IDENTIFICATION KEY BASED ON MORPHOLOGICAL CHARACTERS OF THE SOUTHEAST ASIAN SPECIES OF THE GENUS *CLARIAS* (PISCES : CLARIIDAE)

[Kunci Identifikasi Ikan *Clarias* (Pisces : Clariidae) Asia Tenggara Berdasarkan Ciri Morfologi]

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ABSTRACT

Enam ratus empat puluh lima spesimen ikan *Clarias* terutama dikumpulkan dari Vietnam, Thailand dan Indonesia dipelajari ciri morfometriknya dengan cara pengukuran dan penghitungan meristik. Terdapat 29 titik-titik pengukuran untuk setiap spesimen, 5 penghitungan meristik dan 5 pengamatan morfologi spesifik. Karakter-karakter tersebut (selain panjang standar) dipilih untuk diagnosanya. Data morfometrik diukur menggunakan kalifer dengan ketelitian sampai 0,5 mm. Data tersebut dianalisis untuk membedakan antara spesies dan untuk menyusun kunci identifikasi.

Kata kunci: jenis baru, *Clarias*, kunci identifikasi.

INTRODUCTION

Clariidae naturally occur in Africa, where the diversity is the highest (Teugels, 1986), Minor Asia, the Indian subcontinent and in Southeast Asia. Teugels (1996) reported 14 genera of Clariidae which are presently recognised.

In Africa, 12 genera with 74 species are found: *Channallabes* Günther (1 species), *Clariallabes* Boulenger (15 species), *Clarias* Scopoli (32 species, including a cave dwelling species; Teugels, 1986), *Dinotopterus* Boulenger (with *Bathyclarias* Jackson as its junior synonym; 13 species), *Dolichallabes* Poll (1 species), *Gymnallabes* Günther (3 species), *Heterobranchus* Geoffroy Saint-Hilaire (4 species; Teugels *et al.*, 1990), *Platyallabes* Poll (1 species), *Tanganikallabes* Poll (1 species), *Uegitglanis* Gianferrari (1 cave dwelling species), and *Xenoclarias* Greenwood (1 species).

In the Indian subcontinent and in Southeast Asia, three genera are presently recognised: *Clarias* Scopoli, 1777, present throughout the region (about 18 species following Teugels, 1996; Lim & Ng, 1999; Ng, 1999; Ng, 2001. Teugels *et al.*, 2001), *Encheloclarias*, only occurring in Southeast Asia (5 species; Ng and Lim, 1992), and *Horaglanis* (Menon, 1950) only known from the Indian subcontinent (1 species). The status of the monospecific *Horaglanis* is unclear but most problematic however, is the taxonomy within the *Clarias* genus.

The name *Clarias* was cited for the first time by Gronow in 1763, but it was not considered to be a valid generic name of that author and date as per Opinion No. 89 of the International Commission on Zoological Nomenclature (Smith, 1945) and No. 261 of the Official Index of Rejected and Invalid Works in Zoological Nomenclature, 1958 (Teugels and Roberts, 1987). The name was validated by Scopoli in 1777 acknowledging Gronow as the authority but using a different spelling, i.e. *Chlarias* (and Chlariidae). Subsequent authors, however, favoured the use of Gronow's *Clarias* (and Clariidae) and rejected the spelling *Chlarias* (and Chlariidae) (Teugels & Roberts, 1987). The type species by subsequent designation (Teugels & Roberts, 1987) is *Silurus anguillaris* Linnaeus, 1758.

Günther (1864) gave characteristics of the genus *Clarias* as: long dorsal and anal fin, no adipose, jaws bearing a band of villiform teeth and a band of villiform or granular teeth across the vomer, small eyes with a free orbital margin, eight barbels: one pair of nasal, one pair of maxillary, and two pairs of mandibular barbels, upper and lateral parts of the head osseous, or covered with only a very thin skin, accessory branchial organ attached

to the convex side of the second and fourth branchial arches and received in a cavity behind the gill-cavity proper, ventral fins six-rayed and only pectoral fins possess a spine. Boulenger (1901) added that the swimbladder in this genus is bilobed, disposed transversely and partially enclosed in a bony sheath formed by the transverse process of the fourth and fifth vertebrae.

In a revision made on the African species of the genus *Clarias*, Teugels (1986) recognised 32 valid species which he grouped into six subgenera: *Clarias* (*Clarias*) Scopoli, 1777; *Clarias* (*Dinotopteroides*) Fowler, 1930; *Clarias* (*Platycephaloides*) Teugels, 1982; *Clarias* (*Clarioides*) David, 1937; *Clarias* (*Anguilloclarias*) Teugels, 1982; and *Clarias* (*Brevicephaloides*) Teugels, 1982.

Between the time description of *Clarias batrachus* (Linnaeus, 1758) and that of *C. nebulosus* Deraniyala, 1958, 28 nominal species have been described in Southeast Asia. Several authors have studied *Clarias* systematics; as a result 13 species have been considered as valid [including *C. ater* (McClelland, 1844) and *C. dayi* (Hora, 1936) for which type specimens were lost]. For more than 40 years this number was unchanged. In 1999, 3 species were described (Ng, 1999; Lim & Ng, 1999), 2 new species was added in 2001 (Ng, 2001; Teugels *et al.*, 2001), 3 new species was added in 2003 (Sudarto *et al*, 2003) and 1 species in 2004 (Sudarto *et al*, 2004).

MATERIALS

Six hundred and forty five *Clarias* specimens were mainly collected in Vietnam, Thailand and Indonesia. They were deposited in the Museum Zoologicum Bogoriense (MZB, Cibinong, Indonesia), in the Zoological Reference Collection (ZRC, Singapore), in the Musée Royal de l'Afrique Centrale (MRAC, Tervuren, Belgium) and, in the Muséum National d'Histoire Naturelle (MNHN, Paris, France). The type material of most nominal Asian *Clarias* species and deposited in systematic reference collections was examined.

The number of samples per species per location was fixed between 10 and 30 specimens.

METHODS

The taxonomic method applied is the "non dimensional species analysis", named after the Mayr's "non dimensional species" concept (1942, 1970) and used by Teugels (1986) in the systematic revision of the African *Clarias* species. This method was also used by Tschibwabwa (1997) in the systematic revision of species composing the genus *Labeo*. This method was chosen for two reasons which are similar to the situation faced in resolving the African *Clarias* systematics. Firstly, there is a confusion in nomenclature due to the numerous nominal species which were most often based on inadequate descriptions or having no homogeneity amongst these definitions. Secondly, it has been found to be appropriate for systematic revision of complex groups apart from considering the nature of the material examined, *i.e.* preserved.

Techniques

Morphological biometrical techniques

The collections were studied morphometrically using measurements and meristic counts. For each and every specimen, 29 point-to-point measurements, 5 meristic counts and 5 special morphological observations were made. These characters (except for standard length) were selected on their diagnostic value as demonstrated by Teugels (1982, 1986).

Morphometric data were measured by using the manual distance measurements, made manually using dial callipers correct to tenths of a millimetre. Counts and measurements were made on the left side of the body of the specimens whenever possible.

The measurements were made in the following orientations: the length is the horizontal line, connecting the tip of the snout with the centre of the caudal fin base (measured laterally); the vertical symmetric plane through the horizontal length axis and the dorsal fin base is the depth; the width is measured in the transverse direction, perpendicular on the vertical symmetric plane of the specimens.

The following mesurements were taken:

1. **Standard length** (SL): Measured from the tip of the snout (premaxillae) to the centre base of the

caudal fin (just after the last vertebrae); expressed in mm.

2. **Maximal body depth at anus** (MBD): Measured vertically from the anus to the base of the dorsal fin; expressed as %SL. This feature partially indicates the degree of anguilliformism of the specimens. Its variation, however, due to feeding conditions and to the developmental phase of the ovaries in female specimens has to be taken into account.
3. **Caudal peduncle depth** (CPD): Measured from the base of the caudal end of dorsal fin to that of the caudal end of the anal fin; expressed as %SL.
4. **Head length** (HL): Measured from the tip of the snout (premaxillae) to the tip of the occipital process; expressed as %SL. The tip of the occipital process can be hidden under the skin and therefore has to be pushed down.
5. **Head width** (HW): Measured across its widest point but discounting any lateral projection of the branchiostegal membranes; expressed as %SL.
6. **Snout length** (SNL): Measured from the tip of the upper jaw to the middle of an imaginary vertical line drawn connecting the anterior borders of both eyes; expressed as %HL.
7. **Interorbital width** (IOW): Measured from the medial border of one eye to the other; expressed as %HL.
8. **Eye diameter** (ED): Measured from the anterior to posterior borders of the eye following the horizontal axis; expressed as %HL. This is the greatest horizontal distance across the bony orbit of eye.
9. **Nasal barbel length** (NBL): Measured from the base to the tip. The barbels are often damaged. This can be indicated by unequal length or by the presence of tubercles on the distal part of the barbel. In this case the longest barbel is measured. When both barbels are damaged, no measurement is made. Expressed as %HL.
10. **Maxillary barbel length** (MBL): Measured from the base to the tip; expressed as %HL. See comment under NBL.
11. **Inner mandibular barbel length** (IMBL): Measured from the base to the tip; expressed as %HL. See comment under NBL.
12. **Outer mandibular barbel length** (OMBL): Measured from the base to the tip; expressed as %HL. See comment under NBL.
13. **Occipital process length** (OPL): Measured from the posterior head end (base of the suture separating the supraoccipital bone and pterotic at the posterior head end) to the tip of the processus, on an imaginary line parallel to the horizontal axis. These parts of head may be covered by skin which has to be removed; expressed as %HL.
14. **Occipital process width** (OPW): The distance between the sutures separating the supraoccipital bone and pterotics at the posterior head end; expressed as %HL. Sometimes the skin has to be removed to locate those sutures.
15. **Frontal fontanelle length** (FFL): The maximum length is measured and expressed as %HL. The anterior part of the fontanelle is often hardly visible as the slope with the fontanelle bones and the dermethmoid is rather gradual. To avoid this difficulty, a technique developed by Sydenham (1978) can be used: after drying the surface of the head, a rubbing of the skull bones (frontals and dermethmoid) can be made with pencil and paper. The measurement is taken on the rubbing.
16. **Frontal fontanelle width** (FFW): The maximum width is measured and expressed as %HL. See comments under FFL.
17. **Premaxillary toothplate width** (PMW): The maximum width is measured and expressed as %HL.
18. **Vomerine toothplate width** (VMW): The maximum width is measured and expressed as %HL.
19. **Pre-dorsal length** (PDL): Measured from the tip of the upper jaw to the base of the first dorsal fin ray; expressed as %SL.
20. **Pre-anal length** (PAL): Measured from the tip of the upper jaw to the base of the first anal fin ray; expressed as %SL.
21. **Pre-pelvic length** (PPL): Measured from the tip of the upper jaw to the base of the first pelvic fin ray; expressed as %SL.

22. **Pre-pectoral length** (PPEL): Measured from the tip of the upper jaw to the base of the pectoral spine; expressed as %SL.
23. **Dorsal fin length** (DFL): Measured from the base of the first dorsal fin ray to the base of the last dorsal fin ray; expressed as %SL.
24. **Distance between dorsal and caudal fins** (DCL): An imaginary line is drawn perpendicular to the base of the caudal end of the dorsal fin. Measured from this perpendicular line to the base of caudal fin at the lateral line, expressed as %SL.
25. **Distance between occipital process and the dorsal fin origin** (OPDF): Measured from the tip of occipital process to the base of the first dorsal fin ray; expressed as %SL.
26. **Pectoral spine length** (PESL): Measured from the base to the tip of the pectoral spine; expressed as %SL.
27. **Pectoral fin length** (PEFL): Measured from the pectoral spine base to the tip of longest fin ray; expressed as %SL.
28. **Pelvic fin length** (PFL): Measured from the anterior base to the tip of longest fin ray; expressed as %SL.
29. **Anal fin length** (AFL): Measured from the base of the first to the base of the last anal fin ray; expressed as %SL.

The schematic illustrations of these measurements are presented on Figure1. below.

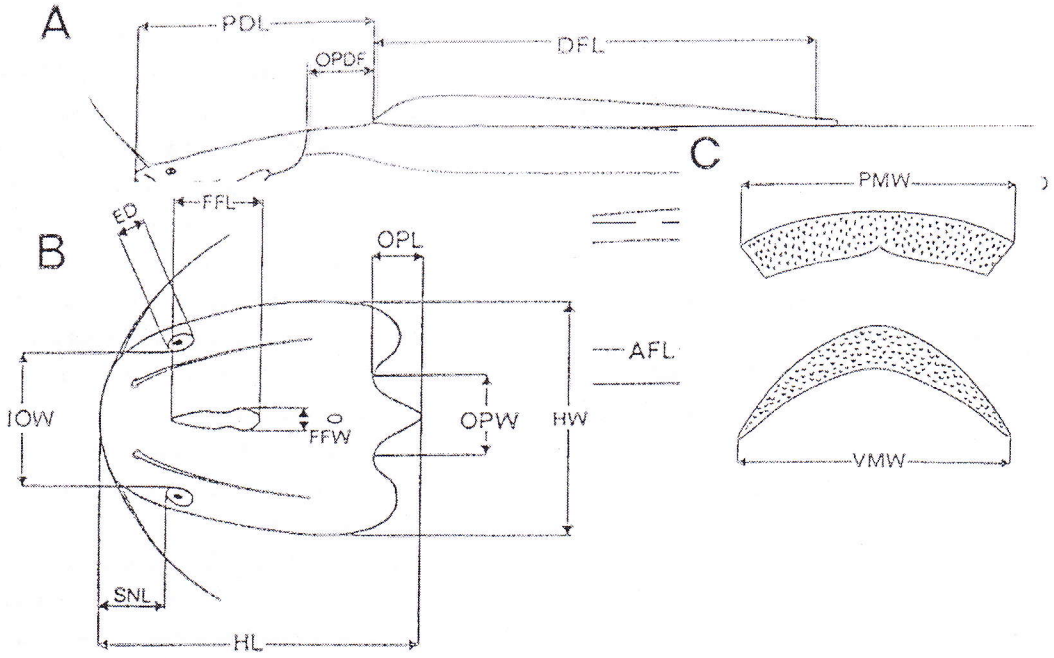

Figure 1: Schematic illustration of some measurements taken on the body of *Clarias* specimens.

A. Standard length (**SL**), Maximal body depth at anus (**MBD**), Caudal peduncle depth (**CPD**), Pre-dorsal length (**PDL**), Pre-anal length (**PAL**), Pre-pelvic length (**PPL**), Pre-pectoral length (**PPEL**), Dorsal fin length (**DFL**), Distance between occipital process and the dorsal fin origin (**OPDF**), Pectoral spine length (**PESL**), Pectoral fin length (**PEFL**), Pelvic fin length (**PFL**), Anal fin length (**AFL**).

B. Eye diameter (**ED**), Frontal fontanelle length (**FFL**), Occipital process length (**OPL**), Frontal fontanelle width (**FFW**), Occipital process width (**OPW**), Head width (**HW**), Interorbital width (**IOW**), Snout length (**SNL**), Head length (**HL**),

C. Premaxillary toothplate width (**PMW**), Vomerine toothplate width (**VMW**),

RESULT

Based on this study 16 species are presently recognised as valid in South-East Asia, namely, Vietnam, Cambodia, Thailand, Malaysia and Indonesia.

KEY IDENTIFICATION

Practical key concerning only species from Southeast Asia and based on morphological characters.

1a Body anguilliform, head short (HL: 16.7-21.1 %SL) and narrow (HW: 11.7-15.0 %SL)——— **-2**

1b Body more compressed with a larger head (HL: 21.2-30.9 %SL; HW: 15.3-21.9 %SL)——— **-3**

2a Short pelvic fin (PFL: 3.8-6.3 %SL), long anal fin (AFL: 59.7-66.8 %SL), long occipital process (OPL: 7.6-13.8 %HL)——— ***C. nieuhofii***

2b Long pelvic fin (PFL: 6.4-7.5 %SL), shorter anal fin (AFL: 56.0-58.9 %SL), short occipital process (OPL: 4.6-6.8 %HL)——— ***-C. pseudonieuhofii***

3a Low number of gill rakers on the first branchial arch (12-13)——— ***-C. abbreviatus***

3b High number of gill rakers on the first branchial arch (27-33)——— ***C. macrocephalus***

3c Number of gill rakers on the first branchial arch between (15-26)——— **-4**

4a Very short distance between the tip of the occipital process and basis of the first dorsal fin ray (OPDF: 1.2-3.8 %SL)——— **-5**

4b Longer distance from the tip of the occipital process to the basis of the first dorsal fin ray (OPDF: 3.8-12.2 %SL)——— **-6**

5a Pectoral spine with numerous fine to sharp serrae on its anterior margin (26-46), absence of black blotches on the body——— ***-C. intermedius***

5b Pectoral spine strongly serrated on its anterior margin (14-22), presence of black blotches on the head, on dorsal and anal fins and on lateral flanks of the body——— ***C. meladerma***

6a Pectoral spine with numerous fine to sharp serrae on its anterior margin——— **-7**

6b Pectoral spine smooth without serrae on its anterior margin——— **-11**

7a Longer anal fin (AFL: 51.9-57.1 %SL)——— **-8**

7b Shorter anal fin (AFL: 42.9-51.6 %SL)——— **-9**

8a Head depth (HD) up to 65.2 %HW (Ng, 1999)——— ***C. leiacanthus***

8b Flattened head (HD: 59.0-63.8 %HW) (Ng, 1999)——— ***C. planiceps***

9a Occipital process rounded, long distance between its tip to basis of the first dorsal fin ray (OPDF: 6.8-11.3 %SL)——— ***-C. olivaceus***

9b Occipital process pointed, short distance between its tip to basis of the first dorsal fin ray (OPDF: 3.8-6.8 %SL)——— **-10**

10a Snout elongated (SNL: 23.8-26.9 %HL) and short pectoral spine (PESL: 8.0-10.3 %SL)——— ***C. fuscus***

10b Snout short (SNL: 17.3-23.6 %HL), pectoral spine robust (PESL: 10.5-15.3%SL)——— ***C. punctatus***

11a Slender body (MBD: 11.0-12.0 %SL)——— ***C. batu***

11b Broad body (MBD: 13.1-18.2 %SL)——— **12**

13a Snout elongated (SNL: 25.2-28.1 %HL) and broad occipital process (OPW: 33.7-39.3 %HL)——— ***C. anfractus***

12b Snout short (SNL: 18.4-25.0 %HL) and narrow occipital process (OPW: 23.6-33.3 %HL)— **-13**

12a Occipital process extremely long and pointed (OPL more than 12 %HL), shorter head (HL less than 23 %SL)——— ***C. microstomus***

13b Occipital process rounded and short (OPL: 5.2-8.0 %HL), longer head (HL: 23.4-26.0 %SL)——— **-14**

14a Short distance from the tip of the occipital process to the basis of first dorsal fin ray (OPDF: 4.5-5.6 %SL)——— ***C. kapuasensis***

14b Long distance from the tip of the occipital process to the basis of first dorsal fin ray (OPDF: 6.4-8.7 %SL)——— ***C. pseudoleiacanthus***

An example of species description for Asian Clarias, Clarias pseudoleiacanthus *(Figure 2).*

***CLARIAS PSEUDOLEIACANTHUS* (new species)**

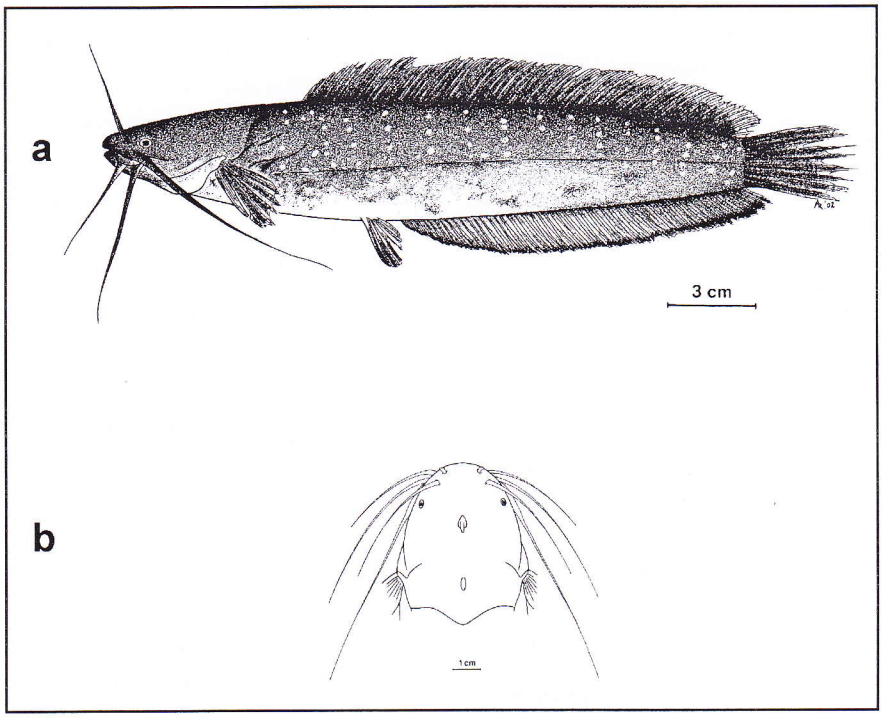

Figure 2: *Clarias pseudoleiacanthus* a: Lateral view of the holotype (MZB 10964); b: Dorsal view of the head of the holotype (MZB 10964).

Original description

Clarias pseudoleiacanthus sp. n. **Sudarto *et al.*** 2003 (Cybium 27(2)).

Material examined

Holotype. – MZB 10964, 220 mm standard length, collected at Satong (peat swamp at about 30 km after Ketapang on the road to Sukadana), Borneo, West Kalimantan, Indonesia, coll. Sudarto and L. Pouyaud, Mar. 2000.

Paratypes. – ZRC 47145, 6 specimens, 175-245 mm SL, same data as the holotype; MNHN 2002-1284, 6 specimens, 176-232 mm SL, same data as the holotype. MRAC 2002-027-P-1-3, 3 specimens, 160-233 mm SL, collected in the peat swampy area around Palangkaraya, Borneo, Central Kalimantan, Indonesia, coll. W. Hadie, Aug. 1999.

Diagnosis

Clarias pseudoleiacanthus is distinguished from all other Asian *Clarias* species by the combination of the following characters: a very short distance between the occipital process and the origin of the dorsal fin (OPDF: 4.5-5.6 %SL), a very short occipital process length (OPL: 5.7-8.0 %HL), long pelvic fin (PFL: 9.1-11.6 %SL) and 17-19 gill rakers on the first branchial arch.

Description

Based on the holotype and 15 paratypes. Measurements are given in Table 1.

Compared to other Southeast Asian *Clarias* species, the head in *C. pseudoleiacanthus* is short and broad and the snout is rounded in dorsal outline. The interorbital distance is more than two fifths of the head length. The eyes are very small and latero-dorsally placed. The frontal fontanelle is short and "sole-shaped" (Teugels, 1986), about twice as long than broad. Its anterior tip never reaches the virtual line between the posterior eye borders. The occipital fontanelle is small, oval-shaped and distantly set from the occipital process basis. The anterior tip of the

occipital fontanelle is always situated posteriorly to the imaginary line connecting the basis of pectoral spines. The occipital process is very short and extremely rounded in all specimens examined; its length is equivalent to the eye diameter.

The barbels are well developed; the nasal and the inner mandibular barbels reach the base of pectoral spine; the maxillary and the outer mandibular barbels attain the dorsal fin origin.

The toothplates are small; the vomerine width is always larger than the premaxillary width.

The dorsal fin origin is situated close to the tip of the occipital process and reaches the caudal fin. Both fins are clearly distinguished and no confluency is noted. There are 66 (holotype) dorsal fin rays. As in the dorsal fin, the anal fin reaches the caudal fin base, but they are not confluent. There are 55-57 (n=3) anal fin rays. The anal fin base is situated closer to the tip of the snout than to the caudal fin base. The anal and dorsal fins are fleshy. The pelvic fins are long and reach the fifth anal fin rays. The pectoral fins are long and largely reach beyond the origin of the first dorsal fin rays. The pectoral spine is broad and covered by skin. Its anterior margin is smooth and no serrations are observed.

The lateral line is visible and its secondary openings can be seen as white spots, regularly placed on the upper side of the flanks.

The number of gill rakers on the complete branchial arch varies between 17 and 19 (n=4) (18 for holotype).

Table 1. Measurements for the holotype and 15 paratypes of *Clarias pseudoleiacanthus*.

SL (mm)	Holotype	Paratypes			
	220	160 - 245			
In % standard length		N	Mean	Min.	Max.	SD
Maximal body depth	17.5	15	17.3	15.7	18.2	0.7
Caudal peduncle depth	7.7	15	7.7	7.1	8.6	0.4
Head length	25.0	15	24.7	23.6	26.0	0.7
Head width	17.5	15	18.0	17.3	18.7	0.5
Predorsal length	30.0	15	29.2	28.0	30.5	0.7
Preanal length	46.6	15	47.6	45.4	49.2	1.1
Prepelvic length	41.1	15	41.7	39.6	43.5	1.1
Prepectoral length	19.3	15	18.3	17.1	19.2	0.6
Dorsal fin length	72.3	15	71.1	69.0	73.7	1.3
Length between dorsal and caudal fin	-0.5	15	0.4	-1.2	1.1	0.8
Length between occipital process and dorsal fin	5.2	15	5.1	4.5	5.6	0.4
Pectoral spine length	9.2	15	10.4	8.7	11.9	0.8
Pectoral fin length	13.5	15	14.9	13.3	16.6	1.0
Pelvic fin length	9.9	15	10.0	9.1	11.6	0.7
Anal fin length	53.6	15	51.3	48.4	54.4	1.6
In % head length		N	Mean	Min.	Max.	SD
Snout length	24.1	15	21.9	18.4	25.0	1.9
Interorbital width	46.1	15	44.4	41.1	47.4	1.6
Eye diameter	5.8	15	5.8	3.6	7.8	1.0
Occipital process length	6.7	15	6.9	5.7	8.0	0.7
Occipital process width	27.9	15	31.0	27.4	33.4	1.3
Frontal fontanelle length	13.2	15	15.9	12.6	20.3	2.1
Frontal fontanelle width	6.4	15	8.6	6.8	11.8	1.4
Premaxillary toothplate width	24.5	15	23.2	20.0	25.6	1.5
Vomerine toothplate width	26.3	15	25.6	24.4	28.1	1.1

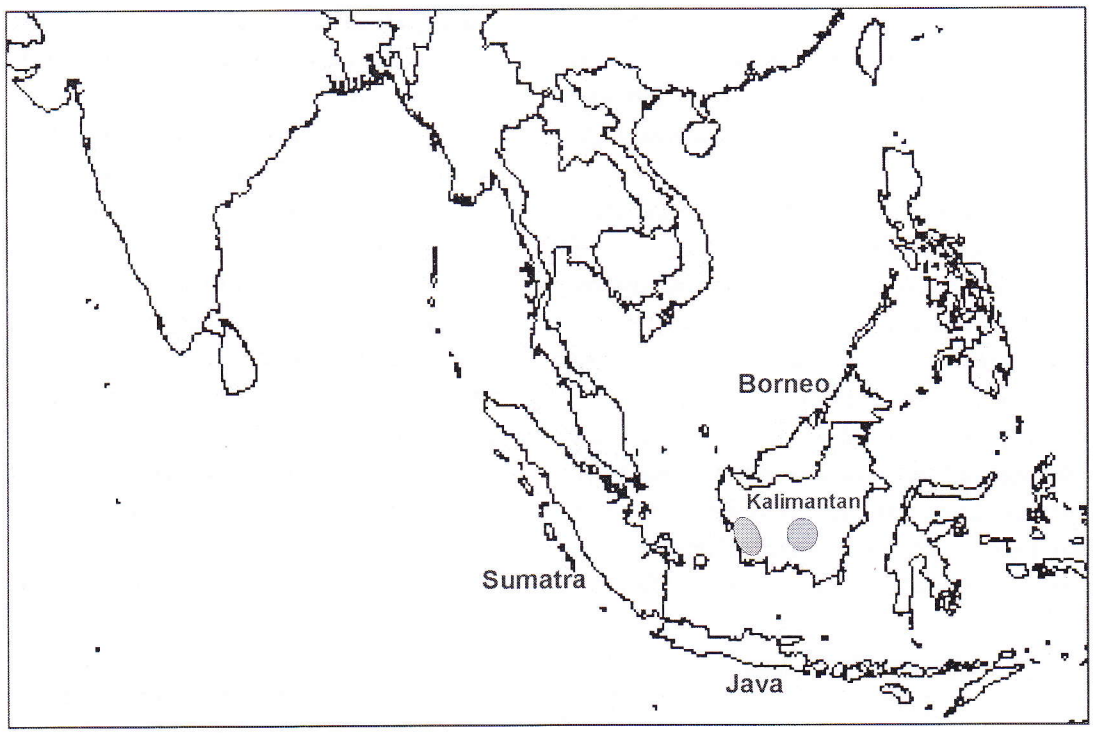

Figure 3: Natural distribution of *Clarias pseudoleiacanthus*

Coloration

Live coloration is black on dorsal and lateral sides of head and body, fading to a paler color on ventral surfaces. The fins and the lips are black. Regular small white or yellow spots are visible on upper and lower side of flanks. On the ventral borders these spots are smaller and more numerous than on the lateral borders.

Distribution

Known from the southern part of the mouth of the Kapuas River in western Kalimantan (Borneo, Indonesia) and in the coastal swampy area near the Barito River in southern Kalimantan (Borneo, Indonesia) (Figure 3).

Habitat

Clarias pseudoleiacanthus inhabits peat swamps in coastal forest areas. The new species was caught together with *C. leiacanthus* and *C. nieuhofii* in West Kalimantan and with *C. meladerma*, *C. leiacanthus, C. intermedius* and *C. nieuhofii* in South Kalimantan.

Conclution

Description of 9 new species within the genus *Clarias* since 1999 proved that the diversity of freshwater from south-east Asia and more especially in the Indonesian archipelago is largerly underestimated. By the way, in the era of biology molecular classical morphological studies, proof their usefullness and shouldn't be neglected.

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