

SYSTEMATIC REVISION OF *PANGASIUS POLYURANODON*
(SILURIFORMES, PANGASIIDAE)
WITH DESCRIPTION OF TWO NEW SPECIES

by

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ABSTRACT. - A detailed morphological study is performed on the widespread species *Pangasius polyuranodon* Bleeker, 1852 and reveals the existence of two new species. *Pangasius mahakamensis* sp. n. is described from the Mahakam River (East Kalimantan, Indonesia) while *Pangasius elongatus* sp. n. is described from Thailand and Vietnam. These new species which belong to the subgenus *Pangasius* (*Pangasius*) are morphologically close to *P. polyuranodon*. *P. mahakamensis* is recognised from the other species of this subgenus by the unique combination of the following characters: short caudal peduncle (14.0-16.7 %SL); large eye (diameter: 22.8-29.4 %HL); short mandibular barbel (its length: 19.6-45.8 %HL); and short predorsal length (30.1-32.7 %SL). *Pangasius elongatus* is characterised by the unique combination of the following characters: an elongated body with a moderate predorsal length (30.1-33.9 %SL), a short snout length (35.2-42.8 %HL), a long caudal peduncle (17.6-21.4 %SL), short mandibular barbels (length: 10.4-39.3 %HL) and large eyes (19.2-25.5 %HL). The results also show that *Pangasius polyuranodon sensu stricto* only consists of populations from Sumatra, Central and West Kalimantan (Indonesia) and Sarawak (Malaysia). A new diagnosis is given for this species.

RÉSUMÉ. - Révision systématique de *Pangasius polyuranodon* (Siluriformes, Pangasiidae) et description de deux nouvelles espèces.

Des études menées sur la variabilité morphologique de plusieurs populations de *Pangasius polyuranodon* ont révélé d'importants niveaux de différenciation chez cette espèce à large répartition. Deux espèces nouvelles sont décrites : *Pangasius mahakamensis* sp. n., endémique de la rivière Mahakam (Kalimantan Est, Indonésie) et *Pangasius elongatus* sp. n., distribué en Thaïlande et au Vietnam. Ces deux espèces qui appartiennent au sous-genre *P. (Pangasius)* sont morphologiquement proches de *Pangasius polyuranodon*. *P. mahakamensis* se distingue des autres espèces du sous-genre par la combinaison unique des caractères suivants : un pédoncule caudal court (14,0-16,7 %SL) ; des yeux de gros diamètre (22,8-29,4 %HL), une distance prédorsale courte (30,1-32,7 %SL) et des barbillons mandibulaires relativement courts (19,6-45,8 %HL). *Pangasius elongatus* se caractérise par la combinaison unique d'un corps allongé avec une distance pré-dorsale courte (30,1-33,9 %SL), un pédoncule caudal long (17,6-21,4 %SL), des barbillons mandibulaires courts (10,4-39,3 %HL) et des yeux de grosse taille (19,2-25,5 %HL). Ces résultats montrent finalement que *Pangasius polyuranodon sensu stricto* est uniquement distribué sur les îles de Sumatra et de Bornéo (Sarawak et régions de Kalimantan Centre et Ouest). Une nouvelle diagnose pour cette espèce est également proposée.

Key words. - Pangasiidae - *Pangasius mahakamensis* - *P. elongatus* - Indonesia - Thailand - Vietnam - New species - Taxonomy - Morphology.

Roberts and Vidthayanon (1991) in a systematic revision of Pangasiidae, a tropical Asian catfish family, recognised two genera: *Helicophagus* Bleeker, 1858 with two valid species and *Pangasius* Valenciennes, 1840 with 19 valid species. Recently, three new species were added in the genus *Pangasius* (Pouyaud *et al.*, 1999; Roberts, 1999; Pouyaud and Teugels, 2000) and another one was described in the genus *Helicophagus* (Ng and Kottelat, 2000). Following Vidthayanon (1993) and Vidthayanon and Roongthongbaisuree (1993), *Pangasius* can be divided in four subgenera: (1) *Pangasius* (*Neopangasius*) Popta, 1904

with palatine teeth in a single large patch and with high vertebral counts; four species, endemic to Borneo, are included in this subgenus: *P. humeralis* Roberts, 1989, *P. kinabatanganensis* Roberts & Vidthayanon, 1991, *P. lithotoma* Roberts, 1989 and *P. nieuwenhuisii* Popta, 1904; (2) *Pangasius* (*Pteropangasius*) Fowler, 1937 with 4 lobes in the swimbladder and multiple segments in the last lobe includes *P. pleurotaenia* Sauvage, 1878 and *P. micronema* Bleeker, 1847; (3) *Pangasius* (*Pangasianodon*) Chevey, 1930 lacking teeth in adults, lacking mandibular barbels and with a single lobed swimbladder and including *P. gigas*

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Chevey, 1930 and *P. hypophthalmus* (Sauvage, 1878); and (4) *Pangasius (Pangasius)* Valenciennes, 1840, for which no diagnostic features are given and including all remaining species. Molecular phylogenies performed by Pouyaud *et al.* (2000) confirm the subgeneric classification proposed for *Pangasius* except for *P. (Neopangasius)*, which is polyphyletic and which should be included in *P. (Pangasius)*.

Gustiano *et al.* (in press) in a detailed morphological and molecular analysis on the widespread *Pangasius kunyit* Pouyaud *et al.* (1999), revealed the presence of two new species. On the basis of their mitochondrial phylogeny, they also mentioned an analogous situation for *Pangasius polyuranodon* Bleeker, 1852, another widespread species belonging to the subgenus *P. (Pangasius)* and probably composed of three distinct species.

The objective of the present study was to perform a detailed morphological study on the samples of *Pangasius polyuranodon* genetically analysed by Gustiano *et al.* (in press). Three morphological entities corresponding to the previously identified genetic groups were found within the nominal species *Pangasius polyuranodon*. Two of them are species new to science. Their description is given below; *P. polyuranodon* is also re-described.

MATERIALS AND METHODS

One hundred and sixty seven specimens belonging to the *Pangasius polyuranodon* complex were studied morphologically. They are deposited in the Museum Zoologicum Bogoriense (MZB, Cibinong, Indonesia) and in the Muséum national d'Histoire naturelle (MNHN, Paris, France). Five hundred and fifty seven specimens representing all other *Pangasius (Pangasius)* species except *P. myanmar* Roberts & Vidthayanon, 1991 and *P. bedado* Roberts, 1999 (see below) served as comparative material. The list of comparative material can be requested at the corresponding author's address.

Thirty three point-to-point measurements were made using dial callipers following Pouyaud *et al.* (1999). Two new measurements were added: anterior width of the snout, taken between the anterior nostrils; and posterior width of the snout, taken between the posterior nostrils. The following abbreviations are used: SL, standard length, HL, head length and ED, eye diameter. Body length was measured using a graduated ruler of one meter. Five counts were taken: total number of gill rakers on the first branchial arch, number of dorsal-, anal-, pectoral- and pelvic-fin rays. Morphological observations include the shape of the swimbladder and the shape of palatine and vomerine tooth patches.

The biometrical data were submitted to principal component analysis (PCA) using Statistica. Measurements were

log-transformed before the PCA was run on the covariance matrix (Bookstein *et al.*, 1985). The first factor of this analysis is considered as the size factor and was not considered in order to minimise the effect of size differences between the samples. Missing data were casewise deleted.

RESULTS

As mentioned above, we have compared the specimens from the *Pangasius polyuranodon* complex with all the other known valid species in the *Pangasius (Pangasius)* subgenus except for *P. myanmar* and *P. bedado*. *Pangasius myanmar*, however has a swimbladder confined to the abdominal cavity with the posterior-most chamber rounded posteriorly (Roberts and Vidthayanon, 1991), while in the *P. polyuranodon* complex, the swimbladder is three-chambered, the posterior one extending beyond the abdominal cavity along the anal fin basis. Following Roberts (1999), *Pangasius bedado* is easily distinguished from the *P. polyuranodon* complex by the number of gill rakers on the first branchial arch (31-33 vs. 17-30).

When examining the *P. polyuranodon* complex, we have labelled the populations according to their geographic origin following the genetic groups evidenced in the mitochondrial phylogeny published by Gustiano *et al.* (in press): specimens from East Kalimantan were labelled as POL 1, those from Indochina (Vietnam and Thailand) as POL 2 and those from Sumatra, Central and West Kalimantan (Indonesia) and Sarawak (Malaysia) as POL 3.

A PCA was carried out using 22 log-transformed measurements (excluding total length, standard length, mandibular barbel length, pectoral-, dorsal-, pelvic-fin length, anal fin height, adipose fin shape, body width, eye diameter, width of mouth and shape of palatine tooth plates) taken on 724 *Pangasius (Pangasius)* specimens. The plot of the second and the third factors of this PCA, explaining 1.40 (55%) of the total variation, is given in figure 1. The second factor is defined (in decreasing order of importance) by the anal-fin length, the vomerine tooth plate length, the dorsal spine width and the caudal peduncle length. The third factor is defined by the vomerine tooth plate length, the maxillary barbel length, the vomerine tooth plate width and the caudal peduncle depth. The specimens of the *P. polyuranodon* complex are mostly situated on the negative sectors of both axes. They overlap with the polygon A, which includes holotypes and conspecific material of *P. humeralis* Roberts, 1989, *P. lithostoma* Roberts, 1989, *P. rheophilus* Pouyaud & Teugels, 2000 and specimens of *P. nieuwenhuisii* (Popty, 1904) and *P. kinabatanganensis* Roberts & Vidthayanon, 1991. Interestingly, the PCA also shows the geographic separation of the *P. polyuranodon* samples (see above).

Polygon B, situated on the negative sector of the second

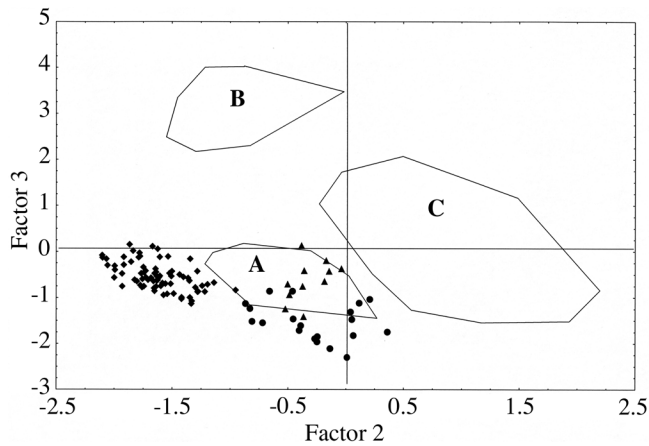


Figure 1. - Plot of the second and the third principal components of a PCA using 22 log-transformed measurements taken on 724 *Pangasius* (*Pangasius*) specimens. A: Polygon including *P. rheophilus*, *P. kinabatanganensis*, *P. humeralis*, *P. nieuwenhuisii*, *P. lithostoma*; B: Polygon including *P. macronema*; C: Polygon including the remaining species of the subgenus *P. (Pangasius)*. ● POL 1: *P. mahakamensis* n. sp.; ▲ POL 2: *P. elongatus* n. sp.; ◆ POL 3: *P. polyuranodon* s.s.

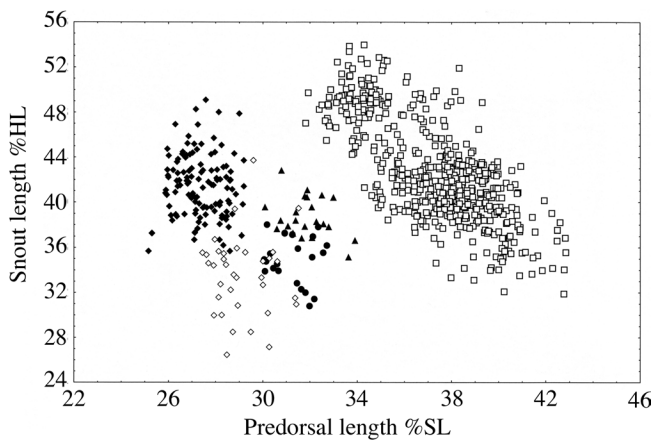


Figure 2. - Scatter plot showing the predorsal length (%SL) in function of the snout length (%HL) for all analysed specimens. ● POL 1: *P. mahakamensis* n. sp.; ▲ POL 2: *P. elongatus* n. sp.; ◆ POL 3: *P. polyuranodon* s.s.; ◇: *P. macronema*; □: the remaining species of the subgenus *P. (Pangasius)*.

factor and on the positive sector of the third factor, represents all the specimens of *Pangasius macronema* Bleeker, 1851. Polygon C, situated mostly on the positive sector of the second factor is composed by the remaining species included in the subgenus *P. (Pangasius)*.

The absence of palatine tooth plates in *P. humeralis*, *P. lithostoma*, *P. nieuwenhuisii* and *P. kinabatanganensis* is the best character for unambiguously distinguishing them from the species included in the *P. polyuranodon* complex.

From *P. rheophilus*, the *P. polyuranodon* complex is easily distinguished by the predorsal length (34.8-37.0 vs. 25.2-33.9 %SL). This character plotted with the snout length also

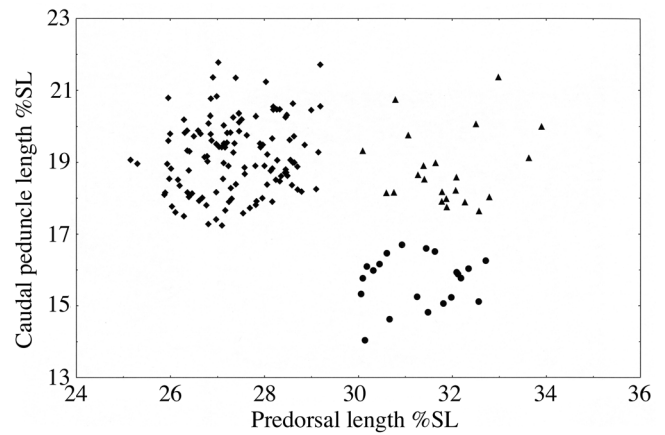


Figure 3. - Scatter plot showing the predorsal length (%SL) in function of the caudal peduncle length (%SL) for the 167 specimens belonging to the *P. polyuranodon* complex: ● POL 1: *P. mahakamensis* n. sp.; ▲ POL 2: *P. elongatus* n. sp.; ◆ POL 3: *P. polyuranodon* s.s.

enables to distinguish the *P. polyuranodon* complex and *P. macronema* from all other *P. (Pangasius)* species (Fig. 2). The mandibular barbel length is the best characters for separating *P. macronema* from the *P. polyuranodon* complex (76.8-144.8 vs. 10.4-45.8 %HL).

Figure 3 illustrates the plot of the predorsal length against the caudal peduncle length for all specimens examined in the *P. polyuranodon* complex. The *P. polyuranodon* specimens from Sumatra, Central and West Kalimantan (Indonesia) and Sarawak (Malaysia) (POL 3) are clearly defined by the combination of a short predorsal length (25.2-29.2 %SL) and a long caudal peduncle (17.2-21.8 %SL). *Pangasius polyuranodon* specimens from Vietnam and Thailand (POL 2) also have a long caudal peduncle (17.6-21.4 %SL), but differ from POL 3 by a longer predorsal length (30.1-33.9 %SL). *P. polyuranodon* from East Kalimantan (POL 1) considerably differs in caudal peduncle length (14.0-16.7 %SL) from POL 2 and POL 3 but have also a longer predorsal length than POL 3 (30.1-32.7 vs. 25.2-29.2 %SL). The head length is another character which enable to distinguish POL 3 from POL 1 and POL 2 (16.1-20.1 vs. 20.2-24.5 %SL).

Pangasius polyuranodon was first described from Bandjermassing (present Banjarmasin, Central Kalimantan) (Bleeker, 1852a). Because samples from the type locality of Banjarmasin are all included in the POL 3 group, we conclude that specimens from POL 3 represent *P. polyuranodon sensu stricto*.

Only one nominal species, *Pangasius juaro* Bleeker, 1852 described from the type locality of Palembang (Sumatra), has been synonymised with *P. polyuranodon* due to the lack of morphological diagnostic characters (see Roberts and Vidthayanon, 1991). Because specimens coming from this type locality are also located in POL 3, we therefore agree

with Roberts and Vidthayanon, 1991 for considering *P. juaro* as a junior synonym of *P. polyura-nodon*.

The two other groups in the *Pangasius polyuranodon* complex should be considered as species new to science because they do not correspond with any other *Pangasius* species. The populations from East Kalimantan (POL 1) are described as *P. mahakamensis* sp. n., while the populations from Thailand and Vietnam (POL 2) are described as *P. elongatus* sp. n.

PANGASIUS MAHAKAMENSIS SP. N.

(Fig. 4)

Material examined

Holotype. - MZB 10886, 127 mm SL; Indonesia: East Kalimantan Province, Mahakam River at Samarinda, July 2000, R. Gustiano and A.H. Kristanto,.

Paratypes. - MZB 10887, 4 specimens, 106-112 mm SL: same data as holotype; MZB 10888, 3, 160-182 mm SL: from Tenggarong, Mahakam River, East Kalimantan, Indonesia, March 1998, R. Gustiano and D. Sadeli; MNHN 2001-0603, 3, 102-146 mm SL: same data as holotype.

Other material examined. - MZB 10889, 10, 78-97 mm SL: same data as holotype.

Diagnosis

Pangasius mahakamensis is distinguished from all other *Pangasius* (*Pangasius*) species by the unique combination of the following characters: short caudal peduncle (14.0-16.7 %SL); large eye (diameter: 22.8-29.4 %HL); short mandibular barbel (length: 19.6-45.8 %HL); and short predorsal length (30.1-32.7 %SL).

Description

Based on the holotype, 10 paratypes and 10 other specimens. The results of measurements taken on the material examined are given in table I.

Snout short and rounded. Postocular distance short. Mouth inferior. Anterior nostrils entirely situated on the anterior margin of the upper lip; posterior nostrils completely on dorsal side of head; distance between anterior nostrils shorter than distance between posterior nostrils. Eyes large and laterally placed. Premaxillary toothplate visible when mouth closed. Premaxillary teeth conical. Vomerine toothband very wide (length about 1.5 times in width) and somewhat oval-shaped; palatine toothplates

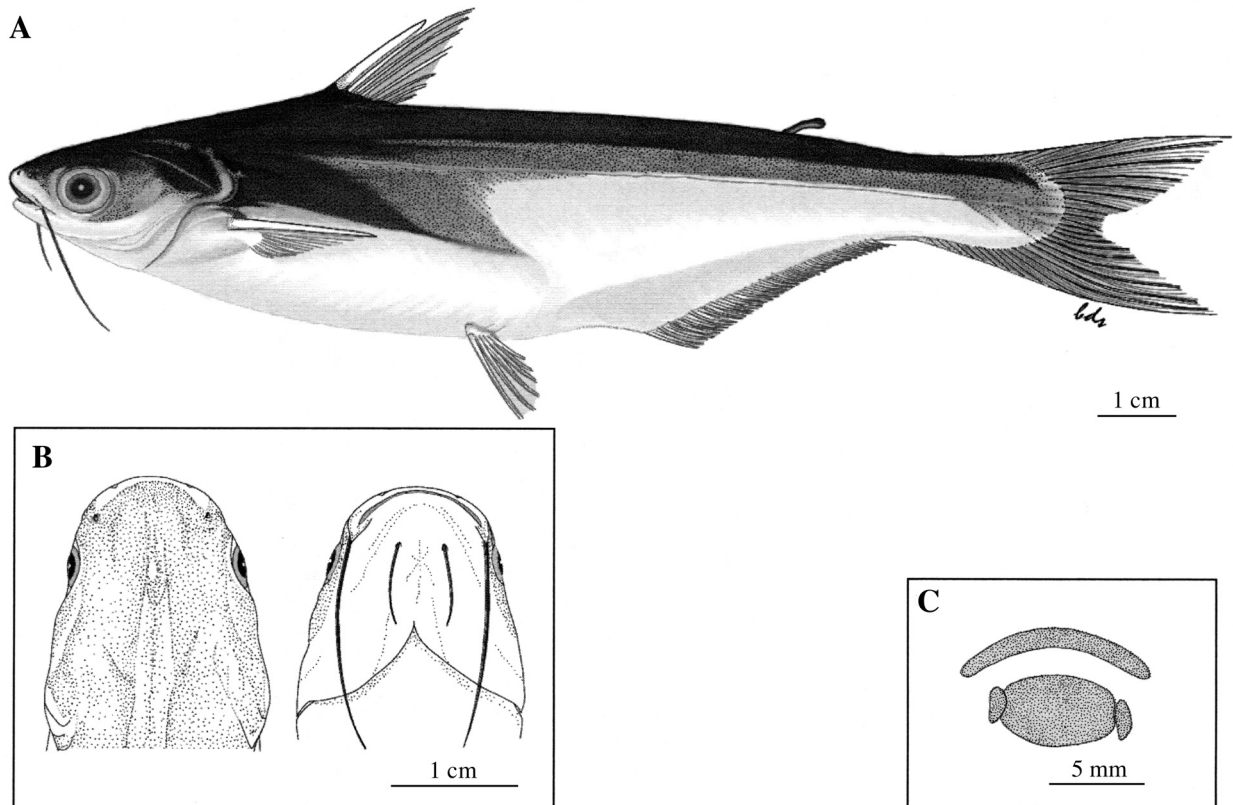


Figure 4. - *Pangasius mahakamensis* sp. n., holotype. **A**: Lateral view; **B**: Dorsal and ventral view of the head; **C**: Premaxillary, vomerine and palatine tooth plates.

Table I. - Measurements taken on the holotype, paratypes and other specimens of *Pangasius mahakamensis* sp. n.

SL (mm)	Holotype	Paratypes					Other specimens examined				
	127	102 - 182					78 - 97				
In % standard length		N	Mean	Min.	Max.	SD	N	Mean	Min.	Max.	SD
Head length	22.2	10	21.1	20.2	22.2	0.6	10	22.6	20.7	24.5	1.1
Head depth	12.6	10	13.3	12.6	14.9	0.7	10	13.7	12.4	15.1	0.9
Head width	15.1	10	14.4	12.9	15.8	0.8	10	14.9	12.9	16.2	1.1
Caudal peduncle length	16.0	10	15.6	14.0	16.5	0.8	10	15.8	14.8	16.7	0.7
Caudal peduncle depth	8.7	10	8.6	7.8	8.9	0.3	10	7.8	7.6	8.1	0.2
Pectoral spine length	18.2	10	21.7	12.3	31.1	1.7	10	16.9	15.5	18.0	0.7
Pectoral fin length	16.5	4	15.9	15.3	17.1	0.9	9	15.9	13.5	17.4	1.1
Dorsal spine length	18.7	10	19.5	17.3	20.7	1.1	10	17.8	15.9	20.2	1.4
Dorsal fin length	15.3	4	16.3	15.4	17.0	0.7	10	15.4	13.6	17.3	1.0
Pelvic fin length	11.4	10	11.7	10.1	12.6	0.8	10	11.7	10.1	13.7	1.0
Anal fin height	10.6	10	13.1	11.5	14.6	0.8	10	13.3	12.2	14.5	0.8
Anal fin length	28.2	10	30.6	25.0	33.9	2.7	10	28.0	24.9	30.1	1.5
Adipose fin height	3.8	10	3.5	2.9	4.4	0.5	10	3.8	2.9	4.5	0.6
Adipose fin width	1.4	10	1.2	0.7	1.7	0.3	10	1.3	0.6	2.1	0.4
Interorbital distance	12.4	10	11.5	10.8	12.5	0.5	10	11.6	9.9	13.1	1.0
Body width	17.0	10	17.6	16.2	18.9	1.0	10	17.3	16.5	18.2	0.7
Predorsal length	30.3	10	30.8	30.1	32.7	1.0	10	31.8	30.9	32.6	0.5
Prepectoral length	19.3	10	19.9	19.2	22.2	0.9	10	20.6	19.1	21.9	0.8
Prepelvic length	45.7	10	43.0	40.8	44.7	1.5	10	43.4	39.8	46.0	1.6
In % head length											
Snout length	35.5	10	35.5	33.9	38.0	1.6	10	34.0	30.8	37.3	2.4
Anterior snout width	28.7	10	30.3	28.1	33.3	1.7	10	29.1	26.3	32.8	2.0
Posterior snout width	39.7	10	38.9	30.5	42.9	3.8	10	35.6	29.8	44.3	4.0
Eye diameter	25.9	10	25.5	22.8	29.4	2.3	10	26.9	24.6	29.3	1.4
Mouth width	43.6	10	43.9	40.2	48.0	2.6	10	40.1	34.6	44.6	3.6
Lower jaw length	25.2	10	24.3	19.1	29.1	3.1	10	24.2	19.7	27.6	2.6
Distance snout-isthmus	46.4	9	51.2	47.0	54.8	2.8	10	47.9	44.5	51.4	2.4
Postocular length	35.1	10	33.5	28.1	36.9	2.6	10	31.5	27.1	37.1	3.7
Vomerine width	22.0	10	25.1	22.1	30.5	2.4	10	22.9	19.9	25.0	1.6
Vomerine length	16.0	10	16.7	14.5	17.9	0.9	10	14.2	11.5	17.8	2.3
Palatine length	11.0	10	13.1	11.7	15.2	1.0	10	10.5	5.7	12.2	1.9
Palatine width	4.6	10	5.4	3.3	7.1	1.2	10	5.1	4.0	5.7	0.6
Dorsal spine width	4.6	10	4.9	4.3	5.6	0.4	10	5.0	4.7	5.7	0.3
Maxillary barbel length	78.7	10	81.8	70.8	100.9	9.3	10	86.2	68.2	106.5	12.3
Mandibular barbel length	29.1	10	30.7	19.6	39.6	5.8	10	32.0	20.2	45.8	9.4

notably laterally placed compared to vomerine toothband. Vomerine teeth molariform. Maxillary barbels long, reaching beyond the pectoral-fin basis. Mandibular barbels much shorter, hardly reaching the isthmus. Gill rakers on the first branchial arch: 20-27 (26 in holotype). Dorsal side of operculum large and rounded. Swimbladder with three chambers extending to above anal fin base.

Body moderately elongated and robust with a short caudal peduncle. Dorsal with two spines; the first very small, hidden under the skin, the second short and slender. I.7 dorsal-fin rays. I.10-13 pectoral-fin rays (I.10 in holotype); pectoral fin reaching level of virtual line corresponding to

last dorsal-fin ray basis. I.6 pelvic-fin rays; pelvic fin short, not reaching anal fin basis. Anal fin with 27-32 soft fin rays (30 in holotype); short anal-fin height. Adipose fin small. Maximal size observed 182 mm SL, probably one of the smallest species among Pangasiidae.

Colouration

On live specimens, head and body dorsally olive to greenish grey, lower side of flanks and belly silver or whitish. Dorsal, pectoral and caudal fins yellowish, other fins hyaline.

Distribution

Pangasius mahakamensis is endemic to East Kalimantan (Indonesia) and it is presently only known from the type locality, the Mahakam River.

Habitat and biology

The Mahakam River is the second largest river in Kalimantan, with a course of some 920 km and a drainage area of 77.700 km² (Christensen, 1992). Specimens smaller than 150 mm were collected in brackish water in the delta of the river, while larger sized specimens were found in the upper part. Both environments have no vegetation on the banks, have a relatively strong current, are deep and the water is turbid. The species is omnivorous, feeding mainly on insects and small fruits. Spawning periods are unknown.

Etymology

Named after the Mahakam basin, where the type material was collected.

PANGASIVS ELONGATUS SP. N.

(Fig. 5)

Pangasius polyuranodon non Bleeker, 1852. Roberts and Vidthayanon, 1991: 136, fig. 21; Vidthayanon, 1993: 100, fig. 21.

Material examined

Holotype. - MZB 10890, 144 mm SL; Vietnam: Lower Mekong River Delta, 1997, N.V. Thuong, H.P. Hung, D.T. Dung, L.A. Kha.

Paratypes. - MNHN 1989-234, 1 specimen, 216 mm SL: Vietnam, locality unknown, Unknown; MNHN 1989-233, 1, 195 mm SL: Thailand, Siam Gulf, Unknown; MNHN 1989243, 2, 115 and 135 mm SL: Thailand, Siam Gulf, 1921, Krempf; MNHN B255, 2, 225 and 278 mm SL: Vietnam, Harmand.; MNHN B-256, 1, 282 mm SL: Vietnam, 1874, Jullien; MNHN 2001-0604, 8, 174-221 mm SL: Vietnam, Chau Doc, Mekong Delta, 20 Jul. 1996, S. Lenormand; MZB 10891, 10, 118-139 mm SL.; Vietnam, Mekong Delta, Vietnam, same data as holotype.

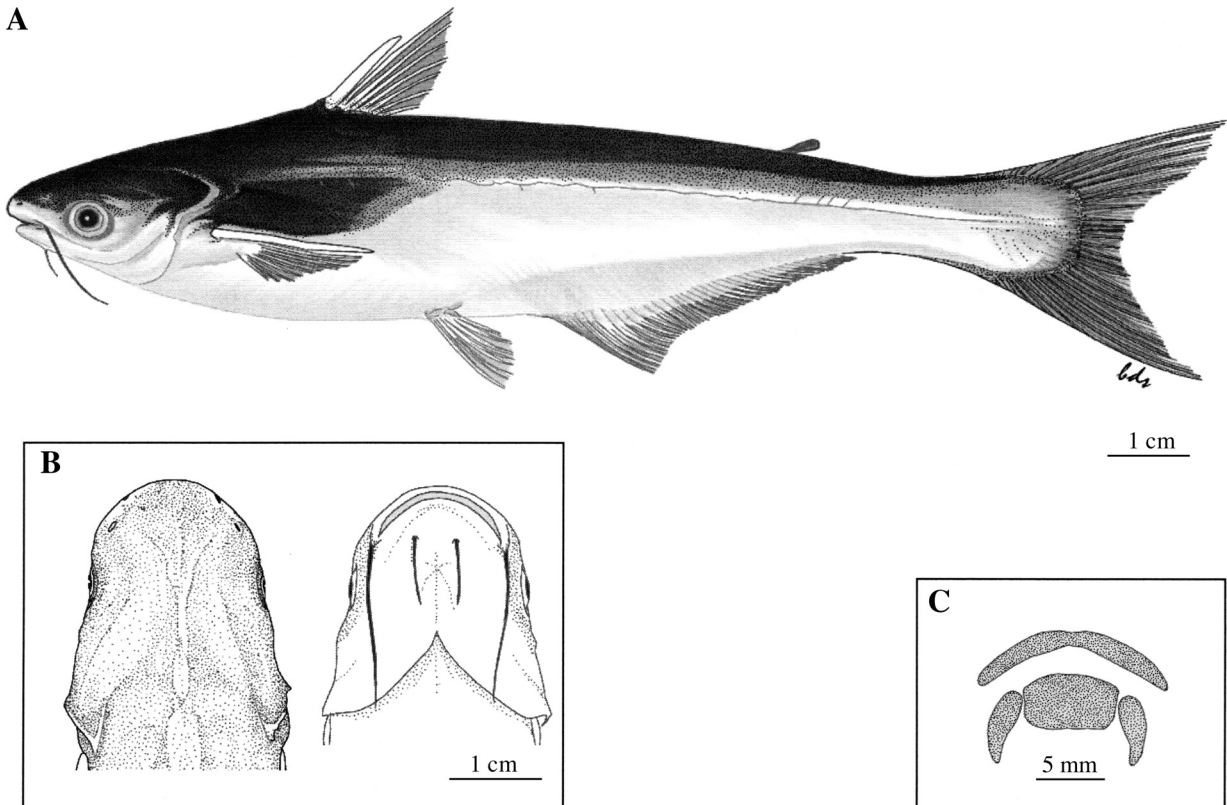


Figure 5. - *Pangasius elongatus* sp. n., holotype. A: Lateral view; B: Dorsal and ventral view of the head; C: Premaxillary, vomerine and palatine tooth plates.

Diagnosis

Pangasius elongatus is distinguished from all other *Pangasius* (*Pangasius*) species by the unique combination of the following characters: body elongated, intermediate predorsal length (30.1-33.9 %SL), short snout length (35.2-42.8 %HL), long caudal peduncle (17.6-21.4 %SL), short mandibular barbels (length: 10.4-39.3 %HL) and large eyes (19.2-25.5 %HL).

Description

Based on the holotype and 24 paratypes. The results of

Table II. - Measurements taken on the holotype and paratypes of *Pangasius elongatus* sp. n.

SL (mm)	Holotype	Paratypes				
	144	115 - 282				
In % standard length		N	Mean	Min.	Max.	SD
Head length	22.2	24	21.7	20.5	23.5	0.8
Head depth	12.6	24	13.0	11.9	14.2	0.6
Head width	14.9	22	15.3	13.4	17.2	0.9
Caudal peduncle length	20.1	24	18.8	17.6	21.4	1.0
Caudal peduncle depth	8.3	24	8.3	7.1	9.3	0.6
Pectoral spine length	16.0	21	17.1	14.4	20.9	1.8
Pectoral fin length	14.2	19	16.2	13.9	19.1	1.6
Dorsal spine length	10.3	23	18.5	14.1	24.0	2.5
Dorsal fin length	19.3	18	16.4	12.0	21.9	2.2
Pelvic fin length	11.5	19	11.3	8.0	13.0	1.3
Anal fin height	13.8	20	13.4	10.8	15.5	1.2
Anal fin length	30.6	24	29.7	27.3	33.5	1.6
Adipose fin height	4.0	24	3.5	2.3	5.1	0.7
Adipose fin width	1.7	24	1.2	0.6	2.3	0.4
Interorbital distance	12.1	24	12.0	10.4	13.5	0.8
Body width	16.8	21	17.3	16.2	19.3	0.8
Predorsal length	32.5	21	31.8	30.1	33.9	1.0
Prepectoral length	19.8	24	20.0	19.0	21.7	0.8
Prepelvic length	42.7	23	42.0	39.8	44.4	1.3
In % head length						
Snout length	40.6	24	38.5	35.2	42.8	1.9
Anterior snout width	28.7	24	29.9	26.5	33.6	1.9
Posterior snout width	44.1	20	44.0	37.8	55.8	4.9
Eye diameter	21.9	24	21.7	19.2	25.5	1.8
Mouth width	44.1	24	42.8	37.2	49.5	3.3
Lower jaw length	21.2	19	24.7	19.5	27.7	2.5
Distance snout-isthmus	52.5	24	51.7	43.9	61.0	4.2
Postocular length	34.1	24	30.6	24.0	37.8	4.7
Vomerine width	20.3	19	20.5	17.4	23.1	1.6
Vomerine length	11.9	15	10.7	8.5	13.4	1.6
Palatine length	17.2	19	13.8	9.5	19.7	2.3
Palatine width	4.7	19	4.4	3.4	5.8	0.6
Dorsal spine width	5.6	24	5.4	4.3	6.7	0.6
Maxillary barbel length	68.1	20	77.5	54.6	94.1	12.4
Mandibular barbel length	29.7	20	27.2	10.4	39.3	8.6

measurements taken on the type series are given in table II.

Snout large and rounded. Post-ocular distance short. Mouth inferior. Anterior nostrils entirely situated on the anterior margin of the upper lip; posterior nostrils completely on dorsal side of head; distance between anterior nostrils shorter than distance between posterior nostrils. Premaxillary toothplate visible when mouth closed. Premaxillary teeth conical. Vomerine toothband very wide (length about 2 times in width) and somewhat rectangular-shaped. Vomerine teeth molariform. Palatine toothplate long and slender. Palatine teeth conical. Eyes large and laterally placed. Maxillary barbels relatively long, reaching the pectoral-fin basis. Mandibular barbel short, not reaching the isthmus, but reaching beyond posterior border of the eye. Gill rakers on the first branchial arch: 17-27 (21 in holotype). Dorsal side of the operculum slender and pointed. Swimbladder with three chambers extending to above anal fin base.

Body elongated and robust with a long caudal peduncle. Dorsal with two spines; the first very small, hidden under the skin, the second short and slender. I.6-8 dorsal-fin rays (I.7 in holotype). I.10-12 pectoral-fin rays (I.10 in holotype); pectoral fin reaching virtual line corresponding to basis of last dorsal-fin ray. I.6 pelvic-fin rays; pelvic fin almost reaching anal-fin base. Anal-fin with 30-33 soft fin rays (32 in holotype). Adipose fin small. Maximal size observed 282 mm SL.

Colouration

On live specimens, head and body dorsally olive to greenish-grey, lower side of flanks and belly silver or whitish. Dorsal, pectoral and caudal fins yellowish, other fins hyaline.

Distribution

Pangasius elongatus is distributed in the lower reaches of the Chao Phraya, Bangpakong and Mekong basins of the Indochinese region.

Habitat and biology

The species is omnivorous, feeding mainly on benthic animals such as molluscs and crustaceans. During the rainy season specimens in the Mekong eat fruits and various debris. Following Vidthayanon (1993), mature specimens were observed from July to August in the Chao Phraya. At present, this species is considered close to extinction in Thailand (Vidthayanon pers. comm.).

Etymology

From the Latin *elongatus*: named for his elongated body.

PANGASIUS POLYURANODON BLEEKER, 1852

(Fig. 6)

Pangasius juaro Bleeker, 1852: 589 (type locality, Palembang).

Pseudopangasius polyuranodon Bleeker, 1862: 76, pl. 78.

Material examined

MNHN 2001-0607, 5 specimens, 223-332 mm SL and MZB 10892, 1, 251 mm SL: Indonesia, Sumatra, Sekayu, Musi River, 27 Feb. 1997, M. Legendre, L. Pouyaud and Sudarto; MNHN 2001-0608, 10, 200-602 mm SL and MZB 10893, 1, 354 mm SL: Indonesia, Sumatra, Jambi market, from Batang Hari River, 04 Mar. 1997, M. Legendre, L. Pouyaud and Sudarto; MZB 10894, 27, 189-495 mm SL:

Indonesia, Sumatra, Jambi market, from Batang Hari River, Oct. 1999, L. Pouyaud and Sudarto; MZB 10895, 6, 200-307 mm SL: Indonesia, Sumatra: Kotabumi market, from Rarem River, Lampung, Oct. 1998, L. Pouyaud and Sudarto; MNHN 2001-0609, 10, 235-317 mm SL: Indonesia, Sumatra, Rengat market, from Indragiri River, Oct. 1998, L. Pouyaud and Sudarto; MNHN 2001-0610, 4, 252-316 mm SL: Indonesia, Central Kalimantan, Muara Teweh market, from Barito River, Jul. 1997, A. Pariselle and A.H. Kristanto; MZB 10896, 2, 156-201 mm SL: Indonesia, Central Kalimantan, Muara Teweh, from Barito River, 27 Jul. 1999, R. Gustiano and D. Sadeli; MZB 10897, 7, 307-477 mm SL: Indonesia, Central Kalimantan, Buntok, from Barito River, 27 Jul. 1999, R. Gustiano and D. Sadeli; MZB 10898, 5, 243-469 mm SL: Indonesia, Central Kalimantan, Banjarmasin (same locality as type), 27 Jul. 1999, R. Gustiano and D. Sadeli; MNHN 2001-0611, 1, 433 mm SL: Indonesia, West Kalimantan, Sanggau market, from Kapuas River, Jul. 1997, A. Pariselle and A.H. Kristanto; MZB 10899, 7, 307-482 mm SL: Indonesia, West Kalimantan, Sintang, from Kapuas River, 27 Jul. 1999, R. Gustiano and

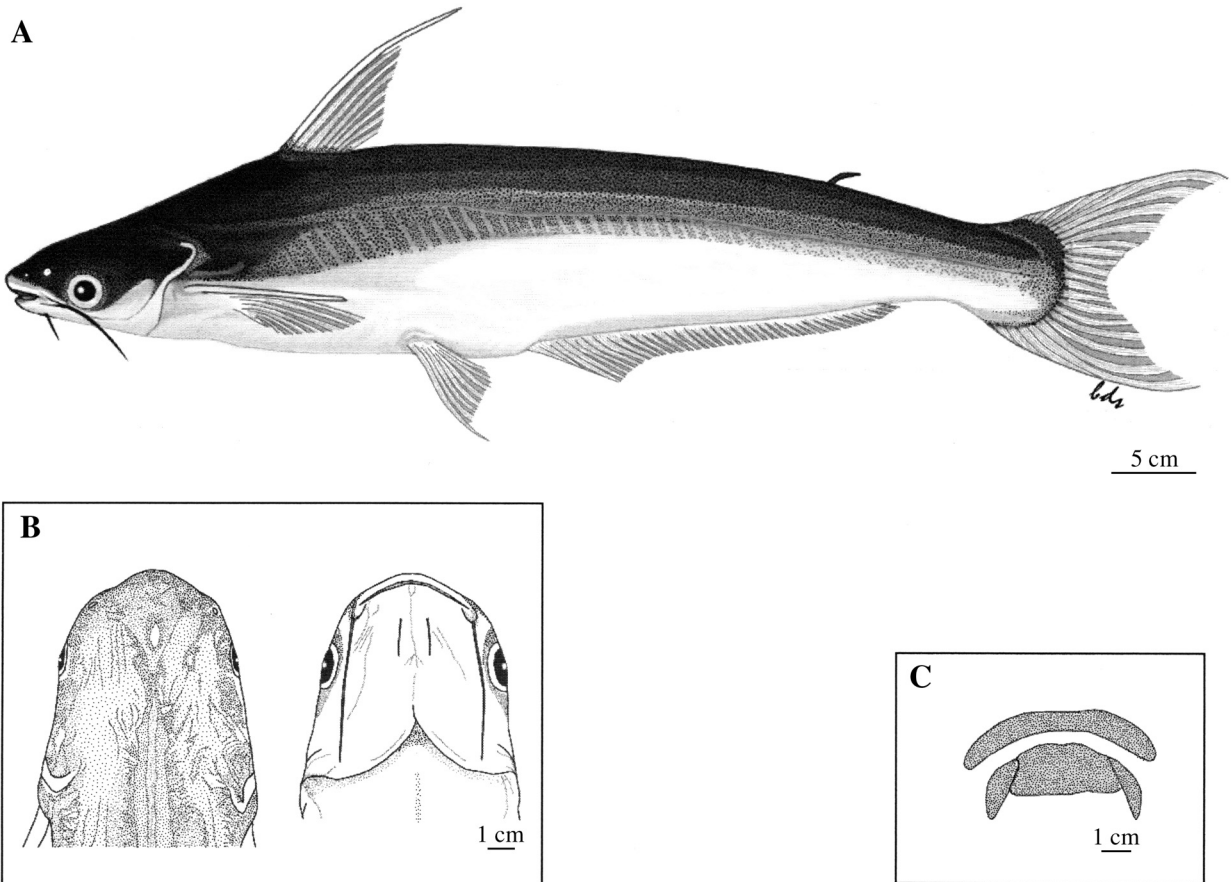


Figure 6. - *Pangasius polyuranodon* IRD 1998-2035; from Jambi, Sumatra (Indonesia). **A**: Lateral view; **B**: Dorsal and ventral view of the head; **C**: Premaxillary, vomerine and palatine tooth plates.

D. Sadeli; MZB 10900, 2, 191 and 198 mm SL: Indonesia, West Kalimantan, Pontianak, from Kapuas River, Mar. 1999, R. Gustiano, D. Sadeli and A.H. Kristanto; MZB 10901, 21, 216-363 mm SL: Indonesia, West Kalimantan, Pontianak, from Kapuas River, 27 Jul. 1999, R. Gustiano and D. Sadeli; MNHN 2001-0612, 5, 242-302 mm SL: Malaysia, West Borneo, Sibu market, from Batang Rajang River, Sarawak, Oct. 1998, A. Pariselle; MNHN 2001-0613, 5, 227-287 mm SL: Malaysia, West Borneo, Kapit market, from Batang Rajang River, Sarawak, Oct. 1998, A. Pariselle.

Diagnosis

Pangasius polyuranodon is distinguished from all other *Pangasius* (*Pangasius*) species by the unique combination of the following characters: somewhat elongated body with a short predorsal length (25.2-29.2 %SL), a long caudal peduncle (17.2-21.8 %SL), a short head length (16.1-20.1 %SL) and short mandibular barbels (length: 11.7-42.2 %HL).

Description

The results of measurements taken on 121 specimens are given in table III.

Head short and flattened. Snout large and broadly rounded. Mouth inferior. Postocular distance short. Anterior nostrils entirely situated on the anterior margin of the upper lip; posterior nostrils completely on dorsal side of head; distance between anterior nostrils shorter than distance between posterior nostrils. Eyes large, latero-ventrally placed; interorbital distance small. Premaxillary toothplate hardly visible when mouth closed; premaxillary teeth conical. Vomerine toothband very wide (length about 1.5 times in width) and somewhat rectangular-shaped; vomerine teeth molariform. Palatine toothplates long and slender. Maxillary barbel reaching the posterior border of the operculum. Mandibular barbels very short, not reaching the isthmus, hardly reaching the level of middle of the eye. Gill rakers on the first branchial arch: 19-30. Swimbladder with three chambers extending to above anal-fin base. Dorsal side of the operculum slender and pointed.

Body slender and elongated with short predorsal, prepectoral and prepelvic lengths and with a long caudal peduncle. Dorsal with two spines; the first very small, hidden under the skin, the second short and slender. I.6-8 dorsal-fin rays. I.9-15 pectoral-fin rays, pectoral fin reaching beyond level of the virtual line corresponding to basis of last dorsal-fin ray. I.6 pelvic-fin rays; short pelvic fin, hardly reaching basis of anal fin. Anal fin long with 33-43 soft fin rays; anal-fin height short. Short filamentous extension in some specimens on tip of the first soft ray of dorsal, pectoral and anal fins. Adipose fin minute. Maximal size observed 602 mm

Table III. - Measurements taken on specimens of *Pangasius polyuranodon*.

In % standard length	N	Mean	Min.	Max.	SD
Head length	121	18.4	16.1	20.1	0.8
Head depth	121	9.8	8.0	11.4	0.7
Head width	121	12.6	11.2	15.1	0.7
Caudal peduncle length	121	19.2	17.2	21.8	1.0
Caudal peduncle depth	119	7.9	6.8	8.9	0.5
Pectoral spine length	108	16.4	2.4	23.2	2.2
Pectoral fin length	26	15.8	7.7	18.9	2.9
Dorsal spine length	92	16.7	11.8	21.0	1.7
Dorsal fin length	16	15.3	12.6	17.0	1.3
Pelvic fin length	120	10.9	8.9	12.7	0.7
Anal fin height	116	11.4	8.6	13.8	1.1
Anal fin length	121	33.4	29.2	38.4	2.0
Adipose fin height	118	2.8	1.8	3.7	0.4
Adipose fin width	118	0.9	0.5	1.5	0.2
Interorbital distance	121	10.0	8.2	12.4	0.7
Body width	119	14.6	12.7	16.0	0.7
Predorsal length	121	27.4	25.2	29.2	0.9
Prepectoral length	120	16.9	15.5	18.3	0.7
Prepelvic length	121	37.9	33.2	43.0	1.8
In % head length					
Snout length	120	41.5	35.7	49.1	2.8
Anterior snout width	120	34.1	30.6	38.2	1.6
Posterior snout width	121	46.9	40.5	54.7	2.9
Eye diameter	121	22.0	16.1	29.6	2.8
Mouth width	121	43.4	35.3	51.2	2.9
Lower jaw length	120	25.7	20.3	31.1	2.3
Distance snout-isthmus	113	53.0	46.6	61.6	3.3
Postocular length	121	31.7	23.8	40.0	3.4
Vomerine width	121	23.7	19.3	28.9	1.6
Vomerine length	121	15.4	12.7	18.9	1.2
Palatine length	121	14.6	11.3	18.7	1.6
Palatine width	121	4.3	2.7	6.1	0.7
Dorsal spine width	120	4.8	3.4	6.1	0.5
Maxillary barbel length	116	79.2	56.6	98.9	9.3
Mandibular barbel length	117	28.4	11.7	42.2	6.1

SL; 800 mm SL reported by Vidthayanon (1993).

Colouration

On live specimens, head and body dorsally olive to greenish-grey, lower side of flanks and belly whitish. Dorsal, pectoral and caudal fins yellowish, other fins pale. Specimens collected from estuarine areas are goldish on lateral sides of head, dorsum and upper part of flanks.

Distribution

Pangasius polyuranodon is presently known from the major drainages from Sumatra (Indonesia), where it was observed in the Musi River, in the Batang Hari River, in the

Indragiri River and in the Rarem River. *P. polyuranodon* is also present in southern and western Kalimantan (Indonesia), where it was found in the Barito River (type locality), in the Kapuas River and in the Batang Rajang River (Sarawak, Malaysia). The species was also recorded from North Borneo (Sabah, Malaysia) in the Kinabatangan River but no specimens were available for the present study.

Habitat and biology

Pangasius polyuranodon inhabits estuaries and lower reaches but it has also been observed in upper reaches during the rainy season. The species is omnivorous with a tendency to opportunism. Mature males and females of about 200 mm SL were caught at night in October 1996 along the banks of the Musi River at Sekayu.

Acknowledgments. - The authors thank S. Lenormand, J. Slembrouck, A. Pariselle, M. Legendre, Sudarto, W. Hadie, D. Sadili, A. Hari Kristanto, O. Komarudin, Ir. Maskur, N.V. Thuong and L.T. Hung for their help in collecting fish samples. B. Dwisusilo made the fish illustrations, for which task we owe him a special thanks. This paper forms part of the INCO.DC project "Catfish Asia" financed by the European Commission (contract IC 18-CT 96-0043).

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Reçu le 23 avril 2001.

Accepté pour publication le 08 mai 2002.