Technical Manual for Artificial Propagation of the Indonesian Catfish, *Pangasius djambal*
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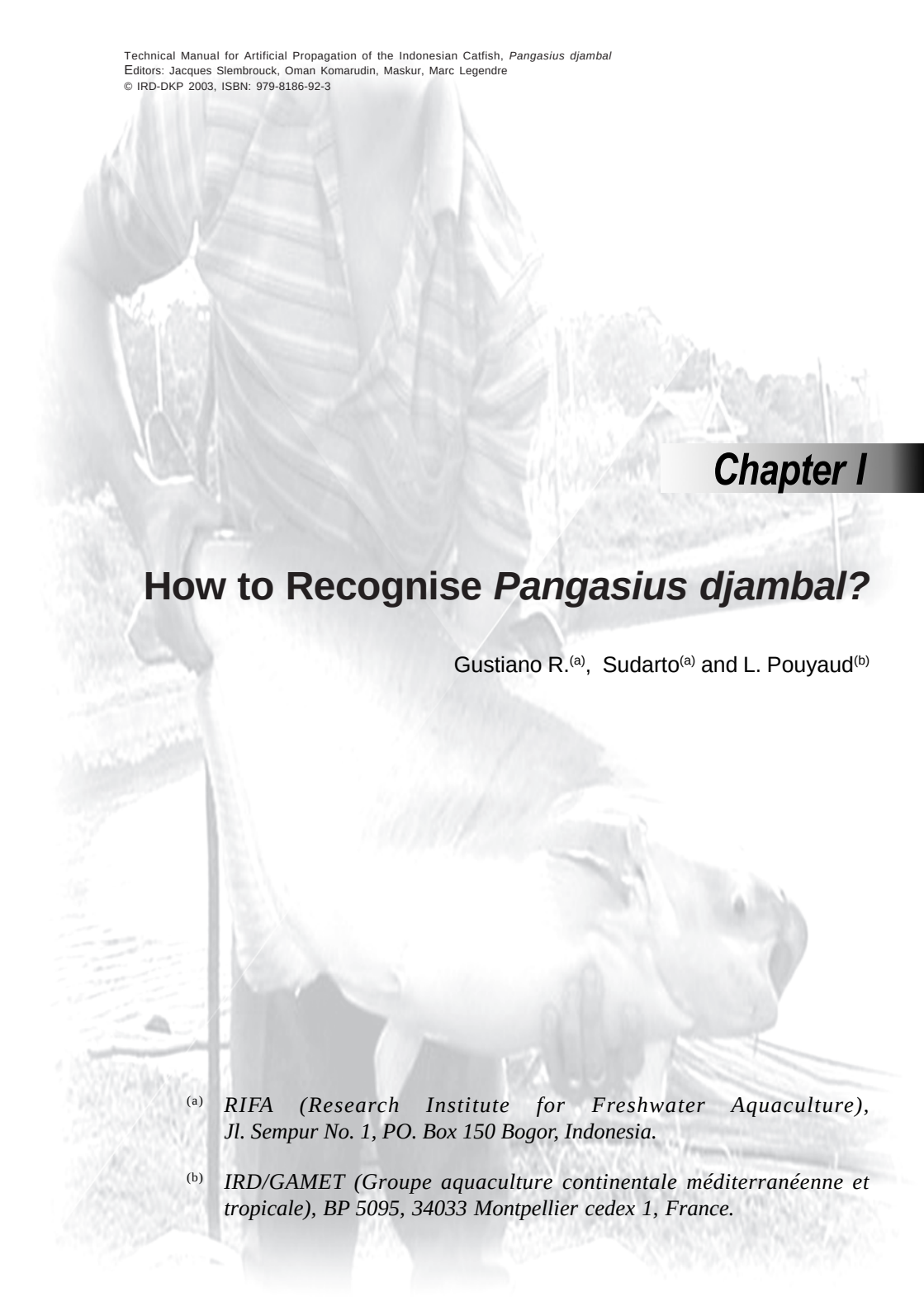

Chapter I

How to Recognise *Pangasius djambal?*

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Systematics is the study of organisms' biodiversity and relationships among the taxa (Elredge, 1992). This involves arranging the diversity into a system of species-classification and defining identification keys (Helfman *et al*., 1997). All theories and strategies for the conservation and sustainable use of the biodiversity can only be efficient when the species are correctly identified. Referring to the literature, it is clear that one of the main barrier to breed wild species and to optimise production of the reared species is the scarcity of systematic knowledge (Lazard, 1999; Legendre, 1999).

Since the taxonomic group of Pangasiidae was first recognised and established as Pangasini Bleeker, 1858 (Ferraris and de Pinna, 1999), its content and classification have been greatly changed through the endeavours of various ichthyologists. Considerable confusion arose in the systematics of this catfish group as most of the previous workers described species without consulting existing type specimens. Nearly all authors encountered problems recognising juveniles of large species, and junior synonyms were often based on small sized specimens. The case of *Pangasius djambal* perfectly illustrates this situation. Vidthayanon (1993) indicated that this species was only known from Java (Batavia, Krawang, Tjikao and Parongkarong Rivers), Kalimantan (Barito and Kapuas Rivers), and Sumatra (Musi River). Roberts and Vidthayanon (1991) reported that this species was reared in Java and in South Sumatra, and was erroneously identified as *P. pangasius* by Meenakarn (1986). Subsequent studies conducted by Legendre *et al*., (2000) and Pouyaud *et al*. (1999, 2000) demonstrated that the pangasiid species reared in Java until 1996 was *Pangasianodon hypophthalmus* (Sauvage, 1878) (ex. *P. sutchi*), and that the local species bred in Sumatra before 1996 could have been *P. djambal*, *P. kunyit* Pouyaud, Teugels and Legendre, 1999, *P. nasutus* Bleeker, 1863, or a possible mix of those species.

SPECIES DIVERSITY OF PANGASIIDAE IN INDONESIA

Following Gustiano (2003), 14 valid species of Pangasiidae are reported from Indonesia, including *P. hypophthalmus* an exotic species introduced from Thailand. These species are distributed in 4 genera, respectively *Helicophagus* Bleeker, 1858 (2 species: *H. typus* Bleeker, 1858 and *H. waandersii* Bleeker, 1858); *Pangasianodon* Chevey, 1930 (1 species: *P. hypophthalmus*); *Pteropangasius* Fowler, 1937 (1 species: *P. micronemus* (Bleeker, 1847) and *Pangasius* Valenciennes, 1840 (12 species: *P. lithostoma* Roberts, 1989; *P. humeralis* Roberts, 1989; *P. nieuwenhuisii* Popta, 1904; *P. macronema* Bleeker, 1851; *P. polyuranodon* Bleeker, 1852;

P. mahakamensis Pouyaud, Gustiano and Teugels, 2002; *P. kunyit*; *P. rheophilus* Pouyaud and Teugels, 2000; *P. nasutus*; *P. djambal* Bleeker, 1846). In Indonesia, the pangasiids inhabit most of the major river drainage systems from the central alluvial plain of Sumatra (Way Rarem, Musi, Batang Hari and Indragiri Rivers), from the eastern part of Java (Brantas and Bengawan Solo Rivers), and from Kalimantan (Kayan, Berau, Mahakam, Barito, Kahayan and Kapuas Rivers).

The species diversity of Pangasiidae is unequally distributed within each major river basin with large species diversity in Sumatra and high endemicity rates in Kalimantan (a species is considered as endemic when its natural distribution is confined to a single river system). The species composition of each major river system is given in Table I.1, which summarises the results given by Vidthayanon (1993), Pouyaud *et al*. (2000) and Gustiano (2003).

Table I.1

Natural distribution of the 13 autochthonous Pangasiidae species per river basin in Indonesia (bold face refers to endemic species).

River basin (Geographic area)	Pangasiidae species composition
Way Rarem (South Sumatra)	*Pteropangasius micronemus, Pangasius polyuranodon*
Musi (South Sumatra)	*Pangasius djambal, Pteropangasius micronemus, Pangasius nasutus, Pangasius polyuranodon, Pangasius kunyit, Helicophagus waandersii, Helicophagus typus*
Batang Hari; Indragiri (Central and North Sumatra)	*Pangasius djambal, Pteropangasius micronemus, Pangasius nasutus, Pangasius polyuranodon, Pangasius kunyit, Helicophagus waandersii, Helicophagus typus*
Brantas, Bengawan Solo (Central and East Java)	*Pangasius djambal, Pteropangasius micronemus*
Barito, Kahayan (Central Kalimantan)	*Pangasius djambal, Pteropangasius micronemus, Pangasius nasutus, Pangasius polyuranodon, Pangasius macronema, Pangasius kunyit, Helicophagus typus*
Kapuas (West Kalimantan)	*Pangasius kunyit, Pteropangasius micronemus, Pangasius nasutus, Pangasius polyuranodon,* ***Pangasius lithostoma, Pangasius humeralis,*** *Helicophagus typus*
Mahakam (East Kalimantan)	*Pangasius kunyit, Pteropangasius micronemus,* ***Pangasius nieuwenhuisii, Pangasius mahakamensis***
Kayan, Berau (East Kalimantan)	***Pangasius rheophilus***

GEOGRAPHIC DISTRIBUTION AND MONITORING OF NATURAL POPULATIONS OF *P. DJAMBAL*

Pangasius djambal is widely distributed throughout Indonesia (Table I.1). Nevertheless, since 1995 field observations and market surveys indicate that captures of this species are in decline in the Musi River (Sumatra) and in the eastern part of Java. This is probably the consequence of a lethal cocktail between strong modification of their natural habitat (dam construction), spoiling, and/or overfishing. Artificial reproduction of *P. djambal* could be a positive alternative to the deterioration of wild stocks through an expected decrease in fisheries pressure and in the promotion of restocking programs. To be successful, propagation of artificial seeds of *P. djambal* should be done according to the spatial distribution of their natural populations (Sudarto *et al*., 2001). According to these authors, *P. djambal* is composed of three natural stocks, respectively in Java, Sumatra and Kalimantan. Each stock is highly differentiated genetically from each other, and should not be genetically polluted or modified by influx of exogenous genes.

METHODOLOGY USED FOR DISTINGUISHING *P. DJAMBAL*

Biometrics is a powerful method to characterise and to distinguish *P. djambal* from all other pangasiid species present in Indonesia. This method is based on morphological measurements taken on the body and on the vomerine and palatine toothplates. Gustiano (2003) in a systematic revision of Pangasiidae used 35 point to point measurements (Plate I.1) which were taken with dial callipers.

MORPHOLOGICAL CHARACTERISTICS OF *P. DJAMBAL*

Pangasius djambal Bleeker, 1846 (Plate I.2) and its junior synonym, *Pangasius bedado* Roberts, 1999 are distinguished by a unique combination of the following characters: 6 pelvic fin rays, robust anterior part of snout width (29.3 – 36.6% of head length), long maxillary barbel (>200% of eye diameter; between 31.8 and 66.2% of head length), adipose fin well developed, vomerine toothplate with lateral extension, long predorsal length (35.5 – 41.9% standard length), great eye diameter (10.1 – 21.3% head length), long distance from the snout extremity to the isthmus (103.8 – 133.3%

snout length), robust dorsal width (5.7 – 9.5% head length), large body width (16.8 – 21.4% standard length), head length (21.8 – 27.1% standard length), head width (13.4 – 19.4% standard length), and 27 to 39 gill rakers on the first branchial arch.

DETERMINATION KEY FOR *P. DJAMBAL*

In order to be effective, this determination procedure must be used following the successive steps given below:

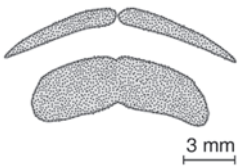
1 **a.** A fish with 8 – 9 pelvic fin rays, a long predorsal length (>37% of standard length), and a slender dorsal spine width (3.5 – 5% of head length) is *Pangasianodon hypophthalmus*, a species introduced in Indonesia from Thailand for aquaculture.
b. A fish with only 6 pelvic fin rays is a local species from Indonesia. See **2**.

2 **a.** A fish with a slender anterior part of snout (<16.5% of head length), with posterior nostril situated between anterior nostrils and orbit, is *Helicophagus waandersii* or *Helicophagus typus*.
b. A fish with a robust anterior part of snout (>16.5% of head length), with posterior nostril close behind anterior ones and above imaginary line from anterior nostrils and orbit belongs to the genera *Pangasius* or *Pteropangasius.* See **3**.

3 **a.** A fish with eye relatively large, minute maxillary barbel (<192% of eye diameter), dorsal and pectoral fins relatively thin, pectoral fin with minute and numerous serrations on the anterior and posterior edge of the fin spine, and minute adipose fin, is *Pteropangasius micronemus.*
b. A fish with relatively long maxillary barbel (>192% of eye diameter), robust dorsal and pectoral fins, and adipose fin well developed, belongs to the genus *Pangasius.* See **4**.

4 **a.** A fish with a vomerine toothplate without lateral extension (Figure I.1) is one of the endemic species from Kalimantan which include *Pangasius lithostoma* (Kapuas), *Pangasius humeralis* (Kapuas) and *Pangasius nieuwenhuisii* (Mahakam).

Figure I.1.
Vomerine toothplate without lateral extension (e.g. *Pangasius humeralis*).



b. A fish with a vomerine toothplate with lateral extension, namely palatine toothplate, (Figure I.2) is one of the following species *Pangasius djambal*, *Pangasius macronema*, *Pangasius polyuranodon*, *Pangasius mahakamensis*, *Pangasius nasutus*, *Pangasius kunyit* or *Pangasius rheophilus.* See **5**.

Figure I.2.
Vomerine toothplate with lateral extension (e.g. *Pangasius polyuranodon*).

5 **a.** A fish with very long maxillary barbel length (100.5 – 203.9% of head length), long mandibular barbel (76.8 – 176.5% of head length) is *Pangasius macronema.*
b. For a fish with maxillary barbel less than 100.5% of head length and mandibular barbel less than 76.8% of head length. See **6**.

6 **a.** A fish with a predorsal length between 25.1 and 31.2% of the standard length and with an eye diameter between 16.0 and 30.3% of the head length is *Pangasius polyuranodon.*
b. A fish with a predorsal length between 30.1 and 32.7% of the standard length and with an eye diameter between 22.8 and 29.4% of the head length is *Pangasius mahakamensis.*
c. For a fish with a predorsal length more than 31.8% of the standard length and with an eye diameter less than 22.8% of the head length, see **7**.

7 **a.** A fish with a short distance from the snout extremity to the isthmus (less than 110% of the snout length) is *Pangasius kunyit.*
b. For a fish with a long distance from the snout extremity to the isthmus (more than 110% of the snout length). See **8**.

8 **a.** A fish with a dorsal spine width between 4.7 and 6.2% of the head length, a head length between 19.6 and 23.2% of the standard length, a head width between 11.0 and 14.2% of the standard length, and a body width between 14.9 and 17.0% of the standard length is *Pangasius rheophilus.*
b. For a fish with a dorsal spine width between 5.4 and 10.4% of the head length, a head length between 21.3 and 28.8% of the standard length, a head width between 11.9 and 20.6% of the standard length, and a body width between 16.5 and 21.4% of the standard length. See **9**.

9 **a.** A fish with 16 to 24 gill rakers on the first branchial arch is *Pangasius nasutus.*

b. A fish with 27 to 39 gill rakers on the first branchial arch is *Pangasius djambal.*

REFERENCES

Elredge, N., 1992. Systematics, ecology and biodiversity crisis. *Columbia University Press*, NY, USA. 220 p.

Ferraris, C.J. Jr and M.C.C. de Pinna, 1999. Higher-level names for catfishes (Actinopterygii: Ostariophysi: Siluriformes). *Proc. Cal. Acad. Sci.*, 51: 1-17.

Gustiano, R., 2003. Taxonomy and phylogeny of pangasiidae catfishes from Asia (Ostariophysi, Siluriformes). Ph.D. Thesis. Katholieke Universiteit Leuven. 304 p.

Helfman, G.S., B.B. Collette and D.E. Facey, 1997. The diversity of fishes. *Blackwell Science Inc.*, MA, USA. 528 p.

Lazard, J., 1999. Interest of basic and applied research on *Pangasius* sp. for aquaculture in the Mekong Delta: Situation and prospects. In: *The biological diversity and aquaculture of Clariid and Pangasiid Catfish in Southeast Asia*. Proc. mid-term workshop of the "Catfish Asia project" (Editors: M. Legendre and A. Pariselle), IRD/GAMET, Montpellier. p:15-20.

Legendre, M., 1999. The Catfish Asia project: Backgrounds aims and prospects. In: *The biological diversity and aquaculture of Clariid and Pangasiid Catfish in Southeast Asia*. Proc. mid-term workshop of the "Catfish Asia project" (Editors: M. Legendre and A. Pariselle), IRD/GAMET, Montpellier. p: 7-14.

Legendre, M., L. Pouyaud, J. Slembrouck, R. Gustiano, A.H. Kristanto, J. Subagja, O. Komarudin, Sudarto and Maskur, 2000. *Pangasius djambal*: A new candidate species for fish culture in Indonesia. *IARD Journal*, 22: 1-14.

Meenakarn, S., 1986. Induced spawning of *Pangasius pangasius* (Hamilton) carried out in South Sumatra, Indonesia. Report of cage culture and seed production subproject of the Small Scale Fisheries Development Project. Directorate General of Fisheries, Indonesia-USAID: 12 pp.

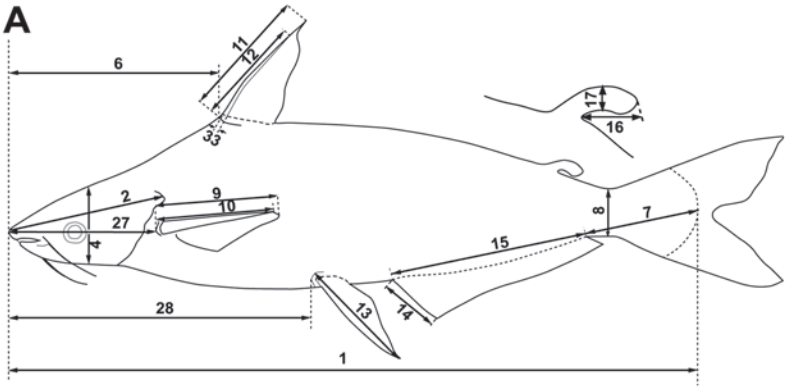
Pouyaud, L., G.G. Teugels and M. Legendre, 1999. Description of a new pangasiid catfish from South-East Asia (Siluriformes). *Cybium*, 23: 247-258.

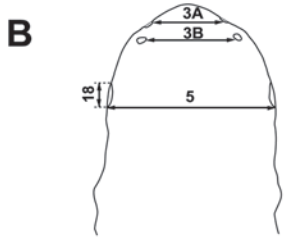
Pouyaud, L., G.G. Teugels, R. Gustiano and M. Legendre, 2000. Contribution to phylogeny of pangasiid catfishes based on allozymes and mitochondrial DNA. *J. Fish Biol*., 56: 1509-1538.

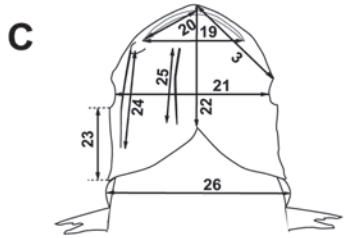
Roberts, T.R. and C. Vidthayanon, 1991. Systematic revision of the Asian catfish family Pangasiidae, with biological observation and description of three new species. *Proc. Acad. Nat. Sci. Philad*. 143: 97-144.

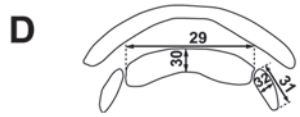
Sudarto, R. Gustiano and L. Pouyaud, 2001. Strategi apakah yang digunakan untuk pembudidayaan *Pangasius djambal* secara terpadu? In: *Program Penelitian untuk Pengembangan Budidaya Ikan Patin Lokal (Siluriformes, Pangasiidae) di Indonesia*. Laporan ke Departemen Luar Negeri, Kedutaan Perancis di Indonesia. 45-50.

Vidthayanon, C., 1993. Taxonomic revision of the catfish family Pangasiidae. Ph.D. Thesis. Tokyo University of Fisheries. 203 p.





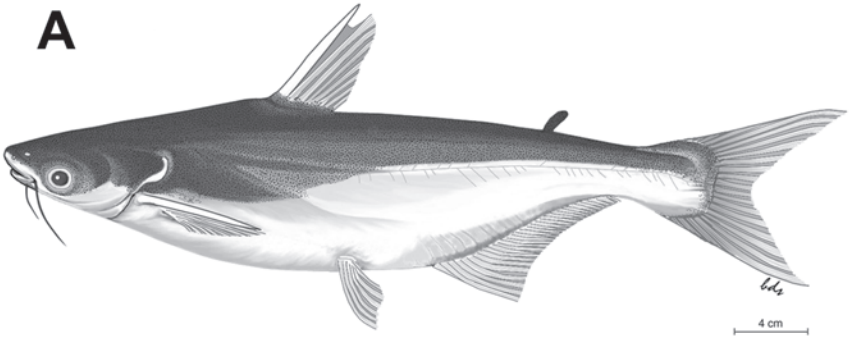


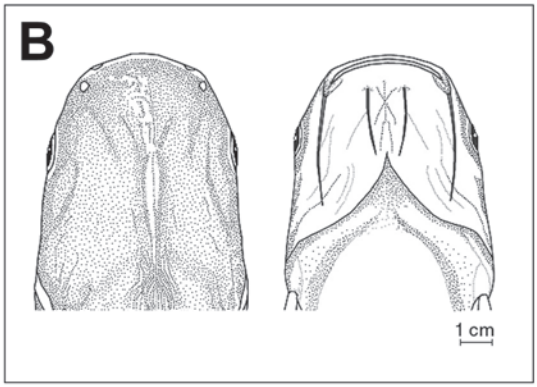


1. Standard length;
2. Head length;
3. Snout length;
3A. Anterior snout width;
3B. Posterior snout width;
4. Head depth;
5. Head width;
6. Predorsal length;
7. Caudal peduncle length;
8. Caudal peduncle depth;
9. Pectoral fin length;
10. Pectoral spine length;
11. Dorsal fin length;
12. Dorsal spine width;
13. Pelvic fin length;
14. Anal fin height;
15. Anal fin length;
16. Adipose fin height;
17. Adipose fin width;
18. Eye diameter;
19. Mouth width;
20. Lower jaw length;
21. Interorbital length;
22. Distance snout to isthmus;
23. Postocular length;
24. Maxillary barbel length;
25. Mandibulary barbel length;
26. Body width;
27. Prepectoral length;
28. Prepelvic length;
29. Vomerine toothplate width;
30. Vomerine toothplate length;
31. Palatine toothplate length;
32. Palatine toothplate width;
33. Dorsal spine width.

Plate I.1.

Measurements taken on *Pangasius* specimens (Gustiano, 2003).





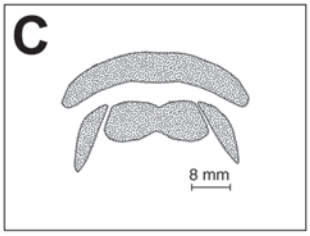


Plate I.2.

Pangasius djambal description.

A. Lateral view of the body (IRD-68, 418 mm SL); **B.** Dorsal (left) and ventral (right) view of the head; **C.** Premaxillary (above) and vomerine (below) toothplates of the same specimen.

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