 11.1%–11.8% vs. 8.9%–10.7%; max. width: 16.1%–17.5% vs. 13.1%–14.9%); a shorter pre-anus length (65.4%–66.3% of SL vs. 66.8%–71.3%); a deeper and longer caudal peduncle (depth: 13%–14% vs. 11.6%–12.6%; length: 16.4%–17.5% vs. 14.6%–16.2%); a wider body at anal fin (9.7%–11.3% vs. 7.6%–9.7%), a

smaller maximum size of 41.7 mm SL vs. 71 mm SL; and a far different color pattern.



Figure 9 a. *Schistura vinciguerrae*, KIZ2012004064, 42.6 mm SL, Tanjiazhai, Tengchong County, Longchuanjiang River subbasin; b. *Schistura polytaenia*, KIZ2012004077, 49 mm SL, male, Mahei village, Tengchong County, Dayingjiang River subbasin.

Zhu (1982:107) describes *Schistura yingjiangensis* (as *Nemacheilus yingjiangensis*) from the Dayingjiang River in Yingjiang County and gives its distributional range as Dayingjiang and Longchuanjiang rivers (1989:65). *Schistura megalodon* is distinguished from *S. yingjiangensis* by i, 9 pectoral fin rays vs. i, 10; lateral line incomplete vs. complete; orbital lobe absent vs. present; pelvic clearly surpasses anus vs. does not surpass; smaller maximum size (41.7 mm SL vs. 61 mm SL); and a longer pre-dorsal length (52.1%–54.2% of SL vs. 44%–50%). In *S. megalodon* the lateral HL is 4.03–4.46 times in SL vs. 4.5–5 times; the eye diameter 1.69–2.12 times in interorbital width vs. 1.4–1.5 times; the eye diameter 5.69–6.15 times in lateral HL vs. 4.2–5 times; and interorbital width 2.81–3.36 times in lateral HL vs. 3.7–4 times. Besides, there are significant differences in the color pattern.

Schistura megalodon is easily distinguished from *S. polytaenia* (Figure 9b) described from the Longchuanjiang River in having constant 17 (9+8) branched caudal fin rays vs. 15–16; vertebrae 4+(32–33) vs. 4+(29–31); lateral line incomplete vs. complete; orbital lobe in males absent vs. present; pelvic fin clearly surpasses anus vs. does not reach; a broad and deeply black, conspicuous basicaudal bar with forward extensions at its extremities vs. short, brown, inconspicuous, does not reach extremities; and a body pattern of 10–12 bars interconnected over the dorsum vs. 18–30 bars and 9–13 saddles along the dorsum. In fact,

the color pattern along the flanks of *S. polytaenia* is highly irregular. It may be more appropriate to define it as mottled rather than barred. This is particularly true in specimens from the Mengjiahe River in Sudian, Yingjiang County.

Another nemacheilid species originally described from upper reaches of the Chaungmagyi River, a left bank, first tier tributary to the Irrawaddy, is the enigmatic *Nemacheilus* (described as *Nemachilus*) *acuticephalus*. Apparently, this species has not been collected since its original description (Hora, 1929). All subsequent authors (inter alia: Kottelat, 1990:97; Talwar & Jhingran, 1992:468) refer to this description. *Schistura megalodon* is distinguished from *N. acuticephalus* in having a broad, straight and distinct basicaudal bar with forward extensions and its extremities vs. a crescent-shaped and pale basicaudal bar not reaching extremities; 10 pectoral fin rays vs. 9; 9+8 branched caudal fin rays vs. 8+8 (taken from Hora, plate 14; see Kottelat); pelvic fin surpasses anus vs. not reaching anus; crests on caudal peduncle absent vs. prominent crests supported by rudimentary rays on the dorsal and ventral extremity of the caudal peduncle; caudal fin slightly emarginate vs. forked. Besides, there are differences in the color pattern. Kottelat placed *N. acuticephalus* in *Schistura*. This generic allocation seems to be incorrect. The prominent caudal peduncle crests, which are in *N. acuticephalus* at least dorsally widely supported by procurrent rudimentary rays, are diagnostic for members of *Homatula*. Its mottled color pattern is also typical of members of *Homatula*. However, its small size of just 40 mm TL and the hitherto absence of this genus in the Irrawaddy basin act contradictorily. In order to finally access the generic allocation of *N. acuticephalus* an in depth examination of either the type series or a large batch of topotypic fresh material is recommend. Until this question is satisfactorily resolved the taxon is tentatively treated as *S. acuticephala* following Kottelat (2012:104).

Key to the species of the genus *Schistura* reported

or expected to occur in the Irrawaddy basin in China:

1. Orbital lobe in males present; lateral line complete2
1. Orbital lobe in males absent3
2. Eight branched dorsal fin rays; barred color pattern with postdorsal bars wider*Schistura yingjiangensis*
2. Seven branched dorsal fin rays; mottled color pattern.....*S. polytaenia*
3. Prominent crests supported by rudimentary rays on the dorsal and ventral extremity of the caudal peduncle; forked caudal fin.....*S. acuticephala*
3. Caudal peduncle crests absent4
4. Processus dentiformis in upper jaw absent; median notch in lower jaw absent; pre-anus length 77.8% of SL; lateral line complete.....*S. sikmaiensis*
4. Processus dentiformis in upper jaw present5
5. Median notch in lower jaw absent; pre-anus length 66.8%–71.3% of SL; lateral line complete*S. vinciguerrae*
5. Median notch in lower jaw present; lateral line incomplete.....6
6. Pre-anus length 71.1%–74.7% of SL; color pattern of irregular bars, in particular over the dorsum*S. malaisei*
6. Pre-anus length 65.4%–66.3% of SL; color pattern of regular bars*S. megalodon* sp. nov.

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References

- Arratia G, Schulze HP, Wilson MVH. 2010. Mesozoic Fishes 5-Global Diversity and Evolution. *Verlag Dr. Friedrich Pfeil*, Munich, 560.
- Blyth E. 1860. Report on some fishes received chiefly from the Sitang River and its tributary streams, Tenasserim Provinces. *Journal of the Asiatic Society of Bengal*, **29**(2): 138-174.
- Clothier CR. 1950. A key to some Southern California fishes, based on vertebral characters. California Department of Fish and Game, Fish Bulletin, No. 79. Bureau of Marine Fisheries, 88.
- Hora SL. 1921. Fish and fisheries of Manipur with some observations on those of the Naga Hills. *Records of the Indian Museum, Calcutta*, **22**: 165-214.
- Hora SL. 1929. Notes on fishes in the Indian Museum. XVII. Loaches

- of the genus *Nemachilus* from Burma. *Records of the Indian Museum, Calcutta*, **31**: 311-334.
- Hora SL. 1935. Notes on fishes in the Indian Museum. XXIV. Loaches of the genus *Nemachilus* from eastern Himalayas, with the description of a new species from Burma and Siam. *Records of the Indian Museum, Calcutta*, 37(Pt1): 49-67, Pl. 1.
- Kottelat M. 1990. Indochinese Nemacheilines. Munich: Verlag Dr. Friedrich Pfeil, 262.
- Kottelat M. 2012. Conspectus cobitidum: An inventory of the loaches of the world (Teleostei: Cypriniformes: Cobitoidei). *The Raffles Bulletin of Zoology*, (S, 26): 1-199.
- Rendahl H. 1948. Die Süßwasserfische Birmas. I. Die Familie Cobitidae. *Arkiv för Zoologi*, **40A**(7): 1-116. (in German)
- Talwar PK, Jhingran AG. 1992. Inland fishes of India and adjacent countries. Volume 1. New Delhi, Bombay, Calcutta: Oxford & IBH Publishing Co. 541.
- Wikipedia contr. 2014. Yingjiang County. Published by Wikipedia, The Free Encyclopedia. Available from: http://en.wikipedia.org/wiki/Yingjiang_County. (accessed: 2014-02-26)
- Zhu SQ. 1982. Five new species of fishes of the genus *Nemachilus* from Yunnan Province, China. *Acta Zootaxonomica Sinica*, **7**(1): 104-111. (in Chinese)
- Zhu SQ. 1989. The loaches of the subfamily Nemacheilinae in China. Nanjing: Jiangsu Science and Technology Publishing House, 150. (in Chinese)
- Zhu SQ, Guo QZ. 1985. Descriptions of a new genus and a new species of noemacheiline loaches from Yunnan Province, China (Cypriniformes: Cobitidae). *Acta Zootaxonomica Sinica*, **10**(3): 321-325.