

Diversity of Pangasiid Catfishes From Sumatra

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ABSTRACT

One of the utmost importance catfish group for fisheries and aquaculture in Southeast Asia is pangasiids. The main constrain to cultivate wild species and optimize the production of cultured species was due to the poorly documented of the genetic resources. In the current study, it presents the diversity of pangasiids catfishes from Sumatra. 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. Four genera with seven species exist in four main rivers, Indragiri; Batang Hari; Musi; Way Rarem, in Sumatra. They are *Helicophagus typus*, *H. Waandersii*, *Pteropangasius micronemus*, *Pangasius polyuranodon*, *P kunyit*, *P. djamba*, and *P. nasutus*. The diagnosis of the species, identification key, distribution and ecology were given.

Key words: Diversity, Pangasiidae, catfish, Sumatra.

ABSTRAK

Salah satu group *catfish* (ikan berkumis) penting untuk perikanan tangkap dan budi daya di Asia Tenggara adalah famili Pangasiidae. Kendala utama untuk membudidayakan spesies dari alam dan meningkatkan produksi ikan budi daya adalah kurangnya informasi tentang plasma nutfah. Studi yang dilakukan menyajikan keragaman pangasius *catfish* dari Sumatra. Sejumlah 999 spesimen digunakan sebagai bahan uji. Pada setiap spesimen dilakukan 35 pengukuran menggunakan jangka sorong untuk menggambarkan keragaman bentuk tubuh. Data diuji dengan *principal component analysis*. Analisis data terdiri dari karakterisasi group menggunakan sebaran data antara pasangan-pasangan karakter pengukuran untuk menghasilkan kunci identifikasi. Empat genera dengan 7 spesies didapatkan dari 4 sungai utama (Indragiri, Batang Hari, Musi, dan Way Rarem) di Sumatra. Spesies-spesies tersebut adalah *Helicophagus typus*, *H. waandersii*, *Pteropangasius micronemus*, *Pangasius polyuranodon*, *P. kunyit*, *P. djambal*, dan *P. nasutus*. Diagnosis dari spesies-spesies tersebut, kunci identifikasi, distribusi, dan ekologi dipaparkan dalam makalah ini.

Kata kunci: Keragaman, Pangasiidae, *catfish*, Sumatra.

INTRODUCTION

The catfishes constitute a significant group in terms of aquaculture production as is evident from the total world fish production of 421 709 mt, valued at US\$ 655.419.500 during 2000, where their contribution was just 1.8% of total the finfish aquaculture production (FAO 2003). One of the great economic importance catfish group for both fisheries and aquaculture in Southeast Asia is pangasiids. They are riverine catfishes generally occurring in freshwater from the Indian subcontinent to the Indonesian Archipelago. Five species also occur in brackish water: *Pangasius pangasius* (Hamilton 1822), *P. krempfi* (Fang and Chaux 1949), *P. kunyit* (Pouyaud *et al.* 1999), *P. sabahensis* (Gustiano *et al.* 2003), and *P. mekongensis* (Gustiano *et al.* 2003). Morphologically, they are recognised by a laterally compressed body, two pairs of barbels (maxillary and mandibular), a short dorsal fin with two hard spines (the first very small, hidden under the skin), a well developed adipose fin, a long anal fin and a strong pectoral spine (Teugels 1996).

Judging from the literature, the main constraint to cultivate wild species and to optimise the production of cultured species is due to the poorly documented of the genetic resources. In current study, it presents the diversity of pangasiids catfishes from Sumatra.

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 (PPEL) from tip of snout to pectoral spine base; prepelvic length (PPL) from tip of snout to first pelvic fin ray base; vomerine width (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.

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 DISCUSSIONS

Seven species exist in four 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 pec-

Table 1. The distribution of species per river.

River and area*	Species
Indragiri (1)	<i>Pteropangasius micronemus</i> , <i>Pangasius nasutus</i> , <i>Pangasius polyuranodon</i> , <i>Pangasius djambal</i> , <i>Pangasius kunyit</i>
Batang Hari (2)	<i>Pteropangasius micronemus</i> , <i>Pangasius nasutus</i> , <i>Pangasius polyuranodon</i> , <i>Pangasius djambal</i> , <i>Pangasius kunyit</i> , <i>Helicophagus wandersii</i> , <i>Helicophagus typus</i>
Musi (3)	<i>Pteropangasius micronemus</i> , <i>Pangasius nasutus</i> , <i>Pangasius polyuranodon</i> , <i>Pangasius djambal</i> , <i>Pangasius kunyit</i> , <i>Helicophagus wandersii</i> , <i>Helicophagus typus</i>
Way Rarem (4)	<i>Pteropangasius micronemus</i> , <i>Pangasius polyuranodon</i>

* numbers for the river and basin indicate the areas on Figure 1.

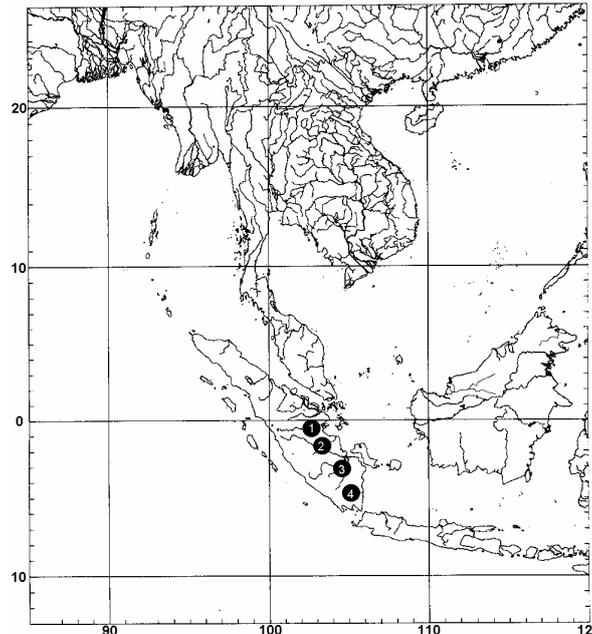


Figure 1. The major rivers of Sumatra: 1. Indragiri, 2. Batang Hari, 3. Musi, 4. Way Rarem.

toral fins robust, and adipose fin relatively robust ***Pangasius***

***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.

Key to Species

1a. 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***
 1b. Anal ray counts more than 35; premaxillary teeth divided into two quadratic bands; gill rakers on the first branchial arch 7-18; eye diameter more than 14% HL; mandibular barbel more than 35%; anal fin length more than 33.6% 2
 2. Vomerine tooth plate length 1.2-4.2% HL; vomerine tooth plate length is about one third of premaxillary tooth plate length ... ***H. waandersii***

***Helicophagus typus* Bleeker, 1858**

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 Musi River, Palembang, South Sumatra; Batang Hari River, Jambi. 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 1858). The stomach of the specimen from west Kalimantan was entirely filled with small clams identified as the bivalve *Potamocorbula* sp. (Musikasinthorn and Utsugi 1998). The gut contents of four specimens obtained from Sumatra were examined and gastropods as well as bivalves were found in the gut (Tan and Ng 2000). In the present study, one specimen from the Musi River had only tubificid worms in the stomach.

***Helicophagus waandersii* Bleeker, 1858**

Diagnosis: anal rays 36-39; premaxillary teeth divided into two quadratic bands; gill rakers on the first branchial arch 7-12; eye diameter 14.9-21.2% HL; vomerine toothplate length 1.2-4.2% HL; vomerine toothplate length is about one third of premaxillary toothplate length.

Distribution: this species occurs in the major river basins in Sumatra, especially Batang Hari River in Jambi Province.

Ecology: this species is molluscivorous, feeds predominantly on bivalves.

***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 complete-

ly 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 the Rarem, Musi, Batang Hari, and Indragiri 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. Predorsal length 25.1-31.2% SL and eye diameter 16.0-30.3% HL ***P. polyuranodon***
- 1b. Predorsal length more than 30.1% SL 2
- 2a. Short distance snout isthmus (less than 110% SNL), gill rakers on the first branchial arch 24-32 ***P. kunyit***
- 2b. Long distance snout isthmus (more than 110% SNL) 3
- 3a. 27-39 gill rakers on the first branchial arch, anterior part of snout width 29.3-36.6.5% HL ***P. djambal***
- 3b. 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 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 polyuranodon* is presently known from the major drainages from Sumatra where it was observed in the Musi, Batang Hari, Indragiri and Way Rarem Rivers.

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 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 Sumatra, where it was observed in the Musi River (Palembang), in the Batang Hari River (Jambi, Muara Jambi and Muara Tebo) and in the Indragiri River (Rengat). In Sumatra, *P. kunyit* was usually identified as *P. pangasius* or *P. djambal*.

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 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* is presently known from most major drainage of Sumatra, in the Musi, Batang Hari, and Indragiri 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 Sumatra, in the Musi, Batang Hari and Indragiri 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).

CONCLUSION

Principal component analysis using biometric measurements enable to distinguish four genera with seven species exist in four main rivers (Indragiri, Batang Hari, Musi, Way Rarem) in Sumatra. They are *Helicophagus typus*, *H. Waandersii*, *Pteropangasius micronemus*, *Pangasius polyuranodon*, *P. kunyit*, *P. djambal* and *P. nasutus*

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