Pangasiid Catfishes of Indonesia

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ABSTRACT

Pangasiidae are economically important riverine catfishes generally occurring in freshwater from the Indian subcontinent to the Indonesian Archipelago. Morphologically, they are recognized by a laterally compressed body, two pairs of barbels, a short dorsal fin with two spines, a well developed adipose fin, a long anal fin, and a strong pectoral spine. The systematics of this family are still poorly known. Consequently, the lack of this basic information is a great barrier in understanding the biology and hence the study of the aquaculture potential of species, the improvement of their seed production and growth performance. Objectives of the study are to present all species and genera of pangasiid catfishes of Indonesia including their distribution and detailed identification.

Key words: Pangasiidae, catfish, systematic, taxonomy, Indonesia.

ABSTRAK

Kelompok ikan pangasius atau pangasiidae merupakan jenis penting ikan "catfish" (bersungut) yang hidup di air tawar dan tersebar dari daratan India hingga kepulauan Indonesia. Secara umum ikan ini memiliki bentuk tubuh memanjang dan ramping, dua pasang sungut, sirip punggung yang relatif pendek dengan dua duri keras, sirip lunak tambahan yang berkembang sempurna sebagai pengontrol renang, dan tulang sirip dada yang kuat. Secara sistematik, kelompok ikan pangasius masih belum dikenal secara baik. Oleh karena itu, kurangnya informasi dasar yang dimiliki pada kelompok ikan ini merupakan hambatan utama untuk memahami sifat-sifat biologinya, pengembangan budidayanya, produksi benih, dan perbaikan keragaannya. Tujuan dari studi yang dilakukan adalah untuk menyajikan semua spesies dan genus ikan pangasius yang ada di Indonesia mencakup distribusi, sebaran, dan kunci identifikasinya secara detail.

Kata kunci: Pangasiidae, pangasius, sistematik, taksonomi, Indonesia.

INTRODUCTION

Catfishes are generally one of the economically important groups of fresh and brackish water fishes in the world: in many countries, they form a significant part of inland fisheries, several species have been introduced in fishculture. Numerous species are of interest to the aquarium industry where they represent a substantial portion of the world trade (Teugels 1996). 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). The present study concerns the taxonomy of freshwater catfish, Pangasiidae because judging from the literature, the main constraint to cultivate wild species and to optimise the production of cultured species is needed to the poorly documented systematics of this family (Legendre 1999).

Considerable confusion has arisen in the systematics of this group of catfish. Most of the previous workers described species without consulting existing type specimens. Nearly all authors have problems recognizing juveniles of the larger species, and junior synonyms are often based on small sized specimens. In their revision of the family Pangasiidae, Roberts and Vidthayanon (1991) recognised only two genera with 21 species: *Pangasius* Valenciennes 1840 (19 species) and *Helicophagus* Bleeker 1858 (2 species). The latter are distinguished on the characters related to the relative position of eyes and nostrils (Weber and de Beaufort 1913), and the shape of snout, ethmoid region and palatal toothbands (Roberts and Vidthayanon 1991, Vidthayanon 1993). Nevertheless, this work was not supported by any phylogenetic study. The monophyly of the genera or the species groups has not been demonstrated yet. It should be noted too that their work was based on a limited number of specimens for many species and that only few morphometric variables were studied. Recently, seven new species were added to the genus *Pangasius* (Pouyaud *et al*. 1999, 2000, 2002,

Roberts 1999, Gustiano *et al*. 2003) and one species was described in the genus *Helicophagus* (Ng and Kottelat 2000).

At present, the only preliminary phylogenetic study on this family has been published by Pouyaud *et al.* (2000) in which the phylogenetic interferences based on molecular data provide support for the recognition of some of the *Pangasius* sub-genera and, or species groups as distinct genera. This confirms that the systematics of this family have not been studied properly (Gustiano 2003).

Of the 28 valid species, few have been reproduced successfully: *P. hypophthalmus* since 1966, and more recently several others including *Pangasianodon gigas*, *Pangasius bocourti* Sauvage 1880 and *Pangasius djambal* Bleeker 1846 (Roberts and Vidthayanon 1991, Legendre *et al*. 2000). Objectives of the study were to present all species and genera of pangasiid catfishes of Indonesia including their distribution and detailed identification.

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. The material from all other examined species was sampled in Bangladesh, Vietnam, Cambodia, Thailand, Malaysia, and Indonesia. Additional material including the types of 49 previously described species housed in various museums was also examined.

On each specimen, 35 point to point measurements covering the possible variation of the body conformation were taken using dial callipers 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 indicate 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

Based on the analysis of 35 measured and five counted characters, the diagnosis of the family, the identification key of the genera and the description of the valid species are given below.

Pangasiidae

Morphologically, pangasiid catfishes are recognized by a laterally compressed body, the presence of two pairs of barbels (one pair of maxillary and one pair of mandibular), the relatively long anal fin, and short dorsal fin with two spines (first small and hidden under the skin), adipose fin small with free posterior margin.

Key to Genera

1a. 8-9 pelvic fin rays, long predorsal length (>37% SL), and slender dorsal spine width (3.5-5% HL) ..... ***Pangasianodon***
1b. 6 pelvic fin rays 2
2a. Slender anterior part of snout (<16.5% HL), posterior nostrils are in between anterior nostrils and orbit ..... ***Helicophagus***
2b. Robust anterior part of snout (>16.5% HL), posterior nostrils close behind anterior ones and above imaginary line from anterior nostrils and orbit 3
3a. 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***
3b. 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

Helicophagus Bleeker 1858b:45 (type species *Helicophagus typus* Bleeker 1858, by monotypy), Günther 1864:64, Weber and De Beaufort 1913:251, Hardenberg 1948:412, Burgess 1989:105, Roberts and Vidthayanon 1991:138, Kottelat *et al*. 1993:100, Rainboth 1996:152.

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 babel more than 35%, anal fin length more than 33.6% ..... ***H. waandersii***

Helicophagus typus Bleeker 1858

H. typus Bleeker 1858b:45 (type locality Musi River, Palembang, South Sumatra, Indonesia), Günther 1864:64, Weber and De Beaufort 1913: 252, Hardenberg 1948:412, Burgess 1989:105, Roberts and Vidthayanon 1991:139, Kottelat *et al*. 1993:100, Musikasinthorn 1998:197, Tan and Ng 2000:287.

Distribution: *H. typus* occurs in the major Indonesian drainages: Musi River, Palembang, South Sumatra, Batang Hari River, Jambi, Sumatra, 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 and Ng 2000). In the present study, one specimen from the Musi River had only tubificid worms in the stomach.

Helicophagus waandersii Bleeker 1858

Helicophagus waandersii Bleeker 1858a:175 (type locality Musi River, Palembang, Sumatra, Indonesia), Günther 1864:65, Weber and De Beaufort 1913:253, Fig. 102. Kottelat *et al*. 1993:100, Tan and Ng 2000:287.

Distibution: This species occurs in the major river basins in Sumatra, especially Batang Hari River in Jambi Province. Lim and Zakaria-Ismail (1995) reported that the species also exists in Pahang River, Peninsula Malaysia.

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

Pangasianodon Chevey 1930

Pangasianodon Chevey 1930:536, Fig. 1, 2 (type *Pangasianodon gigas* Chevey 1930, no type designated), Smith 1945:372, Rainboth 1996:153.

Pangasius (*Pangasianodon*) Roberts and Vidthayanon 1991:102, Vidthayanon 1993:160.

Key to species

Head length less than 29% SL, prepectoral length less than 25% SL, anterior part of snout width less than 30% HL, anal fin length more than 27.5% SL, distance between snout and isthmus more than 37% HL .... ***Pangasianodon hypophthalmus***

Pangasianodon hypophthalmus Sauvage 1878

Helicophagus hypophthalmus Sauvage 1878:235 (type locality Laos), Sauvage 1881:170, Smith 1945:370, Kottelat 1984:881 (Lectotype and paralectotype designation).

Pangasius hypophthalmus: Hora 1923:166, Fowler 1934:88.

Pangasius sutchi Fowler 1937:141, Smith 1945:361.

Pangasius (Pangasianodon) hypophthalmus: Roberts and Vidthayanon 1991:121, Vidthayanon, 1993:26.

Pangasianodon hypophthalmus: Rainboth 1996:153.

Distribution: Found in the large Mekong River and Chao Phraya Basin, and now widely introduced for aquaculture in South East Asia. Common in the lower Mekong, where the young are collected for rearing in floating fish cages. Less common in middle, winter migration in October to December from feeding grounds (Tonle sap Lake in central Cambodia) to spawning areas (Khoné Falls in southern Laos) (see Hogan 2003, Roach 2003). Mekong it is represented by large individuals that lose the dark colouration of the juveniles and subadults and become grey without stripes (see Rainboth 1996).

Ecology: Inhabits large rivers. Omnivorous, feeding on fish and crustaceans as well as on vegetable debris (Rainboth 1996).

Pteropangasius Fowler 1937

Pteropangasius Fowler 1937:142 (type *Pteropangasius cultratus* Smith 1931, by monotypy), Smith 1945:369.

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

Pangasius micronemus Bleeker 1847:8 (type locality, Solo River, Java, Indonesia), Günther 1864:63, Weber and De Beaufort 1912:535, Roberts 1989:132, Roberts and Vidthayanon 1991:129, Kottelat *et al*. 1993:101, Tan and Ng 2000:288.

Pangasius micronema: Weber and De Beaufort 1913:261, Roberts 1989:132, Roberts and Vidthayanon 1991:129, Rainboth 1996:156.

Pangasius rios Bleeker 1851b:205 [type locality Bandjermassing (presently Banjarmasin), South Kalimantan, Indonesia].

Pseudolais tetranema Vaillant 1902:52 (type locality Mahakam River at Tepoe, East Kalimantan, Indonesia).

Pangasius dezwaani Weber and De Beaufort, 1912:14, Fig. 3 (type locality Taluk, Sumatra, Indonesia).

Pangasius hoeksi Hardenberg 1948:412 (type locality Kapuas River, West Kalimantan).

Pangasius tubbi Inger and Chin 1959:287, Fig. 47 (type locality the confluence of the Deramakot River with Kinabatangan River, Kinabatangan District, Sabah (North Borneo), Malaysia.

Distribution: *P. micronemus* occurs in major drainages in Sumatra in the Rarem, Musi, Batang Hari and Indragiri Rivers, in Java in the Solo and Brantas Rivers, in Kalimantan in the Batang Rajang, Kinabatangan, Kapuas, Barito, Mahakam Rivers. In Indochina, the species exists in the Mekong and Chao Phraya 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

Pangasius Cuvier and Valenciennes 1840:45, Günther 1864:61, Weber and De Beaufort 1913:254, Smith 1945, Jayaram 1977:26, 357, Burgess 1989:105, Roberts 1989:131, Roberts and Vidthayanon 1991:112, Kottelat *et al*. 1993:100, Rainboth 1996:154.

Key to Species

1a. Vomerine toothplate without additional toothplate 2
1b. Vomerine toothplate with additional toothplate 4
2a. Anal fin length more than 31% SL and prepelvic length less than 44% SL ..... ***P. lithostoma***
2b. Anal fin length less than 31% SL and prepelvic length 42-52.9% SL 3
3a. Dorsal spine width more than 7.7-9.3% HL and head width more than 14.1-15.6% SL ..... ***P. humeralis***
3b. Dorsal spine width 5.5-7.6% HL and head width 13.8-16.4% SL ..... ***P. nieuwenhuisii***
4a. Maxillary barbel length 100.5-203.9% HL, mandibular barbel 76.8-176.5% HL, and eye diameter 21.9-45% HL ..... ***P. macronema***
4b. Maxillary barbel less than 100.5% HL and mandibular less than 76.8% HL 5
5a. Predorsal length 25.1-31.2% SL and eye diameter 16.0-30.3% HL ..... ***P. polyuranodon***
5b. Predorsal length more than 30.1% SL 6
6a. Eye diameter less than 22.8% HL and predorsal length more than 31.8% SL 7
6b. Eye diameter 22.8-29.4% HL and predorsal length 30.1-32.7% SL ..... ***P. mahakamensis***
7a. Short distance snout isthmus (less than 110% SNL), gill rakers on the first branchial arch 24-32 ..... ***P. kunyit***
7b. Long distance snout isthmus (more than 110% SNL) 8
8a. 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***
8b. 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 9
9a. 27-39 gill rakers on the first branchial arch, anterior part of snout width 29.3-36.6.5% HL ..... ***P. djambal***
9b. 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 lithostoma Roberts 1989

Pangasius lithostoma Roberts 1989:132 (type locality, Kapuas River, Sintang, West Kalimantan, Indonesia), Roberts and Vidthayanon 1991:127.

Distribution: *P. 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

Pangasius humeralis Roberts 1989:131 (type locality Kapuas River, Sintang, West Kalimantan, Indonesia), Roberts and Vidthayanon 1991:121.

Distribution: *P. 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. lithosoma* as 'white seladang'.

Pangasius nieuwenhuisii Popta 1904

Neopangasius nieuwenhuisii Popta 1904:180 (type locality rivière Bo, Mahakam Basin, East Kalimantan, Indonesia), Popta 1906:30.

P. nieuwenhuisi: Weber and De Beaufort 1913:258, Roberts 1989:131, Kottelat *et al.* 1993:102.

P. (*Neopangasius*) *nieuwenhuisii*: Roberts and Vidthayanon 1991:133, Vidthayanon 1993:50.

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^2 (Christensen 1992).

Ecology: The stomach of the holotype contains very hard seeds or higher plants, larger seed crushed some 9 mm intact (Roberts and 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

Pangasius macronema Bleeker 1851a:11 (type locality Barito River, Banjarmasin, South Kalimantan, Indonesia), Günther 1864:62, Weber and De Beaufort 1913:260, Burgess 1989:105, Roberts 1989:133, Robers and Vidthayanon 1991:127, Kottelat *et al.* 1993:101, Rainboth 1996:155.

Pangasius delicatissimus Bleeker 1862 (type locality Krawang, West Jawa, Indonesia).

Pangasius siamensis Steindachner 1879:393 (type locality Me Nam River, Bangkok, Thailand).

Pangasius aequilabialis Fowler 1937:140, Figs.20-23 (type locality Bangkok, Thailand).

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 1998a, 1998b). This species also occurs in the continent of Southeast Asia in the Mekong and Chao Phraya Rivers.

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

Pangasius polyuranodon Bleeker 1852

Pangasius polyuranodon Bleeker 1852a:425 (type locality Barito River, Banjarmasin, South Kalimantan, Indonesia), Weber and De Beaufort, 1913:257, Roberts 1989:133, Kottelat *et al.* 1993:102, Tan and Ng 2000:288.

Pangasius juaro Bleeker 1852b:589 (type locality, Palembang, South Sumatra, Indonesia).

P. polyuranodon Bleeker 1862:72.

Distribution: *P. polyuranodon* is presently known from the major drainages from Sumatra where it was observed in the Musi, Batang Hari, Indragiri and Way Rarem Rivers. *P. polyuranodon* is also 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 and 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. *P. polyuranodon* inhabits estuaries and lower reaches but it has also been observed in upper reaches during the rainy season.

Pangasius mahakamensis Pouyaud, Gustiano, andTeugels 2002

Pangasius mahakamensis Pouyaud *et al*. 2002:246 (type locality Sangasanga, Mahakam River, Samarinda, East Kalimantan, Indonesia).

P. polyuranodon non Bleeker 1852a, Smith 1945:363, Kottelat 1989:14, Roberts and Vidthayanon 1991:136, Vidthayanon 1993:63, Rainboth 1996:157.

Distribution: *P. 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^2 (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 kunyit Pouyaud, Teugels, and Legendre 1999

Pangasius kunyit Pouyaud *et al*. 1999:247, (type locality Mahakam River, Sangasanga, Samarinda, East Kalimantan, Indonesia).

Pangasius n. sp.1 Pouyaud *et al*. 2000:1513 (specimens from Mahakam River, Sangasanga, East Kalimantan, Indonesia).

Distribution: *P. kunyit* is known from most of the major drainages in Sumatra (Indonesia), 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). *P. kunyit* is also present 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). 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 rheophilus Pouyaud and Teugels 2000

Pangasius rheophilus Pouyaud and Teugels 2000:193 (type locality Bahau River, tributary of the upper Kayan at Longpujungan, Bulungan, East Kalimantan, Indonesia).

Pangasius n. sp.2 Pouyaud *et al*. 2000:1513 (specimens from Kayan and Berau Rivers, Bulungan, Kalimantan Timur, Indonesia).

Distribution: *P. rheophilus* is presently known from Kayan and Berau River in the Bulungan Regency, Kalimantan Timur (Indonesia). *P. 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 and Teugels 2000).

Pangasius djambal Bleeker 1846

Pangasius djambal Bleeker 1846:290 [type locality Java, Batavia (presently Jakarta), Indonesia], Günther 1864:62, Roberts and Vidthayanon 1991:116.

Pangasius bedado Roberts 1999:109 (type locality Musi River, Sumatra, Indonesia)

Distribution: *P. djambal* is presently known from most major drainage of Sumatra, in the Musi, Batang Hari, and Indragiri Rivers. The species also occurs in Java, respectively, in the Brantas and Solo Rivers. In Kalimantan, in the Barito, Mendawai, and Kahayan Rivers. Although the type locality of *P. djambal* is Batavia (former name of Jakarta), nowadays the species seems to have disappeared from all rivers of Jawa Barat.

Ecology: In the present study, the gut content of six specimens of *P. 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

Pseudopangasius nasutus Bleeker 1862:72 (type locality Barito River, Banjarmasin, South Kalimantan, Indonesia), Günther 1864:63, Weber and De Beaufort 1913:256, Burgess 1989:105, Roberts 1989:133, Roberts and Vidthayanon 1991:132, Vidthayanon 1993:39, Kottelat *et al*. 1993:73, Tan and Ng 2000:288.

Pangasius ponderosus Herre and Myers 1937 [Herre and Myers 1937:67, pl. 6 (type locality Chandra Dam, Perak, Malaysia)].

Distribution: *P. nasutus* occurs in Sumatra, in the Musi, Batang Hari and Indragiri Rivers. In Kalimantan, in the Kapuas, Barito, Batang Rajang Rivers. In Peninsula Malaysia, in the Perak and Pahang 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

During this study twenty 14 species were recognized as valid in the family of Pangasiidae in Indonesia. The present study recognised four genera: *Pteropangasius* Fowler 1937, *Helicophagus* Bleeker 1858, *Pangasianodon* Chevey 1930, and *Pangasius* Valenciennes 1840.

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