

## RIVERINE CATFISHES OF KALIMANTAN, PANGASIIDAE: DIAGNOSIS, DISTRIBUTION, AND ECOLOGY

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### ABSTRACT

The main constrain to cultivate wild species and optimize the production of cultured species is to due poorly documented of genetic resources. In the current study, it presents the diversity of pangasiids catfishes from Kalimantan. Nine hundreds and ninety nine specimens formed the core of the material examined during this study. On each specimen, 35 point to point measurement, covering the possible variation of the body conformation were taken using dial calipers. Data were subjected to principal component analysis. Data analysis consisted in characterizing groups from scatter plots between pairs of structuring characters for subsequent use in generic identification keys. Three genera with fourteen species exist in eighth main rivers, Barito; Kahayan; Kapuas; Batang Rajang; Kinabatangan; Kayan; Berau, and Mahakam. They are *Helicophagus typus*, *Pteropangasius micronemus*, *Pangasius polyuranodon*, *P. kunyit*, *P. djambal*, *P. macronema*, *P. nasutus*, *P. lithostoma*, *P. humeralis*, *P. kinabatangensis*, *P. sabahensis*, *P. rheophilus*, *P. nieuwenhuisii*, and *P. mahakamensis*. The diagnosis of the species, identification key, distribution, and ecology are given.

**KEYWORDS:** diversity, Pangasiidae, catfish, Kalimantan

### INTRODUCTION

The family of the Pangasiidae belongs to the suborder Siluroidei, order Siluriformes, and superorder Ostariophysi (Fink & Fink, 1981; Nelson, 1994; Teugels, 1996). In general, Pangasiids are riverine catfishes generally occurring in freshwater from the Indian subcontinent to the Indonesian Archipelago. As a consequence of human activities and heavy exploitation, many species in this family are presently being threatened with extinction. The World Conservation Union (IUCN) already lists some species as endangered. Thus, the extraordinary diversity and distribution pattern of the Pangasiidae based on a long evolutionary process is now being rapidly modified under human threats.

In the Mekong Delta, the aquaculture production of *Pangasius* significantly exceeds the production from capture fisheries, showing the economical importance of their aquaculture in the global fisheries sector. Meanwhile, in Indonesia, although more than 10 Pangasiid species have been listed, the only *Pangasius* cultured remained *Pangasianodon hypophthalmus*, introduced from Thailand (Legendre, 1999). Of the 14 valid species from Kalimantan, few have been reproduced successfully: *Pangasius nasutus*, *P. nieuwenhuisii*, and *P. djambal*. Objectives of the study are to present all species and genera of pangasiid catfishes of Kalimantan including their distribution and ecology for aquaculture purposes.

### MATERIALS AND METHODS

Nine hundred and ninety nine specimens, collected during the "Catfish Asia" project (Legendre, 1999), formed the core of the material examined during this

study. On each specimen, 35 point to point measurements covering the possible variation of the body conformation were taken using dial calipers as follows: standard length (SL) from tip of snout to caudal peduncle; head length (HL) from tip of snout to posterior border of operculum; snout length (SNL) from tip of snout to anterior eye border; anterior snout width (SNW1) taken between the anterior nostrils; the posterior snout width (SNW2) taken between posterior nostrils; head depth (HD) taken at the level of the posterior eye border; head width (HW) inter-orbital length taken on frontal part of the head; predorsal distance (PDL) from tip of snout to base of first dorsal spine; caudal peduncle length (CPL) from base of last anal fin ray to middle of caudal peduncle; caudal peduncle depth (CPD) taken as minimum body depth; pectoral spine length (PESL) from its base to its tip; pectoral fin length (PEFL) from pectoral spine base to tip of fin; dorsal spine length (DSP) from base of first dorsal spine to tip; dorsal fin length (DFL) from base of first dorsal spine to tip of fin; pelvic fin length (PFL) from base to tip of fin; anal fin height (AFH) from base of first anal fin ray to tip of longest ray; anal fin length (AFL) from base of first ray to base of last anal ray; adipose fin height (ADFH) from base to tip; maximal adipose fin width (ADFW); maximal orbital diameter (ED); mouth width (WM); lower jaw length (LJL) from tip of snout to corner of mouth; interorbital distance (WT) taken between the eyes; distance snout to isthmus (DSI) from tip of snout to isthmus with a closed mouth; postocular length (OL) from posterior border of eye to posterior border of operculum; maxillary barbel length (MBL); mandibular barbel length (MABL); body width (BW) from left to right scapular excrescence bones close to pectoral spine base; prepectoral length (PEL) from tip of snout to pectoral spine base; prepelvic length (PPL) from tip of snout to first pelvic fin ray base; vomerine width

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(VMW); vomerine length (VML); palatine length (PAL); palatine width (PAW); dorsal spine width (DSW) taken at base of second dorsal spine. The following meristic counts were noted: number of gill rakers on the first branchial arch, number of dorsal, pelvic, pectoral, and anal fin rays. An illustration of the measured characters is shown in Pouyaud *et al.*, (1999), except for SNW1 and SNW2.

### Species Characterization

Data were subjected to principal component analysis (PCA) (Bookstein *et al.*, 1985) using the CSS Statistica package (Stat Soft, Inc.), version 4.5 in order to define structuring characters. For this purpose, measurements were log-transformed in order to minimise the effect of non-normality before the PCA was run on the covariance matrix. The first factor, considered as the size-factor was not taken into account, in order to minimise the effect of size differences between the samples. Allometry is indicated by unequal loadings of variable on the first component, and biological interpretation of allometric data proceed using coefficients of the first components against the second components that was linear. Missing data were casewise deleted. An independent PCA was run on the correlation matrix from the untransformed count data. Finally, data analysis consisted in characterising groups from scatter plots between pairs of structuring characters for subsequent use in generic identification keys.

## RESULTS AND DISCUSSION

Fourteen species exist in eight main rivers in Sumatra (Table 1). Based on the analysis of 35

measured and five counted characters, the diagnosis of the species, the identification key of the species and the description are given below.

### Key to Genera

- 1a. Slender anterior part of snout (<16.5% HL), posterior nostrils are in between anterior nostrils and orbit ***Helicophagus***.
- 1b. Robust anterior part of snout (>16.5% HL), posterior nostrils close behind anterior ones and above imaginary line from anterior nostrils and orbit 2.
- 2a. Eye relatively large, minute maxillary barbel (<192% ED), dorsal and pectoral fins relatively thin, pectoral fin with minute and numerous serrations on the anterior and posterior edge of the fin, and minute adipose fin ***Pteropangasius***.
- 2b. Eye varies from small to large, relatively long maxillary barbel (>192% ED), dorsal and pectoral fins robust, and adipose fin relatively robust ***Pangasius***.

Below, the different genera of pangasiid catfishes of Indonesia are presented. For each genus, a key to the species is given. This is followed by a detailed description for each species recognised as valid.

### *Helicophagus* Bleeker, 1858

Diagnosis: this genus differs from all other pangasiid genera by a short and a large premaxillary toothplate; a narrow mouth (<35% HL); the front border of the snout is pierced by anterior nostrils; a slender anterior part of snout length (<16.5% HL); a short and a large premaxillary toothplate; the posterior nostrils are between and in line with the anterior nostrils and the middle of eye; the vomerine toothplate without additional toothplate.

Table 1. The distribution of fourteen species per river: bold refers to endemic species; \* numbers for the river and basin indicate the areas on Figure 1

River and area*	Species
Barito (1)	<i>Pteropangasius micronemus</i> , <i>Pangasius nasutus</i> , <i>Pangasius polyuranodon</i> , <i>Pangasius djambal</i> , <i>Pangasius macronema</i> , <i>Pangasius kunyit</i> , <i>Helicophagus typus</i>
Kahayan (2)	<i>Pangasius nasutus</i>
Kapuas (3)	<i>Pteropangasius micronemus</i> , <i>Pangasius nasutus</i> , <i>Pangasius polyuranodon</i> , <i>Pangasius kunyit</i> , <b><i>Pangasius lithostoma</i></b> , <b><i>Pangasius humeralis</i></b> , <i>Helicophagus typus</i>
Batang Rajang (4)	<i>Pteropangasius micronemus</i> , <i>Pangasius nasutus</i> and <i>Pangasius polyuranodon</i>
Kinabatangan (5)	<i>Pteropangasius micronemus</i> , <i>Pangasius polyuranodon</i> , <b><i>Pangasius kinabatanganensis</i></b> , and <b><i>Pangasius sabahensis</i></b>
Kayan (6) and Berau (7)	<i>Pangasius rheophilus</i>
Mahakam (8)	<i>Pteropangasius micronemus</i> , <i>Pangasius kunyit</i> , <b><i>Pangasius nieuwenhuisii</i></b> , and <b><i>Pangasius mahakamensis</i></b>

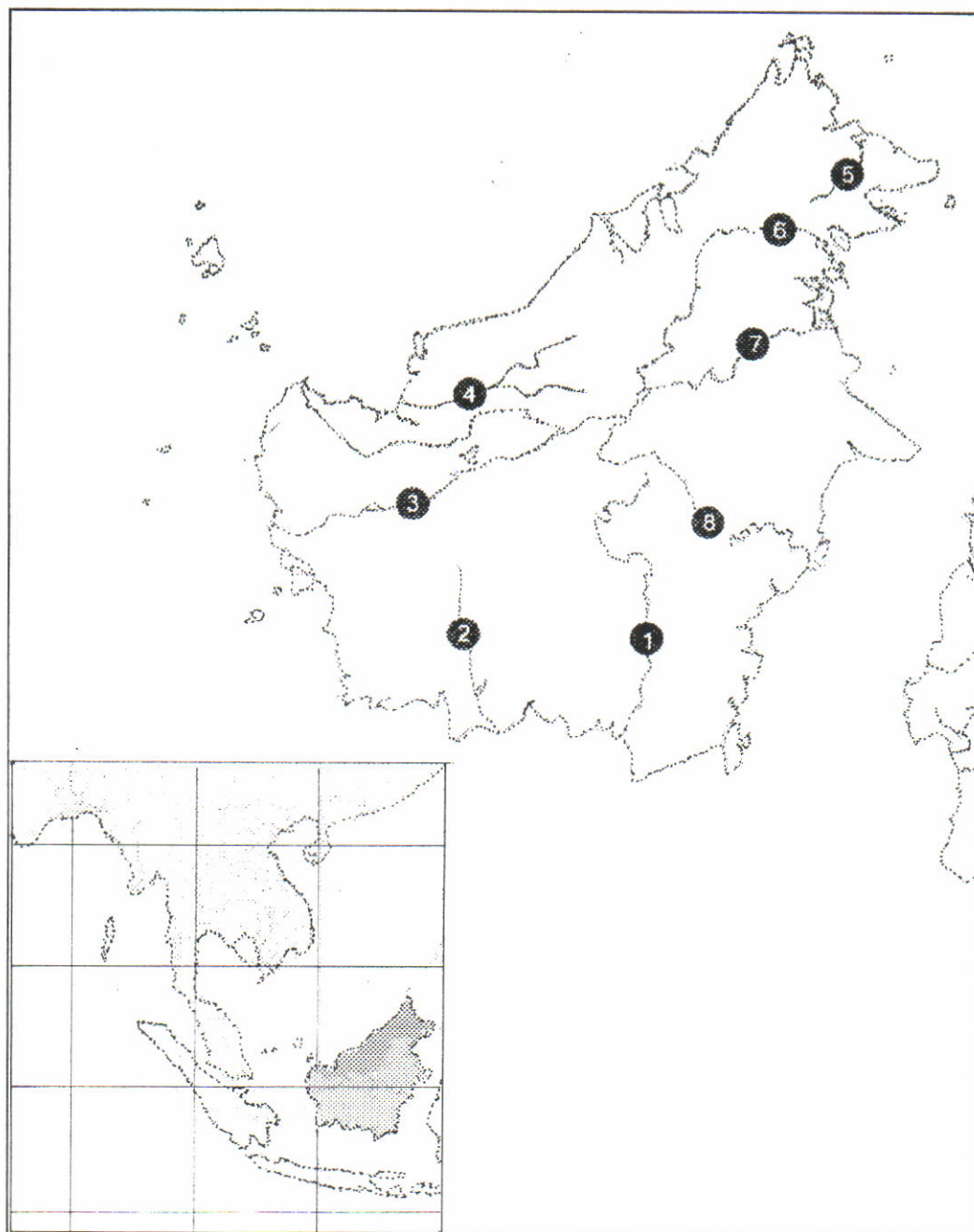


Figure 1. The major rivers of Kalimantan: 1. Barito; 2. Kahayan; 3. Kapuas; 4. Batang Rajang; 5. Kinabatangan; 6. Kayan; 7. Berau; 8. Mahakam.

**Key to Species**

Anal rays 27-30; premaxillary teeth in a single curved band; gill rakers on the first branchial arch 27-33; eye diameter less than 9.3-13.5% HL; mandibular barbel less than 35%; anal fin length less than 32.9%; ***Helicophagus typus***.

***Helicophagus typus* Bleeker, 1858a**

Diagnosis: anal rays 27-30; premaxillary teeth in a single curved band; gill rakers on the first branchial arch 27-33; mandibular barbel less than 35% HL; eye diameter 9.3-13.5% HL; anterior part of snout width 14.7-16.5% HL; anal fin length 29-32.9% SL; body width 14.4-17.2% SL; prepelvic length 41.6-48.3% SL.



Distribution: *Helicophagus typus* occurs in the major Kalimantan drainages: Kapuas River, Sintang, West Kalimantan; Barito River, Muara Teweh, Central Kalimantan. This species occurs in the middle to upper part of the river basins.

Ecology: this species is molluscivorous. The holotype had the stomach entirely filled with hundreds of small gastropods (Bleeker, 1858b). The stomach of the specimen from west Kalimantan was entirely filled with small clams identified as the bivalve *Potamocorbula* sp (Musikasinthorn *et al.*, 1998). The gut contents of four specimens obtained from Sumatra were examined and gastropods as well as bivalves were found in the gut (Tan & Ng, 2000). In the present study, one specimen from the Musi River had only tubificid worms in the stomach.

#### ***Pteropangasius* Fowler, 1937**

Diagnosis: this genus is distinguished from other genera by minute maxillary barbels (<192% ED), dorsal and pectoral fin relatively thin, pectoral fin with numerous minute serrations on the anterior and posterior edge of the spine, minute adipose fin, and eye relatively large.

#### **Key to Species**

Predorsal length 28.1-37.7% SL; anal fin length 22.8-35.2% SL; anal fin rays 26-40; additional toothplates of vomerine toothplate completely separated from vomerine toothplate ***Pteropangasius micronemus***.

#### ***Pteropangasius micronemus* (Bleeker, 1847)**

Diagnosis: predorsal length 28.1-37.7% SL; prepectoral length 15.4-22.6% SL; anal fin rays 26-39; additional toothplate of vomerine toothplate completely separated from vomerine toothplate; eye diameter 15.5-37% HL.

Distribution: *Pangasius micronemus* occurs in major drainages in Kalimantan in the Batang Rajang, Kinabatangan, Kapuas, Barito, Mahakam Rivers.

Ecology: the author revealed that *Pangasius micronemus* is detritivore. In the gut content, I found dung, debris, head of schrimp, insect wing, and fragment of small bones. They live in the middle to upper part of rivers in the shallow part.

#### ***Pangasius valenciennes*, 1840**

Diagnosis: six pelvic fin rays, short predorsal length (<37%), and robust dorsal spine width (>5% HL), robust anterior part of snout length (>16.5% HL), posterior nostrils close behind anterior ones and above imaginary line from anterior nostril and orbit, long and slender premaxillary toothplate, eye varies from small to large, relatively long barbel length (>192% ED), dorsal and pectoral fin robust, and adipose fin relatively robust.

#### **Key to Species**

- 1a. Vomerine toothplate without additional toothplate 2.
- 1b. Vomerine toothplate with additional toothplate 5.
- 2a. High adipose fin (5-6% SL) and narrow anterior part of snout width (22.7-27.2% HL) ***Pangasius kinabatanganensis***.
- 2b. Low adipose fin (less than 5% SL) and large anterior part of snout width (25.5-35.5% HL) 3.
- 3a. Anal fin length more than 31% SL and prepelvic length less than 44% SL ***P. lithostoma***.
- 3b. Anal fin length less than 31% SL and prepelvic length 42-52.9% SL 3.
- 4a. Dorsal spine width more than 7.7-9.3% HL and head width more than 14.1-15.6% SL ***P. humeralis***.
- 4b. Dorsal spine width 5.5-7.6% HL and head width 13.8-16.4% SL ***P. nieuwenhuisii***.
- 5a. Maxillary barbel length 100.5-203.9% HL, mandibular barbel 76.8-176.5% HL, and eye diameter 21.9-45% HL ***P. macronema***.
- 5b. Maxillary barbel less than 100.5% HL and mandibular less than 76.8% HL 6.
- 6a. Predorsal length 25.1-31.2% SL and eye diameter 16.0-30.3% HL ***P. polyuranodon***.
- 6b. Predorsal length more than 30.1% SL 7.
- 7a. Eye diameter less than 22.8% HL and predorsal length more than 31.8% SL 8.
- 7b. Eye diameter 22.8-29.4% HL and predorsal length 30.1-32.7% SL ***P. mahakamensis***.
- 8a. Short distance snout isthmus (less than 110% SNL) 9.
- 8b. Long distance snout isthmus (more than 110% SNL) 10.
- 9a. Maxillary barbel length 79-97%; mandibular length 56-66% HL and dorsal spine width 4.4-5.7% HL ***P. sabahensis***.
- 9b. Gill rakers on the first branchial arch 24-32 ***P. kunyit***.
- 10a. Dorsal spine width 4.7-6.2% HL, head length 19.6-23.2% SL, head width 11-14.2% SL, and body width 14.9-17% SL ***P. rheophilus***.
- 10b. Dorsal spine width 5.4-10.4% HL, head length 21.3-28.8% SL, head width 11.9-20.6% SL, body width 16.5-21.4% SL 11.
- 11a. 27-39 gill rakers on the first branchial arch, anterior part of snout width 29.3-36.6.5% HL ***P. djambal***.
- 11b. Lower gill raker number on the first branchial arch (less than 27), width of mouth 41.9-52.5% HL, vomerine toothplate width 21.9-30.7% HL, and lower jaw length 23.9-31.5% HL ***P. nasutus***.

#### ***Pangasius kinabatanganensis* Roberts & Vidthayanon, 1991**

Diagnosis: *Pangasius kinabatanganensis* is distinguished by the combination of the following characters: single, very big vomerine toothplate, narrow anterior part of snout width (22.7-27.2% HL), mouth subterminal and large 37.6-42.2% HL, adipose



fin big (its height 5-6% SL), anal fin length short 22.5-25.5% SL with 26-31 fin rays.

Distribution: *Pangasius kinabatanganensis* is endemic to the Kinabatangan River in North Borneo (present Sabah), draining into the Sulu Sea, and flowing through flat alluvial plains with a few scattered, low hill (see Inger & Chin, 1962).

Ecology: In the present study, the guts content of five specimens were examined and hard seeds as well as small crustaceans were found in the gut.

#### ***Pangasius lithostoma* Roberts, 1989**

Diagnosis: *Pangasius lithostoma* is distinguished by the following characters: vomerine toothplate single, large and projects downwards from the roof of mouth, small adipose fin (height 2.5-4.3% SL), prepelvic fin 40.1-43.3% HL, anal fin length 32.4-36.4% SL with 36-41 rays, snout oval and rounded, mouth subinferior, humeral process exposed, extending to slightly less than half way to end of pectoral spine.

Distribution: *Pangasius lithostoma* is only known from middle part of Kapuas, the biggest river in West Kalimantan. Kapuas River is the largest and probably has the richest ichthyofauna of any of the modern rivers derived from the Sunda drainage (Roberts, 1989).

#### ***Pangasius humeralis* Roberts, 1989**

Diagnosis: *Pangasius humeralis* is distinguished by the following characters: single enlarged vomerine toothplate, width three times in its length, narrower than other endemic species from Kalimantan, length of humeral process reaches two-third of pectoral spine length, dorsal spine robust 7.7-9.3% HL, compared to the other endemic species, head width 14.1-15.6% SL.

Distribution: *Pangasius humeralis* only occurs in the middle part of the Kapuas in West Kalimantan [see *P. lithostoma* part for explanation]. This species occurs sympatrically with *P. lithostoma* (Roberts, 1989, pers. obs.). The local people differentiate between this species and *P. lithostoma* based on body colouration. They call *P. humeralis* 'black seladang' and *P. lithostoma* as 'white seladang'.

#### ***Pangasius nieuwenhuisii* (Popta, 1904)**

Diagnosis: *Pangasius nieuwenhuisii* is distinguished by the combination of the following characters: vomerine toothplate single and relatively wide, head robust (width 13.8-16.4% SL; length 21.9-24.6% SL; depth 9.6-12.2% SL), dorsal spine width 5.5-7.6% HL, snout ovaly rounded, eye not visible from above, humeral process extend beyond middle of pectoral spine.

Distribution: *Pangasius nieuwenhuisii* is endemic to Kalimantan Timur (Indonesia) and only occurs in the Mahakam basin. The Mahakam River is the second largest river in Kalimantan, with a course of some 920 km and a drainage area of 77.700 km<sup>2</sup> (Christensen, 1992).

Ecology: the stomach of the holotype contains very hard seeds or higher plants, larger seed crushed some 9 mm intact (Roberts & Vidthayanon, 1991). In the present study, the author found hard seeds in the gut content. When the author and fisherman did fishing, we used banana to catch the fish from the middle part of river.

#### ***Pangasius macronema* Bleeker, 1851**

Diagnosis: eye large (21.9-52% HL), maxillary barbel very long reaching the tip of pectoral fin, mandibular barbel 76.8-176.5% HL, maxillary barbel always reaching pectoral fin base (100.5-203.9% HL), gill rakers elongated and slender, 27-46 on the first branchial arch.

Distribution: from all drainages in the Sundaic region, only a single fresh specimen was caught in our study from Barito River, Banjarmasin, Kalimantan Selatan, Indonesia. Of all specimens recorded in literature, two were from Java (Eschmeyer *et al.*, 1998).

Ecology: this species is omnivorous, feeding mainly on insect and small fruits. Scavenger feeding habit is also found (Vidthayanon, 1993).

#### ***Pangasius polyuranodon* Bleeker, 1852**

Diagnosis: recognised by the unique combination of the following characters: somewhat elongated body with a short predorsal length (25.1-31.4% SL), short head length (16.1-20.9% SL), mandibular barbel length (62.8-236.6% ED), eye diameter relatively big (16-30.3% HL), a long caudal peduncle (17.2-21.8% SL), and anal rays 33-42.

Distribution: *Pangasius* is present in southern and western Kalimantan, where it was found in the Barito River (same as type collection from Bleeker), 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 (Inger & Chin, 1962) but no specimens were available for the present study.

Ecology: this species is omnivorous with a tendency to opportunism. In this study, the gut of seven specimens observed contain small gastropods, bivalves, insects, leaves, and detritus. 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. *Pangasius polyuranodon* inhabits estuaries and lower reaches but it has also been observed in upper reaches during the rainy season.



***Pangasius mahakamensis* Pouyaud, Gustiano & Teugels, 2002**

Diagnosis: *Pangasius mahakamensis* is distinguished by the unique combination of following characters: short caudal peduncle (14.0-16.7% SL); relatively large eye diameter (22.8-29.4% HL); mandibular barbel length (85.9-141.8% ED); short head length (20.2-24.5% HL); predorsal length (30.1-32.7% SL) and anal rays 27-32.

Distribution: *Pangasius mahakamensis* is endemic to East Kalimantan, (Indonesia) and it is presently only known from the type locality, the Mahakam River. The Mahakam River is the second largest river in Kalimantan, with a course of some 920 km and a drainage area of 77.700 km<sup>2</sup> (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 transparent.

Ecology: the species is omnivorous, feeding mainly on insects and small fruits (Pouyaud *et al.*, 2002).

***Pangasius sabahensis* Gustiano, Teugels & Pouyaud, 2003**

Diagnosis: *Pangasius sabahensis* is distinguished by the combination of the following characters: the short distance from snout to isthmus (90.9-102.8% SNL), the long mandibular (56.0-66.0% HL) and maxillary barbels (70-97% HL) reaching beyond the posterior border of operculum, the slender dorsal spine (width 4.4-5.7% HL), a broad and rounded head (snout length 44.2-49.6% HL; head depth 11.8-14.0% SL; head width 15.2-18.3% SL), the posterior margin of the dorsal spine with 14-20 strong serrae; the pectoral spine with 16-19 strong serrae on the posterior margin, the short additional toothplates (6.4-10% HL), and 19-23 gill rakers on the first branchial arch.

Distribution: *Pangasius sabahensis* is endemic to northern Borneo and is presently known only from the type locality, the Kinabatangan River, Sabah State, Malaysia. This species is reported from estuarine areas.

Ecology: the species is omnivorous with a tendency towards piscivory increasing with age. *P. sabahensis* occurs sympatrically with *P. micronemus* and *P. kinabatanganensis* in the Kinabatangan River (Gustiano *et al.*, 2003).

***Pangasius kunyit* Pouyaud, Teugels & Legendre, 1999**

Diagnosis: *Pangasius kunyit* is distinguished by the combination of the following characters: the short

distance between snout and isthmus (78.5-96.1% SNL), a somewhat spatulate (broad and rounded) head with a projected snout (head length 21.2-25.4% SL, head width: 15.7-18.9% SL, head depth 10.3-13.4% SL, snout length 45.9-53.9% HL), a robust dorsal spine (width: 6.6-9.3% HL), up to 44 strong serrae on the posterior margin of the dorsal spine, more than 40 strong serrae on posterior margin of the pectoral spine, the short additional toothplates (6.9-14.0% HL), and 24-32 gill rakers on the complete first branchial arch.

Distribution: *Pangasius kunyit* is known from most of the major drainages in Kalimantan where it was found in the Kapuas River (Pontianak, Kalimantan Barat, Indonesia), in the Barito River (Kuala Kapuas and Banjarmasin, Kalimantan Tengah, Indonesia), in the Mahakam River (Samarinda and Sangasanga, Kalimantan Timur, Indonesia).

Ecology: Marine invertebrates were found in gut contents of specimens caught in the delta of the Mahakam River. This species is also piscivorous. In all environments it lives in deeper waters. The species has been collected in fresh and brackish water. Fishermen even report it from plume waters beyond the estuaries (Pouyaud *et al.*, 1999).

***Pangasius rheophilus* Pouyaud & Teugels, 2000**

Diagnosis: *Pangasius rheophilus* is distinguished by the combination of the body width (14.9-17.0% SL), head length (19.6-23.2% SL), head width (11-14.2% SL), dorsal spine width (4.7-6.2% HL) and predorsal length (34.6-36.1% SL). The species is also characterised by a large rectangular vomerine toothplate bordered by long and slender palatine tooth plates. The two-chambered swimbladder is confined to the abdomen.

Distribution: *Pangasius rheophilus* is presently known from Kayan and Berau River in the Bulungan Regency, Kalimantan Timur (Indonesia). *Pangasius rheophilus* has been collected from freshwater near the mouth but also from the upper reaches of the two basins. In the lower reaches, the habitats consist of large pools near the sea, with deep and turbid waters. In the upper reaches, the habitats consist of big torrent characterized by turbulent and clear water (altitude 200-400 m).

Ecology: information from fishermen indicates that immature specimens occur all over the basin; mature specimens seem only present in the upper reaches in running water. Still according to local fishermen, the large specimens are able to cross important water falls by jumping out of the water. Mature fish were caught in November, at the beginning of the rainy season, in the upstream part of the Bahau River (Kayan tributary). Reproductive behaviour is unknown. Skeletal parts of small cyprinid species and remains of fruits were collected in the stomach of a large



specimen (775 mm SL); molluscs predominant in stomach contents of small specimens (Pouyaud & Teugels, 2000).

**Pangasius djambal** Bleeker, 1846

Diagnosis: *Pangasius djambal* is distinguished by unique combination of the following characters: 27-39 gill rakers on the first branchial arch, anterior part of snout width 29.3-36.6% HL, head length 21.8-27.1% SL, head width 13.4-19.4% SL.

Distribution: *Pangasius djambal* occurs in Kalimantan, in the Barito, Mendawai, and Kahayan Rivers.

Ecology: in the present study, the gut content of six specimens of *Pangasius djambal* was examined. The results showed one specimen only contained gastropods; 3 specimens contained gastropods and clams; 1 specimen contained gastropods and seeds. Based on this observation, *P. djambal* is molluscivorous with tendency to opportunism. Specimens in this study were collected from the middle to the upper part of rivers. In all environments, it lives in deeper waters. The environments have a relatively strong current. Nowadays, *P. djambal* already breeds artificially in hatcheries (Legendre et al., 2000).

**Pangasius nasutus** (Bleeker, 1863)

Diagnosis: *Pangasius nasutus* is distinguished by having an inferior mouth, with snout strongly projecting, tooth band of upper jaw entirely exposed when jaws are closed, the jaw teeth very sharp and projected, eye very small (6.6-13% HL), head robust (length 22.8-28.8% SL; width 13-17.2% SL), caudal peduncle slender (depth 5.8-8% SL), body width 16.9-21.7% SL, predorsal length 36.1-40.8% SL, gill rakers on the first branchial arch 16-24.

Distribution: *Pangasius nasutus* occurs in Kalimantan, in the Kapuas, Barito, Batang Rajang Rivers.

Ecology and reproduction: this species tend to be omnivorous, feeding on benthic organisms, hard seed or higher plants, and fishes (pers. obs.). At present, *Pangasius nasutus* has an important commercial value in Sundaic region, where its capture is highly appreciated by fishermen. It is considered as a candidate for aquaculture and its reproduction in captivity has already been achieved (Legendre, 2000: p. 23, 61).

**CONCLUSION**

Principal component analysis using biometric measurements enable to distinguish three genera with fourteen species exist in eight main rivers (Barito,

Kahayan, Kapuas, Batang Rajang, Kinabatangan, Kayan, Berau, and Mahakam) in Kalimantan. They are *Helicophagus typus*, *Pteropangasius micronemus*, *Pangasius macronema*, *P. polyuranodon*, *P. kunyit*, *P. djambal*, *P. nasutus*, *P. kinabatanganensis*, *P. mahakamensis*, *P. sabahensis*, *P. lithostoma*, *P. humeralis*, *P. niuewenhuisii*, and *P. rheophilus*.

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