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Campus de São José do Rio Preto

Arieli Matheus Cherobim

Phylogenetic analysis of *Harttia* Steindachner, 1877 (Siluriformes: Loricariidae: Loricariinae)

São José do Rio Preto
2022

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Tese apresentada como parte dos requisitos para obtenção do título de Doutor em Biologia Animal, junto ao Programa de Pós-Graduação em Biologia Animal, Área de Concentração – Sistemática e Evolução, do Instituto de Biociências, Letras e Ciências Exatas da Universidade Estadual Paulista "Júlio de Mesquita Filho", Campus de São José do Rio Preto.

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Coorientador: Dr. Osvaldo Takeshi Oyakawa
Supervisor de estágio no exterior: Dr. Raphaël Covain

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Comissão Examinadora

Prof. Dr. Francisco Langeani Neto
Universidade Estadual Paulista, campus de São José do Rio Preto
Orientador

Profa. Dra. Lúcia Helena Rapp Py-Daniel
Instituto Nacional de Pesquisas da Amazônia

Prof. Dr. Roberto Esser dos Reis
Pontifícia Universidade Católica do Rio Grande do Sul

Profa. Dra. Fernanda de Oliveira Martins
Instituto Federal do Paraná, campus Londrina

Prof. Dra. Carine Cavalcante Chamon
Universidade Federal do Tocantins, campus de Porto Nacional

São José do Rio Preto
29 de abril de 2021

Para meu grande amor e minha maior saudade, vó Ivoneti (in memoriam)

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"Educação não transforma o mundo.
Educação muda as pessoas.
Pessoas transformam o mundo".
Carlos Rodrigues Brandão (2008, p. 164)

Aviso

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Notice

This thesis is part of the requirements for the PhD degree in Animal Biology, and should not be taken as a scientific publication. Therefore, new information, opinions, and hypotheses, are not available in the scientific literature. Interested people ought to be aware of that public references to this study should be done only after previous acceptance of the author.

RESUMO

O gênero *Harttia* foi descrito por Steindachner, 1877 e atualmente é composto por 27 espécies, assumindo a segunda posição em relação a maior diversidade intragenérica de Loricariinae, sendo superada apenas por *Rineloricaria* com 65 espécies. Contudo, várias espécies aguardam para serem descritas, tornando a sistemática do gênero complexa e longe de ser resolvida. Várias hipóteses de relacionamento filogenético entre os gêneros da subfamília foram propostas ao longo do tempo. Os estudos realizados até o momento concordam em relação ao monofiletismo de *Harttia*, mas não sobre seu posicionamento em relação aos demais Loricariinae. Além disso, as análises disponíveis incluem um pequeno número de espécies e, portanto, não são representativas da história evolutiva do grupo, o que evidencia e justifica a proposição de um estudo mais detalhado. Portanto, o objetivo deste trabalho foi realizar análises filogenéticas independentes com base em caracteres morfológicos e moleculares para as espécies do gênero *Harttia*. A análise morfológica abrangeu 275 caracteres de osteologia e morfologia interna e 64 terminais, incluindo membros de Astroblepidae, todas as subfamílias de Loricariidae, 24 gêneros de Loricariinae e 25 espécies de *Harttia*. O resultado do cladograma de consenso estrito não corrobora o monofiletismo do gênero, demonstrando uma grande radiação das espécies. *Harttia absaberi* foi recuperada como mais próxima dos demais gêneros de Loricariinae do que com as espécies do próprio grupo, e *Cteniloricaria* abrigada dentro de *Harttia*. Já a análise molecular foi reconstruída com 129 sequências, contemplando táxons presentes em trabalhos anteriores e também terminais adicionais. Seis marcadores foram escolhidos: 12S, 16S, *f-rtn4r*, COI, RAG-1 e RAG-2, contemplando genes nucleares e mitocondriais. Os resultados também não corroboram o monofiletismo de *Harttia*, mas é possível definir três grupos monofiléticos entre as espécies. O grupo das Guianas aparece como grupo-irmão de *Cteniloricaria*, esse clado como grupo-irmão das espécies de *Harttia* do Sudeste do Brasil e todos esses grupos relacionados com as espécies da margem direita do rio Amazonas.

Palavras-chave: Região Neotropical, cascudos, filogenia, sistemática, biogeografia.

ABSTRACT

The genus *Harttia* was described by Steindachner, 1877 and is currently composed of 27 species, assuming the second position regarding the highest intrageneric diversity of the Loricariinae, being exceeded only by *Rineloricaria* with 65 species. However, several species are waiting to be described, making the systematics of the genus complex and far from being resolved. Several hypotheses of phylogenetic relationships among the genera of the subfamily have been proposed over time. The studies performed so far agree on the monophyly of *Harttia*, but not on its position relative to the other Loricariinae. Furthermore, the available analyses include a small number of species and are therefore not representative of the evolutionary history of the group, which highlights and justifies the proposition of a more detailed study. Therefore, the aim of this work was to perform independent phylogenetic analyses based on morphological and molecular characters for the species of the genus *Harttia*. The morphological analysis encompassed 275 characters of osteology and internal morphology and 64 terminals, including members of Astroblepidae, all subfamilies of Loricariidae, 24 genera of Loricariinae and 25 species of *Harttia*. The results of the strict consensus cladogram do not corroborate the monophyly of the genus, demonstrating a great radiation of the species. *Harttia absaberi* was recovered as closer to the other genera of Loricariinae than to the species of the group itself, and *Cteniloricaria* harbored inside *Harttia*. The molecular analysis was reconstructed with 129 sequences, contemplating taxa present in previous works and also additional terminals. Six markers were chosen: 12S, 16S, *f-rtn4r*, COI, RAG-1 and RAG-2, contemplating nuclear and mitochondrial genes. The results also do not support the monophyly of *Harttia*, but it is possible to define three monophyletic groups among the species. The group from Guianas appears as a sister group to *Cteniloricaria*, this clade as sister group to the species of *Harttia* from southeastern Brazil, and all these groups are related to the species from the right bank of the Amazon River.

Keywords: Neotropical region, catfishes, phylogeny, systematic, biogeography.

LIST OF FIGURES

GENERAL INTRODUCTION

Figure 6. Shape and cartilage in the mesethmoid tip, ventral view. A) Straight and no cartilage: *Harttia absaberi*, MZUSP 85806, 60.5 mm SL, paratype. B) Spatula and no cartilage: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. C) Arrow and present cartilage: *Harttia gracilis*, MZUSP 99678, 61.0 mm SL. D) T-shaped and no cartilage: *Metaloricaria paucidens*, INPA 5440, 73.7 mm SL. Scale bar 1 mm..... 240

Figure 7. Uncinate process in the mesethmoid tip (arrow), ventral view. A) Absent: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. B) Present: *Harttia absaberi*, MZUSP 85806, 60.5 mm SL, paratype. Scale bar 1 mm..... 241

Figure 8. Ventrolateral crest of the mesethmoid (arrow), dorsal view. A) Absent: *Harttia absaberi*, MZUSP 85806, 60.5 mm SL, paratype. B) Present, wider near vomer: *Reganella depressa*, MZUSP 57729, 152.0 mm SL. C) Present, with the same width along the entire length: *Harttia longipinna*, DZSJRP 3666, 51.5 mm SL, paratype. Scale bar 1 mm..... 242

Figure 9. Dorsolateral crest of the mesethmoid (arrow), dorsal view. A) Absent: *Harttia absaberi*, MZUSP 85806, 60.5 mm SL, paratype. B) Present: *Planiloricaria cryptodon*, MZUSP 56252, 93.1 mm SL. Scale bar 1 mm..... 243

Figure 10. Ventroposterior border of the lateral ethmoid (arrow), dorsal view. A) Little extended, followed by the anterior margin of the orbit: *Lithogenes wahari*, MZUSP 103074, 53.1 mm SL, paratype. B) Slightly enlarged, but not contributing to the orbit floor: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. C) Greatly enlarged, contributing to the orbit floor: *Reganella depressa*, MZUSP 57729, 152.0 mm SL. Scale bar 1 mm..... 244

Figure 11. Dorsal process of the sphenotic (arrow), dorsal view. A) Absent: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. B) Present: *Harttia longipinna*, DZSJRP 3666, 51.5 mm SL, paratype. Scale bar 1 mm..... 245

Figure 12. Relationship between basioccipital (bo), exoccipital (ex) and transcapular ligament (tl), ventral view. Arrows indicate the limit of the basioccipital lateral processes (blp) and the transcapular ligament. A) Small lateral processes, shorter than the basioccipital height but not expanded ventrally; Basioccipital not connected to the transcapular ligament and exoccipital between both; Transcapular ligament not expanded ventrally: *Reganella depressa*, MZUSP

Appendix 1. The evolutionary history was inferred by using the Maximum Likelihood method and General Time Reversible model (NEI & KUMAR, 2000). The bootstrap consensus tree inferred from 1000 replicates (FELSENSTEIN, 1985) is taken to represent the evolutionary history of the taxa analyzed (FELSENSTEIN, 1985). Branches corresponding to partitions reproduced in less than 50% bootstrap replicates are collapsed. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (1000 replicates) are shown next to the branches (FELSENSTEIN, 1985). Initial tree(s) for the heuristic search were obtained automatically by applying Neighbor-Join and BioNJ algorithms to a matrix of pairwise distances estimated using the Maximum Composite Likelihood (MCL) approach, and then selecting the topology with superior log likelihood value. A discrete Gamma distribution was used to model evolutionary rate differences among sites (5 categories (+G, parameter =

LIST OF TABLES

GENERAL INTRODUCTION

CHAPTER 1: Morphological phylogeny of *Harttia* Steindachner, 1877 (Siluriformes: Loricariidae: Loricariinae)

CHAPTER 2: Molecular phylogeny of *Harttia* Steindachner, 1877 (Siluriformes: Loricariidae: Loricariinae)

SUMMARY

GENERAL INTRODUCTION

General aspects about family, subfamily and genus

Loricariidae Rafinesque, 1815 is the largest family of Siluriformes. Ferraris (2007) recognized 96 genera and 716 species, however Fricke *et al*. (2021) indicates 1.024 valid species, with 229 described over the last 10 years (2012-2021). Furthermore, Loricariidae is the most representative family when comparing the number of Siluriformes described over 25 years between 1990 and 2014: 48% of the total, corresponding to 285 species (OTA *et al*., 2015). Due to its highly specialized morphology, the family is one of the best characterized groups of Siluriformes, being recognized since the oldest classifications.

The wide morphological variation allows to divide Loricariidae into a few subfamilies, but this composition has undergone changes. According to Pereira & Reis (2017), the six subfamilies are: Lithogeninae Gosline, 1947, Delturinae Reis, Pereira & Armbruster, 2006, Loricariinae Rafinesque, 1815, Hypostominae Kner, 1853, Hypoptopomatinae Eigenmann & Eigenmann, 1890, and Neoplecostominae Regan, 1904. However, Van Der Laan *et al*. (2021) consider Lithogeninae, Delturinae, Rhinelepinae Armbruster, 2004, Loricariinae, Hypoptopomatinae, and Hypostominae. The phylogenetic relationship among the subfamilies is considered more stable in some cases, and less in others. Lithogeninae and Delturinae are hypotetized to be the two lineages that diverged first, and sequentially, Hypoptopomatinae and Neoplecostominae are recovered as sister groups (PEREIRA & REIS, 2017). The relationships between Loricariinae and Hypostominae are still a matter of debate. Some studies suggest Hypostominae as a sister group to Loricariinae (ARMBRUSTER, 2004, MARTINS *et al*., 2014), while others suggest Hypostominae to be more related to Hypoptopomatinae and Neoplecostominae; and Loricariinae as a sister group to all three subfamilies (PEREIRA & REIS, 2017).

Loricariinae is considered the second largest subfamily, consisting of 32 genera and 257 species (COVAIN & FISCH-MULLER, 2007, RODRIGUEZ *et al*., 2011, COVAIN *et al*., 2016, VAN DER LAAN *et al*., 2021). Members of this group have long and depressed caudal peduncle, and absent adipose fin (COVAIN & FISCH-MULLER, 2007). They are widely distributed in drainages of South and Central America, from Costa Rica to northern Argentina, with the greatest diversity in the Amazon region (OYAKAWA *et al*., 2013). Furthermore, it comprises a

monophyletic group supported by phylogenetic analyses based on morphology (RAPP PY-DANIEL, 1997), molecular characters (MONTOYA-BURGOS *et al*., 1998, COVAIN & FISCH-MULLER, 2007, RODRIGUEZ *et al*., 2011), and more recently, a combined analysis (LONDOÑO-BURBANO & REIS, 2021).

Harttia Steindachner, 1877 presents, as diagnostic features, the absence of keels along the lateral plates, rounded snout, large plates around the anal opening and abrupt narrowing of the caudal peduncle (OYAKAWA *et al*., 2013). The species of the genus have a wide distribution in South America, occurring in the Guiana Shield (*e.g.* Guyana, Suriname, and French Guiana), in the basins of the Amazon region (*e.g.* Orinoco, Xingu, Tapajós, Tocantins, Trombetas, and Uatumã), and in the basins of the southeastern Brazil (*e.g*. Ribeira de Iguape, upper Paraná, Paraíba do Sul, São Francisco, Jequitinhonha, and Doce) (OYAKAWA, 1993; RAPP PY-DANIEL & OLIVEIRA, 2001; LANGEANI *et al.*, 2001; PROVENZANO *et al.*, 2005; COVAIN *et al*., 2012; OYAKAWA *et al*., 2013; OYAKAWA *et al*., 2018; OLIVEIRA & OYAKAWA, 2019) (Table 1). Currently, the genus consists of 27 valid species, with *Harttia loricariformis* Steindachner, 1877, the type species, being the oldest and *Harttia intermontana* Oliveira & Oyakawa, 2019 being the most recent described (OYAKAWA *et al*., 2018; OLIVEIRA & OYAKAWA, 2019). However, several species are waiting to be described, making the systematics of the genus complex and far from being resolved (OYAKAWA *et al*., 2018). Thus, *Harttia* assumes the second position regarding the highest intrageneric diversity of Loricariinae, being surpassed only by *Rineloricaria* Bleeker, 1862 (65 species, FRICKE *et al*., 2021).

Phylogenetic relationships of the genus

For many years, the most accepted classification of the Loricariinae was proposed by Isbrücker (1980), encompassing Harttiini, Farlowellini (*Farlowella* Eigenmann & Eigenmann, 1889), Acestridiini (*Acestridium* Haseman, 1911), and Loricariini. Loricariini was composed of the following subtribes and genera: Rineloricariina (*Ixinandria* Isbrücker & Nijssen, 1979, *Rineloricaria* Bleeker, 1862, *Dasyloricaria* Isbrücker & Nijssen, 1979, and *Spatuloricaria* Schultz, 1944), Loricariina (*Ricola* Isbrücker & Nijssen, 1978, *Paraloricaria* Isbrücker, 1979, *Loricaria* Linnaeus, 1758, *Brochiloricaria* Isbrücker & Nijssen, 1979, *Crossoloricaria* Isbrücker, 1979, *Pseudohemiodon* Bleeker, 1862, and *Rhadinoloricaria* Isbrücker & Nijssen, 1974),

Planiloricariina (*Planiloricaria* Isbrücker, 1971), Reganellina (*Reganella* Eigenmann, 1905), Loricariichthyina (*Limatulichthys* Isbrücker & Nijssen, 1979, *Pseudoloricaria* Bleeker, 1862, and *Loricariichthys* Bleeker, 1862), and Hemiodontichthyina (*Hemiodontichthys* Bleeker, 1862). Whereas Harttiini included the following two subtribes and genera: Harttiina (*Harttiella* Boeseman, 1971, *Harttia* Steindachner, 1877, *Cteniloricaria* Isbrücker & Nijssen, 1979, *Lamontichthys* Miranda Ribeiro, 1939, *Pterosturisoma* Isbrücker & Nijssen, 1978, *Sturisomatichthys* Isbrücker & Nijssen, 1979, and *Sturisoma* Swainson, 1838), and Metaloricariina (*Metaloricaria* Isbrücker, 1975). After this phenetically based classification, several hypotheses of phylogenetic relationship among the genera of Loricariinae have been proposed over time, and with them the composition of the subfamily has undergone changes.

Rapp Py-Daniel (1997) performed the first phylogenetic analysis based on morphological data for Loricariinae (Figure 1 and 2). The results recovered the subfamily as a monophyletic group, being a sister group to the clade formed by representatives of Hypostominae, Ancistrinae and Hypoptopomatinae in the unordered analysis, and a sister group to *Neoplecostomus* Eigenmann & Eigenmann, 1888 in the ordered analysis. Loricariinae was subdivided into two major clades: Loricariini Bonaparte, 1831 and Harttiini Boeseman, 1971, which basically comprise the originally designated genera. Loricariini comprised two subtribes: Hemiodontichthyina (*Hemiodontichthys* Bleeker, 1862, *Reganella* Eigenmann, 1905, *Loricariichthys* Bleeker, 1862, and *Furcodontichthys* Rapp Py-Daniel, 1981) and Planiloricariina (*Rhadinoloricaria* Isbrücker & Nijssen, 1974, *Crossoloricaria* Isbrücker, 1979, *Apistoloricaria* Isbrücker & Nijssen, 1986, *Pseudohemiodon* Bleeker, 1862, *Planiloricaria* Isbrücker, 1971, and *Dentectus* Martín Salazar, Isbrücker & Nijssen, 1982), plus the genera *Loricaria* Linnaeus, 1758, *Spatuloricaria* Schultz, 1944, and *Rineloricaria* Bleeker, 1862 (not monophyletic). The tribe Harttiini was formed by Farlowellina (*Farlowella* Eigenmann & Eigenmann, 1889, *Aposturisoma* Isbrücker, Britski, Nijssen & Ortega, 1983, and *Sturisoma* Swainson, 1838) and Harttiina (*Lamontichthys* Miranda Ribeiro, 1939 and *Harttia* Steindachner, 1877), plus the genus *Sturisomatichthys* Isbrücker & Nijssen, 1979. *Harttia* was recovered as a sister group to *Lamontichthys*, and *Cteniloricaria* Isbrücker & Nijssen, 1979 was considered a junior synonym of *Harttia*. The relationship among the *Harttia* species included in this analysis was completely resolved in the ordered analysis, but partially resolved in the unordered analysis. Despite not including *Harttiella* Boeseman, 1971 in the phylogenetic analysis, the author comments that the genus is very close to *Harttia* based on

the original description, and because of this tentatively includes *Harttiella* in Harttiini. The author also disagrees with the placement of *Metaloricaria* Isbrücker, 1975 in Harttiini, suggesting that the genus should be in Loricariini, but outside any clade.

Montoya-Burgos *et al*. (1998) proposed the first phylogenetic analysis based on molecular data for Loricariidae inferred from partial sequences of the 12S and 16S mitochondrial genes (Figure 3 and 4). In this study, 19 species of Ancistrinae (valid at the time), 21 of Hypostominae, nine of Loricariinae, seven of Hypoptopomatinae and one of Neoplecostominae were analyzed. The results confirmed Loricariinae monophyletic, but no support was found for the monophyly of the other subfamilies. In both Maximum Likelihood and Maximum Parsimony analyses, Loricariinae was recovered as a sister group to Hypostominae (*Pseudorinelepis agassizii* (Steindachner, 1877)) and *Harttia* Steindachner, 1877 was considered the first genus of the subfamily to diverge.

Covain & Fisch-Muller (2007) performed a cluster analysis for the subfamily Loricariinae, where the genera were grouped based on the degree of morphological similarity (Figure 5). In the presented dendogram, it is possible to see that the subfamily was divided into two tribes: Loricariini and Harttiini. Loricariini was divided into the groups: *Pseudohemiodon*, *Loricaria*, *Rineloricaria*, and *Loricariichthys*. The *Pseudohemiodon* group was composed of the genera *Apistoloricaria* Isbrücker & Nijssen, 1986, *Crossoloricaria* Isbrücker, 1979, *Rhadinoloricaria* Isbrücker & Nijssen, 1974, *Dentectus* Martín Salazar, Isbrücker & Nijssen, 1982, *Planiloricaria* Isbrücker, 1971, *Pyxiloricaria* Isbrücker & Nijssen, 1984, *Pseudohemiodon* Bleeker, 1862, and *Reganella* Eigenmann, 1905. The *Loricaria* group was formed by *Brochiloricaria* Isbrücker & Nijssen, 1979, *Ricola* Isbrücker & Nijssen, 1978, *Paraloricaria* Isbrücker, 1979, and *Loricaria* Linnaeus, 1758. The *Rineloricaria* group consisted of *Dasyloricaria* Isbrücker & Nijssen, 1979, *Rineloricaria* Bleeker, 1862, and *Spatuloricaria* Schultz, 1944, with the first two genera being more similar to the *Loricaria* group than *Spatuloricaria*. The genus *Ixinandria* Isbrücker & Nijssen, 1979, was also considered to be a member of the *Rineloricaria* group, but was recovered as being more similar to the Harttiini genera than to members of the group itself. The *Loricariichthys* group was composed of *Furcodontichthys* Rapp Py-Daniel, 1981, *Limatulichthys* Isbrücker & Nijssen, 1979, *Pseudoloricaria* Bleeker, 1862, *Hemiodontichthys* Bleeker, 1862, and *Loricariichthys* Bleeker, 1862. On the other hand, the tribe Harttiini showed a more comprehensive composition, including all genera proposed by Rapp Py-Daniel (1997) and also *Pterosturisoma*

Isbrücker & Nijssen, 1978, *Harttiella* Boeseman, 1971, and *Metaloricaria* Isbrücker, 1975. However, *Metaloricaria* and *Farlowella* Eigenmann & Eigenmann, 1889 were the most divergent taxa among all Loricariinae, forming the base of the tree and remaining outside the group formed by the other genera of Harttiini. The group most similar to *Harttia* Steindachner, 1877 was considered to be the genus *Harttiella*.

Covain *et al*. (2008) presented a molecular phylogeny for Loricariinae based on the 12S and 16S mitochondrial genes, including 14 genera and 20 species (Figure 6). Among the tribe Loricariini two groups were distinguished: Sturisomina and Loricariina. The new subtribe housed the genera *Sturisoma* Swainson, 1838, *Farlowella* Eigenmann & Eigenmann, 1889, *Sturisomatichthys* Isbrücker & Nijssen, 1979, and *Lamontichthys* Miranda Ribeiro, 1939. In Loricariina, the morphological groups *Loricariichthys* (*Hemiodontichthys* Bleeker, 1862, *Limatulichthys* Isbrücker & Nijssen, 1979, *Loricariichthys* Bleeker, 1862, *Rineloricaria* Bleeker, 1862, *Dasyloricaria* Isbrücker & Nijssen, 1979, and *Metaloricaria* Isbrücker, 1975), *Loricaria* Linnaeus, 1758 (includes only this genus) and *Pseudohemiodon* Bleeker, 1862 (*Crossoloricaria* Isbrücker, 1979 and *Planiloricaria* Isbrücker, 1971) were confirmed. The subtribe Harttiini was restricted to a single genus, *Harttia* Steindachner, 1877, which was the first genus to diverge within the subfamily.

Fichberg (2008) analyzed the phylogenetic relationships of species in the genus *Rineloricaria* Bleeker, 1862 based on morphological characters (Figure 7). This study included 64 taxa, being 63 species of Loricariinae (36 of *Rineloricaria* and 27 of the other genera) and one Neoplecostominae. Loricariini was recovered as a monophyletic group in which the following genera were included: *Ixinandria* Isbrücker & Nijssen, 1979, *Spatuloricaria* Schultz, 1944, *Furcodontichthys* Rapp Py-Daniel, 1981, *Ricola* Isbrücker & Nijssen, 1978, *Loricaria* Linnaeus, 1758, *Pseudohemiodon* Bleeker, 1862, *Planiloricaria* Isbrücker, 1971, *Crossoloricaria* Isbrücker, 1979, *Apistoloricaria* Isbrücker & Nijssen, 1986, *Pseudoloricaria* Bleeker, 1862, *Limatulichthys* Isbrücker & Nijssen, 1979, *Reganella* Eigenmann, 1905, *Loricariichthys* Bleeker, 1862, *Hemiodontichthys* Bleeker, 1862, and *Rineloricaria* Bleeker, 1862. Harttiini was also recovered as a natural group, consisting of the genera: *Harttia* Steindachner, 1877, *Sturisoma* Swainson, 1838, *Lamontichthys* Miranda Ribeiro, 1939, *Sturisomatichthys* Isbrücker & Nijssen, 1979, *Farlowella* Eigenmann & Eigenmann, 1889, and *Aposturisoma* Isbrücker, Britski, Nijssen & Ortega, 1983. The result of this study did not find *Harttia* at the base of the subfamily as previously

proposed by Montoya-Burgos *et al*. (1998) and Covain *et al*. (2008), but rather as a sister group to the other genera of Harttiini.

Silva (2009) performed a phylogenetic analysis based on molecular data among the genera of the subfamily Loricariinae with emphasis in *Harttia* Steindachner, 1877 (Figures 8 and 9). In this reconstruction, complete sequences of the mitochondrial genes 12S, Valine transport RNA and 16S, and part of the nuclear gene F-Reticulon-4 were used. The outgroup was *Ancistrus cirrhosus* (Valenciennes 1836), a Hypostominae. Within Loricariini only the *Loricariichthys* group and the new subtribe Sturisomina were recovered with the same members as proposed by Covain *et al*. (2008). Other members of the tribe are: *Loricaria* Linnaeus, 1758, *Brochiloricaria* Isbrücker & Nijssen, 1979, *Pyxiloricaria* Isbrücker & Nijssen, 1984, *Crossoloricaria* Isbrücker, 1979, *Spatuloricaria* Schultz, 1944, and *Rineloricaria* Bleeker, 1862. Harttiini presents the first lineage of Loricariinae to diverge in the phylogeny, harboring only the genus *Harttia* Steindachner, 1877. Also in this study, the nuclear gene F-reticulon-4 and the mitochondrial gene Cytochrome Oxidase subunit I (COI) were sequenced for 10 valid species of the genus and six possible new species. In the topology obtained, *Harttia* is divided into two large clades: a group with species from basins of southeastern Brazil (*e.g*. *H. novalimensis* Oyakawa, 1993, *H. leiopleura* Oyakawa, 1993, *H. torrenticola* Oyakawa, 1993, *H. carvalhoi* Miranda Ribeiro, 1939, *H. gracilis* Oyakawa, 1993, *Harttia* sp. Serra do Cipó, *Harttia* sp. Três Marias, *H. loricariformis* Steindachner, 1877, and *H. kronei* Miranda Ribeiro, 1908), and *H. guianensis* Rapp Py-Daniel & Oliveira, 2001, and another with the species that occur in streams of the right bank of the Amazon River (*e.g*. *H. punctata* Rapp Py-Daniel & Oliveira, 2001, *H. dissidens* Rapp Py-Daniel & Oliveira, 2001, *Harttia* sp. Tapajós 1, *Harttia* sp. Xingu 1, *Harttia* sp. Xingu 2, and *Harttia* sp. Xingu 3). However, in the branch formed by the species *H. novalimensis*, *H. leiopleura*, *H. torrenticola*, *H. carvalhoi*, *H. gracilis*, *Harttia* sp. Serra do Cipó, and *Harttia* sp. Três Marias, the phylogenetic relationships were not resolved due to low support values. Thus, Silva (2009) concluded that species from southeastern basins of Brazil are more closely related to species from the Guianas region, and this large clade is related to species from the right bank of the Amazon River.

Rodriguez *et al*. (2011) presented a molecular phylogeny for the subfamily Loricariinae based on the 12S and 16S mitochondrial genes, and the nuclear gene F-reticulon-4 (Figure 10). In Loricariini the subtribes Loricariina (*Metaloricaria* Isbrücker, 1975, *Dasyloricaria* Isbrücker & Nijssen, 1979, *Crossoloricaria* Isbrücker, 1979, *Planiloricaria* Isbrücker, 1971, *Loricaria*

Linnaeus, 1758, *Spatuloricaria* Schultz, 1944, *Hemiodontichthys* Bleeker, 1862, *Limatulichthys* Isbrücker & Nijssen, 1979, *Loricariichthys* Bleeker, 1862, *Fonchiloricaria* (new genus), and *Rineloricaria* Bleeker, 1862) and Farlowellina (*Lamontichthys* Miranda Ribeiro, 1939, *Sturisomatichthys* Isbrücker & Nijssen, 1979, *Farlowella* Eigenmann & Eigenmann, 1889, and *Sturisoma* Swainson, 1838) were recovered as sister groups. Again, *Harttia* Steindachner, 1877 is considered the only genus belonging to Harttiini, being the first genus of Loricariinae to diverge as previously proposed by Montoya-Burgos *et al*. (1998), Covain *et al*. (2008), and Silva (2009).

Paixão (2012) reconstructed a phylogeny for the genus *Loricariichthys* Bleeker, 1862 based on morphological characters (Figure 11). This study included 54 taxa, with 45 species of Loricariinae (17 of *Loricariichthys*), one of Delturinae, two of Neoplecostominae, three of Hypostominae, and three of Hypoptopomatinae. Only five genera of Loricariinae were not included: *Fonchiiloricaria* Rodriguez, Ortega & Covain, 2011, *Harttiella* Boeseman, 1971, *Pyxiloricaria* Isbrücker & Nijssen, 1984, *Rhadinoloricaria* Isbrücker & Nijssen, 1974, and *Ricola* Isbrücker & Nijssen, 1978. Hypoptopomatinae was recovered as a sister group of Loricariinae, and the latter was divided into two tribes: Loricariini and Harttiini. The former is composed of 19 genera: *Metaloricaria* Isbrücker, 1975, *Ixinandria* Isbrücker & Nijssen, 1979, *Rineloricaria* Bleeker, 1862, *Loricaria* Linnaeus, 1758, *Dentectus* Martín Salazar, Isbrücker & Nijssen, 1982, *Spatuloricaria* Schultz, 1944, *Brochiloricaria* Isbrücker & Nijssen, 1979, *Paraloricaria* Isbrücker, 1979, *Pseudohemiodon* Bleeker, 1862, *Planiloricaria* Isbrücker, 1971, *Crossoloricaria* Isbrücker, 1979, *Apistoloricaria* Isbrücker & Nijssen, 1986, *Dasyloricaria* Isbrücker & Nijssen, 1979, *Furcodontichthys* Rapp Py-Daniel, 1981, *Reganella* Eigenmann, 1905, *Pseudoloricaria* Bleeker, 1862, *Limatulichthys* Isbrücker & Nijssen, 1979, *Hemiodontichthys* Bleeker, 1862, and *Loricariichthys* Bleeker, 1862. The second consists of seven genera: *Harttia* Steindachner, 1877, *Lamontichthys* Miranda Ribeiro, 1939, *Sturisoma* Swainson, 1838, *Sturisomatichthys* Isbrücker & Nijssen, 1979, *Pterosturisoma* Isbrücker & Nijssen, 1978, *Farlowella* Eigenmann & Eigenmann, 1889, and *Aposturisoma* Isbrücker, Britski, Nijssen & Ortega, 1983. The relationships within Harttiini are congruent with the results of Fichberg (2008), with *Harttia* as the sister group of the other genera of Harttiini.

Covain *et al.* (2016) presented the most robust molecular phylogeny known for Loricariinae, based on the analysis of the nuclear (F-reticulon-4) and mitochondrial (12S and 16S) genes (Figure 12). This study included 241 species of Loricariinae, 17 of Hypostominae, and one of

Neoplecostominae. The results indicated that the members of Loricariinae are distributed in two sister tribes: Loricariini and Harttiini. Within Loricariini, two subtribes are distinguished: Farlowellina and Loricariina. The first subtribe was composed of *Lamontichthys* Miranda Ribeiro, 1939, *Pterosturisoma* Isbrücker & Nijssen, 1978, *Sturisoma* Swainson, 1838, *Farlowella* Eigenmann & Eigenmann, 1889, *Aposturisoma* Isbrücker, Britski, Nijssen & Ortega, 1983, and *Sturisomatichthys* Isbrücker & Nijssen, 1979, with *Farlowella*, *Sturisoma*, and *Sturisomatichthys* recovered as paraphyletic groups. The second was formed by *Metaloricaria* Isbrücker, 1975, *Dasyloricaria* Isbrücker & Nijssen, 1979, *Fonchiiloricaria* Rodriguez, Ortega & Covain, 2011, *Rineloricaria* group, *Loricariichthys* group, and *Loricaria-Pseudohemiodon* group, with *Loricaria* Linnaeus, 1758, *Crossoloricaria* Isbrücker, 1979, and *Apistoloricaria* Isbrücker & Nijssen, 1986 being paraphyletic. The tribe Harttiini, as classically defined, constituted a paraphyletic group and was therefore restricted to three genera: *Harttia* Steindachner, 1877, *Cteniloricaria* Isbrücker & Nijssen, 1979, and *Harttiella* Boeseman, 1971. The relationship among the species of *Harttia* was partially resolved. The species from the Guianas region (*H. fluminensis* Covain & Fisch-Muller, 2012, *H. surinamensis* Boeseman, 1971, *H. tuna* Covain & Fisch-Muller, 2012, and *H. guianensis* Rapp Py-Daniel & Oliveira, 2001) formed a highly supported monophyletic group. However, their positioning as the first group of *Harttia* to diverge in the phylogeny was not confirmed due to the low support value. The clade formed by species from the right bank of the Amazon River (*e.g*. *Harttia* sp. Xingu 2, *Harttia* sp. Xingu 3, *Harttia* sp. Xingu 1, *H. duriventris* Rapp Py-Daniel & Oliveira, 2001, *H. dissidens* Rapp Py-Daniel & Oliveira, 2001, *Harttia* sp. Tapajós, *H. punctata* Rapp Py-Daniel & Oliveira, 2001, and *Harttia* sp. Tocantins) plus *H. fowleri* (Pellegrin 1908) was also well supported, but its relationship as a sister group to the species from southeastern Brazil showed low support. The relationships among the species from southeastern Brazil also presented branches with low support and because of this the phylogenetic relationships were not well resolved (*e.g*. *H. leiopleura* Oyakawa, 1993, *H. novalimensis* Oyakawa, 1993, *H. gracilis* Oyakawa, 1993, *H. carvalhoi* Miranda Ribeiro, 1939, *H. torrenticola* Oyakawa, 1993, *Harttia* sp. São Francisco, *Harttia* sp. Três Marias, *H. longipinna* Langeani, Oyakawa & Montoya-Burgos, 2001, *Harttia* sp. Serra do Cipó, *H. loricariformis* Steindachner 1877, and *H. kronei* Miranda Ribeiro, 1908). Thus, despite the low boostrap values, for Covain *et al*. (2016), species from southeastern Brazil represent the sister group of the species from the right bank of the Amazon River plus *H. fowleri*, and this clade is related to species from the Guianas region. In conclusion,

they recovered two clades of *Harttia*: one composed of species mostly from the Brazilian Shield, and another from the Guianas Shield, differing from the result proposed by Silva (2009).

Londoño-Burbano & Reis (2021) proposed the first combined phylogenetic analysis of the Loricariinae with emphasis on Harttiini and Farlowellini (Figure 13). This study included 196 morphological characters and seven molecular markers (the mitochondrial genes Cytochrome b (Cytb), NADH dehydrogenase 2 (nd2), 12S, and 16S, and the nuclear genes Myosin Heavy Chain 6 (MyH6), and Recombination activating genes 1 and 2 (RAG1 and RAG2)). The results indicate that Loricariinae comprises three tribes: Harttiini, Loricariini, and Farlowellini, being the latter two recovered as sister groups and elevated from the subtribes Loricariina and Farlowellina. Loricariini included *Metaloricaria* Isbrücker, 1975, *Loricaria* Linnaeus, 1758, *Pseudohemiodon* Bleeker, 1862, *Dasyloricaria* Isbrücker & Nijssen, 1979, *Rineloricaria* Bleeker, 1862, *Spatuloricaria* Schultz, 1944, *Loricariichthys* Bleeker, 1862, *Limatulichthys* Isbrücker & Nijssen, 1979, and *Hemiodontichthys* Bleeker, 1862. Farlowellini was composed of *Lamontichthys* Miranda Ribeiro, 1939, *Pterosturisoma* Isbrücker & Nijssen, 1978, *Sturisoma* Swainson, 1838, *Sturisomatichthys* Isbrücker & Nijssen, 1979, and *Farlowella* Eigenmann & Eigenmann, 1889. Also regarding Farlowellini, *Aposturisoma* Isbrücker, Britski, Nijssen & Ortega, 1983 was synonymyzed with *Farlowella* (the former was recovered inside the latter), *Sturisoma* was restricted to cis-Andean species, and *Sturisomatichthys* was composed of the valid species already included in the genus, plus the trans-Andean species of *Sturisoma*. The tribe Harttiini was recovered with the same genera assigned by Covain *et al*. (2016): *Harttiella* Boeseman, 1971, *Cteniloricaria* Isbrücker & Nijssen, 1979, and *Harttia* Steindachner, 1877. However, the relationship among these genera proved to be different and with strong posterior probabilities (values = 1): (*Harttiella* + (*Cteniloricaria* + *Harttia*). Within *Harttia*, the species from the Guianas region presented a highly supported monophyletic group: (*H. guianensis* Rapp Py-Daniel & Oliveira, 2001 + (*H. tuna* Covain & Fisch-Muller, 2012 + (*H. fluminensis* Covain & Fisch-Muller, 2012 + *H. surinamensis* Boeseman, 1971))). The same strong monophyletic result was obtained to the species from the Amazon River basin plus *H. fowleri* (Pellegrin 1908): (*H. fowleri* + (*H. dissidens* Rapp Py-Daniel & Oliveira, 2001 + (*H. rhombocephala* Miranda Ribeiro, 1939 + (*H. punctata* Rapp Py-Daniel & Oliveira, 2001 + (*H. duriventris* Rapp Py-Daniel & Oliveira, 2001 + *H. trombetensis* Rapp Py-Daniel & Oliveira, 2001))))). However, the material assigned as *H. rhombocephala* is from the Tocantins River basin, although according to the original description

and Fricke *et al*. (2021), the distribution is “Farias River basin and Eastcoast Rivers, Brazil”. At last, the species from southeastern Brazil also form a highly supported monophyletic group: (*H. kronei* Miranda Ribeiro, 1908 + (*H. loricariformis* Steindachner 1877 + (*H. longipinna* Langeani, Oyakawa & Montoya-Burgos, 2001 + ((*H. carvalhoi* Miranda Ribeiro, 1939 + *H. torrenticola* Oyakawa, 1993) + (*H. gracilis* Oyakawa, 1993 + (*H. leiopleura* Oyakawa, 1993 + (*H. garavelloi* Oyakawa, 1993 + *H. novalimensis* Oyakawa, 1993))))))). Thus, according to Londoño-Burbano & Reis (2021), species from southeastern Brazil represent the sister group of the species from the right and left bank of the Amazon River plus *H. fowleri*, and this clade is related to species from the Guianas region.

Therefore, looking at the proposed hypotheses for *Harttia* Steindachner, 1877, there is consensus on the monophyly of the genus, but not on its positioning relative to the other Loricariinae. In addition the available analyses include a small number of species and, so, are not representative of the evolutionary history of the group, which hightlights and justifies the proposition of a more detailed study of the phylogenetic relationships among its species. Thus, the aim of this work was to perform a phylogenetic analysis of the species of the genus *Harttia* based on morphological (chapter one) and molecular (chapter two) characters, which are presented herein.

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Table 1. Currently recognized species of *Harttia* and their distributions. Modified from Oyakawa *et al*. (2018).

Species	Distribution
Harttia absaberi Oyakawa, Fichberg & Langeani 2013	Upper Paraná – Paraná and Tietê Rivers
Harttia carvalhoi Miranda-Ribeiro 1939	Paraíba do Sul – Paquequer River
Harttia depressa Rapp Py-Daniel & Oliveira 2001	Amazonas – Uatumã and Pitinga Rivers
Harttia dissidens Rapp Py-Daniel & Oliveira 2001	Tapajós – Tapajós and Jamanxim River
Harttia duriventris Rapp Py-Daniel & Oliveira 2001	Upper and Middle Tocantins – above Tucurui dam
Harttia fluminensis Covain, Fisch-Muller 2012	Suriname – Coppename River
Harttia fowleri (Pellegrin 1908)	French Guiana and Brazil – Oyapock River
Harttia garavelloi Oyakawa 1993	Jequitinhonha – Fanado River
Harttia gracilis Oyakawa 1993	Upper Paraná – Grande River
Harttia guianensis Rapp Py-Daniel & Oliveira 2001	French Guiana and Suriname – from the Approuague River to the Maroni River
Harttia intermontana Oliveira & Oyakawa, 2019	Upper Doce
Harttia kronei Miranda-Ribeiro 1908	Ribeira de Iguape – Bethany River, upper Paraná
Harttia leiopleura Oyakawa 1993	São Francisco
Harttia longipinna Langeani, Oyakawa & Montoya-Burgos 2001	São Francisco
Harttia loricariformis Steindachner 1877	Paraíba do Sul, Mata Atlântica
Harttia merevari Provenzano, Machado-Allison, Chernoff, Willink & Petry 2005	Orinoco – Caura River
Harttia novalimensis Oyakawa 1993	São Francisco
Harttia panara Oyakawa, Fichberg & Rapp Py-Daniel 2017	Upper Xingu – Curuá River, tributary of Iriri River
Harttia punctata Rapp Py-Daniel & Oliveira 2001	Tocantins - Araguaia
Harttia rhombocephala Miranda-Ribeiro 1939	Mata Atlântica - Farias River, coastal drainage
Harttia rondoni Oyakawa, Fichberg & Rapp Py-Daniel 2017	Upper Xingu – Curuá River, tributary of Iriri River
Harttia surinamensis Boeseman 1971	Suriname – Suriname River (restrict)
Harttia torrenticola Oyakawa 1993	São Francisco
Harttia trombetensis Rapp Py-Daniel & Oliveira 2001	Amazonas – Trombetas-Mapuera Rivers
Harttia tuna Covain, Fisch-Muller 2012	Suriname-Brazil border - Paru de Oeste River
Harttia uatumensis Rapp Py-Daniel & Oliveira 2001	Amazonas – Uatumã River and at leas two affluents Pitinga (upper Uatumã) and Jatapu (lower Uatumã)
Harttia villasboas Oyakawa, Fichberg & Rapp Py-Daniel 2017	Upper Xingu – Curuá River, tributary of Iriri River

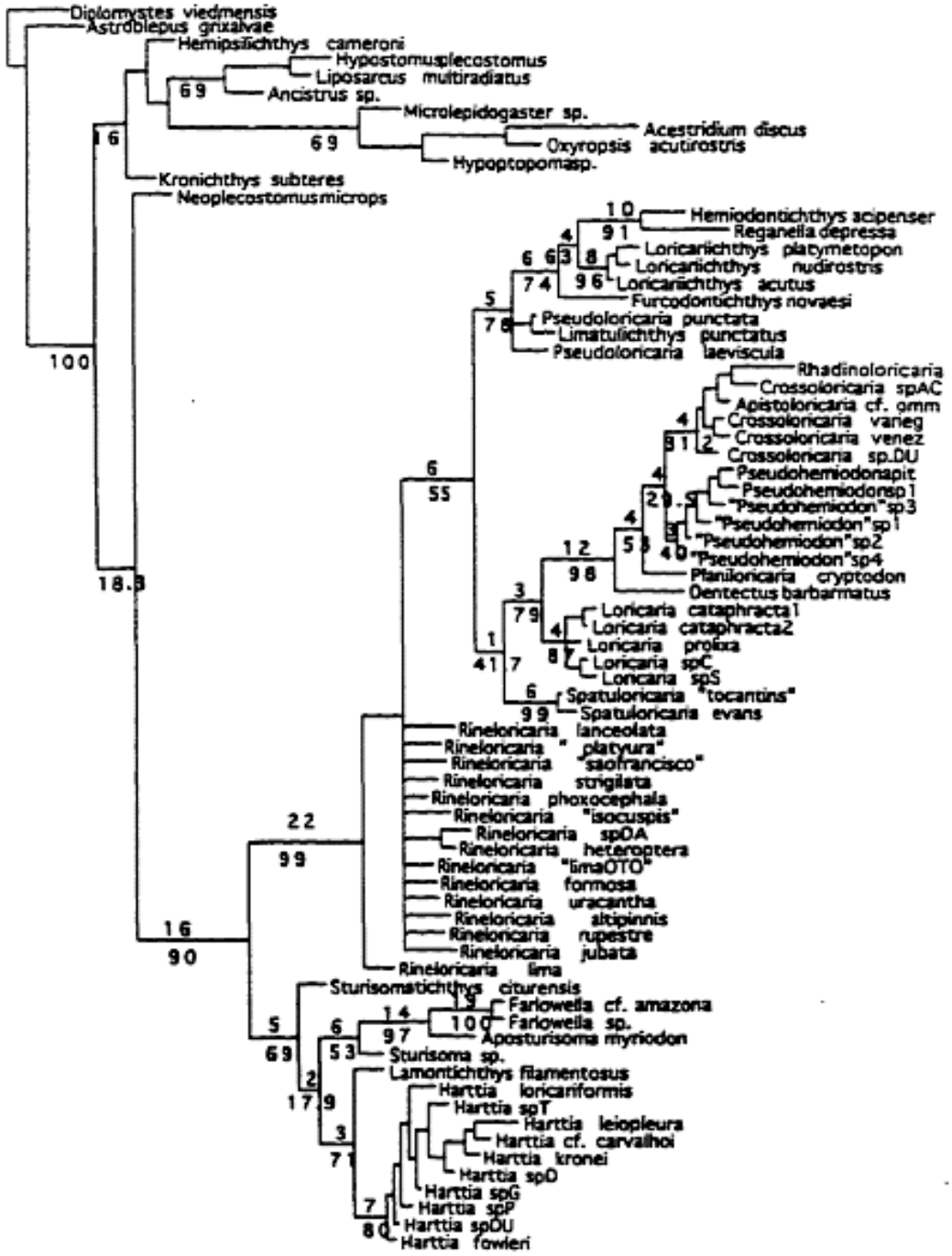

Figure 1. Strict consensus of 162 most parsimonious trees produced by the ordered data set (phylogram = different branch lengths represent approximately the number of changes; decay index = above branches; bootstrap = below branches). From Rapp Py-Daniel (1997).

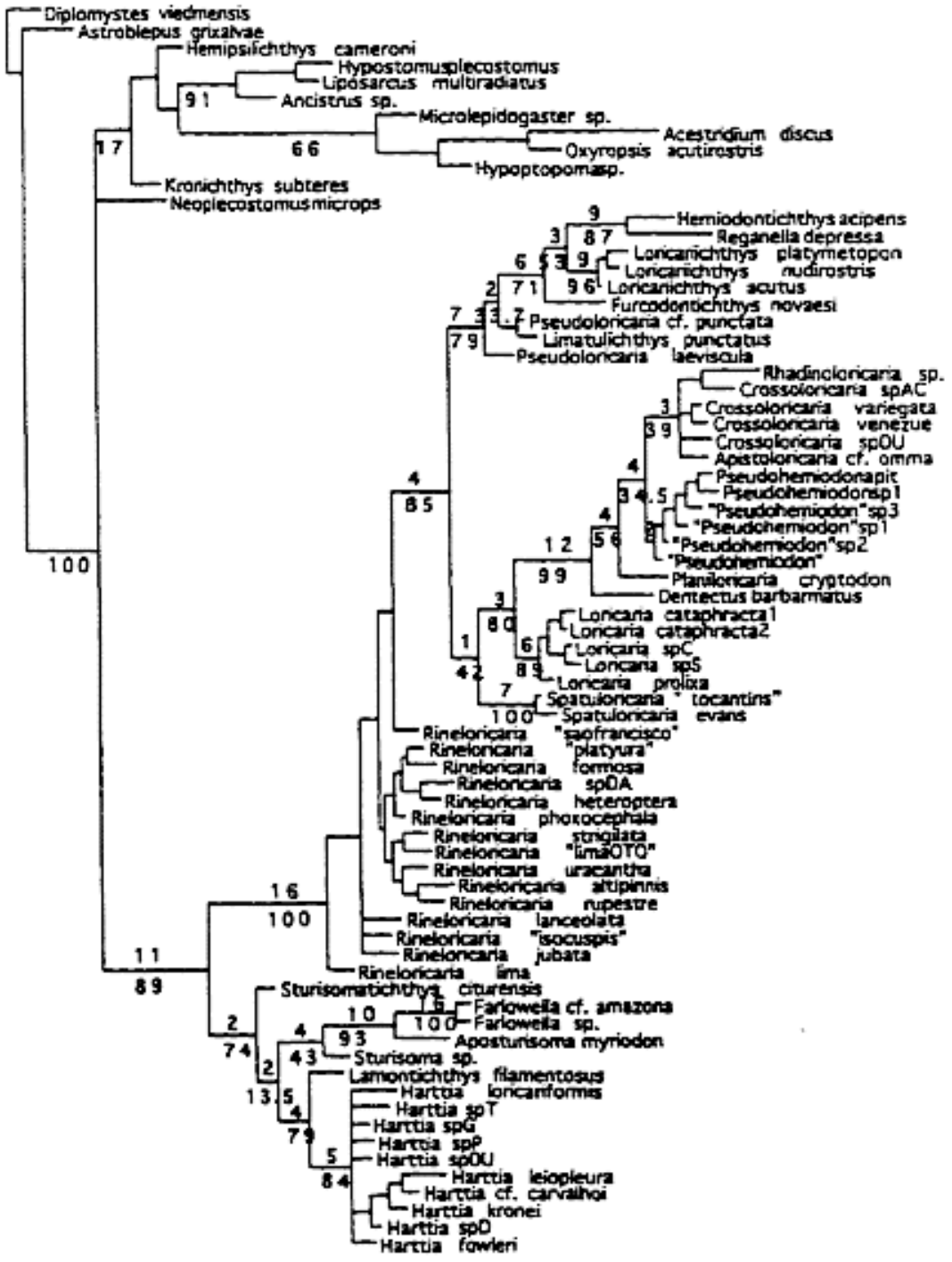

Figure 2. Strict consensus of 54 most parsimonious trees produced by the unordered data set (phylogram = different branch lengths represent approximately the number of changes; decay index = above branches; bootstrap = below branches). From Rapp Py-Daniel (1997).

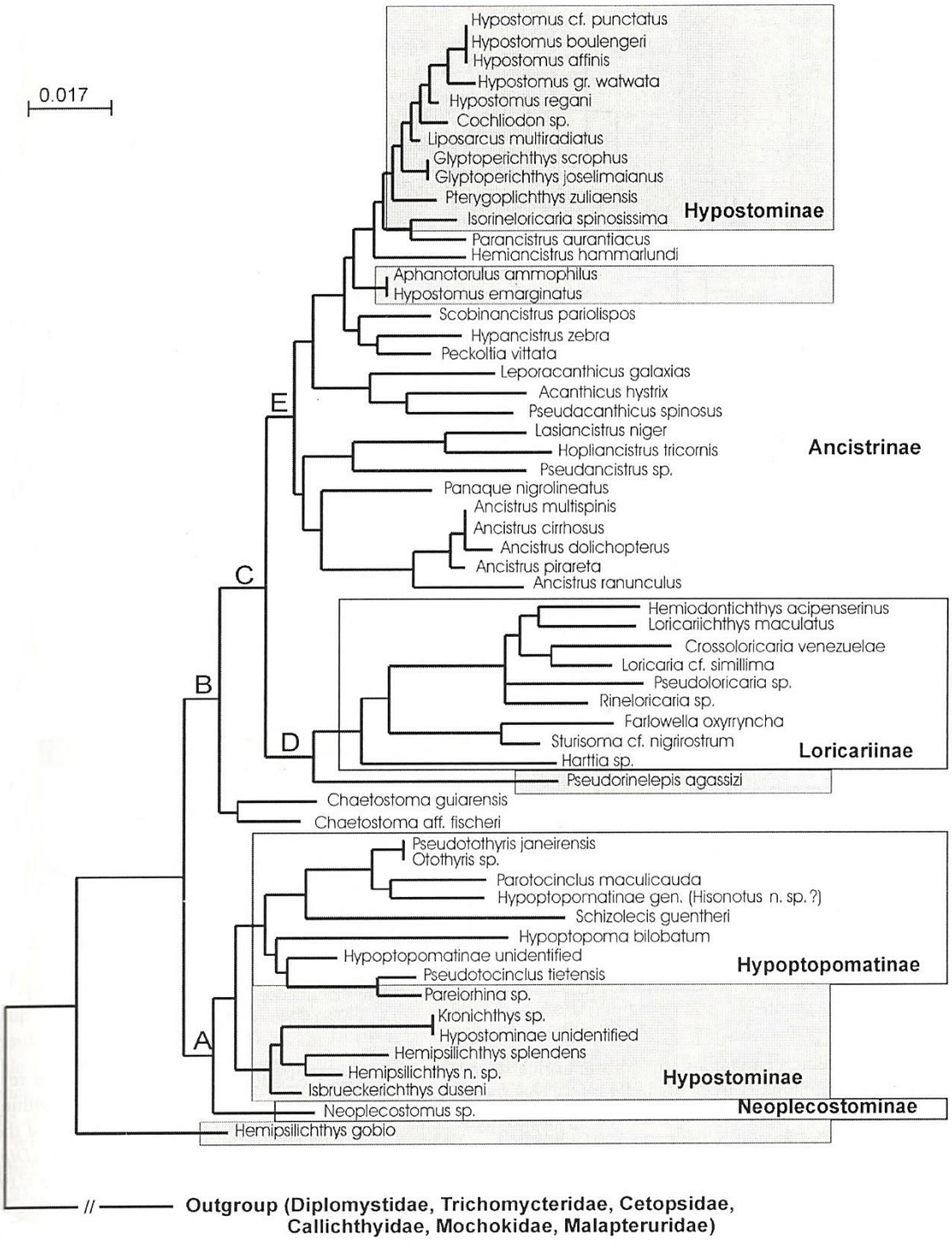

Figure 3. Maximum Likelihood tree for all members of the Loricariidae analyzed. Members of Hypostominae are shown in gray boxes. A, B, C, D, and E are names of clades. From Montoya-Burgos *et al*. (1998).

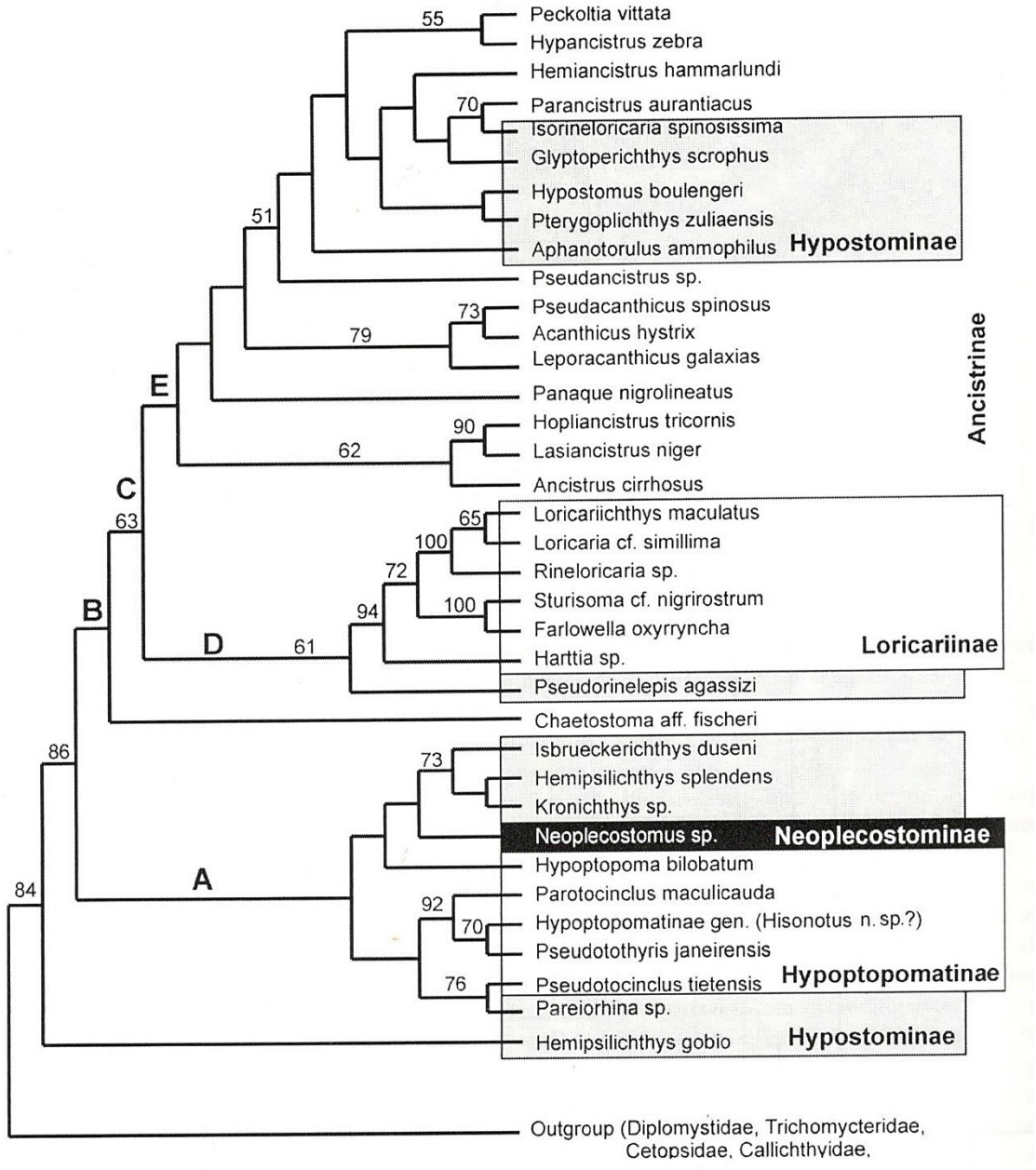

Figure 4. Shortest maximum parsimony tree for all members of the Loricariidae analyzed. Bootstrap values higher than 50 are shown above branches. Members of Hypostominae are shown in gray boxes.A, B, C, D, and E are names of clades. From Montoya-Burgos *et al*. (1998).

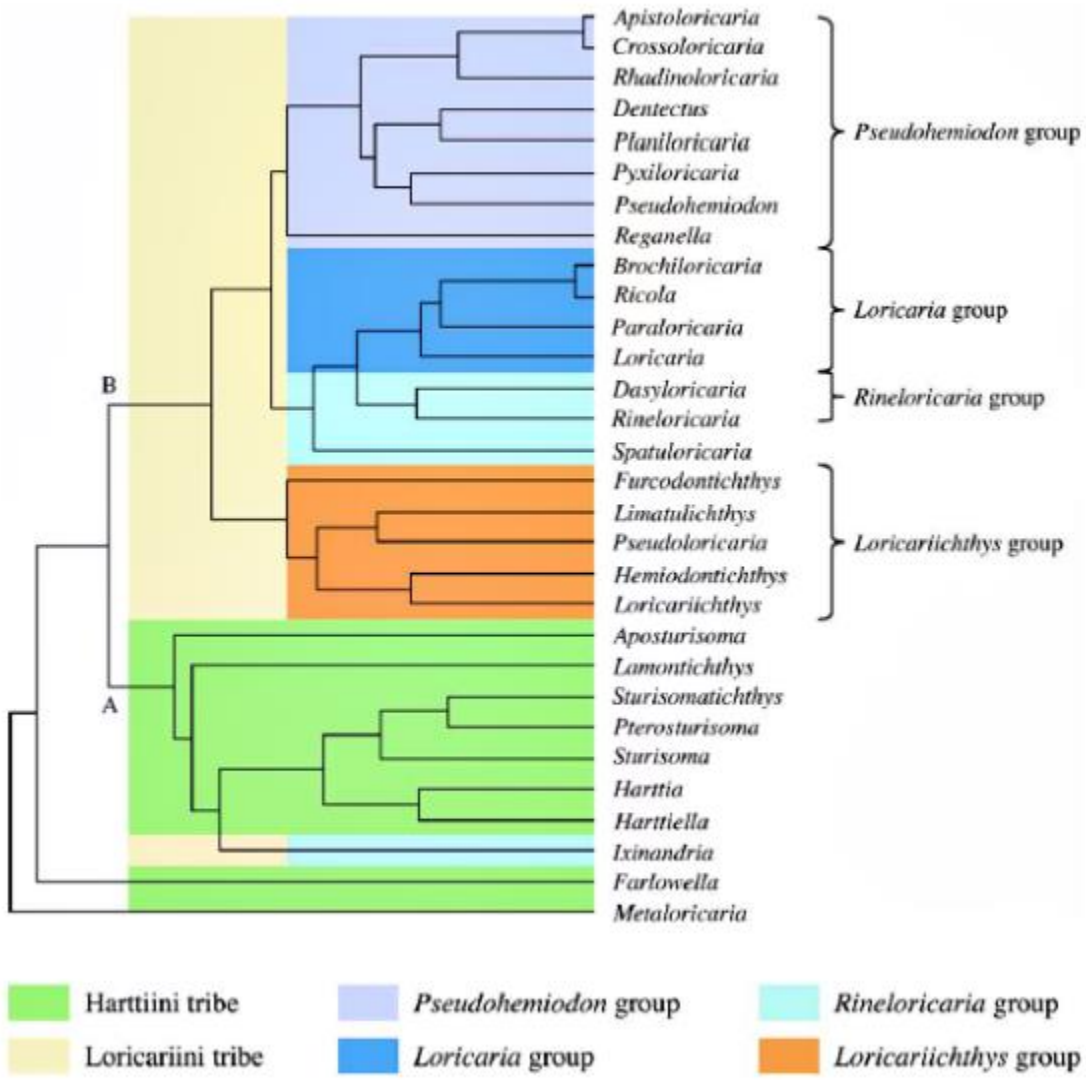

Figure 5. Cluster analysis of the subfamily Loricariinae. Dendrogram based on morphological distances matrix using UPGMA. **A**. Harttiini tribe; **B**. Loricariini tribe. Colors represent the different ranks established: Harttiini tribe, Loricariini tribe, *Loricariichthys* group, *Rineloricaria* group, *Loricaria* group, *Pseudohemiodon* group. From Covain & Fisch-Muller (2007).

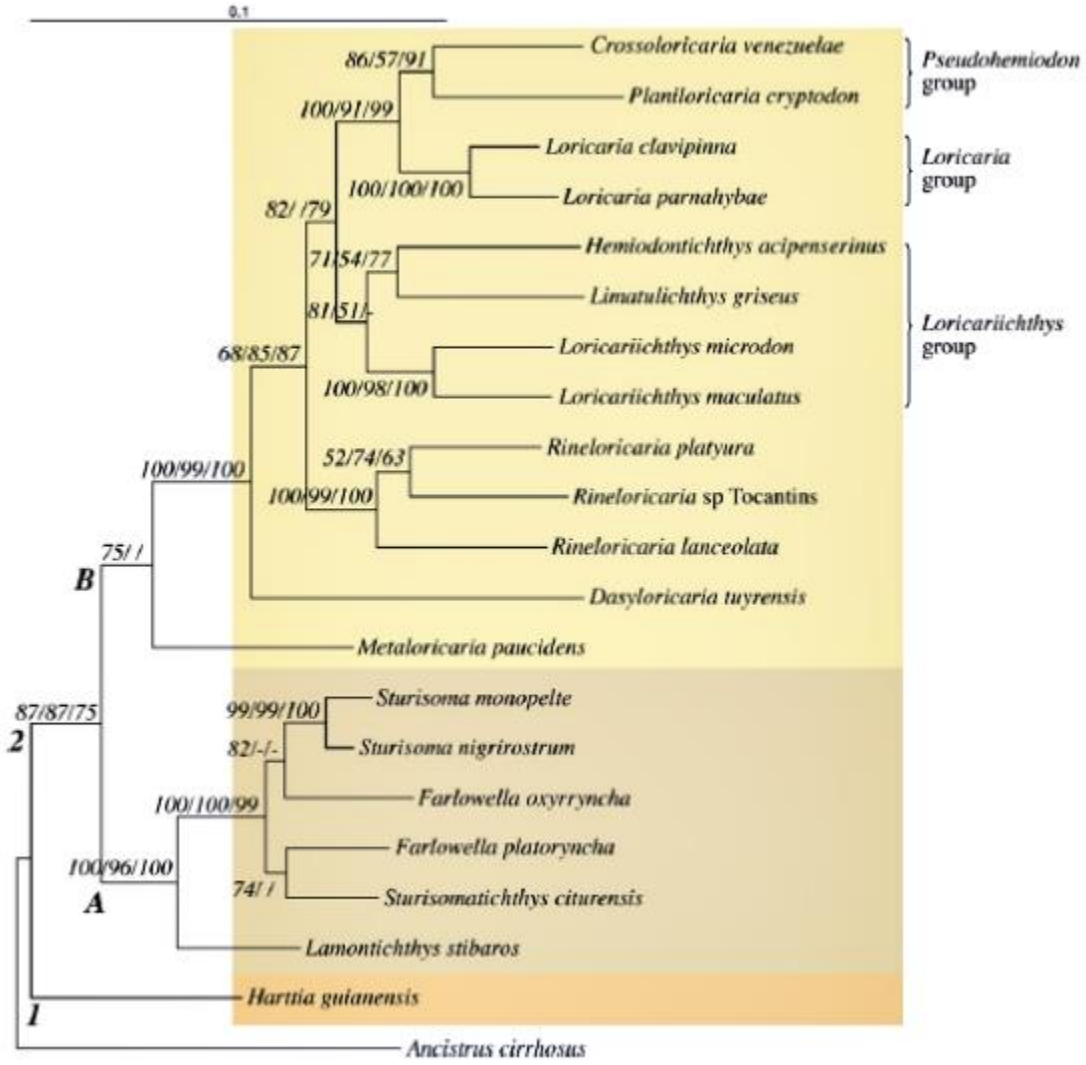

Figure 6. Maximum likelihood tree of the Loricariinae including 14 genera and 20 species inferred from the analysis of partial 12S and 16S gene sequences. Numbers above branches indicate bootstrap supports above 50 for ML, MP, and NJ trees, respectively. Sign (-) indicates that the node was not found in some topologies. 1, Harttiini; 2. Loricariini; A. Sturisomina; B. Loricariina. Scale indicates the number of substitution per site as expected by the model. From Covain *et al*. (2008).

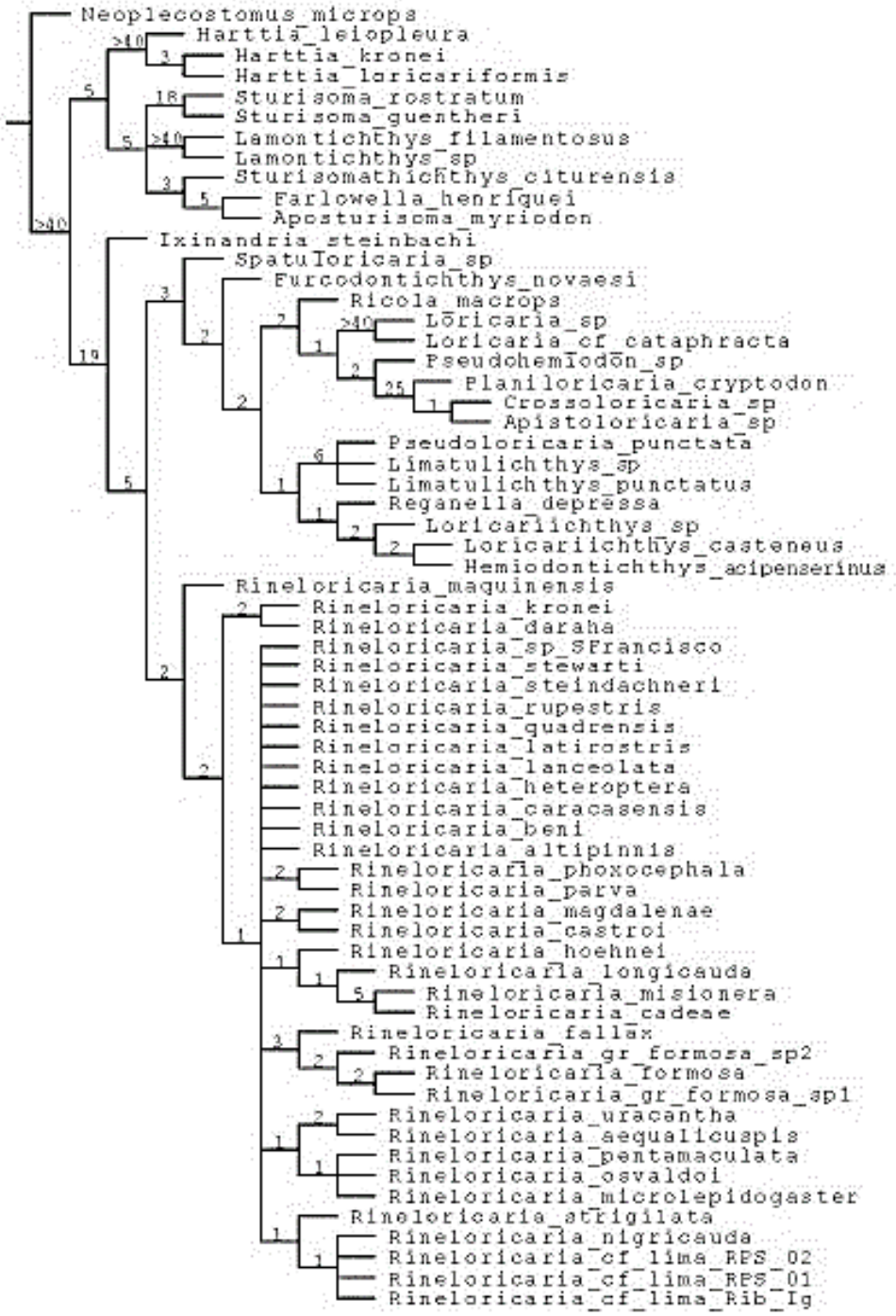

Figure 7. Strict consensus tree of *Rineloricaria* relationships. Numbers above the branches represent Bremer support values. From Fichberg (2008).

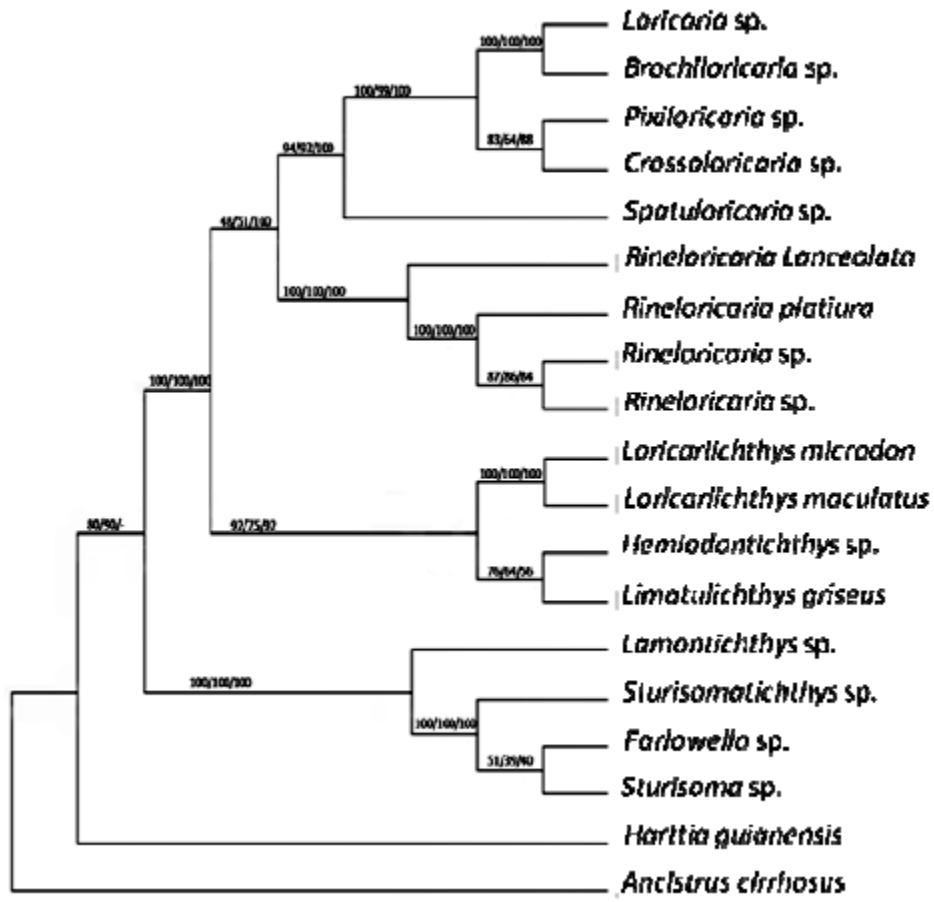

Figure 8. Majority consensus topology found from Maximum Parsimony analysis of the relationships among genera of the subfamily Loricariinae based on molecular characters of 12S, 16S, and F-Reticulon-4 gene sequences. Values above branches represent the bootstrap values (1.000 pseudoreplicates) for Maximum Parsimony, Maximum Likelihood, and Neighbour-Joining analysis, respectively. From Silva (2009).

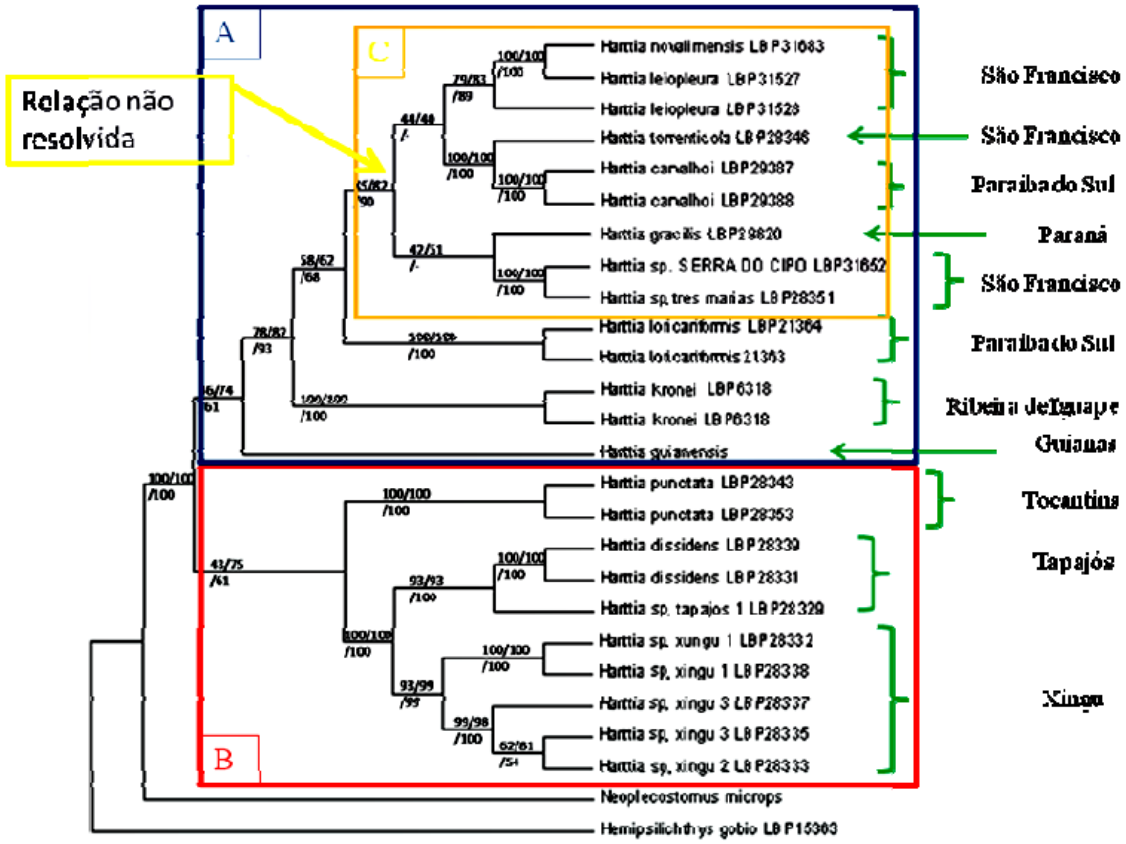

Figure 9. Majority consensus topology found from Maximum Parsiomony analysis of the relationships among *Harttia* species, based on molecular characters of COI and F-Reticulon-4 with the identification of the basins where they occur. "A" represents the group of species from southerastern Brazil plus *Harttia* from the Guianas; "B" represents the group of species that occur in the tributaries of the right bank of the Amazon; "C" represents a group of species whose relationship has not been resolved. Values above branches represent the bootstrap values (1.000 replicates) for Maximum Parsimony and Maximum Likelihood analysis respectively, and the number below represents the bootstrap value (1.000 replicates) from the Neighbour-Joining. From Silva (2009).

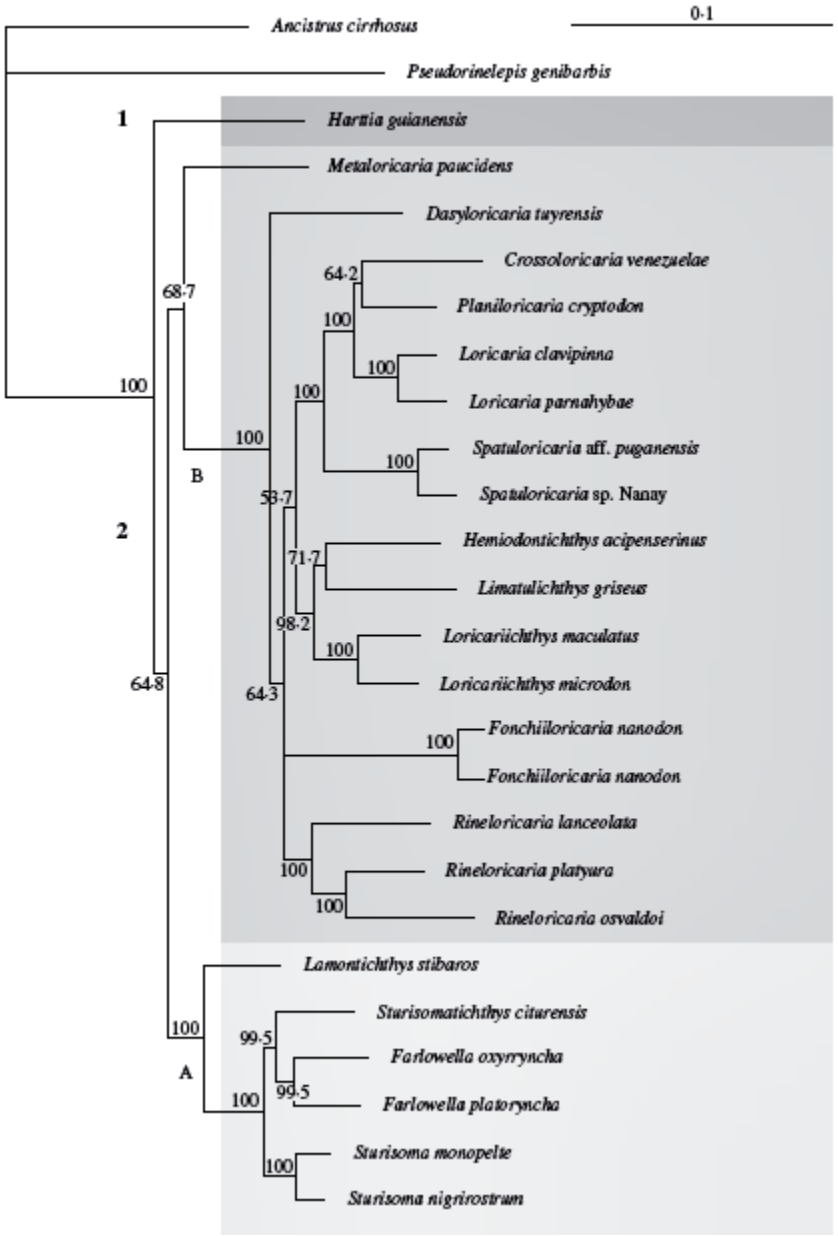

Figure 10. Maximum Likelihood consensus tree of Loricariinae inferred from the combined analysis of sequences of partial 12S and 16S mitochondrial genes and partial F-RTN4 nuclear gene. Numbers above branches indicate bootstrap supports >50. Clades: 1, Harttiini; 2, Loricariini; A, Farlowellina; B, Loricariina. Scale indicates the number of substitutions per site as expected by the model. From Rodriguez *et al*. (2011).

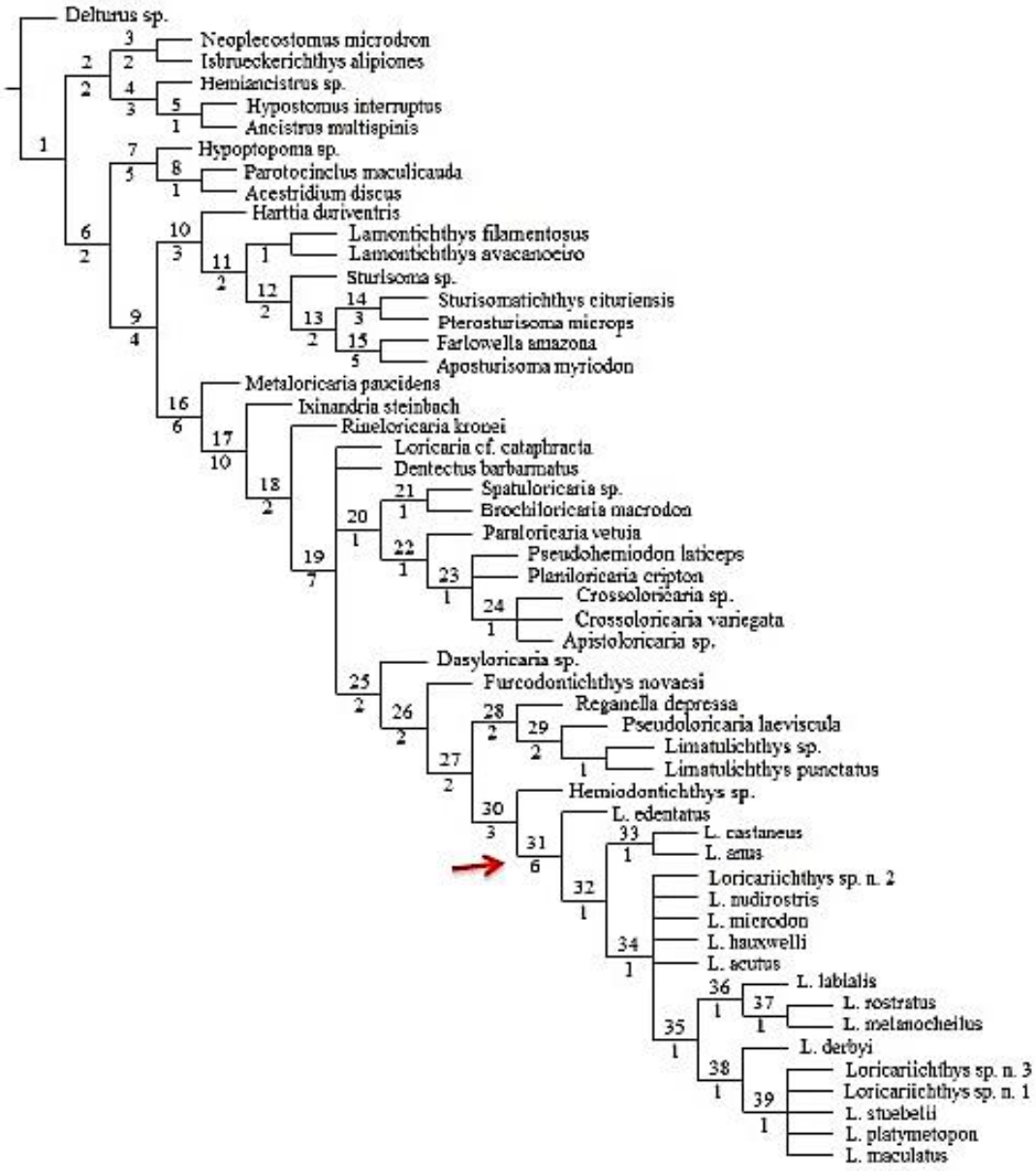

Figure 11. Cladogram of the strict consensus of 36 equally most parsimonious trees (320 steps; CI = 43; RI = 87). Numbers of the clades are indicated above the branches and the Bremer support value below. Arrow indicates the clade formed by *Loricariichthys* species. From Paixão (2012).

Figure 12. Maximum Likelihood tree, labeled subtree of the Harttiini tribe. Numbers above branches indicate bootstrap supports above 50 followed by posterior probabilities above 0.7 respectively. Dash (-) represents low supports. Blackened branches indicate nodes with both bootstrap supports and posterior probabilities below 50 and 0.70. Stars indicate incongruence between ML and Bayesian reconstructions and NAs indicate nodes absent in topologies of Appendices A and B. Bold type refers to type species of different genera. Scale indicates the number of substitutions per site as expected by the model. From Covain *et al*. (2016).

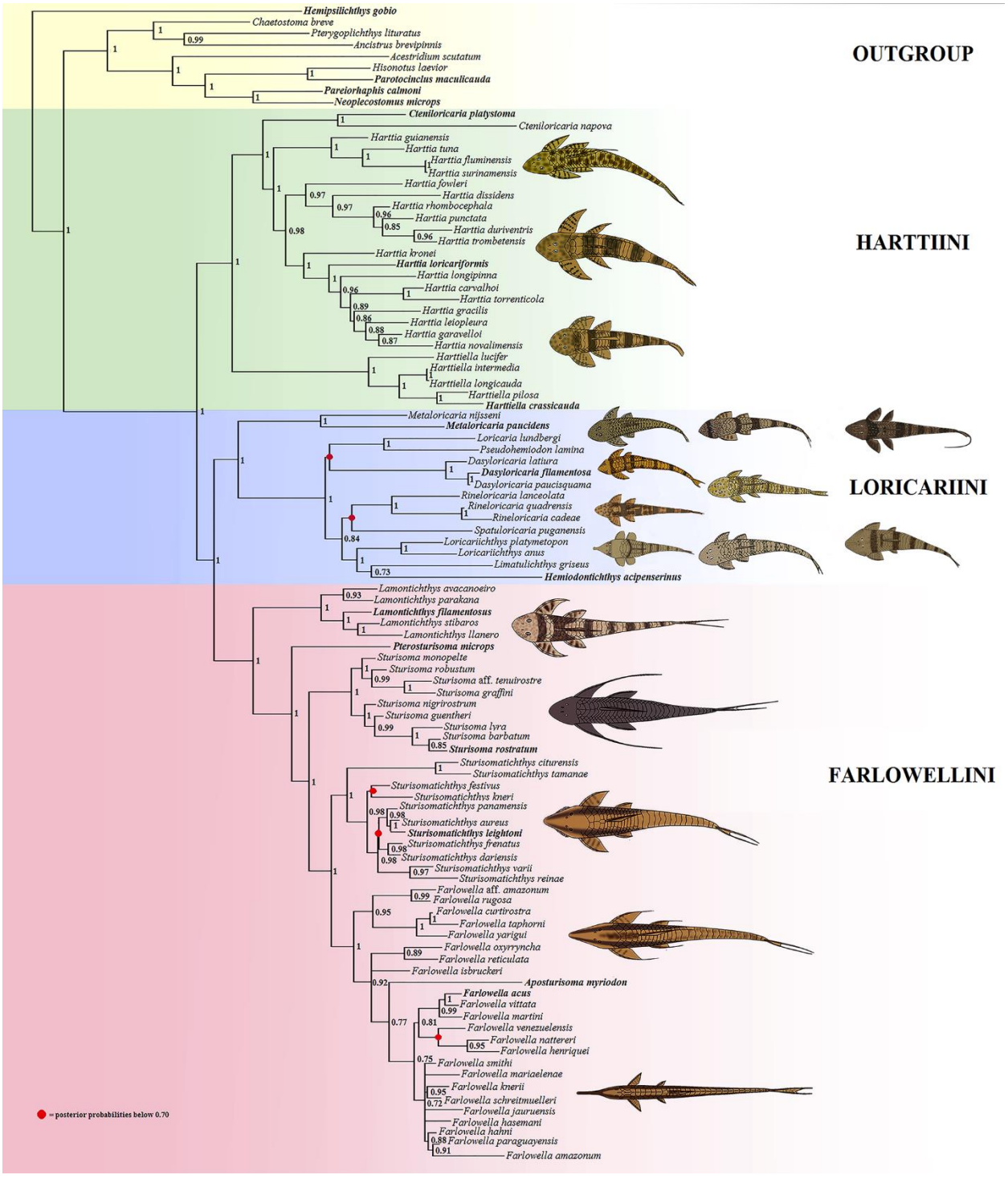

Figure 13. Bayesian Inference Tree. Posterior Probabilities values at nodes. Type-species names in bold. From Londoño-Burbano & Reis (2021).

CHAPTER 1

Morphological phylogeny of *Harttia* Steindachner, 1877 (Siluriformes: Loricariidae: Loricariinae)

ARIELI M. CHEROBIM 1, OSVALDO T. OYAKAWA 2 & FRANCISCO LANGEANI 1

1 UNESP—Universidade Estadual Paulista, Departamento de Zoologia e Botânica, Laboratório de Ictiologia, Instituto de Biociências, Letras e Ciências Exatas, Rua Cristóvão Colombo, 2265, 15054-000, São José do Rio Preto, SP, Brazil.
2 MZUSP—Museu de Zoologia da Universidade de São Paulo, P.O. Box 42694, 04299-970, São Paulo, SP, Brazil.
E-mail: amcherobim@gmail.com, oyakawa@usp.br, francisco.langeani@unesp.br.

Abstract

Harttia holds the second position regarding the highest intrageneric diversity of the Loricariinae with 27 valid species, and as new species are being described, more evident becomes the morphological variation of the group. In the phylogenetic analyses already performed for Loricariinae, *Harttia* has always been represented and recovered as monophyletic, but a small number of species were usually included. Thus, the aim of this work was to perform a phylogenetic analysis based on morphological characters including a greater number of species. The analysis encompassed 275 characters of osteology and internal morphology, and included 64 terminals of which 25 are species of *Harttia*. The strict consensus cladogram does not corroborate the monophyly of the genus. The species of *Harttia* are recovered as lineages that evolved independently, with the species from southeastern Brazil diverging first, followed by the species from the Amazon basin and Guianas Shield. Only the monophyly of two subgroups within *Harttia* have been recovered: one clade composed of some species of the southeastern Brazil (*H. kronei*, *Harttia* sp. São Roque, *H. carvalhoi*, *H. intermontana*, and *H. torrenticola*), and another clade composed of species from the Amazon region and Guianas Shield (*Cteniloricaria platystoma*, *H. trombetensis*, *H. uatumensis*, *Harttia* cf. *fowleri*, and *Harttia* cf. *surinamensis*). The positioning of *H. loricariformis*, the type species of the genus, corresponds to the last southeastern species to

diverge (except *H. absaberi*), being followed by the species from the Amazon region. *Harttia absaberi* was recovered as closer to the other genera of Loricariinae than to the species of the group itself, and *Cteniloricaria* was nested inside *Harttia*.

Keywords: systematic, phylogenetic analysis, synapomorphies, morphology, osteology, loricariid.

Introduction

The genus *Harttia* Steindachner, 1877 holds the second position regarding the highest intrageneric diversity of the subfamily Loricariinae with 27 valid species (OYAKAWA *et al*., 2018; OLIVEIRA & OYAKAWA, 2019). Over the years, some attempts have been made to propose diagnostic features to the genus. Rapp Py-Daniel & Oliveira (2001) recognized that the members of *Harttia* can be easily differentiated from other loricariines due to the combination of "short and broad body, round to triangular head, round orbit, large mouth with numerous teeth, twelve branched caudal-fin rays, large subpreopercle located ventrally, and a single and short oral-valve papilla just behind the premaxillaries gap". The same work also points out the common origin of the species of the genus giving the following synapomorphies: "basipterygia internal anterior processes oriented mesially, preopercle with large ventral process to which subpreopercle is articulated, second basibranchial vestigial, and parapophyses of fourth vertebra not contacting transcapular ligament". Oyakawa *et al.* (2013) indicate as diagnostic features the absence of keels along the lateral plates, rounded snout, large plates around the anal opening and abrupt narrowing of the caudal peduncle. However, as new species are described, more evident becomes the morphological variation of the group, raising questions about shared ancestry and also morphological characteristics that could define the genus.

Rapp Py-Daniel (1997) performed the first phylogenetic analysis based on morphological data for Loricariinae. The subfamily was recovered as a monophyletic group, and was subdivided into two major clades: Loricariini Bonaparte, 1831 and Harttiini Boeseman, 1971, which basically comprise the originally designated genera. The tribe Harttiini was formed by Farlowellina (*Farlowella* Eigenmann & Eigenmann, 1889, *Aposturisoma* Isbrücker, Britski, Nijssen & Ortega, 1983, and *Sturisoma* Swainson, 1838) and Harttiina (*Lamontichthys* Miranda Ribeiro, 1939 and

Harttia), plus the genus *Sturisomatichthys* Isbrücker & Nijssen, 1979. *Harttia* was recovered as a monophyletic group supported by seven synapomorphies: "basipterygium internal anterior processes oriented mesially (152-1, ci = 0.5); point of bifurcation of the infraorbital and supraorbital canals at the border between sphenotic and pterotic-supracleithrum (166-1, ci= 0.5); first ceratobranchial with huge flange (72-2, ci= 0.4); no contact between the basipterygium internal anterior processes (150-0, ci= 0.36); parapophysis of fourth vertebra not contacting transcapular ligament (92-0, ci= 0.33); parietal branch terminal exit on the supraoccipital (174-3, ci=0.33); and preopercle canal straight, with three exits (54-2, ci = 0.3)". The relationships among the ten species of *Harttia* included in this analysis was completely resolved in the ordered analysis, but partially resolved in the unordered analysis. The subclade formed by *Harttia* sp. DI, *Harttia kronei* Miranda Ribeiro, 1908, *Harttia* cf. *carvalhoi*, and *Harttia leiopleura* Oyakawa, 1993, represents the consistently resolved part of the clade, revealing the same relationship in the two hypotheses. Despite of not including *Cteniloricaria* Isbrücker & Nijssen, 1979 and *Harttiella* Boeseman, 1971 in the phylogenetic analysis, the author consider the first as a junior synonym of *Harttia*, and the second as tentatively included in Harttiini and Harttiina, since the genus is very close to *Harttia* based on the original description.

Fichberg (2008) proposed a phylogenetic hypothesis of species in the genus *Rineloricaria* based on morphological caracteres. This study included 64 taxa, being 63 species of Loricariinae (36 of *Rineloricaria* and 27 of the other genera) and one Neoplecostominae. Harttiini was recovered as a monophyletic group supported by 14 sinapomorphies and consisting of the genera: *Harttia*, *Sturisoma* Swainson, 1838, *Lamontichthys* Miranda Ribeiro, 1939, *Sturisomatichthys* Isbrücker & Nijssen, 1979, *Farlowella* Eigenmann & Eigenmann, 1889, and *Aposturisoma* Isbrücker, Britski, Nijssen & Ortega, 1983. *Harttia* was retrieved monophyletic, being supported by one exclusive synapomorphy: middorsal plates rounded on the posterior margin (153-0), and 12 non-exclusive synapomorphies: ventroposterior border of the lateral ethmoid greatly enlarged, contributing to the orbit floor (14-2); rectangular sphenotic, not contributing to the postorbital notch (16-2); pterotic-supracleithrum with some large and irregular perforations (25-1); connection of the ventral process of the complex vertebra fragile since the base (34-1); two supracaudal plates (45-2); triangular and slightly elongated suspensorium (62-0); ventral process of the preopercle inconspicuous or absent (66-0); dorsal hook in epihyal large, projected (82-2); anterior process of the first ceratobranchial present, large with equivalent size to that of the

ceratobranchial (91-3); posterior process of the third epibranchial elongated, laterally expanded (97-1); forth epibranchial as an approximately straight bar (114-0); and maxillary barbel absent (139-0). With respect to phylogenetic placement, *Harttia* was found as a sister group to the other genera of Harttiini and the relationships among the species as follow: (*H. leiopleura* (*H. kronei* + *H. loricariformis* Steindachner, 1877)).

Paixão (2012) reconstructed a phylogeny for the genus *Loricariichthys* Bleeker, 1862 also based on morphological characters. This study included 54 taxa, with 45 species of Loricariinae (17 of *Loricariichthys*), one of Delturinae, two of Neoplecostominae, three of Hypostominae and three of Hypoptopomatinae. Loricariinae was divided into two tribes: Loricariini and Harttiini. *Harttia* was represented by only one species, *Harttia duriventris* Rapp Py-Daniel & Oliveira, 2001, and was retrieved as the first genus to diverge within Harttiini, that also includes *Lamontichthys* Miranda Ribeiro, 1939, *Sturisoma* Swainson, 1838, *Sturisomatichthys* Isbrücker & Nijssen, 1979, *Pterosturisoma* Isbrücker & Nijssen, 1978, *Farlowella* Eigenmann & Eigenmann, 1889, and *Aposturisoma* Isbrücker, Britski, Nijssen & Ortega, 1983.

Londoño-Burbano & Reis (2021) proposed the first combined phylogenetic analysis of the Loricariinae with emphasis on Harttiini and Farlowellini, including 196 morphological characters and seven molecular markers (Cytb, nd2, 12S, 16S, MyH6, RAG1, and RAG2). The subfamily was recovered as a monophyletic group, and subdivided into three tribes: Harttiini Boeseman, 1971, Loricariini Bonaparte, 1831, and Farlowellini Fowler, 1958, being the latter two recovered as sister groups and elevated from the subtribes Loricariina and Farlowellina. The tribe Harttiini was composed of the *Cteniloricaria* Isbrücker & Nijssen, 1979; *Harttia* Steindachner 1877; and *Harttiella* Boeseman, 1971, being supported by nine morphological and 29 molecular synapomorphies. The genus *Harttia* was recovered as sister group of *Cteniloricaria*, and a monophyletic group supported by six morphological and 23 molecular synapomorphies. The phenotypic characters that diagnose this node are: parietal branch curved (39-1); coronoid process of the dentary large, with a small robust area (47-0); dorsal hook of the posterohyal large, projected (87-0); contact between the compound pterotic and the transverse process of the complex centrum by suture (112-1); posterior tip of the hemal spine of the second preural centrum with a cartilage (134-0), and caudal peduncle narrows abruptly towards caudal-fin base (189-1). Within *Harttia*, the species from the Guianas region were recovered as sister group of a clade composed of two monophyletic groups, one being *H. fowleri* (Pellegrin 1908) plus species from the Amazon region,

and other being species from southeastern Brazil. Inside the species from the Guianas region, the following relationships were recovered: (*H. guianensis* Rapp Py-Daniel & Oliveira, 2001 + (*H. tuna* Covain & Fisch-Muller, 2012 + (*H. fluminensis* Covain & Fisch-Muller, 2012 + *H. surinamensis* Boeseman, 1971))). Inside the species from *H. fowleri* plus the species from the Amazon region: (*H. fowleri* + (*H. dissidens* Rapp Py-Daniel & Oliveira, 2001 + (*H. rhombocephala* Miranda Ribeiro, 1939 + (*H. punctata* Rapp Py-Daniel & Oliveira, 2001 + (*H. duriventris* Rapp Py-Daniel & Oliveira, 2001 + *H. trombetensis* Rapp Py-Daniel & Oliveira, 2001))))). And finally, the species from southeastern Brazil: (*H. kronei* Miranda Ribeiro, 1908 + (*H. loricariformis* Steindachner 1877 + (*H. longipinna* Langeani, Oyakawa & Montoya-Burgos, 2001 + ((*H. carvalhoi* Miranda Ribeiro, 1939 + *H. torrenticola* Oyakawa, 1993) + (*H. gracilis* Oyakawa, 1993 + (*H. leiopleura* Oyakawa, 1993 + (*H. garavelloi* Oyakawa, 1993 + *H. novalimensis* Oyakawa, 1993)))))))). However, probably the positioning of *H. rhombocephala* is different from the one proposed in this study, because the material assigned as this species is from the Tocantins River basin, although according to the original description and Fricke *et al*. (2021), the distribution is "Farias River basin and Eastcoast Rivers, Brazil".

Several hypotheses of phylogenetic relationship including genera of Loricariinae have been proposed over the time. The genus *Harttia* has always been represented and recovered as a monophyletic group. However, the relationship among its species has not been deeply investigated, as the available analyses have included a small number of species. Therefore, the aim of this study was to perform a phylogenetic analysis of the species of *Harttia* based on morphological characters, encompassing osteology and external morphology.

Material and Methods

This study examined 64 terminal taxa representing: Astroblepidae and all subfamilies of Loricariidae sensu Pereira & Reis (2017) (Lithogeneinae, Delturinae, Hypostominae, Neoplecostominae, Hypoptopomatinae, and Loricariinae (majority)). The ingroup was composed of 25 species of *Harttia* comprising both valid and undescribed species (Figure 1, 2, and 3). Without considering *Harttia*, 23 genera of Loricariinae were included, except *Aposturisoma* Isbrücker, Britski, Nijssen & Ortega, 1983, *Dasyloricaria* Isbrücker & Nijssen, 1979, *Dentectus* Martín Salazar, Isbrücker & Nijssen, 1982, *Fonchiiloricaria* Rodriguez, Ortega & Covain, 2011,

Ixinandria Isbrücker & Nijssen, 1979, *Pyxiloricaria* Isbrücker & Nijssen, 1984, *Rhadinoloricaria* Isbrücker & Nijssen, 1974, *Ricola* Isbrücker & Nijssen, 1978, and *Sturisomatichthys* Isbrücker & Nijssen, 1979.

The list of specimens is available in Appendix 1, and the material examined is from: AUM, Auburn University Natural History Museum, Auburn, Alabama, U.S.A.; DZSJRP, Coleção de Peixes do Departamento de Zoologia e Botânica do Instituto de Biociências, Letras e Ciências Exatas, Universidade Estadual Paulista, São José do Rio Preto, São Paulo, Brazil; INPA, Instituto Nacional de Pesquisas da Amazônia, Manaus, Amazonas, Brazil; LBP, Laboratório de Biologia de Peixes, Instituto de Biociências, Universidade Estadual Paulista, Botucatu, São Paulo; Brazil; LIRP, Laboratório de Ictiologia de Ribeirão Preto, Faculdade de Filosofia, Letras e Ciências Humanas, Universidade de São Paulo, Ribeirão Preto, São Paulo, Brazil; MCP, Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre, Rio Grande do Sul, Brazil; MZUEL, Museu de Zoologia da Universidade Estadual de Londrina, Londrina, Paraná, Brazil; MZUSP, Museu de Zoologia da Universidade de São Paulo, São Paulo, São Paulo, Brazil; and NUP, Coleção Ictiológica do Núcleo de Pesquisas em Limnologia, Ictiologia e Aqüicultura, Universidade Estadual de Maringá, Paraná, Brazil.

Characters selected for this study were based on the literature, following Rapp Py-Daniel (1997), Armbruster (2004), Fichberg (2008), and Paixão (2012), encompassing 257 characters, plus 18 characters proposed herein, totaling 275 characters of osteology and external morphology. Osteological nomenclature and plate counts followed Schaefer (1997). Vertebrae counts included the five centra incorporated into the Weberian Apparatus, and the compound caudal centrum was counted as a single element. Cleared and stained (c&s) specimens were prepared according to Taylor & Van Dyke (1985). In the matrix (Appendix 2), a dash was used for inapplicable characters.

Phylogenetic analysis was performed on TNT v. 1.5 (GOLOBOFF & CATALANO, 2016). Before initiating the search, maximum trees in memory were expanded to 10.000. The reconstruction was executed with Traditional Search. The parameters were: Wagner trees with 1 random seed and 10 replications, Tree Bisection Reconnection (TBR) with 10 trees to save per replication and replace existing trees activated. A strict consensus was built from the equally parsimonious trees. The Bremer Index was utilized as a branch support measure and also performed in TNT v.1.5, using suboptimal tress with up to 10 steps more than the fundamental

trees (BREMER, 1994). The consistency (CI) and retention (RI) indexes are indicated as CI = -- and RI = -- in cases that correspond to autapomorphies, and are therefore not calculated by TNT. The transformations of character state were analyzed with WinClada (NIXON, 1999-2002). The root was *Astroblepus* sp..

Results

Character description

Characters are organized according to the anteroposterior axis of the body. Consistency index values (CI) and retention index values (RI) are indicated for each character. A brief comment is presented when needed.

Neurocranium

Mesethmoid

1. Anterior process of mesethmoid ("cornua") (modified Rapp Py-Daniel, 1997 char. 1; modified Fichberg, 2008 char. 1). CI = 0.133. RI = 0.000.

(0) Small (Fig. 4B)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi, H. kronei, H. longipinna* and *H. punctata*),** *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Spatuloricaria evansii*.

(1) Absent (Fig. 4A)

Harttia absaberi, H. kronei, H. longipinna, *Apistoloricaria* sp., *Brochiloricaria* sp., *Farlowella oxyrryncha*, *Hemiodontichthys acipenserinus*, *Loricaria lentiginosa*, *Proloricaria prolixa*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(2) Large (Fig. 4C)

Harttia punctata and *Planiloricaria cryptodon*.

Comment: The anterior process of mesethmoid refers to a lateral expansion in its distal margin. According to Schaefer (1990) (Fig. 6), this process is called mesethmoid cornua and it is absent or reduced in loricariids. In this study, the anterior process is considered small (state 0), when its distal margin does not reach the width of the lateral ethmoid in ventral view, or large (state 2), with its distal margin reaching the lateral ethmoid.

2. Chamfer of mesethmoid (modified Rapp Py-Daniel, 1997 char. 2). CI = 0.200. RI = 0.200.

(0) Present (Fig. 5A)

Astroblepus sp., *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Hypoptopoma inexpectata*, *Metaloricaria paucidens* and *Pseudoloricaria laeviuscula*.

(1) Absent (Fig. 5B)

Lithogenes wahari, *Hemipsilichthys nimius*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

Comment: According to Lundberg (1970), the primitive condition of Siluriformes is the presence of two cornuas (= anterior process) in the tip of the mesethmoid, separated by a median cleft. This cleft corresponds to the mesethmoid chamfer, being a small gap in the half of the anterior margin of the mesethmoid.

3. Mesethmoid anterior edge (modified Armbruster, 2004 char. 103). CI = 0.125. RI = 0.533.

(0) Smooth

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia intermontana,*** *Harttiella crassicauda*, *Metaloricaria paucidens*, *Reganella depressa*, *Rineloricaria lanceolata* and *Spatuloricaria evansii*.

(1) Serrated

Hypostomus ancistroides, *Kronichthys heylandi*, **all species of *Harttia* (except *H. intermontana*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

4. Cartilage in mesethmoid anterior edge. CI = 0.333. RI = 0.000.

(0) Present (Fig. 6C)

Astroblepus sp., *Plesioptopoma curvidens* and ***Harttia gracilis*.**

(1) Absent (Fig. 6A, B and D)

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. gracilis*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

5. Shape of mesethmoid tip (modified Paixão, 2012 char. 1). CI = 0.273. RI = 0.200.

(0) Spatula (Fig. 6B)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, **all species of *Harttia* (except *H. absaberi, H. gracilis, H. intermontana, H. kronei* and *H. torrenticola*),** *Brochiloricaria* sp., *Crossoloricaria* spp.,

Cteniloricaria platystoma, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Arrow (Fig. 6C)

Isbrueckerichthys duseni, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia gracilis***, ***H. intermontana*** and ***H. torrenticola*.**

(2) Straight (Fig. 6A)

Harttia absaberi, H. kronei, *Apistoloricaria* sp. and *Rineloricaria pentamaculata*.

(3) T-shaped (Fig. 6D)

Metaloricaria paucidens and *Pseudoloricaria laeviuscula*.

6. Uncinate process in mesethmoid tip (modified Schaefer, 1991 char. 3; modified Pereira, 2008 char. 5). CI = --. RI = --.

(0) Absent (Fig. 7A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Present (Fig. 7B)

***Harttia absaberi*.**

Comment: The uncinate process corresponds to a ventral projection in the tip of the mesethmoid, being anterior to the ventral disk of the mesethmoid.

7. Ventral disk of mesethmoid (modified Rapp Py-Daniel, 1997 char. 3; modified Fichberg, 2008 char. 2). CI = --. RI = --.

(0) Present

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Absent

Reganella depressa.

8. Position of mesethmoid ventral disk (modified Schaefer, 1991 char. 2; modified Rapp Py-Daniel, 1997 char. 4; modified Fichberg, 2008 char. 3). CI = 0.308. RI = 0.182.

(0) Distal

Neoplecostomus microps, *Furcodontichthys novaesi*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Subdistal

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria*

cataphracta, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha* and *Rineloricaria lanceolata*.

(2) Almost in the middle of the mesethmoid

Hypoptopoma inexpectata, ***Harttia absaberi*** and *Pseudohemiodon* spp..

(3) In the middle of the mesethmoid

Hemiodontichthys acipenserinus.

(4) In the proximal portion of the mesethmoid

Farlowella oxyrryncha and *Sturisoma robustum*.

(-) Inapplicable (absent ventral disk)

Reganella depressa.

Comment: The position is distal (state 0) when the disk is in contact with the anterior margin of the mesethmoid. Subdistal (state 1) when the disk is near the margin, but not in contact with it. Almost in the middle of the mesethmoid (state 2) when the disk almost reaches half of the bone. In the middle of the mesethmoid (state 3) when the disk reaches exactly half of the mesethmoid. In the proximal portion of the mesethmoid (state 4) when the disk is in the second half of the bone.

9. Degree of development of mesethmoid disk in ventral view (modified Paixão, 2012 char. 3; modified Fichberg, 2008 char. 4). CI = 0.333. RI = 0.750.

(0) Thin, laminar

Astroblepus sp., *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(1) Robust, drop-shaped, infinity-shaped, 8-shaped

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*,

Plesioptopoma curvidens, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria lentiginosa*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Vestigial

Planiloricaria cryptodon.

(-) Inapplicable (absent ventral disk)

Reganella depressa.

10. Ventrolateral crest of mesethmoid (modified Rapp Py-Daniel, 1997 char. 6). CI = 0.083. RI = 0.542.

(0) Absent (Fig. 8A)

Astroblepus sp., *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, **all species of *Harttia* (except *H. guianensis* and *H. longipinna*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha* and *Sturisoma robustum*.

(1) Present (Fig. 8 B and C)

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia guianensis, H. longipinna,*** *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

Comment: In figure 8C, the crest is observed on the lateral margin of the mesethmoid as a lighter shade than in the center of the mesethmoid. In figure 8A, the crest is absent and there is no difference in coloration.

11. Width of mesethmoid ventrolateral crest (modified Rapp Py-Daniel, 1997 char. 7). CI = 0.167. RI = 0.545.

(0)Wider near vomer (Fig. 8B)

Lithogenes wahari, *Hemipsilichthys nimius*, *Hypoptopoma inexpectata*, *Hemiodontichthys acipenserinus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(1) With the same width along the entire length (Fig. 8C)

Ancistrus multipinnis, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia guianensis, H. longipinna,*** *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa* and *Spatuloricaria evansii*.

(-) Inapplicable (absent crest)

Astroblepus sp., *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, **all species of *Harttia* (except *H. guianensis* and *H. longipinna*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha* and *Sturisoma robustum*.

12. Dorsolateral crest of mesethmoid. CI = 0.500. RI = 0.000.

(0) Absent (Fig. 9A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Present (Fig. 9B)

Planiloricaria cryptodon and *Pseudohemiodon* spp..

Comment: The dorsolateral crest is seen as a lighter shade on the lateral margin of the mesethmoid as shown in figure 9A. When the crest is absent, there is no difference in coloration (figure 9B). It

is the same case as the ventrolateral crest (char. 10), but in one case the crest is dorsal and in the other it is ventral.

Vomer

13. Anterior region of vomer (modified Rapp Py-Daniel, 1997 char. 9; modified Fichberg, 2008 char. 10). CI = 0.125. RI = 0.696.

(0) With long sutures longitudinally, like spikes

Astroblepus sp., *Lithogenes wahari*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Hypoptopoma inexpectata*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(1) With broad sutures transversally and short sutures longitudinally

Hemipsilichthys nimius, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria lentiginosa*, *Paraloricaria vetula*, *Pterosturisoma* cf. *microps* and *Spatuloricaria evansii*.

Comment: The sutures described in this character concern the connection between the anterior region of the vomer and the mesethmoid.

Lateral ethmoid

14. Contact of lateral ethmoid with metapterygoid (modified Rapp Py-Daniel, 1997 char. 10; modified Paixão, 2012 char. 6; modified Fichberg, 2008 char. 11). CI = 0.300. RI = 0.731.

(0) Absent

Astroblepus sp..

(1) Present, only posteriorly

Ancistrus multipinnis, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi, H. intermontana* and *H. leiopleura*),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) Present, anterior and posterior points

Harttia absaberi, H. intermontana, H. leiopleura and *Harttiella crassicauda*.

(3) Present, along the entire margin

Lithogenes wahari, *Hemipsilichthys nimius*, *Isbrueckerichthys duseni*, *Pareiorhina rudolphi*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

15. Kind of contact between lateral ethmoid and dorsal region of metapterygoid (modified Rapp Py-Daniel, 1997 char. 11; modified Paixão, 2012 char. 6; modified Fichberg, 2008 char. 12). CI = 0.286. RI = 0.792.

(0) Only by suture

Lithogenes wahari, *Hemipsilichthys nimius*, *Isbrueckerichthys duseni*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Only by condyle

Ancistrus multipinnis, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi* and *H. intermontana*),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) By condyle and by suture

Harttia absaberi, H. intermontana and *Harttiella crassicauda*.

(-) Inapplicable (absent contact)

Astroblepus sp..

16. Ventroposterior border of lateral ethmoid (modified Rapp Py-Daniel, 1997 char. 13; Fichberg, 2008 char. 14). CI = 0.167. RI = 0.231.

(0) Little extended, followed by the anterior margin of the orbit (Fig. 10A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. duriventris, H. kronei, H. punctata, Harttia* cf. *surinamensis, H. trombetensis* and *H. uatumensis*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Slightly enlarged, but not contributing to the orbit floor (Fig. 10B)

Harttia duriventris, H. kronei, H. punctata, Harttia* cf. *surinamensis, H. trombetensis, H. uatumensis, *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(2) Greatly enlarged, contributing to the orbit floor (Fig. 10C)

Reganella depressa.

Comment: The border is slightly enlarged (state 1) when its final portion reaches the end of infraorbital 4. When is greatly enlarged (state 2) the final portion reaches the infraorbital 5.

17. Ventral wall of nasal capsule (modified Paixão, 2012, char. 5). CI = 0.333. RI = 0.333.

(0) Absent

Astroblepus sp., *Isbrueckerichthys duseni*, *Plesioptopoma curvidens* and *Pseudotocinclus tietensis*.

(1) Present

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

Sphenotic

18. Length of sphenotic (modified Rapp Py-Daniel, 1997 char. 14). CI = 0.333. RI = 0.926.

(0) Reduced, smaller than 50% of the length of the frontal

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma* and *Harttiella crassicauda*.

(1) Large, approximately equal or greater than 50% of the length of the frontal

Ancistrus multipinnis, *Hypostomus ancistroides*, *Pareiorhina rudolphi*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

19. Shape of sphenotic (modified Fichberg, 2008 char. 16). CI = 0.250. RI = 0.850.

(0) Circular

Astroblepus sp., *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*,

Pseudohemiodon spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(1) Rectangular

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricariichthys castaneus*, *Pterosturisoma* cf. *microps*, *Spatuloricaria evansii* and *Sturisoma robustum*.

20. Ventral process of sphenotic (modified Fichberg, 2008 char. 28). CI = 0.154. RI = 0.542.

(0) Absent

Astroblepus sp., *Hypoptopoma inexpectata*, ***Harttia dissidens, H. duriventris, H. garavelloi*** and *Reganella depressa*.

(1) Short

Neoplecostomus microps, *Pareiorhina rudolphi*, ***Harttia novalimensis, Harttia* sp. tapajós 1,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Pterosturisoma* cf. *microps*.

(2) Long

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. dissidens, H. duriventris, H. garavelloi, H. novalimensis* and *Harttia* sp. tapajós 1),** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

Comment: When the ventral process of the sphenotic is short (state 1), it is wider than long. When the ventral process is long (state 2), it is longer than wide.

21. Dorsal process of sphenotic. CI = --. RI = --.

(0) Absent (Fig. 11A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. longipinna*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Present (Fig. 11B)

***Harttia longipinna*.**

Comment: This process is on the margin in contact with frontal. It is a dorsal process in the lateral view of the skull. The process is indicated by an arrow in figure 11B.

22. Contact of sphenotic with posteriormost infraorbital (modified Armbruster, 2004 char. 117). CI = 0.200. RI = 0.000.

(0) Present

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. dissidens, H. duriventris, H. garavelloi* and *Harttia* sp. tapajós 1),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Absent

***Harttia dissidens, H. duriventris, H. garavelloi, Harttia* sp. tapajós 1** and *Lamontichthys* spp..

Comment: This character is related with the contact of the sphenotic with the posteriormost infraorbital. However, when the contact is present (state 0), we observed that the number of the posteriormost infraorbital differs, and decided to register this variation in this comment. In *Astroblepus* sp., *Lithogenes wahari*, *Ancistrus multipinnis*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Harttia absaberi* and *Harttia leiopleura*, it is with the infraorbital 5. In all other terminals coded as state 0, it is with the infraorbital 6.

23. Sphenotic reach in relation to orbit. CI = 0.500. RI = 0.000.

(0) Sphenotic excluded from orbit contour

Astroblepus sp. and *Planiloricaria cryptodon*.

(1) Sphenotic participates on the orbit contour

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

24. Postorbital notch formed by sphenotic (modified Paixão, 2012 char. 7; Fichberg, 2008 char. 29). CI = 0.250. RI = 0.750.

(0) Absent

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Present

Furcodontichthys novaesi, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(-) Inapplicable (sphenotic is not part of the orbit contour)

Astroblepus sp. and *Planiloricaria cryptodon*.

Frontal

25. Frontal reach in relation to orbit (modified Rapp Py-Daniel, 1997 char. 15; modified Fichberg, 2008 char. 17). CI = 0.500. RI = 0.000.

(0) Frontal participates on the orbit contour

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Frontal excluded from orbit contour

Hypostomus ancistroides and *Farlowella oxyrryncha*.

26. Notch at posterior edge of lateral margin of frontal (modified Paixão, 2012 char. 8). CI = 0.200. RI = 0.429.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Apistoloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria*

platystoma, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Present

Brochiloricaria sp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus* and *Reganella depressa*.

(-) Inapplicable (frontal is not part of the orbit contour)

Hypostomus ancistroides and *Farlowella oxyrryncha*.

27. Length of frontal in relation to its greater width (modified Paixão, 2012 char. 9). CI = 0.059. RI = 0.484.

(0) Longer, at least twice wider

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Neoplecostomus microps*, ***Harttia absaberi, H. carvalhoi, H. dissidens, H. duriventris, H. garavelloi, H. guianensis, H. leiopleura, Harttia* cf. *surinamensis, H. trombetensis, H. uatumensis, Harttia* sp. tapajós 1,** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Shorter, less than twice the width

Ancistrus multipinnis, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi, H. carvalhoi, H. dissidens, H. duriventris, H. garavelloi, H. guianensis, H. leiopleura, Harttia* cf. *surinamensis, H. trombetensis, H. uatumensis* and *Harttia* sp. tapajós 1),** *Apistoloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps*, *Rineloricaria lanceolata* and *Sturisoma robustum*.

28. Crest on frontal surface (modified Fichberg, 2008 char. 18). CI = 0.087. RI = 0.344.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *H. absaberi, H. dissidens, H. duriventris, Harttia* cf. *fowleri, H. garavelloi, H. intermontana, H. loricariformis, H. panara, H. rondoni, Harttia* cf. *surinamensis* and *H. trombetensis*),** *Apistoloricaria* sp., *Crossoloricaria* spp., *Lamontichthys* spp., *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Pterosturisoma* cf. *microps*.

(1) Present, being the dorsal crist inconspicuous

Hemipsilichthys nimius, *Kronichthys heylandi*, *Pseudotocinclus tietensis*, ***Harttia absaberi, H. duriventris, Harttia* cf. *fowleri, H. garavelloi, H. intermontana, H. loricariformis, H. panara, H. rondoni, Harttia* cf. *surinamensis, H. trombetensis,*** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Proloricaria prolixa*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(2) Present, being the dorsal crist conspicuous

Hypostomus ancistroides, ***Harttia dissidens,*** *Hemiodontichthys acipenserinus*, *Metaloricaria paucidens*, *Rineloricaria daraha* and *Spatuloricaria evansii*.

Parasphenoid

29. Width of parasphenoid (modified Rapp Py-Daniel, 1997 char. 22; modified Fichberg, 2008 char. 27). CI = 0.111. RI = 0.500.

(0) Parasphenoid enlarged posteriorly

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Metaloricaria paucidens*, *Pseudohemiodon* spp., *Rineloricaria latirostris*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Parasphenoid narrow along its whole length

Isbrueckerichthys duseni, *Neoplecostomus microps*, *Apistoloricaria* sp., *Crossoloricaria* spp., *Hemiodontichthys acipenserinus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*,

Planiloricaria cryptodon, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata* and *Rineloricaria pentamaculata*.

Orbitosphenoid

30. Shape of orbitosphenoid (modified Fichberg, 2008 char. 20). CI = 0.313. RI = 0.686.

(0) Pentagonal

Astroblepus sp..

(1) Quadrangular

Lithogenes wahari, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi, H. intermontana, H. kronei, H. leiopleura, H. longipinna, H. novalimensis, H. torrenticola, Harttia* sp. São Roque,** *Harttiella crassicauda*, *Planiloricaria cryptodon*, *Proloricaria prolixa* and *Pterosturisoma* cf. *microps*.

(2) Fan

All species of *Harttia* (except *H. absaberi, H. carvalhoi, H. intermontana, H. kronei, H. leiopleura, H. longipinna, H. novalimensis, H. torrenticola* and *Harttia* sp. São Roque), *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Lamontichthys* spp., *Loricaria lentiginosa*, *Rineloricaria daraha*, *Rineloricaria latirostris* and *Sturisoma robustum*.

(3) Rectangular

Hemipsilichthys nimius, ***Harttia absaberi,*** *Loricaria cataphracta* and *Loricariichthys castaneus*.

(4) Hourglass

Apistoloricaria sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Metaloricaria paucidens*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(5) Circular

Hypoptopoma inexpectata and *Paraloricaria vetula*.

Comment: The shape of the orbitosphenoid is pentagonal (state 0) when the bone presents five sides and angles, like the geometric figure of the pentagon. Quadrangular (state 1) when it is wider than long, like the geometric figure of the square. Fan (state 2) when it is narrow in the posterior portion, in the region in contact with prootic, remembering the shape of a fan. Rectangular (state 3) when the bone is rectangular and not narrow in the median portion, like the geometric figure of the rectangle. Hourglass (state 4) when it is rectangular and narrow in the median portion, remembering the shape of a hourglass. And finally, circular (state 5) when it remembers the geometric figure of the circle.

31. Width of orbitosphenoid at its narrowest portion (modified Rapp Py-Daniel, 1997 char. 16). CI = 0.333. RI = 0.455.

(0) More than twice the parasphenoid

Astroblepus sp., *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata* and *Paraloricaria vetula*.

(1) 1 ½ or 2 times the parasphenoid

Lithogenes wahari, *Hemipsilichthys nimius*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) As wide as the parasphenoid

Crossoloricaria spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus* and *Metaloricaria paucidens*.

(3) Narrower than the parasphenoid

Limatulichthys griseus, *Pseudoloricaria laeviuscula* and *Reganella depressa*.

32. Length of ventral articulation between orbitosphenoid and lateral ethmoid (modified Rapp Py-Daniel, 1997 char. 17; modified Fichberg, 2008 char. 21). CI = 0.167. RI = 0.444.

(0) About equal or a little greater than the ventral contact between orbitosphenoid and prootic

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *Harttia* cf. *fowleri*, *Harttia* cf. *surinamensis*, *H. trombetensis* and *H. uatumensis*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Much more expanded than the ventral contact between orbitosphenoid and prootic

***Harttia* cf. *fowleri*, *Harttia* cf. *surinamensis*, *H. trombetensis*, *H. uatumensis*,** *Cteniloricaria platystoma*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula*, *Reganella depressa* and *Rineloricaria daraha*.

Basioccipital

33. Lateral processes of basioccipital (modified Rapp Py-Daniel, 1997 char. 21; modified Fichberg, 2008 char. 26). CI = 0.250. RI = 0.429.

(0) Absent

Astroblepus sp..

(1) Small, shorter than the basioccipital height but not expanded ventrally (Fig. 12A)

Lithogenes wahari, *Neoplecostomus microps*, *Brochiloricaria* sp., *Loricaria cataphracta*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(2) Short, but expanded ventrally (Fig. 12B)

Apistoloricaria sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Loricaria lentiginosa* and *Pseudohemiodon* spp..

(3) Large, but expanded only laterally (Fig. 12C)

Hemipsilichthys nimius, *Isbrueckerichthys duseni*, *Pareiorhina rudolphi*, *Pseudotocinclus tietensis*, *Hemiodontichthys acipenserinus* and *Rineloricaria daraha*.

(4) Very large, expanded laterally and ventrally (Fig. 12D)

Ancistrus multipinnis, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Proloricaria prolixa*, *Pterosturisoma* cf. *microps*, *Spatuloricaria evansii* and *Sturisoma robustum*.

Comment: To facilitate the recognition of structures and the evaluation of characters, it is recommended to perform the interpretation of characters 32, 33 e 34 at same time. The lateral processes of basioccipital (blp) match to projections in the posterior portion of the bone, varying in size and orientation (lateral and ventral). The lateral processes of basioccipital (blp) match to projections in the posterior portion of the bone, varying in size and orientation (lateral and ventral). The limits of both are indicated by arrows in the figures. In *Harttia*, the lateral processes of basioccipital are very large, expanded laterally and ventrally, connected by a suture to the ventrally expanded transcapular ligament. In this case, the exoccipital (ex) is connected to both, the process and the ligament (Fig. 12D). Alternatively, in *Reganella depressa*, *Limatulichthys griseus* and *Hemiodontichthys*, the lateral processes of basioccipital are shorter, not contacting the transcapular ligament, being the exoccipital between both (Fig. 12A, B and C). In the photos, it is not possible to notice clearly the ventral orientation, but the observer should depart from the assumption that the structure in question is projected ventrally.

Exoccipital

34. Relationship between basioccipital, exoccipital and transcapular ligament (modified Rapp Py-Daniel, 1997 char. 18; modified Fichberg, 2008 char. 22; modified Paixão, 2012 char. 10). CI = 1.000. RI = 1.000.

(0) Basioccipital posteriorly connected to the transcapular ligament and exoccipital connected to both (Fig. 12D)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma*

inexpectata, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Basioccipital not connected to the transcapular ligament and exoccipital between both (Fig. 12A, B and C)

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

35. Ventral expansion of transcapular ligament (ossified Baudelot's ligament) (modified Fichberg, 2008 char. 23). CI = 0.091. RI = 0.375.

(0) Absent (Fig. 12 A and C)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Pseudotocinclus tietensis*, *Hemiodontichthys acipenserinus*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Present (Fig. 12 B and D)

Ancistrus multipinnis, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Rineloricaria daraha* and *Sturisoma robustum*.

36. Shape of exoccipital in ventral view (modified Fichberg, 2008 char. 24). CI = 0.500. RI = 0.926.

(0) Quadrangular

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Brochiloricaria* sp.,

Crossoloricaria spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus, Loricaria cataphracta, Loricaria lentiginosa, Loricariichthys castaneus*, *Metaloricaria paucidens, Paraloricaria vetula, Planiloricaria cryptodon, Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps, Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Rectangular

All species of *Harttia,* *Cteniloricaria platystoma* and *Harttiella crassicauda*.

Comment: The area of the exoccipital is quadrangular (state 0) when the bone is higher than wide, that is, greater in the anteroposterior axis. When it is rectangular (state 1), it is wider than height, being smaller in the laterolateral axis.

37. Foramen of exoccipital. CI = 0.200. RI = 0.00.

(0) Large (Fig. 13B)

Astroblepus sp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Proloricaria prolixa* and *Rineloricaria pentamaculata*.

(1) Small (Fig. 13A)

Lithogenes wahari, Hemipsilichthys nimius, Ancistrus multipinnis, Hypostomus ancistroides, Isbrueckerichthys duseni, Kronichthys heylandi, Neoplecostomus microps, Pareiorhina rudolphi, Hypoptopoma inexpectata, Plesioptopoma curvidens, Pseudotocinclus tietensis, **all species of *Harttia,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi, Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria lentiginosa*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps, Reganella depressa, Rineloricaria daraha, Rineloricaria lanceolata*, *Rineloricaria latirostris, Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Large with divisions (Fig. 13C)

Hemiodontichthys acipenserinus, Metaloricaria paucidens, Paraloricaria vetula and *Pseudoloricaria laeviuscula*.

Comment: The foramen in the exoccipital is large (state 0) when it is equal to or greater than half of the exoccipital length, and in this case, it forms only an orifice. The foramen is small (state 1)

when the opening is much smaller than half of the exoccipital length. When the foramen is large with divisions (state 2), it is also equal to or greater than half of the exoccipital length, but it presents divisions in the opening, forming two or more orifices.

Pterotic-supracleithrum

38. Shape of pterotic-supracleithrum (modified Armbruster, 2004 char. 108). CI = 0.333. RI = 0.333.

(0) Quadrangular to slightly oval, widest medially

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Trapezoidal, widest at ventral margin

Apistoloricaria sp., *Crossoloricaria* spp., *Loricaria lentiginosa* and *Paraloricaria vetula*.

39. Anterior process of pterotic-supracleithrum (Armbruster, 2004 char. 110). CI = 0.111. RI = 0.556.

(0) Absent (Fig. 14A)

Astroblepus sp., *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp. and *Reganella depressa*.

(1) Present (Fig. 14B and C)

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, **all species of *Harttia*,** *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

40. Anterior process of pterotic-supracleithrum separated mesially from main body, connected by a strut (modified Armbruster, 2004 char. 111). CI = 0.500. RI = 0.944.

(0) Process slightly deflected (Fig. 14B)

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Crossoloricaria* spp., *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Process deflected with a small gap (Fig. 14C)

All species of *Harttia* and *Cteniloricaria platystoma*.

(-) Inapplicable (absent anterior process of pterotic-supracleithrum)

Astroblepus sp., *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp. and *Reganella depressa*.

Comment: The anterior process of pterotic-supracleithrum is deflected with a small gap (state 1), when there is a little hole between the process and the pterotic-supracleithrum, as if the process was in a more ventral level (it is recommended to use a pointed tool to recognize the gap). When the process is slightly deflected (state 0), it occupies the same level of the pterotic-supracleithrum, as if it was continuous with the bone.

41. Perforations of pterotic-supracleithrum (modified Rapp Py-Daniel, 1997 char. 20; modified Fichberg, 2008 char. 25). CI = 0.333. RI = 0.000.

(0) Small and regularly distributed

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Large and irregularly distributed

Hypoptopoma inexpectata, *Plesioptopoma curvidens* and *Pseudotocinclus tietensis*.

42. Ventral crest in anterior margin of pterotic-supracleithrum. CI = 0.091. RI = 0.167.

(0) Absent (Fig. 15A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, ***Harttia* cf. *fowleri*, *H. guianensis*, *H. leiopleura*, *H. loricariformis*, *H. rondoni*, *Harttia* cf. *surinamensis*, *H. trombetensis*, *Harttia* sp. São Roque, *Harttia* sp. tapajós 1, *Harttia* sp. tapajós 2,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Present and short (Fig. 15B)

Hypostomus ancistroides, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pseudotocinclus tietensis*, ***Harttia carvallhoi*, *H. dissidens*, *H. duriventris*, *H. intermontana*, *H. kronei*, *H. novalimensis*, *H. panara*, *H. punctata*, *H. uatumensis*, *H. villasboas*,** *Lamontichthys* spp., *Loricaria lentiginosa*, *Pterosturisoma* cf. *microps* and *Rineloricaria daraha*.

(2) Present and tall (Fig. 15C)

Isbrueckerichthys duseni, ***Harttia absaberi*, *H. garavelloi*, *H. gracilis*, *H. longipinna*, *H. torrenticola*,** *Cteniloricaria platystoma* and *Metaloricaria paucidens*.

Comment: The crest is tall (state 2) when the lifting is clearly visible. In the case of the short crest (state 1), the elevation is not so evident, but it is not completely absent (state 0).

Nasal

43. Shape of nasal bone (modified Rapp Py-Daniel, 1997 char. 171; modified Fichberg, 2008 char. 56). CI = 0.063. RI = 0.464.

(0) Rectangular with slightly curved tip

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *H. absaberi*, *H. garavelloi*, *H. leiopleura*, *Harttia* sp. São Roque, *Harttia* sp. tapajós 1 and *Harttia* sp. tapajós 2),** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps* and *Rineloricaria latirostris*.

(1) L-shaped

Ancistrus multipinnis, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, ***Harttia absaberi*, *H. garavelloi*, *H. leiopleura*, *Harttia* sp. São Roque**, ***Harttia* sp. tapajós 1**, ***Harttia* sp. tapajós 2**, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

44. Length of nasal (ratio between length and height) (modified Fichberg, 2008 char. 57). CI = 0.250. RI = 0.000.

(0) Long

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*,

Pterosturisoma cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Short

Ancistrus multipinnis, *Hypoptopoma inexpectata*, *Farlowella oxyrryncha* and *Harttiella crassicauda*.

Comment: The nasal bone is long (state 0) when it is longer than wide. When it is short (state 1), it is as long as wide.

Weberian Apparatus and axial skeleton

45. Connection of complex centrum to neurocranium via basioccipital (modified Rapp Py-Daniel, 1997 char. 91). CI = --. RI = --.

(0) Basioccipital contacts ventrally to the complex centrum (Fig. 16A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Basioccipital contacts dorsally to the complex centrum (Fig. 16B)

Hemiodontichthys acipenserinus.

(2) Basioccipital does not contact the complex centrum (Fig. 16C)

Cteniloricaria platystoma.

46. Connection between transcapular ligament and transverse process of Weberian apparatus (modified Rapp Py-Daniel, 1997 char. 92; modified Fichberg, 2008 char. 30). CI = 0.250. RI = 0.806.

(0) Contacting ventrally (Fig. 17C)

Astroblepus sp., *Hemipsilichthys nimius*, *Neoplecostomus microps*, *Pseudotocinclus tietensis*, *Planiloricaria cryptodon* and *Rineloricaria latirostris*.

(1) Contacting posteriorly (Fig. 17B)

Lithogenes wahari, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) No contact (Fig. 17A)

All species of *Harttia*, *Cteniloricaria platystoma* and *Harttiella crassicauda*.

47. Length of transverse process of Weberian apparatus (modified Rapp Py-Daniel, 1997 char. 94; modified Fichberg, 2008 char. 32). CI = 0.250. RI = 0.625.

(0) Short, not reaching the border of the pterotic-supracleithrum

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Lamontichthys* spp., *Loricaria lentiginosa* and *Pterosturisoma* cf. *microps*.

(1) Approximately same length as the pterotic-supracleithrum extension

Kronichthys heylandi, *Neoplecostomus microps*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Brochiloricaria* sp., *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Metaloricaria paucidens*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Long, exceeding the pterotic-supracleithrum margin

Apistoloricaria sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp. and *Pseudoloricaria laeviuscula*.

(3) Extending posteriorly and almost reaching to 6th vertebra rib

Farlowella oxyrryncha and *Furcodontichthys novaesi*.

48. Kind of contact between transverse process of Weberian apparatus and pterotic-supracleithrum (modified Rapp Py-Daniel, 1997 char. 93; modified Fichberg, 2008 char. 31). CI = 0.087. RI = 0.364.

(0) Partial suture

Astroblepus sp., *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, **all species of *Harttia* (except *H. duriventris*, *H. panara*, *H. rondoni*, *H. trombetensis*, *H. uatumensis*, *H. villasboas*, *Harttia* sp. tapajós 1 and *Harttia* sp. tapajós 2),** *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Reganella depressa* and *Sturisoma robustum*.

(1) Without suture

Lithogenes wahari, *Hemipsilichthys nimius*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(2) Total suture

Ancistrus multipinnis, *Hypostomus ancistroides*, *Hypoptopoma inexpectata*, ***Harttia duriventris*, *H. panara*, *H. rondoni*, *H. trombetensis*, *H. uatumensis*, *H. villasboas*, *Harttia* sp. tapajós 1, *Harttia* sp. tapajós 2,** *Cteniloricaria platystoma*, *Loricaria lentiginosa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha* and *Rineloricaria lanceolata*.

49. Ventral process of complex vertebra (modified Rapp Py-Daniel, 1997 char. 95; modified Fichberg, 2008 char. 33). CI = 0.333. RI = 0.200.

(0) Absent

Astroblepus sp., *Neoplecostomus microps* and *Hemiodontichthys acipenserinus*.

(1) Short, not exceeding the 6th vertebra

Ancistrus multipinnis, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp.,

Brochiloricaria sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon spp.*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Long, exceeding the 6th vertebra

Lithogenes wahari, *Hemipsilichthys nimius*, *Isbrueckerichthys duseni* and *Harttiella crassicauda*.

50. Development of ventral process of complex vertebra (modified Rapp Py-Daniel, 1997 char. 96; modified Fichberg, 2008 char. 34). CI = 0.214. RI = 0.389.

(0) Absent ventral process of the complex vertebra

Astroblepus sp..

(1) Strong in the arch

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. duriventris, H. guianensis, H. leiopleura, H. loricariformis* and *H. novalimensis*),** *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Loricaria lentiginosa*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) Fragile in the arch

Hypostomus ancistroides, ***Harttia duriventris, H. guianensis, H. leiopleura, H. loricariformis, H. novalimensis,*** *Apistoloricaria* sp., *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(3) Fragile in the middle, in the contact with the complex vertebra

Spatuloricaria evansii.

51. Extension of aortic groove (Rapp Py-Daniel, 1997 char. 98; modified Fichberg, 2008 char. 36). CI = 0.111. RI = 0.579.

(0) Vertebra 6

Astroblepus sp., *Lithogenes wahari*, ***Harttia* cf. *fowleri, H. leiopleura, H. panara, Harttia* cf. *surinamensis, Harttia* tapajós 1,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria lanceolata* and *Spatuloricaria evansii*.

(1) Vertebra 7-8

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, ***Harttia absaberi, H. carvalhoi, H. intermontana, H. kronei, H. longipinna, H. loricariformis, H. torrenticola, Harttia* sp. São Roque,** *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(2) Vertebra 9-11

Hypostomus ancistroides, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia dissidens, H. duriventris, H. garavelloi, H. gracilis, H. guianensis, H. novalimensis, H. punctata, H. rondoni, H. trombetensis, H. uatumensis, H. villasboas, Harttia* tapajós 2,** *Cteniloricaria platystoma* and *Sturisoma robustum*.

52. Anterior hemal canal (modified Rapp Py-Daniel, 1997 char. 100). CI = 0.200. RI = 0.500.

(0) Present, but incomplete in the sixth, seventh and/or eighth vertebrae

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Paraloricaria vetula*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha* and *Rineloricaria pentamaculata*.

(1) Present, complete tube since the sixth vertebrae

Lithogenes wahari, *Apistoloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*,

Loricariichthys castaneus, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Absent

Hypoptopoma inexpectata.

53. Number of vertebrae containing the anterior hemal canal (modified Rapp Py-Daniel, 1997 char. 101). CI = 0.333. RI = 0.524.

(0) Two

Furcodontichthys novaesi.

(1) Three

Kronichthys heylandi and *Rineloricaria latirostris*.

(2) Four

Astroblepus sp., *Ancistrus multipinnis*, *Pareiorhina rudolphi*, *Brochiloricaria* sp., *Crossoloricaria* spp., *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(3) Five

Neoplecostomus microps, *Apistoloricaria* sp., *Farlowella oxyrryncha*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula* and *Rineloricaria daraha*.

(4) Six

Hemipsilichthys nimius, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(5) Ten or more

Lithogenes wahari.

(-) Inapplicable (absent hemal canal)

Hypoptopoma inexpectata.

54. Connection of the 6th rib to the vertebra (modified Rapp Py-Daniel, 1997 char. 112; modified Fichberg, 2008 char. 40). CI = --. RI = --.

(0) One point of articulation

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Two points of articulation

Hypostomus ancistroides.

55. Rib of seventh vertebra (modified Rapp Py-Daniel, 1997 char. 113; modified Fichberg, 2008 char. 41; modified Paixão, 2012 char. 37). CI = 0.167. RI = 0.697.

(0) Present and approximately the same size as the others

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, ***Harttia leiopleura, H. longipinna*** and *Harttiella crassicauda*.

(1) Present, vestigial or short

Plesioptopoma curvidens, **all species of *Harttia* (except *H. leiopleura, H. longipinna, Harttia* cf. *surinamensis* and *H. trombetensis*),** *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa* and *Sturisoma robustum*.

(2) Absent

Ancistrus multipinnis, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, ***Harttia* cf. *surinamensis, H.***

trombetensis, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

56. Rib of eighth vertebra. CI = 0.133. RI = 0.409.

(0) Present and approximately the same size as the others (Fig. 18A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Kronichthys heylandi*, *Plesioptopoma curvidens*, ***Harttia absaberi, H. dissidens, H. garavelloi, H. gracilis, H. guianensis, H. kronei, H. leiopleura, H. longipinna, H. novalimensis, H. punctata, Harttia*** **sp. São Roque,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Present, vestigial or short (Fig. 18B)

Neoplecostomus microps, **all species of *Harttia* (except *H. absaberi, H. dissidens, H. garavelloi, H. gracilis, H. guianensis, H. kronei, H. leiopleura, H. longipinna, H. novalimensis, H. punctata*** **and *Harttia*** **sp. São Roque),** *Lamontichthys* spp. and *Rineloricaria daraha*.

(2) Absent (Fig. 18C)

Hypostomus ancistroides, *Isbrueckerichthys duseni*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, *Farlowella oxyrryncha* and *Planiloricaria cryptodon*.

57. Vertebra that receives first pterygiophore of dorsal fin (modified Rapp Py-Daniel, 1997 char. 103; modified Fichberg, 2008 char. 38). CI = --. RI = --.

(0) The seventh

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella*

crassicauda, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Posteriorly to the seventh

Farlowella oxyrryncha.

58. Neural spine of seventh vertebra in relation to predorsal plates (modified Paixão, 2012 char. 36). CI = 0.400. RI = 0.625.

(0) No contact (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

(1) Short, without contact with the predorsal plates

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Plesioptopoma curvidens* and *Cteniloricaria platystoma*.

(2) Long, in contact with the predorsal plates

Pareiorhina rudolphi, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

59. Articulation between first pterygiophore of dorsal fin and the neural spine (modified Rapp Py-Daniel, 1997 char. 104; modified Fichberg, 2008 char. 39). CI = 0.500. RI = 0.000.

(0) Postero-anterior

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma*

curvidens, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Dorsoventral

Hypostomus ancistroides and *Farlowella oxyrryncha*.

60. Bifid spines (modified Rapp Py-Daniel, 1997 char. 105). CI = 0.375. RI = 0.750.

(0) Only neural spines

Astroblepus sp., *Lithogenes wahari*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, ***Harttia carvalhoi, H. garavelloi, H. gracilis, H. intermontana, H. kronei, H. leiopleura, H. longipinna, H. loricariformis, H. novalimensis, H. torrenticola*** and *Harttiella crassicauda*.

(1) Only hemal spines

Hemipsilichthys nimius and *Hypostomus ancistroides*.

(2) Neural and hemal spines

Kronichthys heylandi, *Neoplecostomus microps*, *Pareiorhina rudolphi* and *Pseudotocinclus tietensis*.

(3) Absent

All species of *Harttia* (except *H. carvalhoi, H. garavelloi, H. gracilis, H. intermontana, H. kronei, H. leiopleura, H. longipinna, H. loricariformis, H. novalimensis* and *H. torrenticola*), *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

61. Paraneural spine and parahemal spine (modified Rapp Py-Daniel, 1997 char. 106; modified Paixão, 2012 char. 34). CI = 0.500. RI = 0.955.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi, H. garavelloi, H. gracilis, H. intermontana, H. kronei, H. leiopleura, H. longipinna, H. loricariformis, H. novalimensis, H. torrenticola*** and *Harttiella crassicauda*.

(1) Present, both paraneural and parahemal spines

All species of *Harttia* (except *H. carvalhoi, H. garavelloi, H. gracilis, H. intermontana, H. kronei, H. leiopleura, H. longipinna, H. loricariformis, H. novalimensis* and *H. torrenticola*), *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

62. Pairing of previous paraneurals and parahemals (modified Rapp Py-Daniel, 1997 char. 107). CI = --. RI = --.

(0) Paraneurals are present on the more anterior vertebrae, parahemals appear after at least 3 to 4 vertebrae

All species of *Harttia* (except *H. carvalhoi, H. garavelloi, H. gracilis, H. intermontana, H. kronei, H. leiopleura, H. longipinna, H. loricariformis, H. novalimensis* and *H. torrenticola*), *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Paraneurals paired with parahemals

Farlowella oxyrryncha.

(-) Inapplicable (absent paraneurals and parahemals spines)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi, H. garavelloi, H. gracilis, H. intermontana, H. kronei, H. leiopleura, H. longipinna, H. loricariformis, H. novalimensis, H. torrenticola*** and *Harttiella crassicauda*.

63. Number of precaudal vertebrae (modified Rapp Py-Daniel, 1997 char. 110; modified Paixão, 2012 char. 35). CI = 0.333. RI = 0.630.

(0) 15 or more

Astroblepus sp. and *Lithogenes wahari*.

(1) 13

Hemipsilichthys nimius, *Hypostomus ancistroides*, *Neoplecostomus microps*, *Harttiella crassicauda* and *Planiloricaria cryptodon*.

(2) 12

Isbrueckerichthys duseni, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, **all species of *Harttia,*** *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(3) 11

Ancistrus multipinnis, *Kronichthys heylandi*, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp. and *Rineloricaria daraha*.

(4) 10

Hypoptopoma inexpectata, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(5) 9

Furcodontichthys novaesi.

64. Number of caudal vertebrae (modified Rapp Py-Daniel, 1997 char. 111). CI = 0.250. RI = 0.690.

(0) 12-18

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, ***H. intermontana, H. leiopleura, H. longipinna, H. novalimensis*** and *Harttiella crassicauda*.

(1) 19-22

Kronichthys heylandi, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. intermontana, H. leiopleura, H. longipinna* and *H. novalimensis*),** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(2) 23-25

Apistoloricaria sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Lamontichthys* spp., *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(3) 26-29

Loricaria cataphracta, *Loricariichthys castaneus*, *Planiloricaria cryptodon* and *Pseudoloricaria laeviuscula*.

65. Hemal spines above anal fin base (modified Rapp Py-Daniel, 1997 char. 102). CI = 0.250. RI = 0.625.

(0) All hemal spines subequal in length

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata* and *Plesioptopoma curvidens*.

(1) Hemal spines above anal fin greatly reduced in lenght

Lithogenes wahari, *Isbrueckerichthys duseni*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys*

novaesi, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

Canals of laterosensory system

66. Number of infraorbital canals (modified Rapp Py-Daniel, 1997 char. 168; modified Fichberg, 2008 char. 53; modified Paixão, 2012 char. 55). CI = 0.167. RI = 0.375.

(0) Less than 6

Astroblepus sp., *Lithogenes wahari*, *Ancistrus multipinnis*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, ***Harttia absaberi*** and ***H. leiopleura*.**

(1) 6

Hemipsilichthys nimius, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi* and *H. leiopleura*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

67. Branching of infraorbital canals (modified Rapp Py-Daniel, 1997 char. 167; modified Fichberg, 2008 char. 52). CI = 0.100. RI = 0.217.

(0) Branches emerge from the canal between two infraorbitals (Fig. 19B)

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi, H. intermontana, H. kronei, H. panara, H. punctata, H. rondoni, Harttia* cf. *surinamensis, Harttia* sp. São Roque,** *Brochiloricaria* sp., *Farlowella oxyrryncha*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Rineloricaria lanceolata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Branches emerge from the canal inside the infraorbitals (Fig. 19C)

Apistoloricaria sp., *Planiloricaria cryptodon* and *Reganella depressa*.

(2) Not branched (Fig. 19A)

Lithogenes wahari, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *H. carvalhoi, H. intermontana, H. kronei, H. panara, H. punctata, H. rondoni, Harttia* cf. *surinamensis* and *Harttia* sp. São Roque),** *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

68. Ossification of branches of infraorbital canals (Rapp Py-Daniel, 1997 char. 169; Fichberg, 2008 char. 54). CI = 0.500. RI = 0.500.

(0) Non ossified (Fig. 19B)

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi, H. intermontana, H. kronei, H. panara, H. punctata, H. rondoni, Harttia* cf. *surinamensis, Harttia* sp. São Roque,** *Brochiloricaria* sp., *Farlowella oxyrryncha*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Rineloricaria lanceolata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Ossified (Fig. 19C)

Apistoloricaria sp., *Planiloricaria cryptodon* and *Reganella depressa*.

(-) Inapplicable (absent branching of infraorbital canals)

Lithogenes wahari, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *H. carvalhoi, H. intermontana, H. kronei, H. panara, H. punctata, H. rondoni, Harttia* cf. *surinamensis* and *Harttia* sp. São Roque),** *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

69. Antero-orbital notch. CI = 0.333. RI = 0.667.

(0) Absent (Fig. 20A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. dissidens, Harttia* cf. *fowleri, H. guianensis, Harttia* cf. *surinamensis, H. trombetensis* and *H. uatumensis*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Present (Fig. 20B)

Harttia dissidens, Harttia* cf. *fowleri, H. guianensis, Harttia* cf. *surinamensis, H. trombetensis, H. uatumensis and *Cteniloricaria platystoma*.

70. Size of suprapreopercle (modified Rapp Py-Daniel, 1997 char. 162; modified Paixão, 2012 char. 57). CI = 0.267. RI = 0.667.

(0) Small, plate smaller than once the canal width

Astroblepus sp., *Lithogenes wahari*, *Kronichthys heylandi*, ***Harttia garavelloi, H. gracilis, H. guianensis, H. kronei, H. leiopleura, H. longipinna, H. torrenticola,*** *Cteniloricaria platystoma* and *Harttiella crassicauda*.

(1) Small, plate greater than once the canal width

Hypostomus ancistroides, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, **all species of *Harttia* (except *H. garavelloi, H. gracilis, H. guianensis, H. intermontana, H. kronei, H. leiopleura, H. longipinna* and *H. torrenticola*),** *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(2) Small, with a ventrolateral projection

***Harttia intermontana*.**

(3) Large, approximate size of the sphenotic

Hemipsilichthys nimius, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*,

Loricariichthys castaneus, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha* and *Spatuloricaria evansii*.

(4) Absent suprapreopercle

Ancistrus multipinnis, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis* and *Farlowella oxyrryncha*.

71. Passage of preopercular canal through infraorbitals (modified Rapp Py-Daniel, 1997 char. 163). CI = --. RI = --.

(0) None

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Passing through infraorbital 6

Farlowella oxyrryncha.

72. Number of ossified canals in preopercular canal (modified Rapp Py-Daniel, 1997 char. 164; modified Fichberg, 2008 char. 50; modified Paixão, 2012 char. 56). CI = 0.143. RI = 0.368.

(0) Three

Hemipsilichthys nimius, *Hypostomus ancistroides*, *Neoplecostomus microps*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Metaloricaria paucidens*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha* and *Sturisoma robustum*.

(1) Two

Astroblepus sp., *Lithogenes wahari*, *Ancistrus multipinnis*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pterosturisoma* cf. *microps*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(2) One

Isbrueckerichthys duseni, *Hypoptopoma inexpectata*, *Brochiloricaria* sp., *Farlowella oxyrryncha*, *Hemiodontichthys acipenserinus*, *Loricariichthys castaneus* and *Planiloricaria cryptodon*.

73. Extra branch from preopercular canal (modified Rapp Py-Daniel, 1997 char. 165). CI = 0.200. RI = 0.543.

(0) One extra branch opening in the skin (not through a dermal plate) (Fig. 21B)

Astroblepus sp., *Lithogenes wahari*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Neoplecostomus microps*, **all species of *Harttia* (except *H. absaberi, H. carvalhoi, H. duriventris, Harttia* cf. *fowleri, H. intermontana, H. leiopleura, Harttia* sp. tapajós 1 and *Harttia* sp. tapajós 2),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha* and *Metaloricaria paucidens*.

(1) One extra branch laying on a dermal plate (Fig. 21C)

Plesioptopoma curvidens, ***Harttia* sp. tapajós 1,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Planiloricaria cryptodon*, *Pseudohemiodon* spp. and *Pseudoloricaria laeviuscula*.

(2) Two extra branches (Fig. 21A)

Hemipsilichthys nimius, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(3) No extra branch, just a pore (Fig. 21D)

Isbrueckerichthys duseni, *Pseudotocinclus tietensis*, ***Harttia absaberi, H. carvalhoi, H. duriventris, Harttia* cf. *fowleri, H. intermontana, H. leiopleura, Harttia* sp. tapajós 2,** *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Pterosturisoma* cf. *microps*, *Reganella depressa* and *Sturisoma robustum*.

(4) No extra branch or pore

Kronichthys heylandi, *Pareiorhina rudolphi* and *Hypoptopoma inexpectata*.

74. Opening of epiphyseal pore (modified Rapp Py-Daniel, 1997 char. 175; modified Fichberg, 2008 char. 61). CI = 0.100. RI = 0.217.

(0) Small pore

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *Harttia* cf. *fowleri, H. gracilis, H. guianensis, H. loricariformis, H. novalimensis, H. torrenticola, H. trombetensis, H. uatumensis* and *H. villasboas*),** *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Planiloricaria cryptodon*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Large pore

Pareiorhina rudolphi, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, ***Harttia gracilis, H. guianensis, H. novalimensis,*** *Cteniloricaria platystoma*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Pterosturisoma* cf. *microps*.

(2) Groove or crack

Harttia* cf. *fowleri, H. loricariformis, H. torrenticola, H. trombetensis, H. uatumensis, H. villasboas, *Apistoloricaria* sp., *Harttiella crassicauda*, *Loricariichthys castaneus*, *Metaloricaria paucidens* and *Rineloricaria latirostris*.

Comment: The pore is small (state 0) when its size is equivalent to the width of the canal of the epiphyseal branch. The pore is large (state 1) when its size is greater than the width of the canal of the epiphyseal branch. The opening is in groove or crack (state 2) when it does not form a circle as in the case of the pore, but a narrow opening.

75. Parietal branch canal. CI = 1.000. RI = 1.000.

(0) Present

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella*

oxyrryncha, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Absent

Ancistrus multipinnis, *Hypostomus ancistroides* and *Kronichthys heylandi*.

76. Shape of parietal branch canal (modified Rapp Py-Daniel, 1997 char. 172; modified Fichberg, 2008 char. 58). CI = 0.143. RI = 0.000.

(0) Straight (Fig. 22A)

Astroblepus sp., *Hypoptopoma inexpectata*, *Limatulichthys griseus*, *Loricaria lentiginosa*, *Proloricaria prolixa*, *Pseudohemiodon* spp. and *Pseudoloricaria laeviuscula*.

(1) Curved (Fig. 22B)

Lithogenes wahari, *Hemipsilichthys nimius*, *Isbrueckerichthys duseni*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(-) Inapplicable (absent parietal branch canal)

Ancistrus multipinnis, *Hypostomus ancistroides* and *Kronichthys heylandi*.

[0, 1] *Neoplecostomus microps*.

77. Length of parietal branch canal (modified Rapp Py-Daniel, 1997 char. 173; Fichberg, 2008 char. 59). CI = 0.083. RI = 0.154.

(0) Very short (Fig. 23A)

Astroblepus sp., *Lithogenes wahari*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, ***Harttia carvalhoi, H. garavelloi, H. leiopleura, H. loricariformis, H. punctata, Harttia* cf. *surinamensis,*** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus* and *Loricaria cataphracta*.

(1) Long (Fig. 23B)

Hemipsilichthys nimius, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. carvalhoi, H. garavelloi, H. leiopleura, H. loricariformis, H. novalimensis, H. punctata, Harttia* cf. *surinamensis, H. torrenticola, H. uatumensis* and *Harttia* sp. São Roque),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(-) Inapplicable (absent parietal branch canal)

Ancistrus multipinnis, *Hypostomus ancistroides* and *Kronichthys heylandi*.

[0, 1] ***Harttia novalimensis, H. torrenticola, H. uatumensis, Harttia* sp. São Roque,** *Farlowella oxyrryncha* and *Rineloricaria daraha*.

78. Exit of parietal branch canal (modified Rapp Py-Daniel, 1997 char. 174; modified Fichberg, 2008 char. 60). CI = 0.148. RI = 0.303.

(0) Ending on the supraoccipital (Fig. 24D)

Astroblepus sp. and *Pseudohemiodon* spp..

(1) Ending on the frontal (Fig. 24A)

Pareiorhina rudolphi, ***Harttia novalimensis, H. punctata, Harttia* cf. *surinamensis, H. trombetensis, H. uatumensis, Harttia* sp. tapajós 2,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Limatulichthys griseus*, *Loricariichthys castaneus* and *Reganella depressa*.

(2) Ending on the border frontal/supraoccipital (Fig. 24B)

Lithogenes wahari, ***Harttia absaberi, H. dissidens, H. duriventris, Harttia* cf. *fowleri, H. guianensis, H. intermontana, H. kronei, H. rondoni, H. villasboas,*** *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula* and *Spatuloricaria evansii*.

(3) Ending on the border frontal/sphenotic (Fig. 24C)

Isbrueckerichthys duseni, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi, H. garavelloi, H. gracilis, H. leiopleura, H. longipinna, H. loricariformis, Harttia* sp. São Roque, *Harttia* sp. tapajós 1**, *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Sturisoma robustum*.

(4) Ending on the sphenotic (Fig. 24E)

Hemipsilichthys nimius and *Rineloricaria pentamaculata*.

(-) Inapplicable (absent parietal branch canal)

Ancistrus multipinnis, *Hypostomus ancistroides* and *Kronichthys heylandi*.

[1, 2] *Neoplecostomus microps*, ***Harttia panara*** and ***H. torrenticola*.**

[0, 2] *Farlowella oxyrryncha* and *Rineloricaria daraha*.

79. Canal plate (modified Rapp Py-Daniel, 1997 char. 160). CI = 0.250. RI = 0.000.

(0) Absent

Astroblepus sp., *Ancistrus multipinnis*, ***Harttia leiopleura*** and ***H. novalimensis.***

(1) Present

Lithogenes wahari, *Hemipsilichthys nimius*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. leiopleura* and *H. novalimensis*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

80. Shape of canal plate. CI = 0.333. RI = 0.909.

(0) Quadrangular or rectangular (Fig. 25A)

Lithogenes wahari, *Hemipsilichthys nimius*, *Hypostomus ancistroides*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Triangular (Fig. 25B)

Isbrueckerichthys duseni, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. leiopleura* and *H. novalimensis*),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(-) Inapplicable (absent canal plate)

Astroblepus sp., *Ancistrus multipinnis*, ***Harttia leiopleura*** and ***H. novalimensis.***

81. Localization of canal plate (modified Fichberg, 2008 char. 49). CI = 0.200. RI = 0.833.

(0) Ventral

Lithogenes wahari, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. leiopleura* and *H. novalimensis*),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Lateroventral

Hemipsilichthys nimius, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(-) Inapplicable (absent canal plate)

Astroblepus sp., *Ancistrus multipinnis*, ***Harttia leiopleura*** and ***H. novalimensis.***

82. Orientation of sensorial canal present in canal plate (modified Rapp Py-Daniel, 1997 char. 161; modified Fichberg, 2008 char. 47). CI = 0.333. RI = 0.909.

(0) Anteriorly

Lithogenes wahari, *Hemipsilichthys nimius*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. leiopleura* and *H. novalimensis*)**, *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps*, *Reganella depressa* and *Sturisoma robustum*.

(1) Laterally

Hypostomus ancistroides, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(-) Inapplicable (absent canal plate)

Astroblepus sp., *Ancistrus multipinnis*, ***Harttia leiopleura*** and ***H. novalimensis*.**

Suspensorium

83. Shape of suspensorium (modified Fichberg, 2008 char. 62). CI = 0.150. RI = 0.500.

(0) Rectangular

Astroblepus sp., *Ancistrus multipinnis*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Plesioptopoma curvidens*, ***Harttia* cf. *fowleri*, *H. panara*, *H. rondoni*, *Harttia* cf. *surinamensis*, *H. villasboas*, *Harttia* sp. tapajós 1,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Metaloricaria paucidens* and *Pterosturisoma* cf. *microps*.

(1) Quadrangular

Hemipsilichthys nimius, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Pareiorhina rudolphi*, **all species of *Harttia* (except *Harttia* cf. *fowleri*, *H. panara*, *H. rondoni*, *Harttia* cf. *surinamensis*, *H. villasboas* and *Harttia* sp. tapajós 1),** *Crossoloricaria* spp., *Harttiella crassicauda*, *Lamontichthys* spp. and *Pseudohemiodon* spp..

(2) Elongated rectangular

Lithogenes wahari, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(3) Right triangle

Planiloricaria cryptodon.

Comment: The shape of the suspensorium refers to the group formed by metapterygoid, hyomandibular, quadrate and preopercle. The dentaries do not participate in this delimitation. When it is rectangular (state 0), its length is twice its width. Quadrangular (state 1), when its length is once its width. Elongated rectangular (state 2), when its length is greater than twice its width. And finally, right triangle (state 3), when it resembles this geometric figure.

84. Contact between metapterygoid and lateral ethmoid. CI = --. RI = --.

(0) Absent

Astroblepus sp..

(1) Present

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

85. Type of contact between metapterygoid and lateral ethmoid (modified Fichberg, 2008 char. 69). CI = 0.222. RI = 0.696.

(0) Flat

Lithogenes wahari, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi*),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Partially sutured

Harttia absaberi, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(2) Completely sutured

Hemipsilichthys nimius, *Isbrueckerichthys duseni*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Spatuloricaria evansii*.

(-) Inapplicable (absent contact)

Astroblepus sp..

86. Canal of metapterygoid (modified Rapp Py-Daniel, 1997 char. 36; Fichberg, 2008 char. 70). CI = 0.143. RI = 0.250.

(0) Absent

Astroblepus sp., *Hemipsilichthys nimius*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Hemiodontichthys acipenserinus*, *Loricariichthys castaneus*, *Pseudoloricaria laeviuscula*, *Reganella depressa* and *Rineloricaria lanceolata*.

(1) Present

Lithogenes wahari, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

87. Crest of metapterygoid (modified Rapp Py-Daniel, 1997 char. 38; modified Paixão, 2012 char. 14). CI = 0.200. RI = 0.667.

(0) Absent

Astroblepus sp., *Hemipsilichthys nimius*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Hemiodontichthys acipenserinus*, *Loricariichthys castaneus*, *Pseudoloricaria laeviuscula*, *Reganella depressa* and *Rineloricaria lanceolata*.

(1) Present and low

Lithogenes wahari, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Rineloricaria daraha*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(2) Present and high

Ancistrus multipinnis, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

Comment: The crest of the metapterygoid is low (state 1), when it reaches half the height of the metapterygoid canal. When it reaches the height of the metapterygoid canal, the crest is high (state 2).

88. Anterior margin of of metapterygoid (modified Rapp Py-Daniel, 1997 char. 37). CI = 0.136. RI = 0.208.

(0) With no expansion (Fig. 26A)

Astroblepus sp., *Apistoloricaria* sp., *Farlowella oxyrryncha* and *Proloricaria prolixa*.

(1) With a developed expansion in the midanterior portion of the metapterygoid (Fig. 26B)

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *Harttia* cf. *fowleri*, *H. leiopleura*, *H. loricariformis*, *Harttia* cf. *surinamensis*, *H. torrenticola*, *H. trombetensis* and *H. uatumensis*),** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Limatulichthys*

griseus, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps*, *Reganella depressa* and *Sturisoma robustum*.

(2) With an extremely developed expansion in the midanterior portion of the metapterygoid (Fig. 26C)

***Harttia* cf. *fowleri*, *H. leiopleura*, *H. loricariformis*, *Harttia* cf. *surinamensis*, *H. torrenticola*, *H. trombetensis*, *H. uatumensis*,** *Harttiella crassicauda*, *Lamontichthys* spp., *Pseudoloricaria laeviuscula*, *Rineloricaria daraha* and *Rineloricaria lanceolata*.

(3) With an extremely developed expansion in the ventroanterior portion of metapterygoid (Fig. 26D)

Lithogenes wahari, *Hypoptopoma inexpectata*, *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Pseudohemiodon* spp., *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

89. Suture between metapterygoid and hyomandibula (modified Rapp Py-Daniel, 1997 char. 39). CI = 0.118. RI = 0.444.

(0) Small

Astroblepus sp., ***Harttia absaberi*, *H. dissidens*, *H. duriventris*, *Harttia* cf. *fowleri*, *H. guianensis*, *H. punctata*, *Harttia* cf. *surinamensis*, *H. uatumensis*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata* and *Sturisoma robustum*.

(1) Large

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi*, *H. dissidens*, *H. duriventris*, *Harttia* cf. *fowleri*, *H. guianensis*, *H. punctata*, *Harttia* cf. *surinamensis* and *H. uatumensis*),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps* and *Spatuloricaria evansii*.

(2) Absent

Furcodontichthys novaesi, *Hemiodontichthys acipenserinus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Proloricaria prolixa*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

Comment: The suture is small (state 0) when the interdigitations occur in only one part of the contact, corresponding up to ⅓ of the region between the two bones. The suture is large (state 1) when the interdigitations occur over almost all or all extension of the contact, being present from ⅔ of the region. Finally, the suture is is absent (state 2) when there is no interdigitation and the bones are parallel along the whole contact.

90. Connection of hyomandibula to skull (modified Rapp Py-Daniel, 1997 char. 44; modified Fichberg, 2008 char. 65; modified Paixão, 2012 char. 11). CI = 0.133. RI = 0.581.

(0) Greater with prootic and smaller with pterotic-supracleithrum

Astroblepus sp., *Lithogenes wahari*, *Hypostomus ancistroides*, *Neoplecostomus microps*, *Pseudotocinclus tietensis*, ***Harttia intermontana, H. leiopleura, H. longipinna, H. novalimensis, H. torrenticola,*** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(1) With prootic and pterotic-supracleithrum with equivalent areas

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *H. intermontana, H. leiopleura, H. longipinna, H. novalimensis* and *H. torrenticola*),** *Farlowella oxyrryncha*, *Lamontichthys* spp., *Metaloricaria paucidens* and *Reganella depressa*.

(2) Exclusively with prootic

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Rineloricaria daraha* and *Spatuloricaria evansii*.

91. Extension of hyomandibula condyle (modified Rapp Py-Daniel, 1997 char. 42). CI = 1.000. RI = 1.000.

(0) Long, the whole connection of hyomandibula to the skull through condyle (Fig. 27A)

Astroblepus sp., *Lithogenes wahari* and *Hemipsilichthys nimius*.

(1) Media, about ⅔ of the connection performed by condyle (Fig. 27B)

Ancistrus multipinnis, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

92. Anterior process of hyomandibula (Rapp Py-Daniel, 1997 char. 45). CI = 0.250. RI = 0.000.

(0) Present

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Absent

Farlowella oxyrryncha, *Lamontichthys* spp., *Loricaria lentiginosa* and *Reganella depressa*.

93. Posterior contact between hyomandibula and pterotic-supracleithrum (modified Rapp Py-Daniel, 1997 char. 47). CI = 0.167. RI = 0.375.

(0) Absent

Astroblepus sp..

(1) Only syndesmotic

Hemipsilichthys nimius, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *H. absaberi*),** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Sutural and syndesmotic

Lithogenes wahari, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Pseudotocinclus tietensis*, ***Harttia absaberi,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Reganella depressa*.

94. Margin of hyomandibula in contact with pterotic-supracleithrum. CI = 0.185. RI = 0.290.

(0) Straight (Fig. 28A)

Hemipsilichthys nimius, *Neoplecostomus microps*, ***Harttia dissidens, H. garavelloi, H. gracilis, H. guianensis, H. kronei, H. punctata, H. torrenticola, H. trombetensis, H. uatumensis,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Lamontichthys* spp., *Loricaria cataphracta*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon* and *Reganella depressa*.

(1) With a small elevation near to the proximal condyle (Fig. 28B)

Hypostomus ancistroides, *Isbrueckerichthys duseni*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absberi, H. dissidens, Harttia* cf. *fowleri, H. garavelloi, H. gracilis, H. guianensis, H. kronei, H. punctata, H. torrenticola, H. trombetensis* and *H. uatumensis*),** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Loricaria lentiginosa*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) With a large elevation near the proximal condyle (Fig. 28C)

Astroblepus sp., *Kronichthys heylandi*, ***Harttia absberi, Harttia* cf. *fowleri*** and *Rineloricaria daraha*.

(3) With a flap along the whole extension (Fig. 28D)

Farlowella oxyrryncha, *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(4) With a very distinct process that makes part of the margin (Fig. 28E)

Ancistrus multipinnis, *Hemiodontichthys acipenserinus* and *Loricariichthys castaneus*.

(5) With a very distinct process that does not make part of the margin (Fig. 28F)

Lithogenes wahari.

95. Shape of hyomandibula depression or concavity (modified Rapp Py-Daniel, 1997 char. 41). CI = 0.083. RI = 0.500.

(0) Small concavity area

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *Harttia* cf. *fowleri, H. punctata, H. rondoni, Harttia* cf. *surinamensis, H. trombetensis* and *H. villasboas*),** *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata* and *Rineloricaria latirostris*.

(1) Large concavity area

Harttia* cf. *fowleri, H. punctata, H. rondoni, Harttia* cf. *surinamensis, H. trombetensis, H. villasboas, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

96. Crest on lateral surface of hyomandibula for insertion of levator arcus palatini muscle (modified Rapp Py-Daniel, 1997 char. 40; modified Fichberg, 2008 char. 64; modified Paixão, 2012 char. 12). CI = 0.087. RI = 0.475.

(0) Present, well protruding, complete

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Neoplecostomus microps*, ***Harttia absaberi, H. duriventris, H. garavelloi, H. intermontana, H. panara, H. punctata,***

H. rondoni, H. torrenticola, Harttia **sp. tapajós 2,** *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Paraloricaria vetula*, *Pterosturisoma* cf. *microps*, *Rineloricaria latirostris* and *Sturisoma robustum*.

(1) Present, smooth, incomplete

Isbrueckerichthys duseni, *Kronichthys heylandi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi, H. dissidens, Harttia*** **cf.** ***fowleri, H. gracilis, H. guianensis, H. kronei, H. loricariformis, H. trombetensis, H. uatumensis, H. villasboas, Harttia*** **sp. São Roque,** ***Harttia*** **sp. tapajós 1,** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Limatulichthys griseus* and *Spatuloricaria evansii*.

(2) Absent

Pareiorhina rudolphi, *Hypoptopoma inexpectata*, ***Harttia leiopleura, H. longipinna, H. novalimensis, Harttia*** **cf.** ***surinamensis,*** *Apistoloricaria* sp., *Crossoloricaria* spp., *Hemiodontichthys acipenserinus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata* and *Rineloricaria pentamaculata*.

97. Size of quadrate (modified Rapp Py-Daniel, 1997 char. 48). CI = 0.167. RI = 0.688.

(0) Large, high

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of** ***Harttia,*** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps* and *Reganella depressa*.

(1) Small, elongated

Apistoloricaria sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

98. Connection of quadrate to dermal plates (modified Rapp Py-Daniel, 1997 char. 49). CI = 0.333. RI = 0.500.

(0) Not sutured

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Sutured

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Hemiodontichthys acipenserinus* and *Pseudohemiodon* spp..

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

99. Shape of preopercle (modified Rapp Py-Daniel, 1997 char. 50). CI = 0.143. RI = 0.700.

(0) Thin, elongated

Astroblepus sp., *Hemipsilichthys nimius*, *Pareiorhina rudolphi*, *Brochiloricaria* sp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Broad, robust

Lithogenes wahari, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Reganella depressa* and *Sturisoma robustum*.

100. Shape of preopercle canal (modified Rapp Py-Daniel, 1997 char. 54). CI = 0.188. RI = 0.435.

(0) Straight with two exits

Ancistrus multipinnis, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Brochiloricaria* sp., *Farlowella oxyrryncha*, *Hemiodontichthys acipenserinus*, *Loricariichthys castaneus* and *Planiloricaria cryptodon*.

(1) Straight with three or more exits, but not branched

Astroblepus sp., *Lithogenes wahari*, *Pareiorhina rudolphi*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pterosturisoma* cf. *microps*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(2) T-shaped with three exits, branched

Hemipsilichthys nimius, *Neoplecostomus microps*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula*, *Reganella depressa* and *Sturisoma robustum*.

(3) Curved and branched, three exits

Hypostomus ancistroides, *Hypoptopoma inexpectata*, *Apistoloricaria* sp., *Crossoloricaria* spp., *Pseudohemiodon* spp. and *Rineloricaria daraha*.

101. Ventral process of preopercle (modified Rapp Py-Daniel, 1997 char. 53; Fichberg, 2008 char. 66; Paixão, 2012 char. 13). CI = 0.500. RI = 0.967.

(0) Absent or inconspicuous (Fig. 29A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Well developed (Fig. 29B)

All species of *Harttia*, *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

102. Connection of preopercle with dermal plates (modified Rapp Py-Daniel, 1997 char. 52). CI = 0.231. RI = 0.286.

(0) Preopercle vaguely connected to dermal plates

Isbrueckerichthys duseni, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Contact via a dorsal ridge on preopercle

Apistoloricaria sp., *Crossoloricaria* spp., *Pseudohemiodon* spp. and *Reganella depressa*.

(2) Preopercle strongly sutured to dermal plates

Hemiodontichthys acipenserinus and *Planiloricaria cryptodon*.

(3) No contact

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Plesioptopoma curvidens*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Rineloricaria lanceolata* and *Rineloricaria latirostris*.

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

Comment: The preopercle is vaguely connected to dermal plates (state 0) when a part of the preopercle is in contact with the plates and another part is free. The contact via dorsal ridge on preopercle (state 1) occurs when the dermal plates fold in the ventral region and get in contact with the tip of the preopercle. The preopercle is strongly suture to dermal plates (state 2), when there is contact between both along the whole region, but in this case the plates do not fold ventrally, not reaching the ridge of the preopercle. No contact (state 3) occurs when the preopercle is free along the whole region.

103. Exposed face of preopercle (modified Rapp Py-Daniel, 1997 char. 51). CI = 0.120. RI = 0.353.

(0) None

Astroblepus sp., *Lithogenes wahari*, *Ancistrus multipinnis*, *Hypoptopoma inexpectata*, ***Harttia absaberi, H. carvalhoi, H. duriventris, Harttia* cf. *fowleri, H. garavelloi, H. guianensis, H. intermontana, H. longipinna, H. loricariformis, H. punctata, H. rondoni, Harttia* cf. *surinamensis, H. torrenticola, H. uatumensis, Harttia* sp. tapajós 2,** *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(1) Small area exposed and ornamented

Hypostomus ancistroides, *Kronichthys heylandi*, *Neoplecostomus microps*, ***Harttia gracilis, H. kronei, H. leiopleura, H. villasboas, Harttia* sp. São Roque,** *Hemiodontichthys acipenserinus* and *Sturisoma robustum*.

(2) Large area exposed and ornamented

Hemipsilichthys nimius, *Isbrueckerichthys duseni*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia novalimensis,*** *Apistoloricaria* sp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Reganella depressa*.

(3) Very small and not ornamented

***Harttia dissidens, H. panara, H. trombetensis, Harttia* sp. tapajós 1,** *Brochiloricaria* sp., *Harttiella crassicauda*, *Pterosturisoma* cf. *microps* and *Spatuloricaria evansii*.

Comment: Ornamented means covered by odontodes.

Mandibular arch

104. Shape of autopalatine (with respect to margin) (modified Rapp Py-Daniel, 1997 char. 23; Fichberg, 2008 char. 67; modified Paixão 2012 char. 26). CI = 0.200. RI = 0.429.

(0) Rod-shaped, without lateral flap (Fig. 30A)

Astroblepus sp., *Hemipsilichthys nimius*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *Harttia* cf. *fowleri, H. guianensis, H. panara, H. rondoni, Harttia* cf. *surinamensis, H. trombetensis* and *H. uatumensis*),** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Paraloricaria vetula*, *Pseudoloricaria laeviuscula* and *Rineloricaria latirostris*.

(1) Rectangular, with a lateral flap along the extension of the bone (Fig. 30B)

Furcodontichthys novaesi, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Reganella depressa*, *Rineloricaria daraha* and *Rineloricaria pentamaculata*.

(2) Rectangular with the distal portion more expanded, triangular lateral flap with distal portion forming an acute angle (Fig. 30C)

Ancistrus multipinnis, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, ***Harttia* cf. *fowleri, Harttia* cf. *surinamensis,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Hemiodontichthys acipenserinus*, *Loricaria lentiginosa*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp. and *Rineloricaria lanceolata*.

(3) Elongated approximately rectangular, with well-developed lateral flap that covers 2/3 of the lateral extension of the bone in the distal portion (Fig. 30D)

Lithogenes wahari, *Crossoloricaria* spp., *Loricaria cataphracta*, *Metaloricaria paucidens* and *Spatuloricaria evansii*.

(4) Elongated with expanded base, well-developed flap that covers 1/3 of the length of the bone in the proximal portion (Fig. 30E)

Harttia guianensis, H. panara, H. rondoni, H. trombetensis, H. uatumensis, *Farlowella oxyrryncha*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

105. Anterior process of autopalatine (modified Rapp Py-Daniel, 1997 char. 26; Fichberg, 2008 char. 68; modified Paixão, 2012 char. 27). CI = 0.500. RI = 0.967.

(0) Absent (Fig. 31A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*,

Planiloricaria cryptodon, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Present (Fig. 31B and C)

All species of *Harttia*, *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

106. Palatine splint (modified Rapp Py-Daniel, 1997 char. 27; modified Fichberg, 2008 char. 73; modified Paixão, 2012 char. 28). CI = 0.111. RI = 0.529.

(0) Present and long

Lithogenes wahari, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi, H. dissidens, H. duriventris, Harttia* cf. *fowleri, H. garavelloi, H. gracilis, H. guianensis, H. kronei, H. leiopleura, H. longipinna, H. loricariformis, Harttia* cf. *surinamensis, H. trombetensis, Harttia* sp. tapajós 1** and *Metaloricaria paucidens*.

(1) Present and short

Astroblepus sp., *Hypostomus ancistroides*, ***Harttia intermontana, H. novalimensis, H. panara, H. punctata, H. torrenticola, H. villasboas,*** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) Absent

Hemipsilichthys nimius, *Ancistrus multipinnis*, ***Harttia absaberi, H. rondoni, H. uatumensis, Harttia* sp. São Roque, *Harttia* sp. tapajós 2,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

Comment: The palatine splint is present and long (state 0) when it is almost the size of the autopalatine or greater than the half of it. When it is present and short (state 1), its size is smaller than half of the autopalatine.

107. Condyles and processes of autopalatine for articulation with lateral ethmoid (modified 24 Rapp Py-Daniel, 1997 char. 24). CI = 0.333. RI = 0.500.

(0) One condyle and one long posterior process

Astroblepus sp., *Lithogenes wahari*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Pseudohemiodon* spp. and *Pseudoloricaria laeviuscula*.

(1) One posterior condyle and two short posterior processes

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) One posterior condyle and one short posterior process

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Planiloricaria cryptodon*, *Proloricaria prolixa* and *Reganella depressa*.

(3) One posterior condyle, one shorter process and other more well-developed process

Loricariichthys castaneus.

108. Relative lenght between maxillary and autopalatine (modified Rapp Py-Daniel, 1997 char. 31; modified Fichberg, 2008 char. 72). CI = 0.500. RI = 0.895.

(0) Maxillary clearly greater than autopalatine

Astroblepus sp., *Lithogenes wahari* and *Hemipsilichthys nimius*.

(1) Maxillary with the same size or slightly greater than autopalatine

Ancistrus multipinnis, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) Maxillary smaller than autopalatine

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

109. Median thickness of maxillary in relation to thickness of autopalatine (modified Fichberg, 2008 char. 74). CI = 0.200. RI = 0.789.

(0) Maxillary up to half of the thickness of the autopalatine (Fig. 32A)

Astroblepus sp., *Lithogenes wahari*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(1) Maxillary with approximately the same thickness as the autopalatine (Fig. 32B)

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Spatuloricaria evansii* and *Sturisoma robustum*.

110. Condyle of maxillary (modified Rapp Py-Daniel, 1997 char. 29). CI = 1.000. RI = 1.000.

(0) Only one condyle

Astroblepus sp. and *Lithogenes wahari*.

(1) Two equal condyles coming from the same point

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria spp.*, *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*,

Proloricaria prolixa, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

111. Extensions in condyle of maxillary (modified Rapp Py-Daniel, 1997 char. 30). CI = 1.000. RI = 1.000.

(0) Membranous extensions absent

Astroblepus sp. and *Lithogenes wahari*.

(1) Dorsal condyle with a well-developed bony crest

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Both condyles united anteriorly by a huge protuberance

Reganella depressa.

112. Distal portion of ventral projection of maxillary in relation to proximal portion (Paixão, 2012 char. 29). CI = 0.400. RI = 0.897.

(0) Wider

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Neoplecostomus microps*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda* and *Lamontichthys* spp..

(1) Narrower

Ancistrus multipinnis, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Apistoloricaria* sp.,

Brochiloricaria sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) With similar width

Loricariichthys castaneus.

113. Approximate angle of inclination of maxillary projection in relation to main axis of bone (modified Paixão, 2012 char. 30). CI = 0.048. RI = 0.286.

(0) Approximately 90°

Astroblepus sp., *Lithogenes wahari*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi, H. duriventris, Harttia* cf. *fowleri, H. intermontana, H. leiopleura, H. longipinna, H. novalimensis, H. panara, H. rondoni, H. torrenticola, H. villasboas, Harttia* sp. tapajós 1,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Paraloricaria vetula*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Sturisoma robustum*.

(1) Greater than 90°

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Hypoptopoma inexpectata*, ***Harttia absaberi, H. dissidens, H. garavelloi, H. gracilis, H. guianensis, H. kronei, H. loricariformis, H. punctata, Harttia* cf. *surinamensis, H. trombetensis, H. uatumensis, Harttia* sp. São Roque, *Harttia* sp. tapajós 2,** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

114. Shape of premaxilla in ventral view (modified Rapp Py-Daniel, 1997 char. 28; Fichberg, 2008 char. 71; modified Paixão 2012 char. 25). CI = 0.333. RI = 0.800.

(0) Rectangular

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Pseudotocinclus*

tietensis, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps*, *Reganella depressa* and *Sturisoma robustum*.

(1) Quadrangular

Hypoptopoma inexpectata, *Plesioptopoma curvidens*, *Furcodontichthys novaesi*, *Metaloricaria paucidens*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(2) Oval

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Spatuloricaria evansii*.

115. Condyle in premaxilla (modified Paixão, 2012 char. 21). CI = 0.333. RI = 0.846.

(0) Present

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Absent

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

116. Size of premaxilla condyle in relation to area with teeth (modified Paixão, 2012 char. 22). CI = 0.667. RI = 0.667.

(0) Equal of the area with teeth or larger

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*,

Farlowella oxyrryncha, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Loricariichthys castaneus*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Approximately ½ of the area with teeth

Furcodontichthys novaesi, *Limatulichthys griseus*, *Metaloricaria paucidens* and *Pseudoloricaria laeviuscula*.

(2) Very tiny, almost vestigial

Spatuloricaria evansii.

(-) Inapplicable (absent condyle)

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

117. Position of premaxilla condyle (modified Paixão, 2012 char. 23). CI = 0.667. RI = 0.750.

(0) Posterior (Fig. 33A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Lateral (Fig. 33B)

Hemiodontichthys acipenserinus, *Limatulichthys griseus*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula* and *Spatuloricaria evansii*.

(2) Mesial (Fig. 33C)

Loricariichthys castaneus.

(-) Inapplicable (absent condyle)

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

118. Relative size of premaxilla (Paixão, 2012 char. 24). CI = 0.600. RI = 0.889.

(0) Large, same size or greater than maxillary

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Median, around 1/2 to 1/3 the size of the maxillary

Furcodontichthys novaesi, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Pseudoloricaria laeviuscula*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(2) Small, 1/4 the size of the maxillary

Loricariichthys castaneus and *Proloricaria prolixa*.

(3) Tiny, smaller than 1/4 the size of the maxillary

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Hemiodontichthys acipenserinus*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp. and *Reganella depressa*.

119. Shape of dentary (modified Rapp Py-Daniel, 1997 char. 33). CI = 0.174. RI = 0.457.

(0) Oval, robust

Astroblepus sp..

(1) Quadrangular, robust

Lithogenes wahari, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi, H. duriventris, Harttia* cf. *fowleri, H. gracilis, H. loricariformis, H. panara, H. torrenticola, H. villasboas, Harttia* sp. tapajós 1,** *Farlowella oxyrryncha*, *Harttiella crassicauda* and *Rineloricaria lanceolata*.

(2) Rectangular, robust

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Pareiorhina rudolphi*, **all species of *Harttia* (except *H. carvalhoi, H. duriventris, Harttia* cf. *fowleri, H. gracilis, H. loricariformis, H. panara, H. torrenticola, H. villasboas* and *Harttia* sp. tapajós 1),** *Cteniloricaria platystoma*, *Lamontichthys* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria latirostris* and *Sturisoma robustum*.

(3) Oval, slender

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Metaloricaria paucidens*, *Pseudohemiodon* spp., *Rineloricaria daraha*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(4) Rectangular, slender

Furcodontichthys novaesi, *Hemiodontichthys acipenserinus*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa* and *Reganella depressa*.

120. Size of dentary fossae (modified Rapp Py-Daniel, 1997 char. 34). CI = 1.000. RI = 1.000.

(0) Absent dentary fossae

Astroblepus sp..

(1) Large

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) Reduced

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

121. Posterolateral prolongation of dentary, length in relation to greatest width of dentary (Paixão, 2012 char. 15). CI = 0.200. RI = 0.733.

(0) Short, much smaller than the greatest width of the dentary

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria lentiginosa*, *Paraloricaria vetula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Long, larger than the greatest width of the dentary

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

122. Coronoid process in dentary in relation to area where the teeth are inserted (modified Paixão, 2012 char. 16). CI = 0.333. RI = 0.789.

(0) Absent

Astroblepus sp., *Furcodontichthys novaesi*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Spatuloricaria evansii*.

(1) Present, well separated and smaller

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) Present, continuous with the region where the teeth are inserted and of similar size

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Rineloricaria pentamaculata*.

123. Mesethmoidal cartilage (modified Rapp Py-Daniel, 1997 char. 5, Paixão, 2012 char. 2). CI = 1.000. RI = 1.000.

(0) Absent (Fig. 34A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Present (Fig. 34B)

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

Comment: The presence of the mesethmoidal cartilage is related to the development of the premaxilla. When the premaxilla is less developed this cartilage is present, assisting in the anchorage between the premaxilla and the maxillary bone, as it occurs in Loricariini. When the premaxilla is more developed this cartilage is absent, because there is no need of an extra connection between the premaxilla and the maxillary, as in Harttiini sensu Py-Daniel (*Harttia*, *Cteniloricaria*, *Farlowella*, *Harttiella*, *Lamontichthys*, *Pterosturisoma*, and *Sturisoma*).

124. Cartilage between dentary and maxillary barbel (modified Rapp Py-Daniel, 1997 char. 32; Paixão, 2012 char. 20). CI = 0.111. RI = 0.200.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricariichthys castaneus*,

Metaloricaria paucidens, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(1) Present

Brochiloricaria sp., *Limatulichthys griseus*, *Loricaria lentiginosa*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Spatuloricaria evansii*.

Hyoid arch

125. Interhyal. CI = --. RI = --.

(0) Present

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Absent

Kronichthys heylandi.

126. Shape and thickness of interhyal (modified Fichberg, 2008 char. 75). CI = 0.160. RI = 0.087.

(0) Laminar, quadrangular or rectangular

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Pareiorhina rudolphi*, **all species of *Harttia* (except *H. dissidens*, *Harttia* cf. *fowleri*, *H. garavelloi*, *H. guianensis*, *H. longipinna* and *H. trombetensis*),** *Apistoloricaria* sp., *Crossoloricaria* spp., *Farlowella*

oxyrryncha, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Pseudoloricaria laeviuscula* and *Rineloricaria latirostris*.

(1) Nodular, globular

Neoplecostomus microps, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia garavelloi,*** *Reganella depressa* and *Sturisoma robustum*.

(2) Laminar, rectangular with tip

Harttia dissidens, Harttia **cf.** ***fowleri, H. guianensis, H. trombetensis,*** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Lamontichthys* spp., *Loricaria cataphracta*, *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata* and *Rineloricaria pentamaculata*.

(3) Laminar, elongated

Harttia longipinna, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Proloricaria prolixa* and *Spatuloricaria evansii*.

(4) Broom-shaped

Pseudohemiodon spp..

(-) Inapplicable (absent interhyal)

Kronichthys heylandi.

127. Connection of interhyal with hyomandibula (modified Rapp Py-Daniel, 1997 char. 56). CI = 0.500. RI = 0.600.

(0) Free, articulate

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Partially sutured

Hypostomus ancistroides, *Pareiorhina rudolphi*, *Apistoloricaria* sp., *Crossoloricaria* spp., *Planiloricaria cryptodon* and *Pseudohemiodon* spp..

(2) Absent

Reganella depressa.

(-) Inapplicable (absent interhyal)

Kronichthys heylandi.

128. Posterior condyle in interhyal for articulation with epihyal (modified Rapp Py-Daniel, 1997 char. 57). CI = 0.071. RI = 0.188.

(0) Present

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *H. garavelloi, H. gracilis* and *H. novalimensis*),** *Apistoloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha* and *Spatuloricaria evansii*.

(1) Absent

Hypostomus ancistroides, *Pareiorhina rudolphi*, *Pseudotocinclus tietensis*, ***Harttia garavelloi, H. gracilis, H. novalimensis,*** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(-) Inapplicable (absent interhyal)

Kronichthys heylandi.

129. Shape of urohyal (modified Fichberg, 2008 char. 77). CI = 0.500. RI = 0.913.

(0) V-shaped

Astroblepus sp. and *Lithogenes wahari*.

(1) Elliptical

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp. and *Pterosturisoma* cf. *microps*.

(2) Triangular or shell-shaped

Hypoptopoma inexpectata, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

Comment: The shape of the urohyal is triangular or shell-shaped (state 2) when the posterior region is wider than the anterior, forming a triangle when the tips are straighter or a shell when they are rounded. The shape is elliptical (state 1) when the anterior and posterior regions are the same size, whereas the corners can be more rounded or straighter. In the V-shaped (state 0) there are two well-defined tips.

130. Connection of hipohyal with ceratohyal (modified Rapp Py-Daniel, 1997 char. 62; Fichberg, 2008 char. 83; modified Paixão, 2012 char. 40). CI = 0.143. RI = 0.333.

(0) Synchondral

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. punctata*),** *Apistoloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Sutural and synchondral

Lithogenes wahari, ***Harttia punctata,*** *Brochiloricaria* sp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp. and *Reganella depressa*.

131. Anterior margin of ceratohyal (Fichberg, 2008 char. 80). CI = 0.071. RI = 0.409.

(0) Flat

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *H. guianensis* and *H. leiopleura*),** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp. and *Sturisoma robustum*.

(1) Serrated

Hypostomus ancistroides, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pseudotocinclus tietensis*, ***Harttia guianensis, H. leiopleura,*** *Apistoloricaria* sp., *Crossoloricaria* spp., *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

132. Anterior margin of ceratohyal (modified Rapp Py-Daniel, 1997 char. 63; modified Fichberg, 2008 char. 84). CI = 0.200. RI = 0.613.

(0) Opposite expansion, inward (Fig. 35D)

Astroblepus sp..

(1) Expanded, but the hipohyal not expanded (Fig. 35B)

Hemipsilichthys nimius, *Hypostomus ancistroides*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, ***Harttia absaberi, H. leiopleura,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) As expanded as the hipohyal (Fig. 35C)

Lithogenes wahari, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Pareiorhina rudolphi*, **all species of *Harttia* (except *H. absaberi* and *H. leiopleura*),** *Cteniloricaria platystoma*, *Lamontichthys* spp. and *Planiloricaria cryptodon*.

(3) Not expanded (Fig. 35A)

Kronichthys heylandi, *Plesioptopoma curvidens*, *Crossoloricaria* spp., *Hemiodontichthys acipenserinus* and *Metaloricaria paucidens*.

133. Ventral crest in anterior margin of ceratohyal. CI = 0.111. RI = 0.200.

(0) Absent (Fig. 36A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. dissidens, H. duriventris, Harttia* cf. *fowleri, H. garavelloi, H. gracilis, H. novalimensis, Harttia* cf. *surinamensis* and *H. uatumensis*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Present (Fig. 36B)

Isbrueckerichthys duseni, *Pareiorhina rudolphi*, ***Harttia dissidens, H. duriventris, Harttia* cf. *fowleri, H. garavelloi, H. gracilis, H. novalimensis, Harttia* cf. *surinamensis, H. uatumensis*** and *Harttiella crassicauda*.

134. Angle of inclination of ventral lamina of anterior ceratohyal (Paixão, 2012 char. 39). CI = 0.250. RI = 0.786.

(0) Approximately 90° in relation to the main axis of the bone

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria*

paucidens, *Paraloricaria vetula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Greater than 100° in relation to the main axis of the bone

Brochiloricaria sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

135. Connection of ceratohyal with epihyal (modified Rapp Py-Daniel, 1997 char. 60; modified Fichberg, 2008 char. 81). CI = 0.667. RI = 0.909.

(0) Synchondral

Astroblepus sp..

(1) One synchondral connection and one suture

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Two sutures interspersed by cartilage

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Hemiodontichthys acipenserinus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp. and *Reganella depressa*.

136. Cross-sectional shape of dorsal border of hyoid arch (modified Rapp Py-Daniel, 1997 char. 59). CI = 0.400. RI = 0.800.

(0) Strongly angled

Astroblepus sp., *Lithogenes wahari*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Reganella depressa*.

(1) Rounded

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Blade-shaped ridge

Hemiodontichthys acipenserinus, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula* and *Proloricaria prolixa*.

137. Dorsal hook in epihyal (modified Rapp Py-Daniel, 1997 char. 61; modified Fichberg, 2008 char. 82). CI = 0.167. RI = 0.750.

(0) Present and conspicuous

Astroblepus sp., *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Absent or inconspicuous

Lithogenes wahari, *Hemipsilichthys nimius*, *Hypostomus ancistroides*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

138. Number of branchiostegal rays (modified Rapp Py-Daniel, 1997 char. 55; modified Fichberg, 2008 char. 79). CI = --. RI = --.

(0) Four

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Less than four

Farlowella oxyrryncha.

Branchial arches

139. Number of ossified basibranchials (Rapp Py-Daniel, 1997 char. 64; Fichberg, 2008 char. 85; modified Paixão, 2012 char. 41). CI = 0.250. RI = 0.727.

(0) Only the first

Astroblepus sp., *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia longipinna*** and ***H. novalimensis*.**

(1) The first and the second

Lithogenes wahari, *Hemipsilichthys nimius*, **all species of *Harttia* (except *H. longipinna* and *H. novalimensis*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

140. Basibranchials bone texture (Rapp Py-Daniel, 1997 char. 65). CI = 0.143. RI = 0.333.

(0) Compact

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Trabeculate

Lithogenes wahari, *Apistoloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps* and *Rineloricaria daraha*.

141. Shape of first basibranchial (modified Rapp Py-Daniel, 1997 char. 66; modified Fichberg, 2008 char. 86). CI = 0.211. RI = 0.000.

(0) Hourglass

Astroblepus sp., *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *H. duriventris, H. garavelloi, H. loricariformis, H. rondoni, H. trombetensis* and *Harttia* sp. tapajós 1),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria latirostris* and *Spatuloricaria evansii*.

(1) Rectangular

Lithogenes wahari, ***Harttia duriventris, H. garavelloi,*** *Crossoloricaria* spp., *Planiloricaria cryptodon* and *Rineloricaria pentamaculata*.

(2) Fan

Hemipsilichthys nimius, *Pseudotocinclus tietensis*, ***Harttia loricariformis, H. trombetensis,*** *Lamontichthys* spp., *Proloricaria prolixa*, *Rineloricaria lanceolata* and *Sturisoma robustum*.

(3) Inverted fan

***Harttia rondoni, Harttia* sp. tapajós 1,** *Pseudohemiodon* spp. and *Pseudoloricaria laeviuscula*.

(4) Quadrangular

Hypostomus ancistroides.

142. Size of first basibranchial (modified Rapp Py-Daniel, 1997 char. 66; modified Fichberg, 2008 char. 87). CI = 0.143. RI = 0.250.

(0) Long

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. kronei, H. leiopleura, H. longipinna, H. novalimensis* and *Harttia* sp. São Roque),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Short

Hypostomus ancistroides, *Isbrueckerichthys duseni*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, ***Harttia kronei, H. leiopleura, H. longipinna, H. novalimensis*** and ***Harttia* sp. São Roque.**

Comment: The first basibranchial is long (state 0) when the length is greater than the width. When it is short (state 1), the width is approximately equal to the length.

143. Second basibranchial. CI = 0.250. RI = 0.571.

(0) Absent

Astroblepus sp., *Hypostomus ancistroides, Isbrueckerichthys duseni, Kronichthys heylandi, Neoplecostomus microps, Pareiorhina rudolphi*, *Plesioptopoma curvidens* and *Pseudotocinclus tietensis*.

(1) Present

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypoptopoma inexpectata*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

144. Shape of second basibranchial (modified Fichberg, 2008 char. 88). CI = 0.375. RI = 0.688.

(0) Shell-shaped

Lithogenes wahari.

(1) Nodular, vestigial

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypoptopoma inexpectata*, ***Harttia carvalhoi*, *H. gracilis*, *H. intermontana*, *H. kronei*, *H. leiopleura*, *H. longipinna*, *H. novalimensis*, *H. torrenticola*, *Harttia* sp. São Roque** and *Harttiella crassicauda*.

(2) Hourglass, fan, quadrangular

All species of *Harttia* (except *H. carvalhoi*, *H. gracilis*, *H. intermontana*, *H. kronei*, *H. leiopleura*, *H. longipinna*, *H. novalimensis*, *H. torrenticola* and *Harttia* sp. São Roque), *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(3) Rectangular

Apistoloricaria sp., *Loricaria cataphracta*, *Planiloricaria cryptodon*, *Pseudoloricaria laeviuscula* and *Rineloricaria daraha*.

(-) Inapplicable (absent second basibranchial)

Astroblepus sp., *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens* and *Pseudotocinclus tietensis*.

Comment: The second basibranchial is bony in most cases, but is eventually cartilaginous. This character concerns only the shape of the second basibranchial, contemplating bony and cartilaginous in the same state, without differentiation.

145. Size of second basibranchial (modified Rapp Py-Daniel, 1997 char. 67; modified Fichberg, 2008 char. 89). CI = 0.250. RI = 0.842.

(0) Short

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypoptopoma inexpectata*, **all species of *Harttia* (except *H. absaberi*),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps*, *Reganella depressa* and *Sturisoma robustum*.

(1) Long

Harttia absaberi, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(-) Inapplicable (absent second basibranchial)

Astroblepus sp., *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens* and *Pseudotocinclus tietensis*.

Comment: The second basibranchial is short (state 0) when it is as wide as it is long. When it is long (state 1) it is longer than wide.

146. Rakers in third basibranchial (modified Rapp Py-Daniel, 1997char. 68). CI = 0.500. RI = 0.000.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Apistoloricaria* sp.,

Brochiloricaria sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Present

Hemiodontichthys acipenserinus and *Reganella depressa*.

147. Hipobranchials (modified Rapp Py-Daniel, 1997 char. 70). CI = 0.500. RI = 0.500.

(0) Non ossified

Astroblepus sp., *Lithogenes wahari* and *Harttiella crassicauda*.

(1) Ossified, the first pair

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

[1, 2] *Kronichthys heylandi*.

148. Shape of first pair of hipobranchials (modified Rapp Py-Daniel, 1997 char. 71; modified Fichberg, 2008 char. 90; modified Paixão, 2012 char. 42). CI = 0.500. RI = 0.000.

(0) Fan (Fig. 37A and B)

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria*

cataphracta, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Rod (Fig. 37C)

Isbrueckerichthys duseni and *Metaloricaria paucidens*.

(2) Hourglass (Fig. 37D)

Apistoloricaria sp. and *Rineloricaria latirostris*.

(-) Inapplicable (non ossified hipobranchials)

Astroblepus sp., *Lithogenes wahari* and *Harttiella crassicauda*.

149. Anterior process of first ceratobranchial (modified Rapp Py-Daniel, 1997 char. 72; modified Fichberg, 2008 char. 91; modified Paixão, 2012 char. 43). CI = 0.214. RI = 0.607.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Crossoloricaria* spp., *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Reganella depressa* and *Rineloricaria pentamaculata*.

(1) Reduced, nodular like a protuberance

Apistoloricaria sp., *Brochiloricaria* sp., *Furcodontichthys novaesi*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Spatuloricaria evansii*.

(2) Present and short

Hemipsilichthys nimius, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia garavelloi,*** *Farlowella oxyrryncha* and *Metaloricaria paucidens*.

(3) Present and long

Ancistrus multipinnis, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, **all species of *Harttia* (except *H. garavelloi*),** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

150. Width of anterior process of first ceratobranchial (modified Fichberg, 2008 char. 92). CI = 0.286. RI = 0.844.

(0) Absent anterior process or reduced protuberance

Astroblepus sp., *Lithogenes wahari*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Same thickness of the first ceratobranchial

Hemipsilichthys nimius, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia garavelloi,*** *Farlowella oxyrryncha*, *Lamontichthys* spp. and *Metaloricaria paucidens*.

(2) Wide lamina

Ancistrus multipinnis, *Hypostomus ancistroides*, **all species of *Harttia* (except *H. garavelloi*),** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

151. Width of ceratobranchial 3 in relation to ceratobranchials 1 and 2 (modified Paixão, 2012 char. 44). CI = 0.500. RI = 0.947.

(0) Same width

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps*, *Rineloricaria lanceolata* and *Sturisoma robustum*.

(1) Wider

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon*

spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

152. Anterior process of first epibranchial (modified Rapp Py-Daniel, 1997 char. 73; modified Fichberg, 2008 char. 93). CI = 0.111. RI = 0.529.

(0) Absent or inconspicuous (Fig. 38A)

Astroblepus sp., *Plesioptopoma curvidens*, ***Harttia absaberi, H. dissidens, H. duriventris, Harttia* cf. *fowleri, H. guianensis, H. panara, H. punctata, H. rondoni, Harttia* cf. *surinamensis, H. trombetensis, Harttia* sp. tapajós 2,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp. and *Sturisoma robustum*.

(1) Conspicuous (Fig. 38B)

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi, H. garavelloi, H. gracilis, H. intermontana, H. kronei, H. leiopleura, H. longipinna, H. loricariformis, H. novalimensis, H. torrenticola, H. uatumensis, H. villasboas, Harttia* sp. São Roque, *Harttia* sp. tapajós 1,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

153. Posterior process of first epibranchial (modified Fichberg, 2008 char. 94). CI = 0.067. RI = 0.462.

(0) Conspicuous

Astroblepus sp., *Lithogenes wahari*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, ***Harttia duriventris, H. garavelloi, H. gracilis, H. kronei, H. leiopleura, H. longipinna, H. panara, H. punctata, Harttia* cf. *surinamensis, H. uatumensis, H. villasboas,** *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Reganella depressa*.

(1) Absent or inconspicuous

Hemipsilichthys nimius, *Plesioptopoma curvidens*, ***Harttia absaberi, H. carvalhoi, H. dissidens, Harttia* cf. *fowleri, H. guianensis, H. intermontana, H. loricariformis, H. novalimensis, H. rondoni, H. torrenticola, H. trombetensis, Harttia* sp. São Roque, *Harttia* sp. tapajós 1, *Harttia* sp. tapajós 2,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

154. Anterior process of second epibranchial (modified Fichberg, 2008 char. 95). CI = 0.143. RI = 0.760.

(0) Absent or inconspicuous

Astroblepus sp., *Hemipsilichthys nimius*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Conspicuous

Lithogenes wahari, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

155. Posterior process of second epibranchial (modified Rapp Py-Daniel, 1997 char. 74; modified Fichberg, 2008 char. 96). CI = 0.182. RI = 0.640.

(0) Conspicuous

Astroblepus sp., *Lithogenes wahari*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Plesioptopoma curvidens*, ***Harttia gracilis, H. villasboas,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Reganella depressa*, *Rineloricaria daraha* and *Spatuloricaria evansii*.

(1) Forming canal

Hemipsilichthys nimius, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. gracilis* and *H. villasboas*),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) Absent

Hemiodontichthys acipenserinus, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Pseudoloricaria laeviuscula*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

156. Shape of third epibranchial (modified Rapp Py-Daniel, 1997 char. 76; Fichberg, 2008 char. 113; modified Paixão, 2012 char. 50). CI = 0.500. RI = 0.905.

(0) Bar approximately straight

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Bar with a median curvature

Lithogenes wahari, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa* and *Pseudohemiodon* spp..

(2) Sinusoidal

Furcodontichthys novaesi, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

157. Posterior process of third epibranchial (modified Rapp Py-Daniel, 1997 char. 76; modified Fichberg, 2008 char. 97). CI = 0.222. RI = 0.632.

(0) Conspicuous

Astroblepus sp., *Lithogenes wahari*, *Plesioptopoma curvidens*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Spatuloricaria evansii*.

(1) Forming canal

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Pterosturisoma* cf. *microps*, *Reganella depressa* and *Sturisoma robustum*.

(2) Absent

Furcodontichthys novaesi, *Hemiodontichthys acipenserinus*, *Pseudoloricaria laeviuscula*, *Rineloricaria daraha* and *Rineloricaria pentamaculata*.

Comment: The posterior process of the third epibranchial forms a canal (state 1) when it turns anteriorly in an arch, originating a tube in the dorsal portion of the third epibranchial.

158. Shape of forth epibranchial (modified Fichberg, 2008 char. 114). CI = 0.250. RI = 0.714.

(0) Sinusoidal (Fig. 39A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Neoplecostomus microps*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) L-shaped bar (Fig. 39B)

Ancistrus multipinnis, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Proloricaria prolixa*, *Pterosturisoma* cf. *microps*, *Reganella depressa* and *Sturisoma robustum*.

(2) Bar approximately straight (Fig. 39C)

Lamontichthys spp. and *Metaloricaria paucidens*.

159. Size of forth epibranchial (modified Rapp Py-Daniel, 1997 char. 77). CI = 0.333. RI = 0.750.

(0) Shorter or approximately the same size as the third epibranchial

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(1) Longer than the third epibranchial

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp. and *Spatuloricaria evansii*.

160. Rectangular flap in fourth epibranchial (modified Rapp Py-Daniel, 1997 char. 78; modified Fichberg, 2008 char. 99). CI = 0.200. RI = 0.840.

(0) Absent (Fig. 39A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, ***Harttia absaberi,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Present (Fig. 39B and C)

Ancistrus multipinnis, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all**

species of *Harttia* (except *H. absaberi*), *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens* and *Sturisoma robustum*.

161. Posterior process of fourth epibranchial (modified Fichberg, 2008 char. 100). CI = 0.091. RI = 0.500.

(0) Absent (Fig. 40A)

Astroblepus sp., *Lithogenes wahari,* **all species of *Harttia* (except *H. absaberi, H. gracilis, H. intermontana, H. panara, Harttia* cf. *surinamensis, H. torrenticola, H. villasboas* and *Harttia* sp. São Roque),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Present (Fig. 40B)

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia absaberi, H. gracilis, H. intermontana, H. panara, Harttia* cf. *surinamensis, H. torrenticola, H. villasboas, Harttia* sp. São Roque,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha* and *Pterosturisoma* cf. *microps*.

162. Branchial filaments on fourth epibranchial (modified Rapp Py-Daniel, 1997 char. 79; modified Fichberg, 2008 char. 101). CI = 0.333. RI = 0.800.

(0) Present, but restricted only on the lateral

Astroblepus sp., *Lithogenes wahari*, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Present throughout most or all of the bone

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) No filaments

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon* and *Pseudohemiodon* spp..

163. Shape of third pharyngobranchial (modified Rapp Py-Daniel, 1997 char. 80; modified Fichberg, 2008 char. 102). CI = 0.222. RI = 0.125.

(0) Rod with expanded base

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi* and *H. garavelloi*),** *Apistoloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Rod

Lithogenes wahari, *Hypostomus ancistroides*, *Neoplecostomus microps*, ***Harttia absaberi, H. garavelloi,*** *Brochiloricaria* sp., *Loricaria cataphracta*, *Paraloricaria vetula* and *Proloricaria prolixa*.

(2) Boot

Reganella depressa.

Comment: The third pharyngobranchial has a rod shape (state 1) when the anterior and posterior extremities are the same size. It is considered a rod with an expanded base (state 0) when the anterior extremity is thinner and the posterior extremity is wider.

164. Length of third pharyngobranchial (modified Paixão, 2012 char. 51). CI = 0.333. RI = 0.909.

(0) Long, when the length is greater than three times the width

Astroblepus sp., *Lithogenes wahari*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Short, when the length is less than three times the width

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

165. Shape of fourth pharyngobranchial (modified Rapp Py-Daniel, 1997 char. 81; modified Fichberg, 2008 char. 103). CI = 1.000. RI = 1.000.

(0) Rod

Astroblepus sp.. and *Lithogenes wahari*.

(1) Robust, discoidal

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Reduced ossified area, nodular, surrounded by dense cartilage

Harttiella crassicauda.

Comment: As an additional information, the fourth pharyngobranchial is cartilaginous in *Astroblepus* sp. and bony in *Lithogenes wahari* and all other examined taxa.

166. Upper pharyngeal tooth plates (modified Rapp Py-Daniel, 1997 char. 89; Fichberg, 2008 char. 109; modified Paixão, 2012 char. 53). CI = 0.286. RI = 0.808.

(0) Laminar plate

Astroblepus sp., *Lithogenes wahari*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(1) With dorsal bony flap

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) Thick plate

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp. and *Spatuloricaria evansii*.

167. Shape of upper pharyngeal tooth plates (modified Rapp Py-Daniel, 1997 char. 87; modified Fichberg, 2008 char. 108; modified Paixão, 2012 char. 54). CI = 0.500. RI = 0.864.

(0) Ovals

Astroblepus sp., *Lithogenes wahari*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Curved club

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda* and *Pterosturisoma* cf. *microps*.

(2) Rectangle triangle

Lamontichthys spp. and *Sturisoma robustum*.

(3) Quadrangular

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Paraloricaria vetula*, *Planiloricaria cryptodon* and *Pseudohemiodon* spp..

168. Shape of lower pharyngeal tooth plates (modified Rapp Py-Daniel, 1997 char. 82; modified Fichberg, 2008 char. 105). CI = 1.000. RI = 1.000.

(0) Two triangular and expanded plates (Fig. 41A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(1) Two triangular and thin plates (Fig. 41B)

Furcodontichthys novaesi, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Pseudoloricaria laeviuscula*, *Reganella depressa* and *Spatuloricaria evansii*.

(2) Plates joined together forming a large triangle (Fig. 41C)

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa* and *Pseudohemiodon* spp..

169. Teeth of lower pharyngeal tooth plates (modified Rapp Py-Daniel, 1997 char. 85; modified Fichberg, 2008 char. 106). CI = 0.375. RI = 0.800.

(0) Cover almost the entire plate (Fig. 42A)

Astroblepus sp., *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon*

spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Restricted to a small mesial triangular area (Fig. 42B)

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *H. absaberi*),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha* and *Lamontichthys* spp..

(2) Restricted to the posterior border (Fig. 42C)

Pareiorhina rudolphi, ***Harttia absaberi,*** *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(3) Absent (Fig. 42D)

Pseudotocinclus tietensis and *Harttiella crassicauda*.

170. Number of rows of teeth of lower pharyngeal tooth plate (modified Fichberg, 2008 char. 107). CI = 0.500. RI = 0.850.

(0) Teeth not arranged in organized rows

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *H. absaberi*),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Lamontichthys* spp. and *Loricariichthys castaneus*.

(1) One row

Harttia absaberi, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) Two rows

Metaloricaria paucidens.

(3) More than three rows

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella*

depressa, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(-) Inapplicable (absent teeth in lower pharyngeal tooth plate)

Pseudotocinclus tietensis and *Harttiella crassicauda*.

171. Ventral surface of lower pharyngeal tooth plates (modified Rapp Py-Daniel, 1997 char. 83; modified Paixão, 2012 char. 48). CI = 0.667. RI = 0.875.

(0) Flat

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) With crest

Furcodontichthys novaesi, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula* and *Proloricaria prolixa*.

(2) Convex

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Planiloricaria cryptodon* and *Pseudohemiodon* spp..

172. Processes of lower pharyngeal tooth plates (modified Rapp Py-Daniel, 1997 char. 84). CI = 0.150. RI = 0.452.

(0) Present, in the anterior margin (Fig. 43A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *H. absaberi, H. dissidens, H. duriventris, Harttia* cf. *fowleri, H. garavelloi, H. gracilis, H. loricariformis, H. punctata, H. uatumensis* and *Harttia* sp. tapajós 1)** and *Cteniloricaria platystoma*.

(1) Present, in the posterior margin (Fig. 43B)

Harttia absaberi, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Present, on both margins (Fig. 43C)

Kronichthys heylandi, *Neoplecostomus microps* and *Pseudotocinclus tietensis*.

(3) Absent (Fig. 43D)

Hypostomus ancistroides, *Isbrueckerichthys duseni*, ***Harttia dissidens, H. duriventris, Harttia* cf. *fowleri, H. garavelloi, H. gracilis, H. loricariformis, H. punctata, H. uatumensis, Harttia* sp. tapajós 1,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

173. Lateral sides of lower pharyngeal tooth plates (modified Rapp Py-Daniel, 1997 char. 86). CI = 0.077. RI = 0.368.

(0) Covered with rakers with an ossified center

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi* and *H. garavelloi*),** *Apistoloricaria* sp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa* and *Rineloricaria lanceolata*.

(1) Covered with non-ossified rakers

Ancistrus multipinnis, *Neoplecostomus microps*, ***Harttia absaberi, H. garavelloi,*** *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Rineloricaria daraha*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

174. Molariform teeth in upper and lower pharyngeal tooth plates (modified Rapp Py-Daniel, 1997 char. 90; Fichberg, 2008 char. 111; Paixão, 2012 char. 49). CI = 0.333. RI = 0.800.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(1) Present

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Reganella depressa* and *Spatuloricaria evansii*.

175. Connection between lower pharyngeal tooth plates (or ceratobranchial 5) (Paixão, 2012 char. 45; modified Armbruster, 2004 char. 12). CI = 0.500. RI = 0.889.

(0) Absent (Fig. 41A e B)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(1) Present (Fig. 41C)

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp. and *Spatuloricaria evansii*.

Comment: When the connection between the lower pharyngeal tooth plates is absent, the ceratobranchials 5 are thin and there is no mesial connection between them, being clearly separated and presenting conic teeth. The presence of a connection has been described previously by Armbruster (2004), being observed in *Crossoloricaria* and *Loricaria*. According to the author, the ceratobranchials 5 are enlarged, thick, and sutured or held tightly together, and have molariform teeth. According to Armbruster (2004), powdered seeds were found in the digestive system of these two species, suggesting that these modifications in the pharyngeal plates are adaptations to granivory. Since the seeds found were crushed, apparently this feeding habitat does not aid in the dispersal of viable seeds.

176. Branchial rakers (modified Rapp Py-Daniel, 1997 char. 69). CI = 0.333. RI = 0.913.

(0) Short and few in number (Fig. 44A)

Astroblepus sp., *Lithogenes wahari*, *Neoplecostomus microps*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Long and very numerous (Fig. 44B)

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

Comment: Branchial rakers are short and few in number (state 0) when the space between one raker and another is wide, being equivalent to three or more rakers. Rakers are long and very numerous (state 1) when the space between one raker and another is reduced, being equivalent to one more raker. Ossification of the base of the rakers is related to the clearning and staining process and is therefore not included in the states. Ossified base occurs in both state 0 and state 1.

Pectoral girdle

177. Anteroventral margin of cleithrum (modified Rapp Py-Daniel, 1997 char. 140; modified Fichberg, 2008 char. 128). CI = 0.400. RI = 0.875.

(0) Curved, expanded anteriorly in the lateral region

Astroblepus sp., *Plesioptopoma curvidens*, *Farlowella oxyrryncha* and *Sturisoma robustum*.

(1) Almost straight

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp. and *Pterosturisoma* cf. *microps*.

(2) Curved, expanded anteriorly in the mesial region

Lithogenes wahari, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

178. Lateroanterior process of cleithrum (modified Rapp Py-Daniel, 1997 char. 141). CI = 0.429. RI = 0.000.

(0) Absent

Astroblepus sp., *Farlowella oxyrryncha* and *Sturisoma robustum*.

(1) Small

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(2) Large, anterior

Paraloricaria vetula, *Planiloricaria cryptodon* and *Pseudohemiodon* spp..

(3) Large, lateral

Reganella depressa.

179. Ventral abductor fossa (modified Rapp Py-Daniel, 1997 char. 146). CI = 0.667. RI = 0.000.

(0) Large opening with two different depths

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Only one depression, relatively deep and closed in itself

Pseudotocinclus tietensis and *Hemiodontichthys acipenserinus*.

(2) Completely closed fossa

Hypoptopoma inexpectata.

180. Symphysis of cleithrum (modified Rapp Py-Daniel, 1997 char. 143). CI = 0.133. RI = 0.350.

(0) Absent suture

Astroblepus sp., *Lithogenes wahari*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, ***Harttia* cf. *fowleri*, *Harttia* cf. *surinamensis*,** *Loricaria cataphracta*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Rineloricaria latirostris* and *Spatuloricaria evansii*.

(1) Partial suture

Ancistrus multipinnis, *Pseudotocinclus tietensis*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Planiloricaria cryptodon*, *Pseudoloricaria laeviuscula*, *Rineloricaria daraha*, *Rineloricaria lanceolata* and *Rineloricaria pentamaculata*.

(2) Complete suture

Hemipsilichthys nimius, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *Harttia* cf. *fowleri* and *Harttia* cf. *surinamensis*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Reganella depressa* and *Sturisoma robustum*.

181. Cleithral symphysis length versus coracoid symphysis length (modified Rapp Py-Daniel, 1997 char. 142; modified Paixão, 2012 char. 64). CI = 1.000. RI = 1.000.

(0) Equal or smaller

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Twice as big

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Reganella depressa*.

182. Symphysis of coracoid (modified Fichberg, 2008 char. 130). CI = 0.133. RI = 0.500.

(0) Totally connected

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi*, *H. dissidens*, *H. duriventris*, *H. guianensis*, *H. panara*, *H. rondoni*, *H. villasboas* and *Harttia* sp. tapajós 1),** *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Hemiodontichthys acipenserinus*, *Metaloricaria paucidens*,

Planiloricaria cryptodon, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Sturisoma robustum*.

(1) Extensively connected in the posterior region, and anterior region with small disconnected area

Ancistrus multipinnis, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, ***Harttia dissidens, H. duriventris, H. guianensis, H. panara, H. rondoni, H. villasboas*** **and** ***Harttia*** **sp. tapajós 1,** *Apistoloricaria* sp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(2) Totally disconnected

***Harttia absaberi*.**

183. Bony lamina at anterior margin of coracoid (modified Paixão, 2012 char. 65). CI = 0.167. RI = 0.783.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, **all species of** ***Harttia*** **(except** ***H. absaberi*****),** *Apistoloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Harttiella crassicauda* and *Sturisoma robustum*.

(1) Present, covering only the lateral edges of the fossa

Plesioptopoma curvidens, ***Harttia absaberi,*** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

184. Orientation of coracoid posterior process (modified Fichberg, 2008 char. 129). CI = 0.091. RI = 0.286.

(0) Inclined laterally, forming an angle greater than 15° in relation to the body axis

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Straight, oriented parallel in relation to the body axis (angle of 90°)

Lithogenes wahari, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

185. Relative length of coracoid posterior process in relation to inferior margin of coracoid (modified Rapp Py-Daniel, 1997 char. 145; Fichberg, 2008 char. 127). CI = 0.095. RI = 0.457.

(0) Posterior process of coracoid short, smaller than the length of the inferior margin of coracoid

Astroblepus sp., *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, ***Harttia absaberi,*** *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(1) Posterior process of coracoid long, greater than the inferior margin of coracoid

Lithogenes wahari, *Hemipsilichthys nimius*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi, H. gracilis, H. loricariformis, H. panara, H. uatumensis* and *Harttia* sp. tapajós 2),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Lamontichthys* spp., *Loricariichthys castaneus* and *Sturisoma robustum*.

(2) About the same size

Ancistrus multipinnis, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Plesioptopoma curvidens*, ***Harttia gracilis, H. loricariformis, H. panara, H. uatumensis* e *Harttia* sp. tapajós 2,** *Apistoloricaria* sp., *Harttiella crassicauda*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa* and *Spatuloricaria evansii*.

186. Pectoral skeleton (Rapp Py-Daniel, 1997 char. 147). CI = 0.500. RI = 0.000.

(0) Not exposed

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Exposed

Hypoptopoma inexpectata and *Pseudotocinclus tietensis*.

187. Number of pectoral-fin branched rays (modified Rapp Py-Daniel, 1997 char. 139; modified Fichberg, 2008 char. 132). CI = 0.600. RI = 0.000.

(0) 12

Astroblepus sp..

(1) 9

Lithogenes wahari.

(2) 7

Harttia leiopleura, *Lamontichthys* spp. and *Rineloricaria daraha*.

(2) 6

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. leiopleura*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*,

Loricariichthys castaneus, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

Pelvic girdle

188. Shape of pelvic girdle as a whole (ratio between length and width) (modified Fichberg, 2008 char. 118). CI = 0.143. RI = 0.556.

(0) Rectangular, expanded, much longer than wide

Astroblepus sp., *Hypostomus ancistroides*, *Kronichthys heylandi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Farlowella oxyrryncha*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa* and *Spatuloricaria evansii*.

(1) Rectangular, slightly expanded, longer than wide

Lithogenes wahari, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Pseudoloricaria laeviuscula*, *Reganella depressa* and *Sturisoma robustum*.

(2) Quadrangular, as wide as it is long

Hemipsilichthys nimius, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

Comment: The shape of the pelvic girdle is much longer than it is wide (state 1) when the length is approximately twice the width.

189. Internal anterior process of basipterygium (modified Rapp Py-Daniel, 1997 char. 150; modified Fichberg, 2008 char. 119). CI = 0.300. RI = 0.632.

(0) Processes tips with no contact between them

Astroblepus sp., *Lithogenes wahari*, *Lamontichthys* spp. and *Planiloricaria cryptodon*.

(1) Tips of the processes converge mesially and almost touch each other, connecting by a ligament, surrounding a large median fenestra

All species of *Harttia,* *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Processes connect almost completely, followed by a median fenestra

Ancistrus multipinnis, *Hypostomus ancistroides*, *Limatulichthys griseus*, *Loricaria lentiginosa*, *Metaloricaria paucidens* and *Pseudoloricaria laeviuscula*.

(3) Processes connect almost completely, fused anteriorly and not followed by a median fenestra

Hemipsilichthys nimius, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp. and *Pseudohemiodon* spp..

190. Orientation of basipterygium internal anterior process (Rapp Py-Daniel, 1997 char. 152; Fichberg, 2008 char. 121). CI = 0.333. RI = 0.867.

(0) Anteriorly

Astroblepus sp., *Lithogenes wahari*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Planiloricaria cryptodon* and *Pseudohemiodon* spp..

(1) Mesially

Hemipsilichthys nimius, **all species of *Harttia,*** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

191. External anterior process of basipterygium (modified Rapp Py-Daniel, 1997 char. 151; modified Fichberg, 2008 char. 120; modified Paixão, 2012 char. 66). CI = 0.333. RI = 0.571.

(0) Tips converge mesially and almost touch each other, being connected in the midline by a ligament

Astroblepus sp., *Isbrueckerichthys duseni* and *Kronichthys heylandi*.

(1) Tips converge mesially and are fused in the midline, forming a pair of anterior foramen

Neoplecostomus microps, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata* and *Plesioptopoma curvidens*.

(2) Present, but far from each other

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(3) Absent

Lithogenes wahari, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Planiloricaria cryptodon*, *Proloricaria prolixa* and *Pseudohemiodon* spp..

192. Width of laminar expansions of external anterior process of basipterygium (modified Rapp Py-Daniel, 1997 char. 155; modified Fichberg, 2008 char. 125). CI = 0.400. RI = 0.842.

(0) Dorsal wider than ventral

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pareiorhina rudolphi* and *Plesioptopoma curvidens*.

(1) Dorsal and ventral with similar width

All species of *Harttia*, *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Dorsal narrower than ventral

Kronichthys heylandi, *Hypoptopoma inexpectata*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(-) Inapplicable (absent external anterior process of basipterygium)

Lithogenes wahari, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Planiloricaria cryptodon*, *Proloricaria prolixa* and *Pseudohemiodon* spp..

193. Size of external anterior process of basipterygium in relation to internal anterior process (modified Paixão, 2012 char. 68). CI = 0.400. RI = 0.500.

(0) Greater

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Equal

Furcodontichthys novaesi, *Hemiodontichthys acipenserinus*, *Loricariichthys castaneus*, *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria lanceolata* and *Sturisoma robustum*.

(2) Smaller

Hypostomus ancistroides.

(-) Inapplicable (absent external anterior process of basipterygium)

Lithogenes wahari, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Planiloricaria cryptodon*, *Proloricaria prolixa* and *Pseudohemiodon* spp..

194. Ventrolateral process (modified Rapp Py-Daniel, 1997 char. 158). CI = 0.231. RI = 0.643.

(0) Conspicuous, laterally curved

Astroblepus sp., *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Proloricaria prolixa* and *Reganella depressa*.

(1) Conspicuous, ventrally expanded

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Paraloricaria vetula*, *Pseudoloricaria laeviuscula*, *Rineloricaria latirostris* and *Spatuloricaria evansii*.

(2) Inconspicuous, small elevation

Lithogenes wahari, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Pseudohemiodon* spp., *Rineloricaria lanceolata* and *Rineloricaria pentamaculata*.

(3) Absent

All species of *Harttia*, *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha* and *Sturisoma robustum*.

195. Size and shape of lateropterygium (modified Rapp Py-Daniel, 1997 char. 157; modified Fichberg, 2008 char. 124; modified Paixão, 2012 char. 70). CI = 0.400. RI = 0.769.

(0) Sheet shape

Astroblepus sp. and *Lithogenes wahari*.

(1) Long, nail-shaped and articulated to the basipterygium by ligaments

Ancistrus multipinnis, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis* and *Harttiella crassicauda*.

(2) Short, nail-shaped and articulated to the basipterygium by ligaments

Hemipsilichthys nimius, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(3) Very reduced, elliptical, freely soaked in soft tissue

Brochiloricaria sp., *Loricaria cataphracta*, *Planiloricaria cryptodon* and *Spatuloricaria evansii*.

(4) Absent

Apistoloricaria sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Reganella depressa*.

196. Arrector ventralis flaps (modified Rapp Py-Daniel, 1997 char. 156). CI = 0.375. RI = 0.545.

(0) Absent or rudimentary (Fig. 45A)

Astroblepus sp., *Lithogenes wahari*, *Isbrueckerichthys duseni*, *Kronichthys heylandi* and *Neoplecostomus microps*.

(1) Conspicuous crests, anteromesially oriented, connected in the midline, forming an inverted V (Fig. 45B)

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Pareiorhina rudolphi*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Very enlarged and folded crests, covering the main body of the basipterygium (Fig. 45C)

Furcodontichthys novaesi, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon* and *Proloricaria prolixa*.

(3) Conspicuous crests, mesially oriented, meeting at the midline, forming a single transverse crest (Fig. 45D)

Hypoptopoma inexpectata, *Plesioptopoma curvidens* and *Pseudotocinclus tietensis*.

197. Type of connection of basipterygium symphysis (modified Rapp Py-Daniel, 1997 char. 148; modified Fichberg, 2008 char. 115). CI = 0.250. RI = 0.842.

(0) Presence of a very long cartilage, with reduced anterior and posterior bone contact

Astroblepus sp., *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata* and *Rineloricaria pentamaculata*.

(1) Presence of a long cartilage, with large anterior and posterior bone contact

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps*, *Rineloricaria latirostris*, *Spatuloricaria evansii* and *Sturisoma robustum*.

Comment: The anterior and posterior bone contact is reduced (state 0) when they correspond to an area smaller than half the size of the cartilage. Bone contact is considered large (state 1) when the area is greater than half the size of the cartilage.

198. Symphysis of basipterygium: type of bone contact (modified Rapp Py-Daniel, 1997 char. 149; modified Fichberg, 2008 char. 116). CI = 0.500. RI = 0.000.

(0) Suture only in the anterior region of the cartilage

Astroblepus sp., *Pterosturisoma* cf. *microps* and *Reganella depressa*.

(1) Suture anterior and posterior to the cartilage

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Suture only in the posterior region of the cartilage

Loricaria lentiginosa.

199. Shape of cartilage in symphysis of basipterigyum (modified Fichberg, 2008 char. 117). CI = 0.143. RI = 0.786.

(0) Thin rectangle

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Wide rectangle

Ancistrus multipinnis, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Plesioptopoma curvidens*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps*, *Rineloricaria latirostris* and *Sturisoma robustum*.

200. Shape of posterior process of basipterigyum (modified Rapp Py-Daniel, 1997 char. 153; modified Fichberg, 2008 char. 122). CI = 0.400. RI = 0.500.

(0) Pointed

Astroblepus sp..

(1) Rounded or broad lanceolate

Lithogenes wahari, *Hemipsilichthys nimius*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*,

Rineloricaria lanceolata, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Thin lanceolate

Ancistrus multipinnis, *Farlowella oxyrryncha*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula* and *Proloricaria prolixa*.

201. Relative size of basipterygium processes (modified Rapp Py-Daniel, 1997 char. 154; Fichberg, 2008 char. 123). CI = 0.200. RI = 0.385.

(0) Anterior process shorter than the posterior process

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Pseudoloricaria laeviuscula*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Spatuloricaria evansii*.

(1) Anterior process slightly longer or equal to the posterior process

Lithogenes wahari, *Lamontichthys* spp., *Limatulichthys griseus*, *Pterosturisoma* cf. *microps*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(2) Anterior process longer than the posterior process

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp. and *Reganella depressa*.

202. Basipterygium muscular fossa (modified Rapp Py-Daniel, 1997 char. 159). CI = --. RI = --.

(0) Compact or with small and evenly distributed perforations

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys*

novaesi, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Bone like a thin sheet, largely trabeculated, with a large foramen posteriorly

Pseudohemiodon spp..

203. Number of pelvic-fin branched rays (modified Fichberg, 2008 char. 126). CI = 0.500. RI = 0.000.

(0) 4

Astroblepus sp. and *Farlowella oxyrryncha*.

(1) 5

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

Dorsal, anal, adipose and caudal fins

204. Number of dorsal-fin branched rays (modified Fichberg, 2008 char. 42). CI = 0.667. RI = 0.500.

(0) 6

Astroblepus sp., *Lithogenes wahari* and *Farlowella oxyrryncha*.

(1) 7

Ancistrus multipinnis, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) 8

Hemipsilichthys nimius.

205. First element of dorsal fin (modified Rapp Py-Daniel, 1997 char. 114; Fichberg, 2008 char. 37). CI = 0.133. RI = 0.536.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Isbrueckerichthys duseni*, *Hypoptopoma inexpectata*, ***Harttia carvalhoi, H. garavelloi, H. guianensis, H. intermontana, H. kronei, H. leiopleura, H. loricariformis, H. novalimensis, H. torrenticola, H. trombetensis, H. uatumensis, Harttia* sp. tapajós 1,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa* and *Spatuloricaria evansii*.

(1) Present, as a small disjointed plate

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia absaberi, H. dissidens, H. duriventris, Harttia* cf. *fowleri, H. gracilis, H. longipinna, H. panara, H. punctata, H. rondoni, Harttia* cf. *surinamensis, H. villasboas, Harttia* sp. São Roque, *Harttia* sp. tapajós 2,** *Cteniloricaria platystoma*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(2) Present, as a plate articulated to the pterygiophore

Hypostomus ancistroides.

206. Type of articulation of dorsal spine (second dorsal-fin ray) (modified Rapp Py-Daniel, 1997 char. 115). CI = 0.125. RI = 0.759.

(0) Condyle

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi, Harttia* cf. *fowleri, H. loricariformis, H. novalimensis, H. rondoni, Harttia* cf. *surinamensis* and *H. torrenticola*),** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp. and *Rineloricaria latirostris*.

(1) Ring-shaped bone structure

Harttia absaberi, Harttia* cf. *fowleri, H. loricariformis, H. novalimensis, H. rondoni, Harttia* cf. *surinamensis, H. torrenticola, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

207. Number of dorsal-fin pterygiophores (modified Rapp Py-Daniel, 1997 char. 116). CI = 0.667. RI = 0.000.

(0) 7

Astroblepus sp. and *Farlowella oxyrryncha*.

(1) 8

Lithogenes wahari, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) 9

Hemipsilichthys nimius.

208. Extension of contact between adjacent pterygiophores of dorsal fin (modified Rapp Py-Daniel, 1997 char. 117). CI = 0.250. RI = 0.609.

(0) All pterygiophores partially separated

Astroblepus sp., *Isbrueckerichthys duseni*, *Neoplecostomus microps* and *Harttiella crassicauda*.

(1) First and second in complete contact, the others partially separated

Lithogenes wahari, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma* and *Farlowella oxyrryncha*.

(2) Restricted contact only between second and third pterygiophores, all others in complete contact

Hemipsilichthys nimius, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(3) Complete contact between all pterygiophores

Furcodontichthys novaesi, *Lamontichthys* spp., *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

209. Orientation of lateral processes of second pterygiophore of dorsal fin (modified Rapp Py-Daniel, 1997 char. 118). CI = 0.143. RI = 0.429.

(0) Straight, laterally directed

Astroblepus sp., *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, ***Harttia intermontana, H. longipinna, H. torrenticola,*** *Farlowella oxyrryncha* and *Rineloricaria daraha*.

(1) Inclined, oblique, anteriorly directed

Lithogenes wahari, *Hemipsilichthys nimius*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. intermontana, H. longipinna* and *H. torrenticola*),** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella*

crassicauda, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) Strongly curved, oriented dorso-anteriorly

Apistoloricaria sp., *Crossoloricaria* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

210. Connecting bone (modified Rapp Py-Daniel, 1997 char. 119). CI = 0.250. RI = 0.550.

(0) Contacting the processes of the second pterygiophore of dorsal fin

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia* (except *H. absaberi*),** *Cteniloricaria platystoma*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(1) Contacting the processes of the first pterygiophore of dorsal fin

Neoplecostomus microps, *Pareiorhina rudolphi*, *Pseudotocinclus tietensis*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Spatuloricaria evansii*.

(2) No contact with pterygiophores

Harttia absaberi, *Limatulichthys griseus*, *Pterosturisoma* cf. *microps*, *Reganella depressa* and *Sturisoma robustum*.

(3) Absent

Farlowella oxyrryncha.

211. Number of anal-fin branched rays (modified Fichberg, 2008 char. 43). CI = 1.000. RI = 1.000.

(0) 5

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) 4

Ancistrus multipinnis and *Hypostomus ancistroides*.

212. Number of anal-fin pterygiophores (modified Rapp Py-Daniel, 1997 char. 121). CI = 0.400. RI = 0.400.

(0) 6 or more

Astroblepus sp. and *Lithogenes wahari*.

(1) 5

Hemipsilichthys nimius, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. leiopleura*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) 4

Ancistrus multipinnis, *Hypostomus ancistroides*, ***Harttia leiopleura,*** *Farlowella oxyrryncha* and *Metaloricaria paucidens*.

213. Extension of contact between adjacent pterygiophores of anal fin (modified Rapp Py-Daniel, 1997 char. 122). CI = 0.250. RI = 0.143.

(0) Elongated and well separated from each other

Astroblepus sp., *Lithogenes wahari*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi* and *Harttiella crassicauda*.

(1) Long, almost in contact with each other

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Short, almost in contact with each other

Farlowella oxyrryncha, *Hemiodontichthys acipenserinus* and *Metaloricaria paucidens*.

214. Articulation of first pterygiophore of anal fin with vertebral column (modified Paixão, 2012 char. 71). CI = 0.417. RI = 0.750.

(0) Beyond the 15th center

Astroblepus sp., *Lithogenes wahari* and *Kronichthys heylandi*.

(1) In the 14th

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Pseudotocinclus tietensis*, *Harttiella crassicauda* and *Planiloricaria cryptodon*.

(2) In the 13th

Plesioptopoma curvidens, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(3) In the 12th

Hypoptopoma inexpectata, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa*,

Pseudohemiodon spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata* and *Spatuloricaria evansii*.

(4) In the 11th

Hemiodontichthys acipenserinus, *Limatulichthys griseus*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(5) In the 10th

Furcodontichthys novaesi.

215. Adipose fin (Rapp Py-Daniel, 1997 char. 123; modified Fichberg, 2008 char. 46; Paixão, 2012 char. 76). CI = 0.250. RI = 0.500.

(0) Absent

Astroblepus sp., *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Present

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi* and *Neoplecostomus microps*.

216. Length of the second preural centrum and caudal skeleton (modified Rapp Py-Daniel, 1997 char. 136). CI = 0.125. RI = 0.741.

(0) Second preural centrum much shorter than caudal skeleton

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi, H.***

***carvalhoi, H. gracilis, H. intermontana, H. novalimensis* and *Harttia* sp. São Roque),** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Second preural centrum about the same size or slightly larger than caudal skeleton

***Harttia absaberi, H. carvalhoi, H. gracilis, H. intermontana, H. novalimensis, Harttia* sp. São Roque,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

217. Apophyses of second preural centrum (modified Rapp Py-Daniel, 1997 char. 130; modified Paixão, 2012 char. 75). CI = 0.333. RI = 0.800.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Reganella depressa* and *Sturisoma robustum*.

(1) Single

Ancistrus multipinnis, *Hypostomus ancistroides* and *Pterosturisoma* cf. *microps*.

(2) Double

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

218. Neural and hemal spines of second preural center (modified Rapp Py-Daniel, 1997 char. 133). CI = 1.000. RI = 1.000.

(0) Expansion large, soft and continuous dorsally and ventrally

Astroblepus sp. and *Lithogenes wahari*.

(1) Large and completely expanded dorsally and ventrally, showing a conspicuous angle at the anterolateral corner, anterior border of second preural centrum about as deep as posterior end of hypural plates

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens* and *Pseudotocinclus tietensis*.

(2) Slightly expanded dorsal and ventrally, anterior surface of second preural centrum much shallower than posterior end of hypural plates

All species of *Harttia*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

219. Length of neural spine of second preural centrum (modified Rapp Py-Daniel, 1997 char. 134). CI = 0.500. RI = 0.917.

(0) Long, almost reaching the posterodorsal corner of the hypural plate

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis* and *Metaloricaria paucidens*.

(1) Short, not reaching half up the hypural plate

All species of *Harttia*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

220. Hemal spine of second preural centrum (modified Rapp Py-Daniel, 1997 char. 135). CI = 0.333. RI = 0.840.

(0) Short, without uncinate process

Astroblepus sp., ***Harttia absaberi,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Extremely developed, with uncinate process with cartilaginous tip

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. absaberi*),** *Cteniloricaria platystoma* and *Harttiella crassicauda*.

(2) Well developed, but without uncinate process

Metaloricaria paucidens, *Proloricaria prolixa*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

221. Shape of hypural plates (modified Rapp Py-Daniel, 1997 char. 125). CI = 0.133. RI = 0.350.

(0) Asymmetrical, lower plate larger than upper

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, ***Harttia guianensis, H. leiopleura, H. loricariformis, H. panara, Harttia* sp. São Roque, *Harttia* sp. tapajós 1,** *Apistoloricaria* sp., *Planiloricaria cryptodon*, *Rineloricaria daraha*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Symmetrical, both plates about the same size

Plesioptopoma curvidens, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. guianensis, H. leiopleura, H. loricariformis, H. panara, Harttia* sp. São Roque and *Harttia* sp. tapajós 1),** *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria*

lentiginosa, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Sturisoma robustum*.

(2) Asymmetrical, upper plate larger than lower

Metaloricaria paucidens.

222. Posterior end of hypural plates (modified Rapp Py-Daniel, 1997 char. 126). CI = 0.083. RI = 0.313.

(0) Deep notch with caudal fenestra

Astroblepus sp., *Lithogenes wahari*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, ***Harttia carvalhoi, H. gracilis, H. guianensis, H. intermontana, H. kronei, H. leiopleura, H. longipinna, H. loricariformis, H. novalimensis, H. punctata, Harttia* cf. *surinamensis, H. trombetensis, Harttia* sp. São Roque,** *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Deep notch without fenestra

Hypostomus ancistroides, *Kronichthys heylandi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, ***Harttia absaberi, H. dissidens, H. duriventris, Harttia* cf. *fowleri, H. garavelloi, H. panara, H. rondoni, H. torrenticola, H. uatumensis, H. villasboas, Harttia* sp. tapajós 1, *Harttia* sp. tapajós 2,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Planiloricaria cryptodon*, *Rineloricaria daraha*, *Rineloricaria lanceolata* and *Spatuloricaria evansii*.

(2) Shallow or absent notch

Hemipsilichthys nimius, *Pseudotocinclus tietensis*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

223. Dorsal and ventral crests of hypural (modified Rapp Py-Daniel, 1997 char. 128). CI = --. RI = --.

(0) Absent

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Present, only the dorsal

Lithogenes wahari.

224. Shape of hypurapophysis (modified Rapp Py-Daniel, 1997 char. 129). CI = --. RI = --.

(0) Low

Astroblepus sp..

(1) Large, wing-shaped

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

225. Epural (Rapp Py-Daniel, 1997 char. 127; modified Paixão, 2012 char. 74). CI = 0.400. RI = 0.909.

(0) Large, well developed

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma*

inexpectata, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Harttiella crassicauda* and *Metaloricaria paucidens*.

(1) Very reduced

All species of *Harttia*, *Cteniloricaria platystoma*, *Lamontichthys* spp., *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Absent (fused?)

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

226. Length of lateral line (modified Rapp Py-Daniel, 1997 char. 138; modified Paixão, 2012 char. 58) . CI = 0.250. RI = 0.600.

(0) Complete, last canal of the last lateral plate not ending at the supracaudal plates

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Kronichthys heylandi*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi, H. leiopleura, H. longipinna, H. novalimensis, Harttia* sp. São Roque** and *Harttiella crassicauda*.

(1) Short, canals ending 1 to 4 plates before the supracaudal plates

Hypostomus ancistroides, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata* and *Plesioptopoma curvidens*.

(2) Long, last canal of the lateral line inside the supracaudal plate

Lithogenes wahari, **all species of *Harttia* (except *H. carvalhoi, H. leiopleura, H. longipinna, H. novalimensis* and *Harttia* sp. São Roque),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

227. Number of supracaudal plates (Rapp Py-Daniel, 1997 char. 137; Fichberg, 2008 char. 45). CI = 0.250. RI = 0.778.

(0) More than 3

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. carvalhoi, H. gracilis, H. intermontana, H. longipinna, H. torrenticola* and *Harttia* sp. São Roque),** *Cteniloricaria platystoma*, *Loricaria cataphracta*, *Metaloricaria paucidens* and *Sturisoma robustum*.

(1) 3

***Harttia carvalhoi, H. gracilis, H. intermontana, H. torrenticola, Harttia* sp. São Roque,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(2) 2

Harttia longipinna and *Harttiella crassicauda*.

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

228. Size of supracaudal plates (modified Rapp Py-Daniel, 1997 char. 137). CI = 1.000. RI = 1.000.

(0) Short

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens* and *Pseudotocinclus tietensis*.

(1) Elongated

All species of *Harttia,* *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

229. Number of caudal-fin branched rays (modified Rapp Py-Daniel, 1997 char. 124; modified Fichberg, 2008 char. 44; modified Paixão, 2012 char. 72). CI = 0.750. RI = 0.967.

(0) 14 or more

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens* and *Pseudotocinclus tietensis*.

(1) 12

All species of *Harttia,* *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) 11

Astroblepus sp. and *Farlowella oxyrryncha*.

(3) 10

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

External morphology

230. Shape of head (margin in dorsal view, between the two opercula) (modified Fichberg, 2008 char. 134). CI = 0.375. RI = 0.722.

(0) Rounded

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps*, *Rineloricaria lanceolata* and *Rineloricaria latirostris*.

(1) Triangular

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Rineloricaria daraha*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(2) Very pointed and long

Farlowella oxyrryncha, *Hemiodontichthys acipenserinus*, *Reganella depressa* and *Sturisoma robustum*.

(3) Half of a hexagon

Lithogenes wahari.

231. Covering of anterior extremity of mesethmoid (modified Rapp Py-Daniel, 1997 char. 8; Fichberg, 2008 char. 6). CI = 0.143. RI = 0.647.

(0) Skin

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Rineloricaria daraha*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Plates

Hypoptopoma inexpectata, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria lanceolata* and *Sturisoma robustum*.

232. Shape of nasal cavity opening (modified Fichberg, 2008 char. 138). CI = 0.091. RI = 0.286.

(0) Rounded

Astroblepus sp., *Ancistrus multipinnis*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, ***Harttia carvalhoi, H. duriventris, H. garavelloi, H. gracilis, H. intermontana, H. leiopleura, H. longipinna, H. novalimensis, H. punctata, H. villasboas, Harttia* sp. São Roque, *Harttia* sp. tapajós 1,** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Proloricaria prolixa*, *Rineloricaria daraha*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(1) Elliptical (perpendicular to the head axis)

Lithogenes wahari, *Hemipsilichthys nimius*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia absaberi, H. dissidens, Harttia* cf. *fowleri, H. guianensis, H. kronei, H. loricariformis, H. panara, H. rondoni, Harttia* cf. *surinamensis, H. torrenticola, H. trombetensis, H. uatumensis, Harttia* sp. tapajós 2,** *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria lanceolata* and *Spatuloricaria evansii*.

(2) Triangular

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Limatulichthys griseus*, *Pseudohemiodon* spp. and *Reganella depressa*.

233. Shape of orbit contour (Fichberg, 2008 char. 135). CI = 0.200. RI = 0.692.

(0) Rounded

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria*

paucidens, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(1) Elliptical

Brochiloricaria sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha* and *Spatuloricaria evansii*.

234. Interorbital distance (modified Fichberg, 2008 char. 136). CI = 0.111. RI = 0.636.

(0) Small (smaller than twice the orbital diameter)

Astroblepus sp., *Hemipsilichthys nimius*, **all species of *Harttia* (except *H. intermontana, H. kronei, H. leiopleura, H. novalimensis, H. panara, H. torrenticola, H. villasboas* and *Harttia* sp. São Roque),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Large (greater than or equal to twice the orbital diameter)

Lithogenes wahari, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia intermontana, H. kronei, H. leiopleura, H. novalimensis, H. panara, H. torrenticola, H. villasboas, Harttia* sp. São Roque,** *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

235. Ornamentation of dorsal surface of head (parieto-supraoccipital, frontal and nasal) (Fichberg, 2008 char. 180). CI = 0.133. RI = 0.519.

(0) Absent, head without crests or recesses and notches

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. dissidens, Harttia* cf. *fowleri, H. garavelloi, H. guianensis, H. panara, H. rondoni, Harttia* cf. *surinamensis, H. torrenticola* and *H.***

***villasboas*),** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Planiloricaria cryptodon*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Present, with well defined crests, adorned by odontodes and deep notches

Brochiloricaria sp., *Hemiodontichthys acipenserinus*, *Metaloricaria paucidens*, *Pseudohemiodon* spp. and *Rineloricaria latirostris*.

(2) Present, with shallow crests and notches

***Harttia dissidens*, *Harttia* cf. *fowleri*, *H. garavelloi*, *H. guianensis*, *H. panara*, *H. rondoni*, *Harttia* cf. *surinamensis*, *H. torrenticola*, *H. villasboas*,** *Apistoloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

236. Odontodes grouped in rows along nasal, frontal, parieto-supraoccipital and predorsal plates (modified Fichberg, 2008 char. 19). CI = 0.500. RI = 0.000.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Present, being three well defined rows

Hemiodontichthys acipenserinus and *Proloricaria prolixa*.

237. Pigmentation pattern around epiphyseal pore (modified Fichberg, 2008 char. 137). CI = 0.333. RI = 0.600.

(0) Non pigmented

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Pigmented

Hemiodontichthys acipenserinus, *Loricaria lentiginosa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

238. Space among sphenotic, pterotic and frontal. CI = 0.500. RI = 0.000.

(0) Absent (Fig. 46A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *Harttia* tapajós 1),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Present (Fig. 46B)

***Harttia* tapajós 1** and *Loricaria lentiginosa*.

Comment: In the dorsal region of the skull, there is a suture line that delimits the contact among sphenotic, pterotic and frontal bones. In *Harttia* tapajós 1 and *Loricaria lentiginosa*, the suture line is interrupted, giving rise to a gap/hole among these bones (state 1).

239. Supraoccipital carinae (modified Rapp Py-Daniel, 1997 char. 187). CI = 0.286. RI = 0.762.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula* and *Sturisoma robustum*.

(1) One carina

Hypostomus ancistroides, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis* and *Spatuloricaria evansii*.

(2) Two carinae

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

240. Lips (modified Rapp Py-Daniel, 1997 char. 176). CI = 0.125. RI = 0.767.

(0) Fleshy (Fig. 47A)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, ***Harttia garavelloi, H. leiopleura, H. punctata,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Bony plates over the lips (Fig. 47B and C)

Hypostomus ancistroides, *Pareiorhina rudolphi*, *Pseudotocinclus tietensis*, **all species of *Harttia* (except *H. garavelloi, H. leiopleura* and *H. punctata*),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

Comment: In this case, the lip should be bounded ventrally. In *Harttia*, *Cteniloricaria* and *Harttiella* the plates are at the beginning of the upper lip, close to the snout. In the other genera with state 1, the plates are in the mesial region of the upper lip.

241. Upper lip papillae (Rapp Py-Daniel, 1997 char. 181). CI = 0.667. RI = 0.889.

(0) Absent

Astroblepus sp. and *Loricariichthys castaneus*.

(1) Small, rounded

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(2) Long, filamentous

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa* and *Pseudohemiodon* spp..

242. Arrangement of papillae on lower lips (modified Fichberg, 2008 char. 141). CI = 0.667. RI = 0.882.

(0) Arranged in concentric rows around the oral cavity or evenly distributed with nearly equal sizes

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps*, *Reganella depressa* and *Sturisoma robustum*.

(1) Randomly arranged

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*,

Metaloricaria paucidens, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp. and *Pseudoloricaria laeviuscula*.

(2) Varying between large and small papillae, interspersed in an approximately organized manner
Rineloricaria daraha, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(3) Arranged in rows approximately transverse to the axis of the oral cavity
Planiloricaria cryptodon.

(4) Forming ripples at the edge of the lip
Lithogenes wahari.

243. Lower lip border (modified Rapp Py-Daniel, 1997 char. 177). CI = 0.286. RI = 0.762.

(0) Flat
Astroblepus sp., *Lithogenes wahari*, *Isbrueckerichthys duseni*, *Pareiorhina rudolphi*, *Furcodontichthys novaesi*, *Limatulichthys griseus*, *Loricariichthys castaneus* and *Pseudoloricaria laeviuscula*.

(1) With papillae
Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) With fringes
Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

244. Maxillary barbel (modified Rapp Py-Daniel, 1997 char. 179). CI = 0.333. RI = 0.800.

(0) Simple

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Bifurcate or fringed

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp. and *Pseudoloricaria laeviuscula*.

245. Relative size of maxillary barbel (modified Rapp Py-Daniel, 1997 char. 178; modified Fichberg, 2008 char. 139). CI = 0.333. RI = 0.800.

(0) Short, not reaching the length of the lower lip

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Long, reaching or exceeding the length of the lower lip

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp. and *Pseudoloricaria laeviuscula*.

246. Number of premaxillary teeth (modified Rapp Py-Daniel, 1997 char. 183). CI = 0.273. RI = 0.750.

(0) More than 50

Hemipsilichthys nimius, *Ancistrus multipinnis*, **all species of *Harttia*,** *Cteniloricaria platystoma* and *Lamontichthys* spp..

(1) 7-40

Astroblepus sp., *Lithogenes wahari*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria latirostris* and *Sturisoma robustum*.

(2) 1-6

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(3) Absent

Hemiodontichthys acipenserinus, *Planiloricaria cryptodon* and *Reganella depressa*.

247. Cusps of premaxillary teeth (modified Rapp Py-Daniel, 1997 char. 184; modified Fichberg, 2008 char. 143). CI = 0.750. RI = 0.750.

(0) Asymmetrical, elongated, bifid

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Asymmetrical, rounded, bifid

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp. and *Pseudohemiodon* spp..

(2) Symmetrical, elongated, equal cusps

Furcodontichthys novaesi.

(3) Unicuspid

Paraloricaria vetula and *Proloricaria prolixa*.

(-) Inapplicable

Hemiodontichthys acipenserinus, *Planiloricaria cryptodon* and *Reganella depressa*.

[0, 1] *Astroblepus* sp..

248. Number of dentary teeth (modified Fichberg, 2008 char. 169). CI = 0.250. RI = 0.571.

(0) Up to 7

Lithogenes wahari, *Brochiloricaria* sp., *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) 8-10

Neoplecostomus microps, *Apistoloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Loricaria cataphracta* and *Loricaria lentiginosa*.

(2) 10-20

Hypoptopoma inexpectata, *Pseudotocinclus tietensis*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Metaloricaria paucidens*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Reganella depressa*.

(3) More than 20

Astroblepus sp., *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, **all species of *Harttia,*** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(-) Inapplicable (absent dentary teeth)

Loricariichthys castaneus.

249. Size of premaxillary teeth in relation to dentary teeth (modified Fichberg, 2008 char. 170). CI = 0.231. RI = 0.444.

(0) Premaxillary teeth reach the same size as the dentary teeth

Astroblepus sp., *Hemipsilichthys nimius*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Premaxillary teeth smaller than dentary teeth

Lithogenes wahari, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Hypoptopoma inexpectata*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Limatulichthys griseus*, *Metaloricaria paucidens*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(2) Premaxillary teeth larger than dentary teeth

Crossoloricaria spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Pseudoloricaria laeviuscula* and *Spatuloricaria evansii*.

(3) Absent premaxillary teeth

Hemiodontichthys acipenserinus, *Planiloricaria cryptodon* and *Reganella depressa*.

(-) Inapplicable

Loricariichthys castaneus.

250. Curvature of dentary teeth (modified Fichberg, 2008 char. 144). CI = 0.500. RI = 0.952.

(0) Very slight curvature or no apparent curvature

Astroblepus sp., *Lithogenes wahari*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Curved around 90° into the oral cavity

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(-) Inapplicable

Loricariichthys castaneus.

251. Crown shape of teeth (modified Paixão, 2012 char. 18). CI = 1.000. RI = 1.000.

(0) Distal half flattened laterally and proximal half flattened dorsoventrally

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) With canal on the inner face

Neoplecostomus microps.

(2) Rounded

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

252. Angle of inclination of cusp of teeth (modified Paixão, 2012 char. 19). CI = 0.500. RI = 0.952.

(0) Greater than 90° with the major axis of the tooth

Astroblepus sp., *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria*

prolixa, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Approximately 90° with the major axis of the tooth

Lithogenes wahari, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

253. Papillae of oral cavity (floor/region posterior to premaxilla, covering autopalatine) (modified Rapp Py-Daniel, 1997 char. 182; modified Fichberg, 2008 char. 142). CI = 0.455. RI = 0.667.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Hemiodontichthys acipenserinus*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(1) Unique, large, wide

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(2) Tuff, several long filaments

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Proloricaria prolixa* and *Pseudohemiodon* spp..

(3) Double, large, wide

Isbrueckerichthys duseni and *Furcodontichthys novaesi*.

(4) Triple, being the inner one larger and the lateral smaller

Limatulichthys griseus.

(5) Double, diagonal

Spatuloricaria evansii.

254. Internal maxillary barbel (modified Rapp Py-Daniel, 1997 char. 180). CI = 0.500. RI = 0.000.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(1) Present

Metaloricaria paucidens and *Spatuloricaria evansii*.

255. Dermal plates. CI = 1.000. RI = 1.000.

(0) Absent

Astroblepus sp. and *Lithogenes wahari*.

(1) Present

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

256. Shape of predorsal plates (modified Fichberg, 2008 char. 150). CI = 0.333. RI = 0.714.

(0) Semitrapezoidal without keel

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Metaloricaria paucidens*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha* and *Sturisoma robustum*.

(1) Semitrapezoidal with keel

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(2) Trapezoidal with keel

Hemiodontichthys acipenserinus.

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

257. Number of plate series at height of dorsal fin (modified Fichberg, 2008 char. 167). CI = 0.250. RI = 0.833.

(0) 5 rows of plates

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(1) 4 rows of plates

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria*

lentiginosa, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria lanceolata* and *Spatuloricaria evansii*.

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

258. Keels on dorsal plates (modified Fichberg, 2008 char. 151). CI = 0.125. RI = 0.364.

(0) Absent

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(1) Present

Hypostomus ancistroides, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Apistoloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Proloricaria prolixa* and *Spatuloricaria evansii*.

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

259. Dermal plates arrangement (Fichberg, 2008 char. 175). CI = 1.000. RI = 1.000.

(0) Non-imbricated

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia,*** *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps* and *Sturisoma robustum*.

(1) Imbricated

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

260. Keels on median and midventral plates. CI = 0.250. RI = 0.875.

(0) Absent

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda* and *Lamontichthys* spp..

(1) Present

Kronichthys heylandi, *Pareiorhina rudolphi*, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

261. Arrangement of odontodes on plates covering the body (Fichberg, 2008 char. 160). CI = 0.250. RI = 0.000.

(0) Random arrangement

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp.,

Cteniloricaria platystoma, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Arranged in well defined longitudinal rows

Hemiodontichthys acipenserinus, *Loricaria cataphracta*, *Proloricaria prolixa* and *Pseudohemiodon* spp..

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

262. Plates in abdominal region (modified app Py-Daniel, 1997 char. 189; modified Fichberg, 2008 char. 155). CI = 0.100. RI = 0.471.

(0) Absent

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, ***Harttia carvalhoi, H. garavelloi, H. gracilis, H. guianensis, H. intermontana, H. kronei, H. leiopleura, H. loricariformis, H. novalimensis, H. torrenticola, H. trombetensis, H. uatumensis, Harttia* sp. São Roque,** *Furcodontichthys novaesi* and *Harttiella crassicauda*.

(1) Present, partial cover

Isbrueckerichthys duseni, ***Harttia longipinna, H. punctata, H. rondoni,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Rineloricaria daraha* and *Spatuloricaria evansii*.

(2) Present, complete cover

Hypostomus ancistroides, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Pseudotocinclus tietensis*, ***Harttia absaberi, H. dissidens, H. duriventris, Harttia* cf. *fowleri, H. panara, Harttia* cf. *surinamensis, H. villasboas, Harttia* sp. tapajós 1, *Harttia* sp. tapajós 2,** *Farlowella oxyrryncha*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

263. Shape of abdominal plates (modified Rapp Py-Daniel, 1997 char. 190). CI = 0.364. RI = 0.125.

(0) Patches of odontodes

Isbrueckerichthys duseni, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Proloricaria prolixa* and *Spatuloricaria evansii*.

(1) Very small, irregular, packed

Hypostomus ancistroides and *Neoplecostomus microps*.

(2) Small, approximately quadrangular

Pseudotocinclus tietensis, ***Harttia absaberi, H. dissidens, H. duriventris, Harttia* cf. *fowleri, H. longipinna, H. panara, H. punctata, H. rondoni, Harttia* cf. *surinamensis, H. villasboas, Harttia* sp. tapajós 1, *Harttia* sp. tapajós 2,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Metaloricaria paucidens*, *Planiloricaria cryptodon*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(3) Large, quadrangular

Farlowella oxyrryncha, *Hemiodontichthys acipenserinus*, *Loricariichthys castaneus* and *Sturisoma robustum*.

(4) Large, rectangular and inclined

Hypoptopoma inexpectata.

(-) Inapplicable (absent abdominal plates)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, ***Harttia carvalhoi, H. garavelloi, H. gracilis, H. guianensis, H. intermontana, H. kronei, H. leiopleura, H. loricariformis, H. novalimensis, H. torrenticola, H. trombetensis, H. uatumensis, Harttia* sp. São Roque,** *Furcodontichthys novaesi* and *Harttiella crassicauda*.

264. Organization of abdominal plates (modified Rapp Py-Daniel, 1997 char. 191). CI = 0.143. RI = 0.143.

(0) Not organized

Hypostomus ancistroides, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Pseudotocinclus tietensis*, ***Harttia absaberi, H. dissidens, H. duriventris, Harttia* cf. *fowleri, H. longipinna, H. panara, H. punctata, H. rondoni, Harttia* cf. *surinamensis, H. villasboas, Harttia* sp. tapajós 1, *Harttia* sp. tapajós 2,** *Cteniloricaria platystoma*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(1) Organized in series

Hypoptopoma inexpectata, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Hemiodontichthys acipenserinus*, *Reganella depressa* and *Sturisoma robustum*.

(-) Inapplicable (absent abdominal plates)

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Kronichthys heylandi*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, ***Harttia carvalhoi, H. garavelloi, H. gracilis, H. guianensis, H. intermontana, H. kronei, H. leiopleura, H. loricariformis, H. novalimensis, H. torrenticola, H. trombetensis, H. uatumensis, Harttia* sp. São Roque,** *Furcodontichthys novaesi* and *Harttiella crassicauda*.

265. Shape of median body region (between pectoral and pelvic girdle) (Fichberg, 2008 char. 159). CI = 0.154. RI = 0.607.

(0) Approximately an inverted triangle (with the pectoral girdle much expanded laterally)

Astroblepus sp., *Lithogenes wahari*, *Isbrueckerichthys duseni*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia leiopleura,*** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Hemiodontichthys acipenserinus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp. and *Spatuloricaria evansii*.

(1) Approximately rectangular (longer than wide)

Ancistrus multipinnis, *Hypostomus ancistroides*, *Kronichthys heylandi*, **all species of *Harttia* (except *H. carvalhoi, H. intermontana, H. leiopleura, H. punctata, H. torrenticola* and *Harttia* sp. São Roque),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(2) Approximately square (as long as it is wide)

Hemipsilichthys nimius, Pareiorhina rudolphi, ***Harttia carvalhoi, H. intermontana, H. punctata, H. torrenticola, Harttia*** **sp. São Roque,** *Limatulichthys griseus, Metaloricaria paucidens* and *Pseudoloricaria laeviuscula*.

266. Plates of lateral series (modified Rapp Py-Daniel, 1997 char. 188). CI = 0.333. RI = 0.692.

(0) Absent

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis* and ***Harttia leiopleura*****.**

(1) Present, flattened

All species of *Harttia* (except *H. leiopleura*), *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(2) Present, angled

Farlowella oxyrryncha, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus* and *Sturisoma robustum*.

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

267. Minimum number of plates in lateral series (modified Fichberg, 2008 char. 149). CI = 0.250. RI = 0.500.

(0) Absent lateral series plates

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis* and ***Harttia leiopleura*****.**

(1) 3

Harttia gracilis, H. novalimensis and ***H. torrenticola*.**

(2) 4

***Harttia carvalhoi, H. intermontana, H. kronei, Harttia* sp. São Roque,** *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus* and *Reganella depressa*.

(3) 5

Harttia garavelloi, H. longipinna, H. loricariformis, *Brochiloricaria* sp., *Limatulichthys griseus* and *Metaloricaria paucidens*.

(4) 6

Harttia absaberi, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Loricariichthys castaneus*, *Pseudohemiodon* spp., *Pterosturisoma* cf. *microps*, *Rineloricaria latirostris* and *Spatuloricaria evansii*.

(5) 7

Harttia rondoni, H. uatumensis, *Lamontichthys* spp., *Pseudoloricaria laeviuscula*, *Rineloricaria daraha*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(6) More than 7

***Harttia dissidens, H. duriventris, Harttia* cf. *fowleri, H. guianensis, H. panara, H. punctata, Harttia* cf. *surinamensis, H. trombetensis, H. villasboas, Harttia* sp. tapajós 1, *Harttia* sp. tapajós 2,** *Apistoloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa* and *Rineloricaria lanceolata*.

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

268. Relative position of pelvic-fin insertion (modified Fichberg, 2008 char. 179). CI = 0.125. RI = 0.417.

(0) After the dorsal fin

Astroblepus sp., *Hypostomus ancistroides*, *Harttiella crassicauda* and *Planiloricaria cryptodon*.

(1) Before the dorsal fin

Lithogenes wahari, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi***, ***Harttia* sp. tapajós 2**, *Farlowella oxyrryncha*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Proloricaria prolixa*, *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Spatuloricaria evansii*.

(2) Same position as dorsal fin

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Isbrueckerichthys duseni*, **all species of *Harttia* (except *H. carvalhoi* and *Harttia* sp. tapajós 2)**, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Pseudohemiodon* spp., *Rineloricaria lanceolata* and *Sturisoma robustum*.

269. Relative length of pelvic fin (modified Fichberg, 2008 char. 171). CI = 0.125. RI = 0.611.

(0) Not exceed beyond the origin of the anal fin

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, *Brochiloricaria* sp., *Farlowella oxyrryncha*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Reganella depressa*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(1) Exceeds the insertion of the anal fin

Ancistrus multipinnis, *Hypostomus ancistroides*, **all species of *Harttia***, *Apistoloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Lamontichthys* spp., *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

270. Preanal plate (modified Rapp Py-Daniel, 1997 char. 192). CI = 0.167. RI = 0.667.

(0) Absent

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi*, *H. garavelloi*, *H. intermontana*, *H. kronei*, *H. leiopleura*, *H. novalimensis*** and *Harttiella crassicauda*.

(1) Present

Hypoptopoma inexpectata, **all species of *Harttia* (except *H. carvalhoi, H. garavelloi, H. intermontana, H. kronei, H. leiopleura* and *H. novalimensis*),** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

271. Series of plates between urogenital pore and anal fin (modified Fichberg, 2008 char. 162). CI = 0.357. RI = 0.609.

(0) Pterygiophore not apparent, covered by skin

Hemipsilichthys nimius, *Isbrueckerichthys duseni*, *Neoplecostomus microps* and *Plesioptopoma curvidens*.

(1) Two or three rows of plates and 1st pterygiophore always apparent

Ancistrus multipinnis, *Hypostomus ancistroides*, *Kronichthys heylandi* and *Pareiorhina rudolphi*.

(2) Three rows of plates with the 1st pterygiophore of the anal fin apparent on the second

Hypoptopoma inexpectata, **all species of *Harttia* (except *H. carvalhoi, H. intermontana* and *H. kronei*),** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(3) Three rows of plates with the 1st pterygiophore of the anal apparent on the third

Harttia intermontana, *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Spatuloricaria evansii*.

(4) Three rows of plates with the 1st pterygiophore of the anal not apparent

Pterosturisoma cf. *microps*.

(5) Four rows of plates with the 1st pterygiophore of the anal apparent on the second or third

Pseudotocinclus tietensis, ***Harttia carvalhoi, H. kronei,*** *Harttiella crassicauda*, *Rineloricaria daraha* and *Rineloricaria latirostris*.

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

272. Caudal peduncle (modified Rapp Py-Daniel, 1997 char. 108; Fichberg, 2008 char. 181). CI = 1.000. RI = 1.000.

(0) Compressed (with more than two series of plates)

Hemipsilichthys nimius, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens* and *Pseudotocinclus tietensis*.

(1) Depressed (with coalescing ventral and dorsal plates)

All species of *Harttia,* *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Lamontichthys* spp., *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(-) Inapplicable (absent dermal plates)

Astroblepus sp. and *Lithogenes wahari*.

273. Final portion of caudal peduncle in dorsal view (after anal fin) (modified Fichberg, 2008 char. 172). CI = 0.200. RI = 0.692.

(0) Ending smoothly

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, ***Harttia carvalhoi, H. garavelloi, H. gracilis, H.***

***intermontana, H. kronei, H. leiopleura, H. loricariformis, H. novalimensis, H. panara, H. torrenticola, H. villasboas, Harttia* sp. São Roque, *Harttia* sp. tapajós 1,** *Apistoloricaria* sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Furcodontichthys novaesi*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata*, *Spatuloricaria evansii* and *Sturisoma robustum*.

(1) Ending abruptly

***Harttia absaberi, H. dissidens, H. duriventris, Harttia* cf. *fowleri, H. guianensis, H. longipinna, H. punctata, H. rondoni, Harttia* cf. *surinamensis, H. trombetensis, H. uatumensis, Harttia* sp. tapajós 2,** *Cteniloricaria platystoma* and *Lamontichthys* spp..

274. Cross section of caudal peduncle (modified Paixão, 2012 char. 38). CI = 0.500. RI = 0.867.

(0) Oval to cylindrical

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, **all species of *Harttia*,** *Cteniloricaria platystoma*, *Farlowella oxyrryncha*, *Harttiella crassicauda*, *Lamontichthys* spp., *Metaloricaria paucidens*, *Pterosturisoma* cf. *microps*, *Reganella depressa*, *Rineloricaria daraha*, *Rineloricaria lanceolata*, *Rineloricaria latirostris*, *Rineloricaria pentamaculata* and *Sturisoma robustum*.

(1) Approximately rectangular in horizontal

Apistoloricaria sp., *Brochiloricaria* sp., *Crossoloricaria* spp., *Furcodontichthys novaesi*, *Hemiodontichthys acipenserinus*, *Limatulichthys griseus*, *Loricaria cataphracta*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Proloricaria prolixa*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula* and *Spatuloricaria evansii*.

(2) Approximately rectangular in vertical

Pareiorhina rudolphi and *Pseudotocinclus tietensis*.

275. Size of upper caudal-ray filament (modified Fichberg, 2008 char. 161). CI = 0.167. RI = 0.375.

(0) No prolongation

Astroblepus sp., *Lithogenes wahari*, *Hemipsilichthys nimius*, *Ancistrus multipinnis*, *Hypostomus ancistroides*, *Isbrueckerichthys duseni*, *Kronichthys heylandi*, *Neoplecostomus microps*, *Pareiorhina rudolphi*, *Hypoptopoma inexpectata*, *Plesioptopoma curvidens*, *Pseudotocinclus tietensis*, **all species of *Harttia*,** *Brochiloricaria* sp., *Cteniloricaria platystoma*, *Harttiella crassicauda*, *Hemiodontichthys acipenserinus*, *Loricaria lentiginosa*, *Loricariichthys castaneus*, *Metaloricaria paucidens*, *Proloricaria prolixa* and *Sturisoma robustum*.

(1) Medium, smaller than half the standard length of the fish

Furcodontichthys novaesi, *Limatulichthys griseus*, *Loricaria cataphracta*, *Pseudohemiodon* spp., *Pseudoloricaria laeviuscula*, *Reganella depressa*, *Rineloricaria lanceolata*, *Rineloricaria latirostris* and *Rineloricaria pentamaculata*.

(2) Long, greater than half the standard length of the fish

Apistoloricaria sp., *Crossoloricaria* spp., *Farlowella oxyrryncha*, *Lamontichthys* spp., *Paraloricaria vetula*, *Planiloricaria cryptodon*, *Pterosturisoma* cf. *microps*, *Rineloricaria daraha* and *Spatuloricaria evansii*.

Phylogenetic reconstruction

The phylogenetic analysis resulted in 39 equally parsimonious trees with a length of 2.119 steps, a consistency index of 0.237, and a retention index of 0.638. From these, a strict consensus cladogram was constructed (Figure 48, CI = 0.229, and RI = 0.620). The list of synapomorphies for the consensus tree is available in Appendix 3.

The morphological phylogeny recovers the subfamily Loricariinae as a monophyletic group. Nor the tribe Harttiini sensu Rapp Py-Daniel (1997) or the tribes Harttiini and Farlowellini sensu Londoño-Burbano & Reis (2021) are retrieved. The monophyly of the genus *Harttia* is not recovered, and *H. absaberi* appears more closely related to other genera than to other species of its own genus. Only some genera previously included in Loricariini sensu Py-Daniel and sensu Londoño-Burbano & Reis (2021) constitutes a monophyletic assemblage.

Considering only the members of Loricariinae, the first split leads to the genus *Harttiella*, included for the first time in a phylogenetic analysis based exclusively on morphological characters. Then, the species of *Harttia* are recovered as lineages that evolved independently, with the species from southeastern Brazil diverging first (*e.g. H. leiopleura*, *H. longipinna*, *H. novalimensis*, a clade composed of five species (*H. kronei*, *Harttia* sp. São Roque, *H. carvalhoi*, *H. intermontana* and *H. torrenticola*), *H. garavelloi* plus *H. gracilis*, and *H. loricariformis*),

followed by the species from the Amazon basin and Guianas Shield (*e.g. H. dissidens, H. duriventris, H. guianensis, H. punctata, H. rondoni*, *Harttia* sp. Tapajós 1, *Harttia* sp. Tapajós 2, *H. panara* plus *H. villasboas*, and a clade composed of *Cteniloricaria* and five species of *Harttia* (*Cteniloricaria platystoma, H. trombetensis, H. uatumensis*, *Harttia* cf. *fowleri*, and *Harttia* cf. *surinamensis*)). After that, there is the largest monophyletic clade inside Loricariinae, with *H. absaberi* diverging first, being more closely related to the other genera of Loricariinae than to the species of *Harttia* themselves. The next genera, which diverge independently from each other, are all members of Harttiini sensu Rapp Py-Daniel (1997) and Farlowellini sensu Londoño-Burbano & Reis (2021): *Lamontichthys*, *Pterosturisoma*, *Sturisoma*, and *Farlowella*. It is only after this point that genera belonging to Loricariini sensu Rapp Py-Daniel (1997) and sensu Londoño-Burbano & Reis (2021) are recovered: *Metaloricaria*, *Rineloricaria*, *Loricariichthys*, *Hemiodontichthys*, *Reganella*, *Limatulichthys*, *Furcodontichthys*, *Pseudoloricaria*, *Spatuloricaria*, *Paraloricaria*, *Loricaria*, *Proloricaria*, *Brochiloricaria*, *Apistoloricaria*, *Crossoloricaria*, *Planiloricaria*, and *Pseudohemiodon*.

Discussion

The morphological phylogeny presented in this chapter recovers the subfamily Loricariinae as a monophyletic group, as previously proposed by the morphological analyses of Rapp Py-Daniel (1997), Fichberg (2008), and Paixão (2012), and by the combined analysis of Londoño-Burbano & Reis (2021). Here, the subfamily is retrieved as sister group to members of the subfamilies Hypoptopomatinae, Neoplecostominae, and Hypostominae, as also suggested by Pereira & Reis (2017). The Loricariinae (clade 82; Figure 48; Appendix 3) is supported by nine exclusive synapomorphies: rectangular exoccipital (char. 36, 0 → 1); ventral process of the preopercle well developed (char. 101, 0 → 1); anterior process of the autopalatine present (char. 105, 0 → 1); dorsal and ventral laminar expansions of external anterior process of basipterygium with similar width (char. 192, 0 → 1); neural and hemal spines of the second preural center slightly expanded dorsally and ventrally, anterior surface of the second preural centrum much shallower than the posterior end of hypural plates (char. 218, 1 → 2); neural spine of the second preural centrum short, not reaching half up the hypural plate (char. 219, 0 → 1); supracaudal plates elongated (char. 228, 0 → 1); plates of the lateral series present, flattened (char. 266, 0 → 1); and caudal peduncle

depressed, with coalescing ventral and dorsal plates (char. 272, 0 → 1); and also 10 non-exclusive synapomorphies: neural spine of the seventh vertebra long, in contact with the predorsal plates (char. 58, 1 → 2); hemal spines above the anal fin base greatly reduced in length (char. 65, 0 → 1); anterior process of the first ceratobranchial present and long (char. 149, 2 → 3); anterior process of the first ceratobranchial as a wide lamina (char. 150, 1 → 2); tips of the internal anterior process of the basipterygium converging mesially and almost touching each other, connected by a ligament, surrounding a large median fenestra (char. 189; 3 → 1); 12 caudal-fin branched rays (char. 229, 0 → 1); nasal cavity opening rounded (char. 232, 1 → 0); bony plates over the lips (char. 240, 0 → 1); median body region approximately rectangular (char. 265, 0 → 1); and length of the pelvic fin exceeding the insertion of the anal fin (char. 269, 0 → 1).

Within Loricariinae, nor the tribe Harttiini sensu Rapp Py-Daniel or the tribes Harttiini and Farlowellini sensu Londoño-Burbano & Reis (2021) are recovered. The first genus within the subfamily to diverge is *Harttiella*, being sister to the other genera of Loricariinae. In Rapp Py-Daniel (1997), this genus was not included in the phylogeny, and in Londoño-Burbano & Reis (2021), it was considered sister group of a clade composed of *Harttia* plus *Cteniloricaria*. For *Harttiella* (clade 43; Figure 48; Appendix 3), represented by *H. crassicauda*, we recover one exclusive autapomorphy: fourth pharyngobranchial with reduced ossified area, nodular, surrounded by dense cartilage (char. 165, 1 → 2); and 23 non-exclusive autapomorphies: contact of the lateral ethmoid with the metapterygoid by anterior and posterior points (char. 14, 1 → 2); contact between the lateral ethmoid and the dorsal region of the metapterygoid by condyle and by suture (char. 15, 1 → 2); crest on the frontal surface present and inconspicuous (char. 28, 0 → 1); short nasal bone (char. 44, 0 → 1); transverse process of the Weberian apparatus approximately the same length as the pterotic-supracleithrum extension (char. 47, 0 → 1); opening of the epiphyseal pore as a groove or a crack (char. 74, 0 → 2); contact between the metapterygoid and the lateral ethmoid partially sutured (char. 85, 0 → 1); anterior margin of the metapterygoid with an extremely developed expansion in the midanterior portion (char. 88, 1 → 2); palatine splint present and short (char. 106, 0 → 1); angle of inclination of the maxillary projection in relation to the main axis of the bone greater than 90° (char. 113, 0 → 1); ventral crest in the anterior margin of the ceratohyal present (char. 133, 0 → 1); hipobranchials non ossified (char. 147, 1 → 0); anterior process of the first epibranchial absent or inconspicuous (char. 152, 1 → 0); posterior process of the first epibranchial absent or inconspicuous (char. 153, 0 → 1); teeth of the lower

pharyngeal tooth plates absent (char. 169, 1 → 3); process of the lower pharyngeal tooth plates absent (char. 172, 0 → 3); lateral sides of the lower pharyngeal tooth plates covered with non-ossified rakers (char. 173, 0 → 1); symphysis of the coracoid extensively connected in the posterior region, and anterior region with a small disconnected area (char. 182, 0 → 1); coracoid posterior process straight, oriented parallel in relation to the body axis (angle of 90°) (char. 184, 0 → 1); all adjacent pterygiophores of the dorsal fin partially separated (char. 208, 1 → 0); connecting bone contacting the processes of the first pterygiophore of the dorsal fin (char. 210, 0 → 1); adjacent pterygiophores of the anal fin elongated and well separated from each other (char. 213, 1 → 0); and two supracaudal plates (char. 227, 0 → 2).

After *Harttiella*, the species of the genus *Harttia* are recovered: first the species from the Southeastern Brazil, and later those from the Amazon region and the Guianas Shield. The monophyly of the genus *Harttia* is not recovered, and *H. absaberi* appears more closely related to other genera of the Loricariinae than to other species of its own genus. Thus, we will not present synapomorphies for the genus *Harttia*, only for the clade composed of Loricariinae minus *Harttiella* (clade 81; Fig. 48; Appendix 3). This clade is supported by two exclusive synapomorphies: anterior process of the pterotic-supracleithrum deflected with a small gap (char. 40, 0 → 1), and epural very reduced (char. 225, 0 → 1). In relation to the first character, there is a little hole between the process and the pterotic-supracleithrum, as if the process was in a more ventral level (Figure 14C). This condition was recovered exclusively in *Harttia* and *Cteniloricaria*, but did not result in the monophyly of the group. In all other taxa examined, the anterior process is absent to just slightly deflected, occupying the same level of the pterotic-supracleithrum, as if it was continuous with the bone (Figures 14A and B). Besides, the following non-exclusive synapomorphies also support this clade: mesethmoid anterior edge serrate (char. 3, 0 → 1); ventrolateral crest of the mesethmoide absent (char. 10, 1 → 0); crest on the lateral surface of the hyomandibula for insertion of the levator arcus palatini muscle absent (char. 96, 0 → 2); dentary rectangular, robust (char. 119, 1 → 2); anterior margin of the ceratohyal as expanded as the hipohyal (char. 132, 1 → 2); first basibranchial short (char. 142, 0 → 1); ventrolateral process absent (char. 194, 0 → 3); articulation of the first pterygiophore of the anal fin with the 13th center of the vertebral column (char. 214, 1 → 2); and premaxillary with more than 50 teeth (char. 246, 1 → 0).

Within the species of *Harttia* some monophyletic groups are recovered: the clade 85 composed of *H. kronei*, *Harttia* sp. São Roque, *H. carvalhoi*, *H. intermontana*, and *H. torrenticola* (all from southeastern Brazil), the clade 89 consisting of the sister-species *H. garavelloi* and *H. gracilis* (both from southeastern Brazil), the clade 91 encompassing *H. panara* and *H. villasboas* (both from the right bank of the Amazon River), and the clade 88 composed of *Cteniloricaria platystoma*, *H. trombetensis*, *H. uatumensis*, *Harttia* cf. *fowleri*, and *Harttia* cf. *surinamensis* (species from the Guianas Shield and the left bank of the Amazon River).

The clade 85 (Fig. 48; Appendix 3) is diagnosed by one non-exclusive synapomorphy: branches of the infraorbital canal emerge between two infraorbitals (char. 67, 2 → 0), with reversal in *H. torrenticola*.

The clade 89 (Fig. 48; Appendix 3) is diagnosed by four non-exclusive synapomorphies: ventral crest in the anterior margin of the pterotic-supracleithrum present and tall (char. 42, 0 → 2); margin of the hyomandibula in contact with the pterotic-supracleithrum straight (char. 94, 1 → 0); posterior condyle in the interhyal for the articulation with the epihyal absent (char. 128, 0 → 1); and ventral crest in the anterior margin of the ceratohyal present (char. 133, 0 → 1).

The clade 91 (Fig. 48; Appendix 3) is diagnosed by 11 non-exclusive synapomorphies: ventral crest in the anterior margin of the pterotic-supracleithrum present and short (char. 42, 0 → 1); rectangular suspensorium (char. 83, 1 → 0); palatine splint present and short (char. 106, 0 → 1); angle of inclination of the maxillary projection in relation to the main axis of the bone approximately 90° (char. 113, 1 → 0); dentary quadrangular, robust (char. 119, 2 → 1); posterior process of the first epibranchial conspicuous (char. 153, 1 → 0); posterior process of the fourth epibranchial present (char. 161, 0 → 1); processes of the lower pharyngeal tooth plates present, in the anterior margin (char. 172, 3 → 0); interorbital distance large, greater than or equal to twice the orbital diameter (char. 234, 0 → 1); ornamentation of the dorsal surface of the head (parieto-supraoccipital, frontal and nasal) present, with shallow crests and notches (char. 235, 0 → 2); and final portion of the caudal peduncle ending smoothly in dorsal view (after anal fin) (char. 273, 1 → 0).

And finally, the clade 88 (Fig. 48; Appendix 3) is diagnosed by six non-exclusive synapomorphies: ventroposterior border of the lateral ethmoid slightly enlarged, but not contributing to the orbit floor (char. 16, 0 → 1), with reversal in *Harttia* cf. *fowleri*; crest on the frontal surface present and inconspicuous (char. 28, 0 → 1), with reversal in *H. uatumensis*; length

of the ventral articulation between orbitosphenoid and lateral ethmoid much more expanded than the ventral contact between orbitosphenoid and prootic (char. 32, 0 → 1); antero-orbital notch present (char. 69, 0 → 1); exit of the parietal branch canal ending on the frontal (char. 78, 2 → 1); with reversal in *Harttia* cf. *fowleri*; and hyomandibula depression with a large concavity area (char. 95, 0 → 1); with reversal in *H. uatumensis*.

The largest monophyletic group within Loricariinae recovered in this analysis is composed of *Harttia absaberi* plus all other genera of the subfamily, except *Harttiella*, *Harttia*, and *Cteniloricaria* (clade 76; Fig. 48; Appendix 3). This clade is supported by seven non-exclusive synapomorphies: contact between the transverse process of the Weberian apparatus and the pterotic-supracleithrum by partial suture (char. 48, 2 → 0); aortic groove extending until vertebra 7-8 (char. 51, 2 → 1); no extra branch, just a pore, from the preopercular canal (char. 73, 0 → 3); lateral sides of the lower pharyngeal tooth plates covered with non-ossified rakers (char. 173, 0 → 1); bony lamina at the anterior margin of the coracoid present, covering only the lateral edges of the fossa (char. 183, 0 → 1); hemal spine of the second preural centrum short, without uncinate process (char. 220, 1 → 0); and minimum number of plates in the lateral series equal to six (char. 267, 6 → 4).

In this study, *Harttia absaberi* was recovered as more closely related to the other genera of Loricariinae than to the other species of the same genus. *Harttia absaberi* (clade 12; Fig. 48; Appendix 3) is diagnosed by two exclusive autapomorphies: uncinate process in the mesethmoid tip present (char. 6, 0 → 1); and symphysis of the coracoid totally disconnected (char. 182, 1 → 2); and 18 non-exclusive autapomorphies: anterior process of the mesethmoid absent (char. 1, 0 → 1); mesethmoid tip straight (char. 5, 0 → 2); mesethmoid ventral disk almost in the middle of the mesethmoid (char. 8, 1 → 2); contact of the lateral ethmoid with the metapterygoid present, by anterior and posterior points (char. 14, 1 → 2); contact between the lateral ethmoid and the dorsal region of the metapterygoid by condyle and by suture (char. 15, 1 → 2); crest on the frontal surface present and inconspicuous (char. 28, 0 → 1); rectangular orbitosphenoid (char. 30, 2 → 3); nasal bone L-shaped (char. 43, 0 → 1); infraorbital canals less than 6 (char. 66, 1 → 0); contact partially sutured between metapterygoid and lateral ethmoid (char. 85, 0 → 1); small suture between metapterygoid and hyomandibula (char. 89, 1 → 0); posterior contact between hyomandibula and pterotic-supracleithrum sutural and syndesmotic (char. 93, 1 → 2); margin of the hyomandibula in contact with the pterotic-supracleithrum with a large elevation near the proximal condyle (char.

94, 1 → 2); second basibranchial long (char. 145, 0 → 1); posterior process of the fourth epibranchial present (char. 161, 0 → 1); third pharyngobranchial rod (char. 163, 0 → 1); processes of the lower pharyngeal tooth plates present, in the posterior margin (char. 172, 3 → 1); and posterior process of the coracoid short, smaller than the length of the inferior margin of the coracoid (char. 185, 1 → 0).

The phylogenetic position of *H. absaberi* was previously raised by Covain *et al*. (2016), that suggested *H. absaberi* as a member of Farlowellina. Their conclusion was based on the extension of the abdominal cover. In Harttiini, the abdominal cover can be present or absent, and when it is present, never extends to the lower lip margin. In Farlowellina, the abdominal cover always extends to the lower lip margin, and this condition was reported to *H. absaberi* by Covain *et al*. (2016) - this pattern of abdominal covering was also observed in the specimens included in this analysis. Thus, the internal and external morphological differences present in *H. absaberi* in comparison to the other species of *Harttia*, plus the phylogenetic positioning demonstrated by our results, allow us to believe that *H. absaberi* probably belongs to a different lineage than the other species of the genus *Harttia*.

In conclusion, the morphological phylogeny recovered the genus *Harttia* as polyphyletic, contrary to the results found in previous studies that support its monophyly (RAPP PY-DANIEL, 1997; MONTOYA-BURGOS, 1998; COVAIN & FISCH-MULLER, 2007; COVAIN *et al.*, 2008; FICHBERG, 2008; SILVA, 2009; RODRIGUEZ *et al.*, 2011; PAIXÃO, 2012; COVAIN *et al*., 2016, LONDOÑO-BURBANO & REIS, 2021). We hope to improve our analysis in the future in order to clarify the phylogenetic history of the genus and its species.

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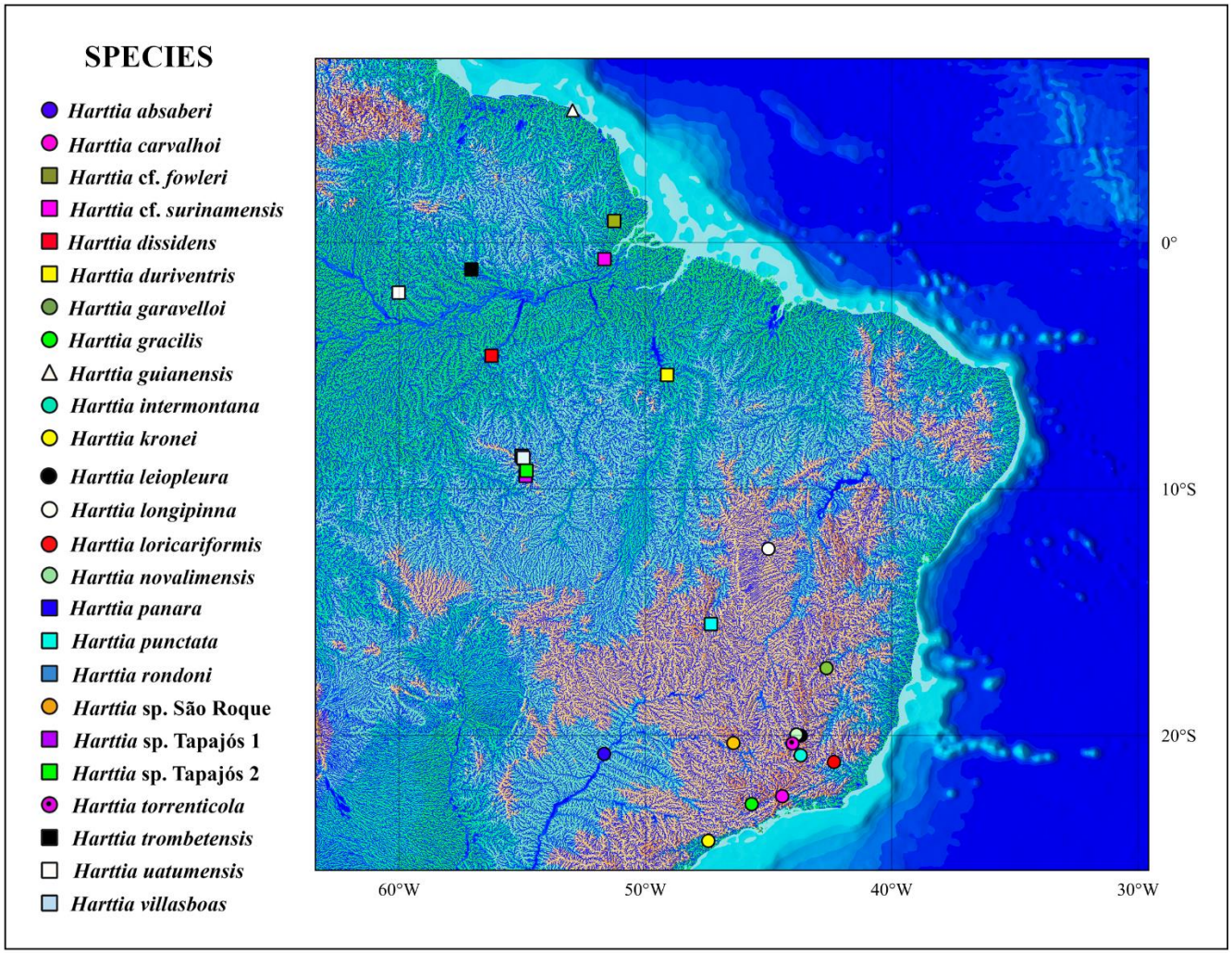

Figure 1. Geographic distribution of the species of *Harttia* included in the morphological analysis (Complete). The locality shown is from the material examined. The symbols representing *H. panara* and *H. rondoni* are below the symbol of *H. villasboas* due to the proximity of the localities.

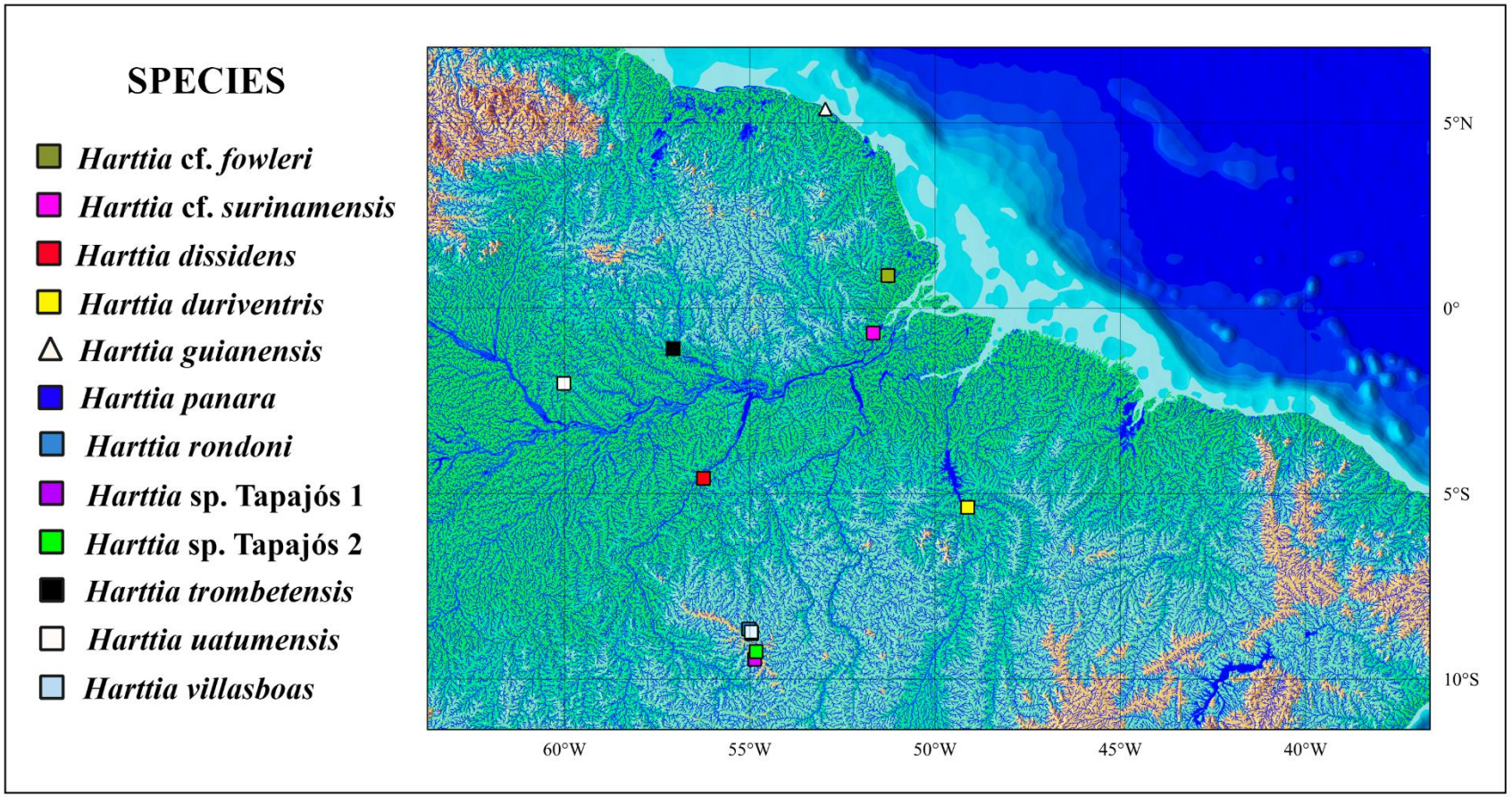

Figure 2. Geographic distribution of the species of *Harttia* included in the morphological analysis (Northern detail). The locality shown is from the material examined. The symbols representing *H. panara* and *H. rondoni* are below the symbol of *H. villasboas* due to the proximity of the localities.

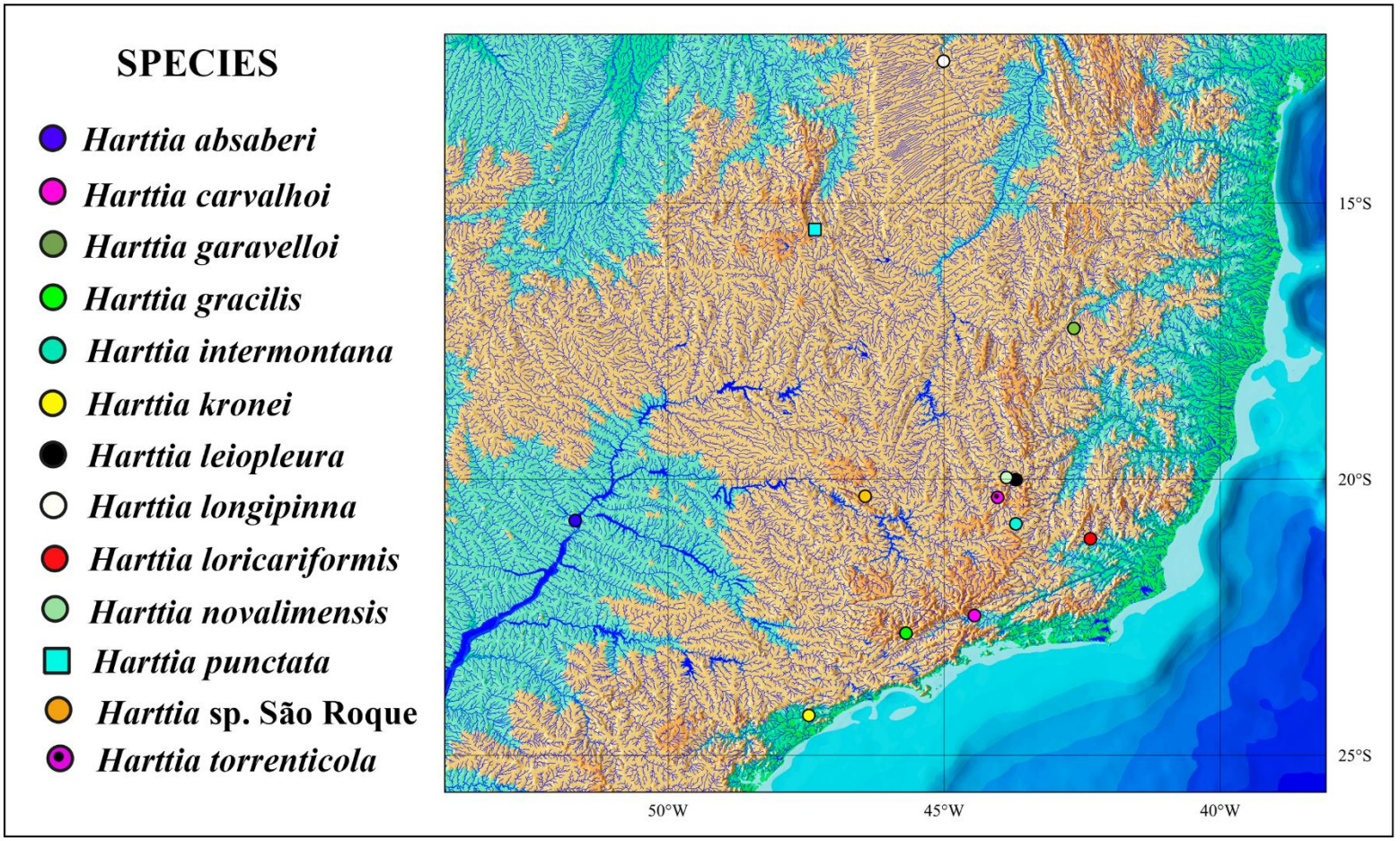

Figure 3. Geographic distribution of the species of *Harttia* included in the morphological analysis (Southern detail). The locality shown is from the material examined.

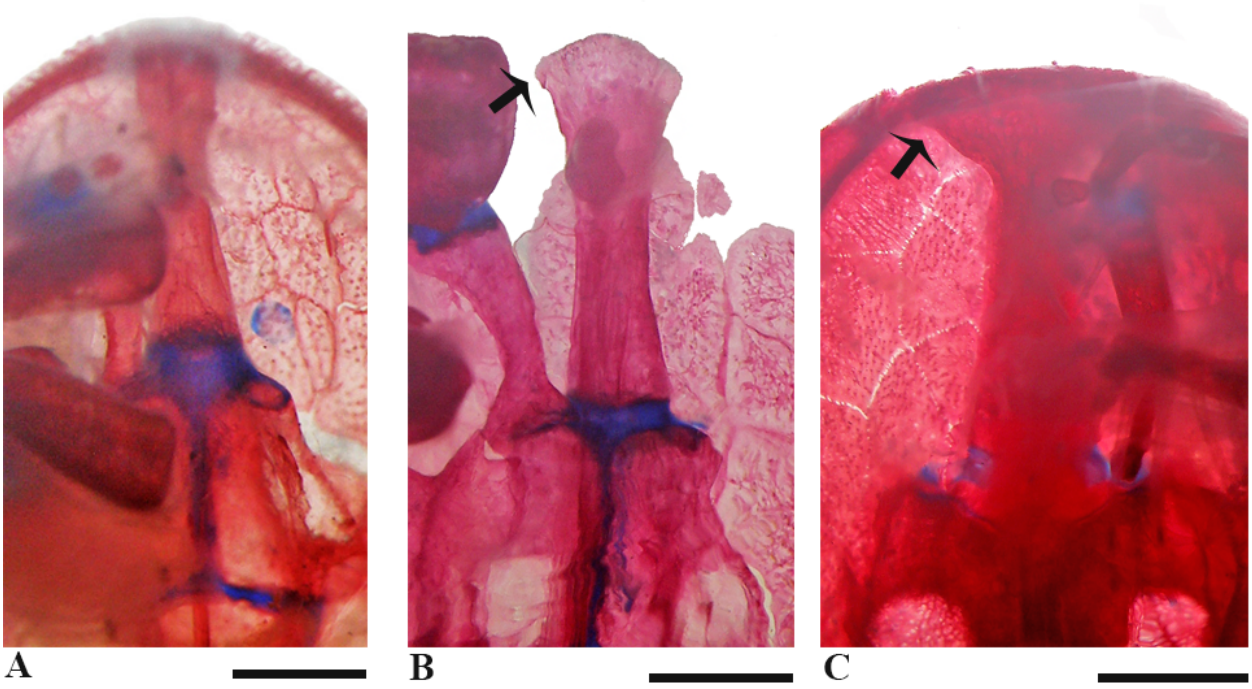

Figure 4. Anterior process of the mesethmoid (arrow), ventral view. A) Absent: *Harttia absaberi*, MZUSP 85806, 60.5 mm SL, paratype. B) Small: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. C) Large: *Planiloricaria cryptodon*, MZUSP 56252, 93.1 mm SL.Scale bar 1 mm.

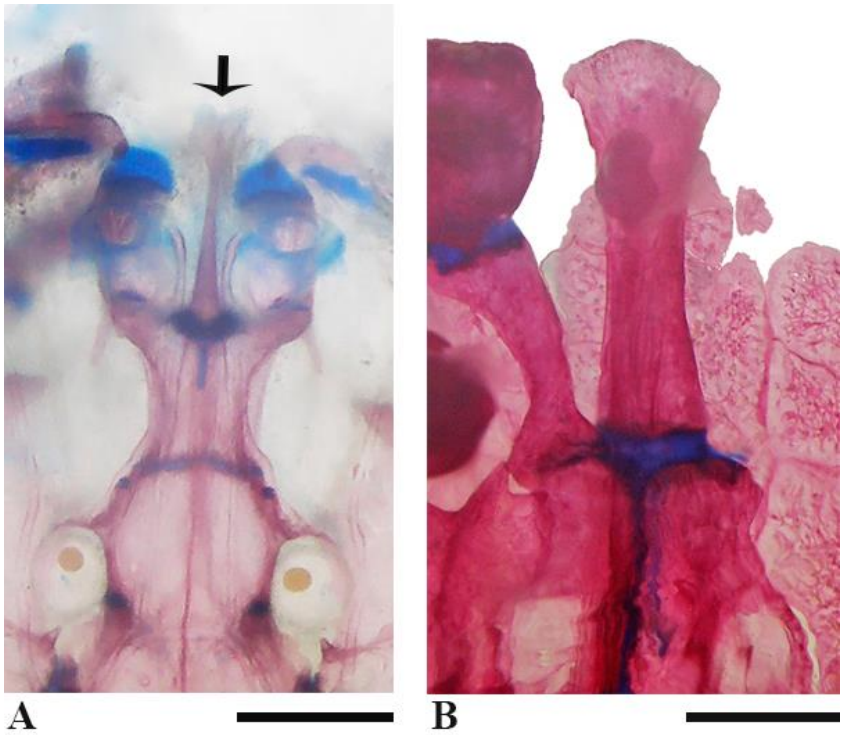

Figure 5. Chamfer of the mesethmoid (arrow), ventral view. A) Present: *Astroblepus* sp., MZUEL 13511, 47.5 mm SL. B) Absent: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. Scale bar 1 mm.

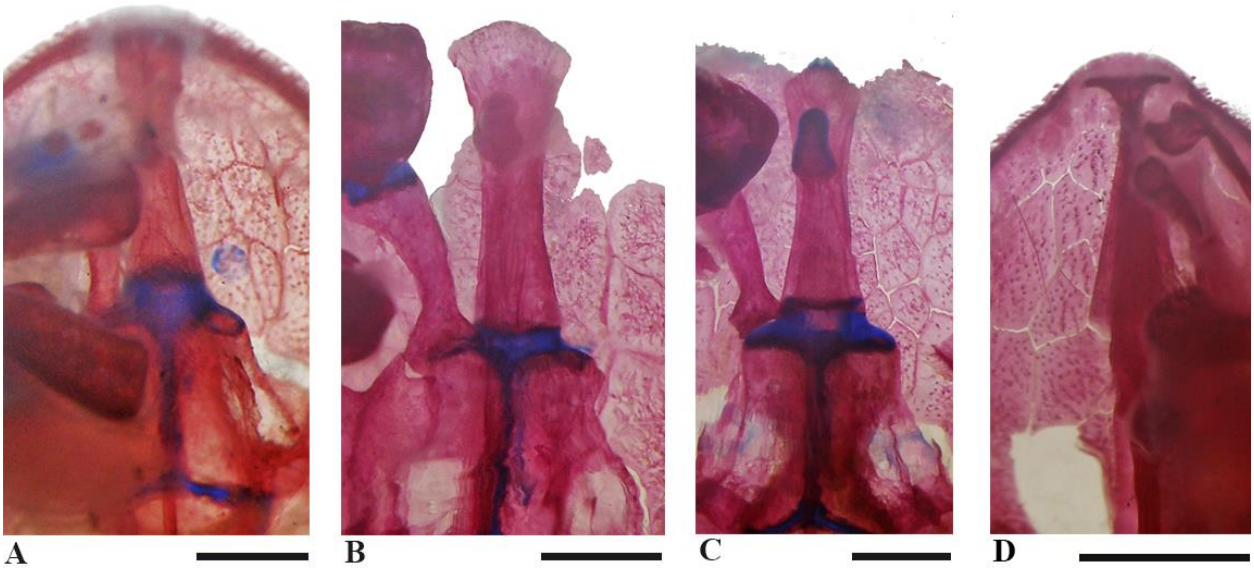

Figure 6. Shape and cartilage in the mesethmoid tip, ventral view. A) Straight and no cartilage: *Harttia absaberi*, MZUSP 85806, 60.5 mm SL, paratype. B) Spatula and no cartilage: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. C) Arrow and present cartilage: *Harttia gracilis*, MZUSP 99678, 61.0 mm SL. D) T-shaped and no cartilage: *Metaloricaria paucidens*, INPA 5440, 73.7 mm SL. Scale bar 1 mm.

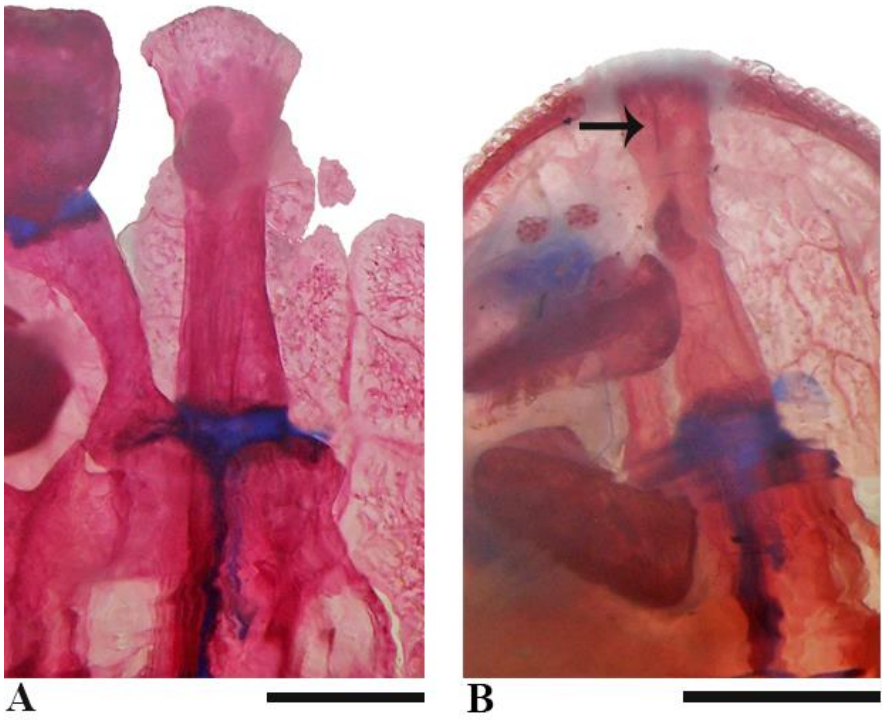

Figure 7. Uncinate process in the mesethmoid tip (arrow), ventral view. A) Absent: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. B) Present: *Harttia absaberi*, MZUSP 85806, 60.5 mm SL, paratype. Scale bar 1 mm.

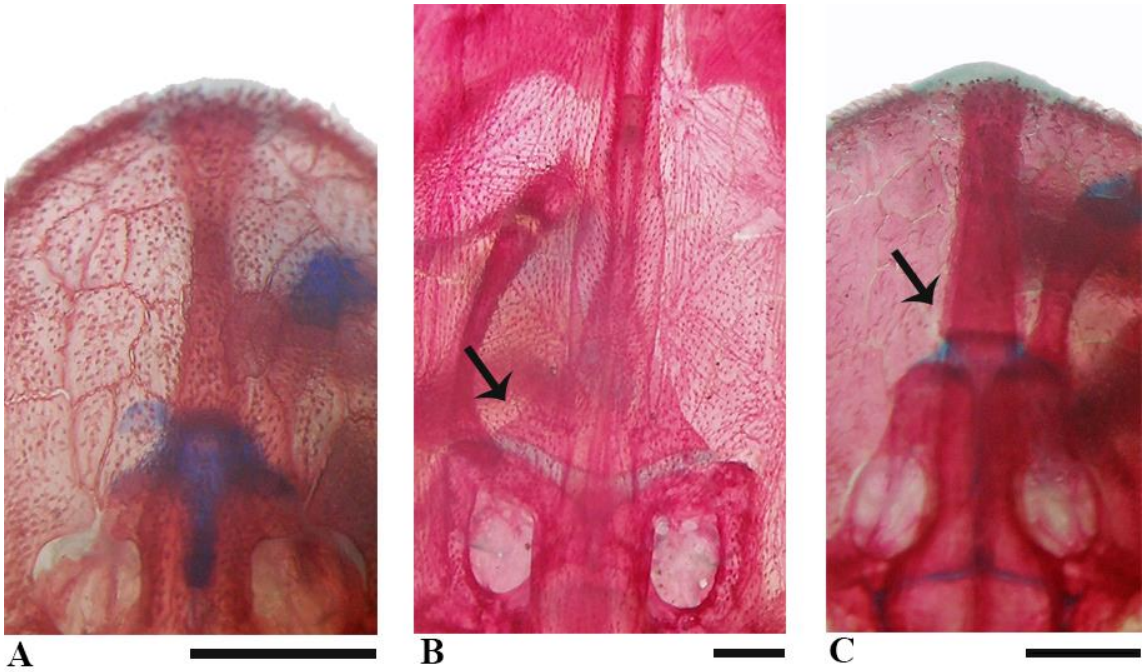

Figure 8. Ventrolateral crest of the mesethmoid (arrow), dorsal view. A) Absent: *Harttia absaberi*, MZUSP 85806, 60.5 mm SL, paratype. B) Present, wider near vomer: *Reganella depressa*, MZUSP 57729, 152.0 mm SL. C) Present, with the same width along the entire length: *Harttia longipinna*, DZSJRP 3666, 51.5 mm SL, paratype. Scale bar 1 mm.

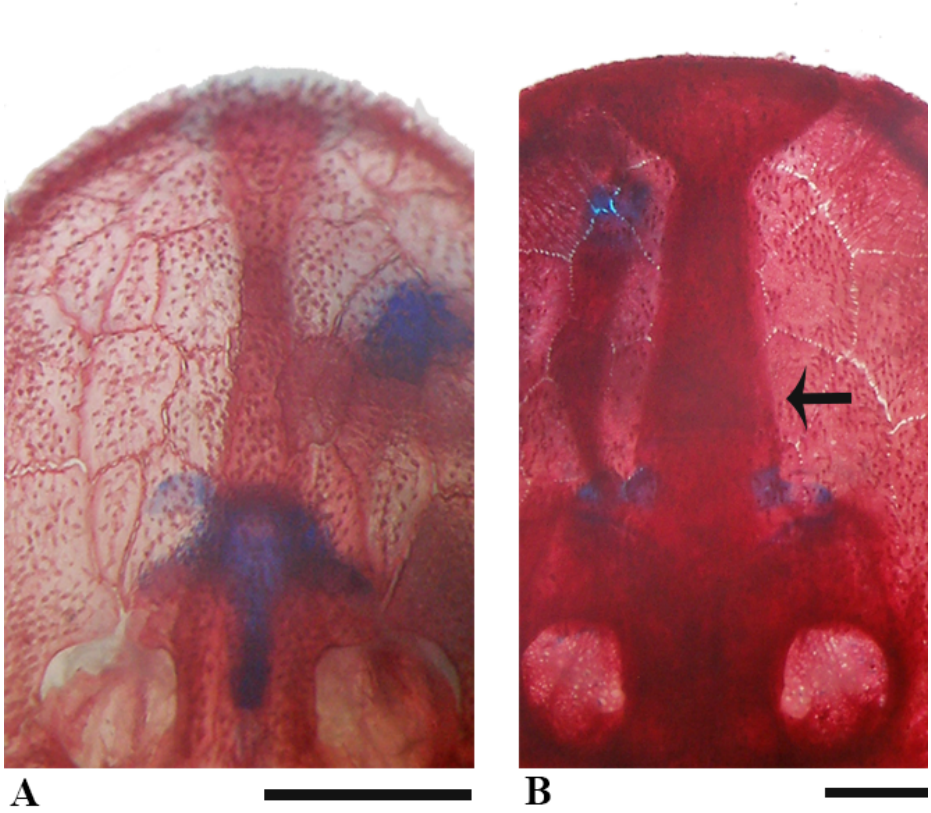

Figure 9. Dorsolateral crest of the mesethmoid (arrow), dorsal view. A) Absent: *Harttia absaberi*, MZUSP 85806, 60.5 mm SL, paratype. B) Present: *Planiloricaria cryptodon*, MZUSP 56252, 93.1 mm SL.Scale bar 1 mm.

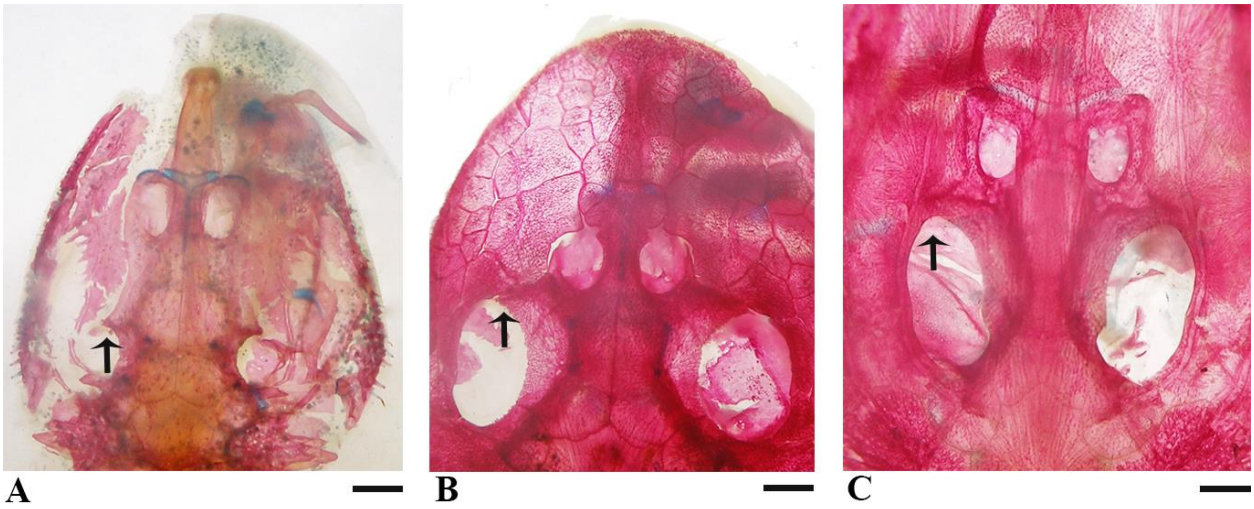

Figure 10. Ventroposterior border of the lateral ethmoid (arrow), dorsal view. A) Little extended, followed by the anterior margin of the orbit: *Lithogenes wahari*, MZUSP 103074, 53.1 mm SL, paratype. B) Slightly enlarged, but not contributing to the orbit floor: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. C) Greatly enlarged, contributing to the orbit floor: *Reganella depressa*, MZUSP 57729, 152.0 mm SL. Scale bar 1 mm.

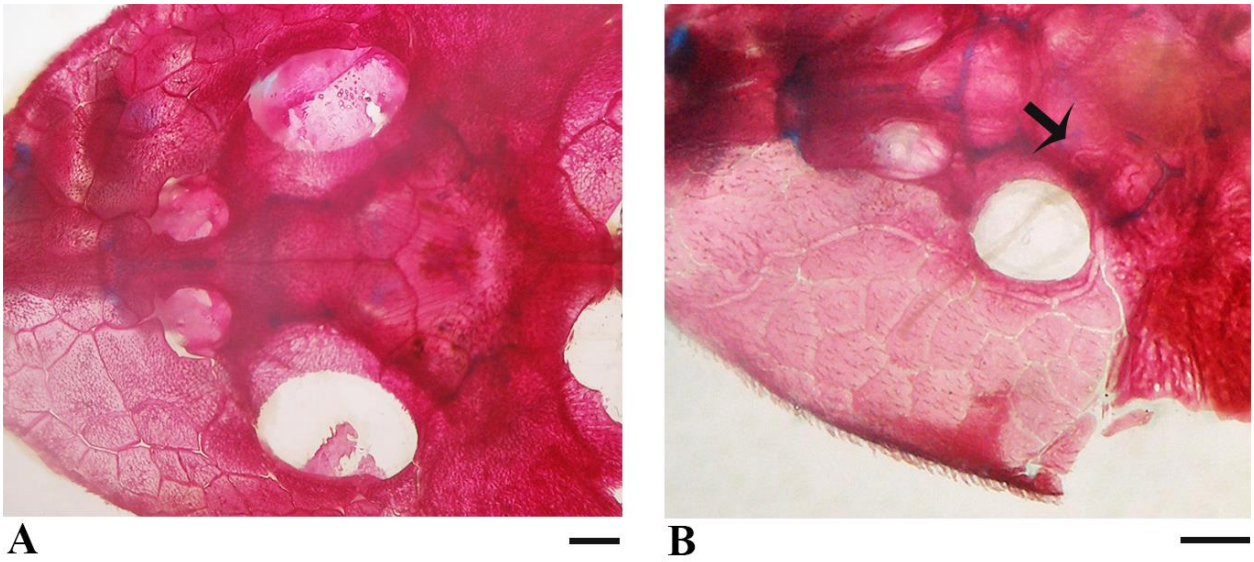

Figure 11. Dorsal process of the sphenotic (arrow), dorsal view. A) Absent: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. B) Present: *Harttia longipinna*, DZSJRP 3666, 51.5 mm SL, paratype. Scale bar 1 mm.

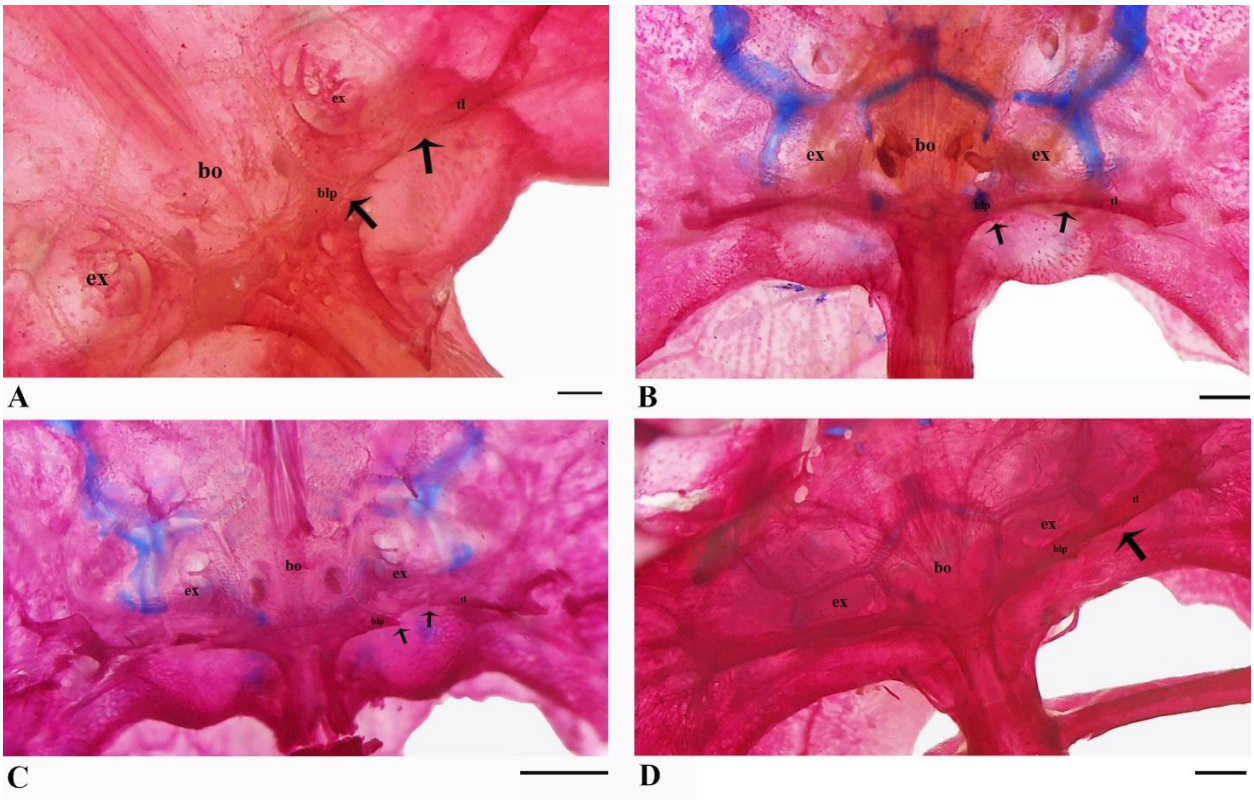

Figure 12. Relationship between basioccipital (bo), exoccipital (ex) and transcapular ligament (tl), ventral view. Arrows indicate the limit of the basioccipital lateral processes (blp) and the transcapular ligament. A) Small lateral processes, shorter than the basioccipital height but not expanded ventrally; Basioccipital not connected to the transcapular ligament and exoccipital between both; Transcapular ligament not expanded ventrally: *Reganella depressa*, MZUSP 57729, 152.0 mm SL. B) Short lateral processes but expanded ventrally; Basioccipital not connected to the transcapular ligament and exoccipital between both; Transcapular ligament expanded ventrally: *Limatulichthys griseus*, DZSJRP 13585, 133.4 mm SL. C) Large lateral processes but expanded only laterally; Basioccipital not connected to the transcapular ligament and exoccipital between both; Transcapular ligament not expanded ventrally: *Hemiodontichthys acipenserinus*, DZSJRP 21189, 89.0 mm SL. D) Very large lateral processes expanded laterally and ventrally; Basioccipital posteriorly connected to the transcapular ligament and exoccipital connected to both; Transcapular ligament expanded ventrally: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. Scale bar 1 mm.

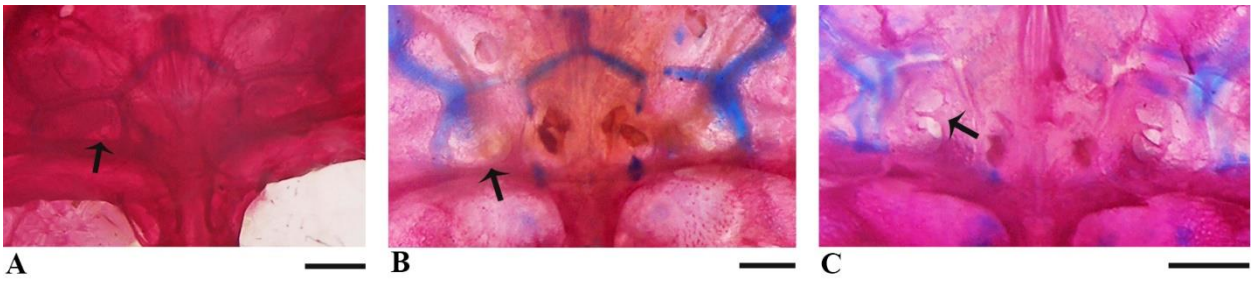

Figure 13. Foramen of the exoccipital (arrow), ventral view. A) Small: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. B) Large: *Limatulichthys griseus*, DZSJRP 13585, 133.4 mm SL. C) Large with divisions: *Hemiodontichthys acipenserinus*, DZSJRP 21189, 89.0 mm SL. Scale bar 1 mm.

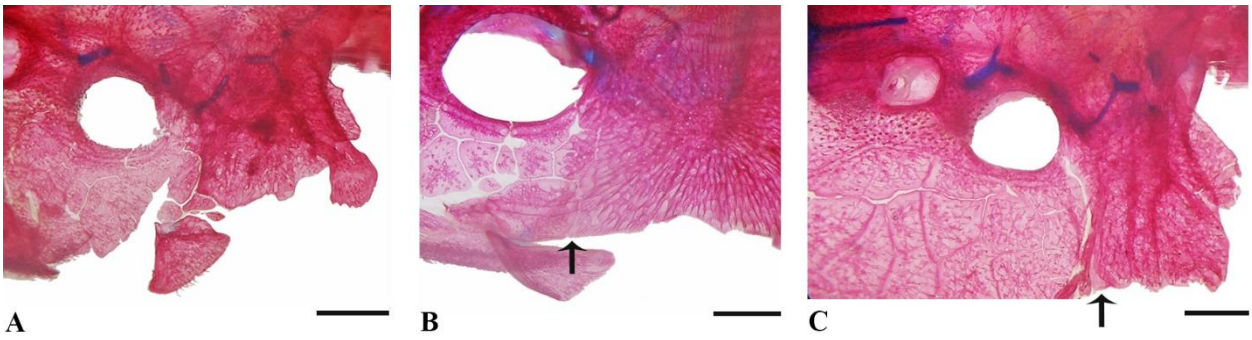

Figure 14. Anterior process of the pterotic-supracleithrum (arrow), lateral view. A) Absent: *Neoplecostomus microps*, DZSJRP 2144, 62.8mm SL. B) Present, slightly deflected: *Loricaria cataphracta*, MZUSP 14106, 111.9 mm SL. C) Present, deflected with a small gap: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. Scale bar 1 mm.

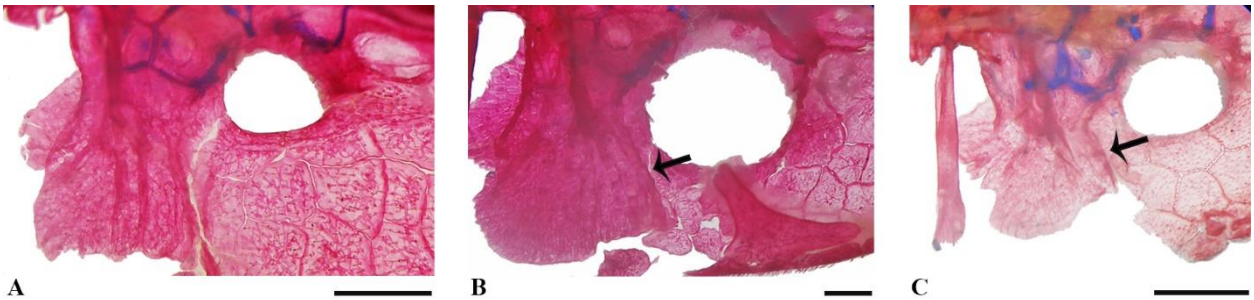

Figure 15. Ventral crest in the anterior margin of the pterotic-supracleithrum (arrow), ventral view. A) Absent: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. B) Present and short: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. C) Present and tall: *Harttia absaberi*, MZUSP 85806, 60.5 mm SL, paratype. Scale bar 1 mm.

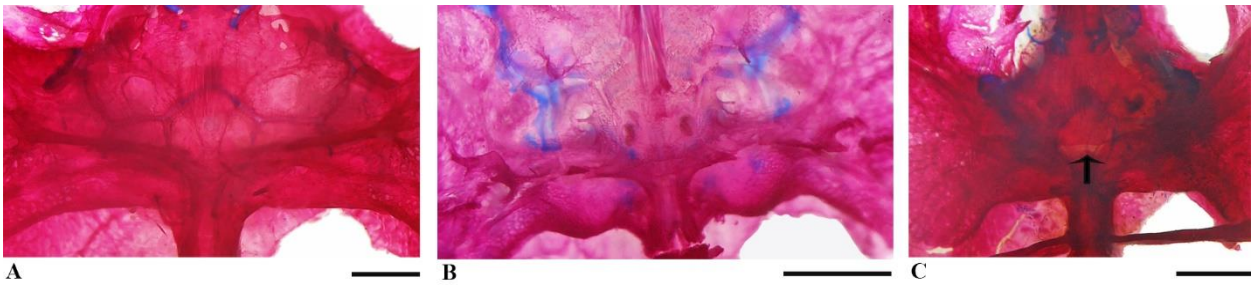

Figure 16. Connection of the complex centrum to the neurocranium via basioccipital, ventral view. A) Basioccipital contacts ventrally to the complex centrum: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. B) Basioccipital contacts dorsally to the complex centrum: *Hemiodontichthys acipenserinus*, DZSJRP 21189, 89.0 mm SL. C) Basioccipital does not contact the complex centrum (arrow): *Cteniloricaria platystoma*, INPA 58231, 80.4 mm SL. Scale bar 1 mm.

Figure 17. Connection between the transcapular ligament (white arrow) and the transverse process of the Weberian apparatus (black arrow), ventral view. A) No contact: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. B) Contacting posteriorly: *Reganella depressa*, MZUSP 57729, 152.0 mm SL. C) Contacting ventrally: *Astroblepus* sp., MZUEL 13511, 47.5 mm SL. Scale bar 1 mm.

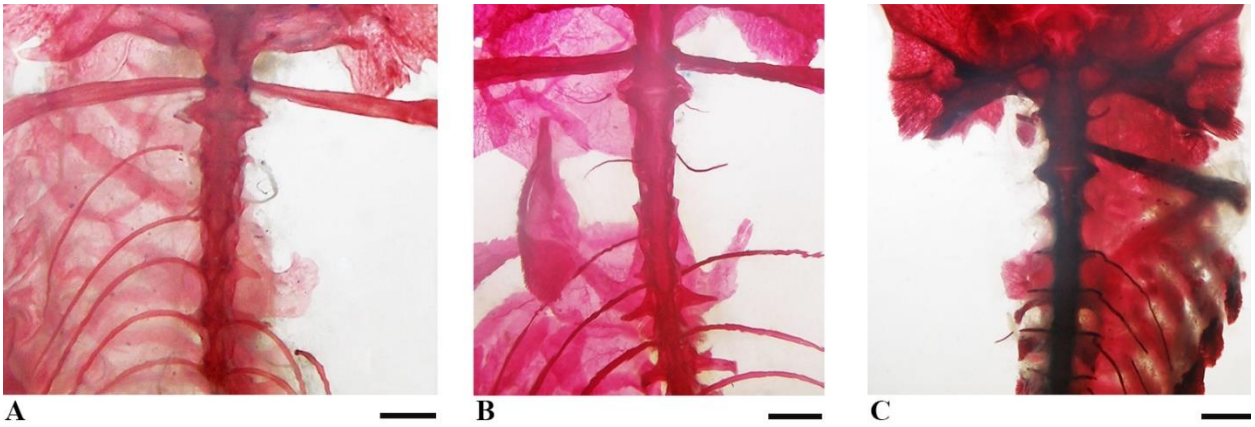

Figure 18. Rib of the eight vertebra, ventral view. A) Present and approximately the same size as the others: *Harttia absaberi*, MZUSP 85806, 60.5 mm SL, paratype. B) Present, vestigial or short: *Harttia duriventris*, MZUSP 34226, 93.2 mm SL. C) Absent: *Planiloricaria cryptodon*, MZUSP 56252, 93.1 mm SL. Scale bar 1 mm.

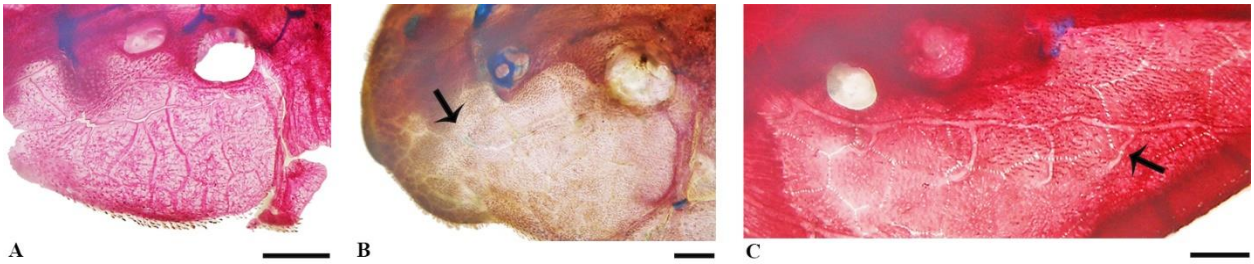

Figure 19. Branching of the infraorbital canals (arrow), lateral view. A) Not branched: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. B) Branches emerge from the canal between two infraorbitals; Non ossified: *Hemipsilichthys nimius*, DZSJRP 20430, 85.9 mm SL. C) Branches emerge from the canal inside the infraorbitals; Ossified: *Planiloricaria cryptodon*, MZUSP 56252, 93.1 mm SL. Scale bar 1 mm.

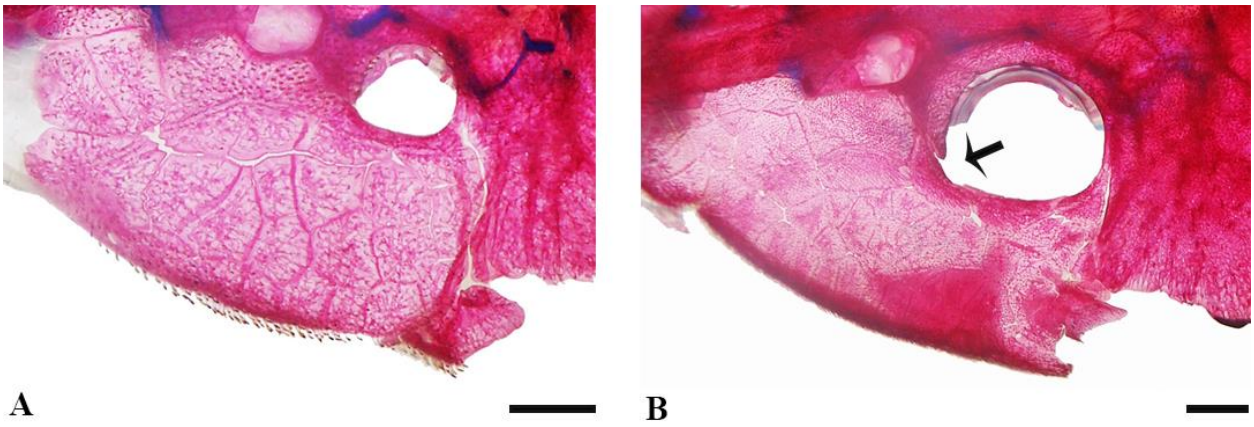

Figure 20. Antero-orbital notch (arrow), lateral view. A) Absent: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. B) Present: *Harttia* cf. *fowleri*, INPA 7845, 105.3 mm SL. Scale bar 1 mm.

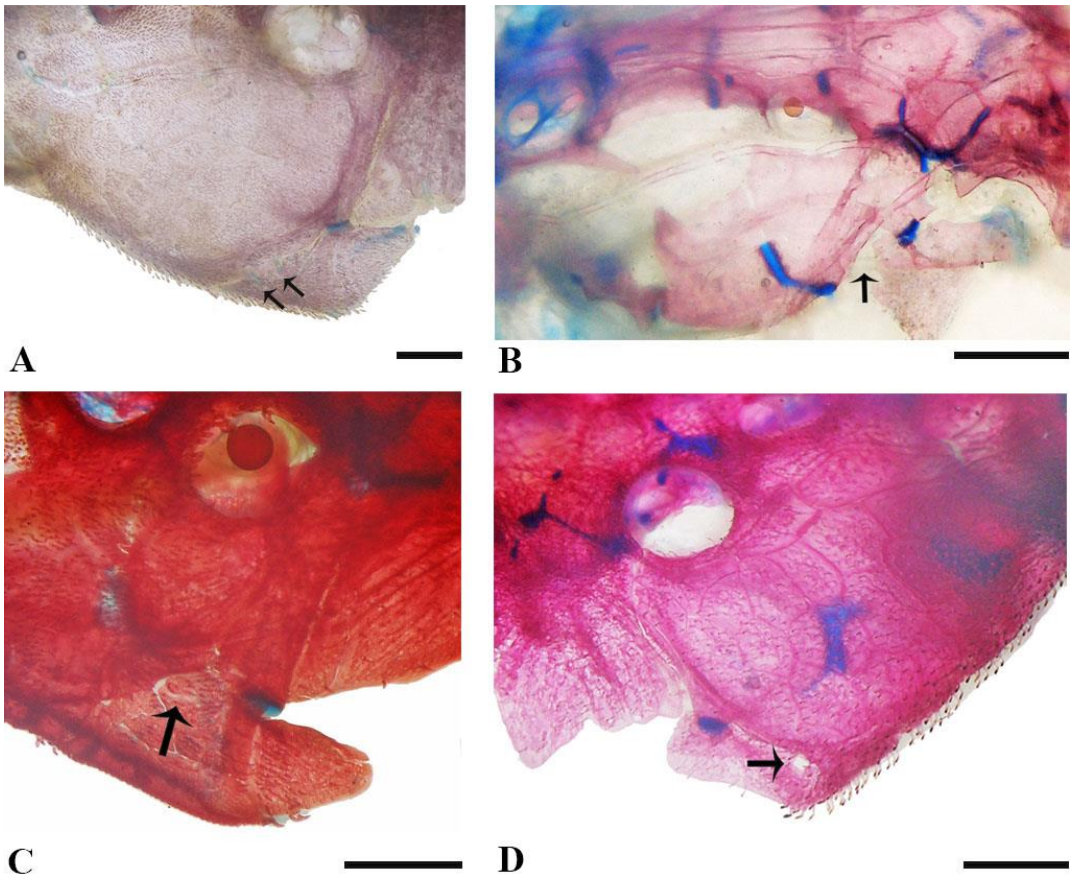

Figure 21. Extra branch from the preopercular canal (arrow), lateral view. A) Two extra branches: *Hemipsilichthys nimius*, DZSJRP 20430, 85.9 mm SL. B) One extra branch opening in the skin (not through a dermal plate): *Astroblepus* sp., MZUEL 13511, 47.5 mm SL. C) One extra branch laying on a dermal plate: *Apistoloricaria* sp., MZUSP 55629, 102.1 mm SL. D) No extra branch, just a pore: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. Scale bar 1 mm.

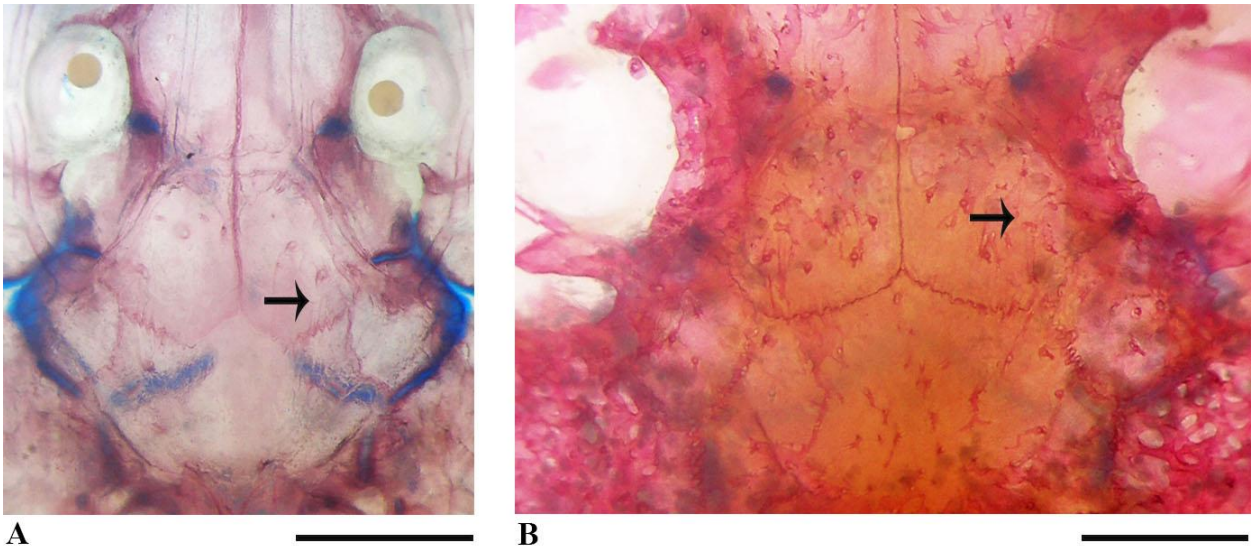

Figure 22. Shape of the parietal branch canal (arrow), dorsal view. A) Straight: *Astroblepus* sp., MZUEL 13511, 47.5 mm SL. B) Curved: *Lithogenes wahari*, MZUSP 103074, 53.1 mm SL, paratype. Scale bar 1 mm.

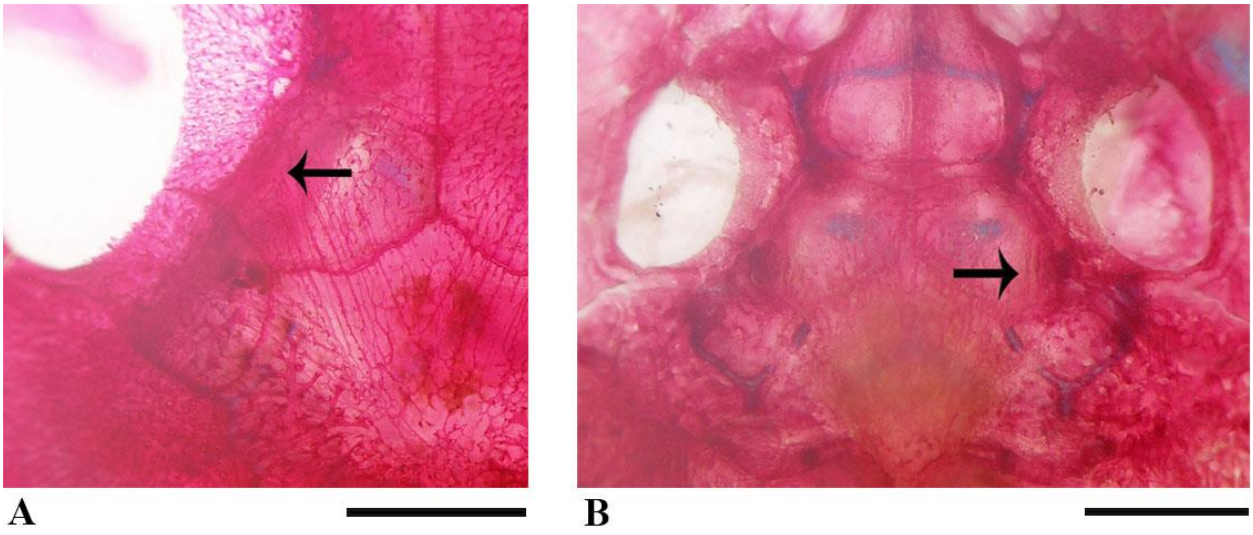

Figure 23. Length of the parietal branch canal (arrow), dorsal view. A) Very short: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. B) Long: *Harttia longipinna*, DZSJRP 3666, 51.5 mm SL, paratype. Scale bar 1 mm.

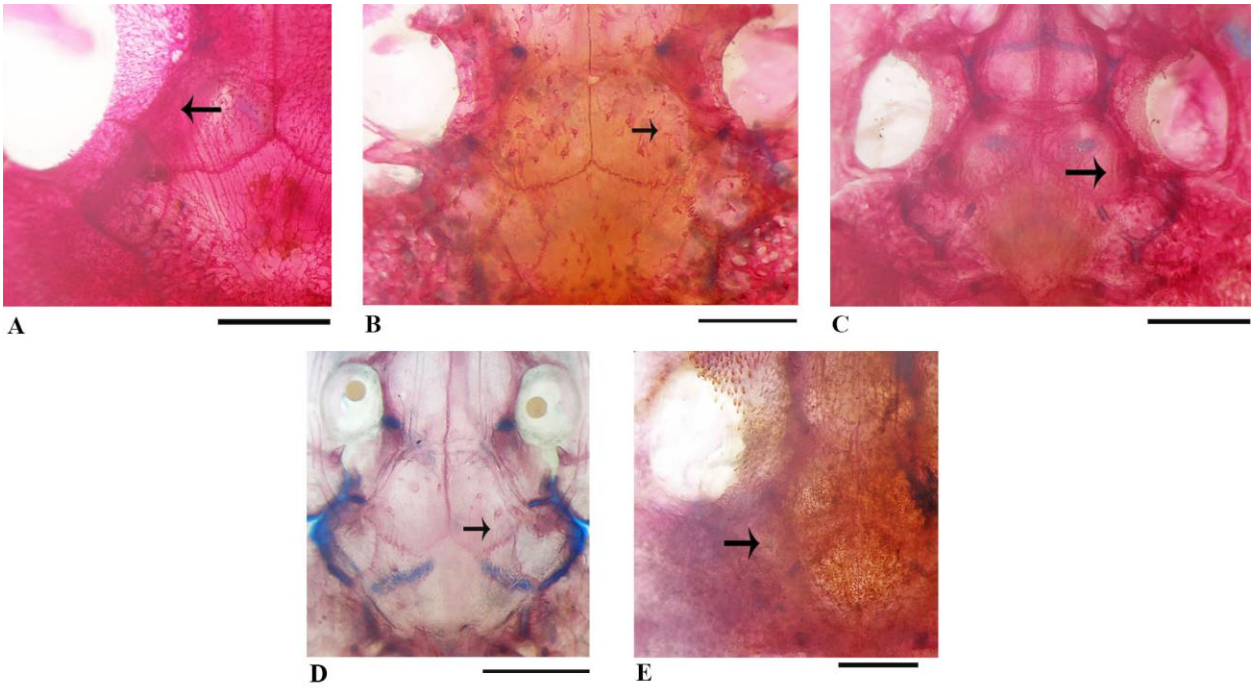

Figure 24. Exit of the parietal branch canal (arrow), dorsal view. A) Ending on the frontal: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. B) Ending on the border frontal/supraoccipital: *Lithogenes wahari*, MZUSP 103074, 53.1 mm SL, paratype. C) Ending on the border frontal/sphenotic: *Harttia longipinna*, DZSJRP 3666, 51.5 mm SL, paratype. D) Ending on the supraoccipital: *Astroblepus* sp., MZUEL 13511, 47.5 mm SL. E) Ending on the sphenotic: *Hemipsilichthys nimius*, DZSJRP 20430, 85.9 mm SL. Scale bar 1 mm.

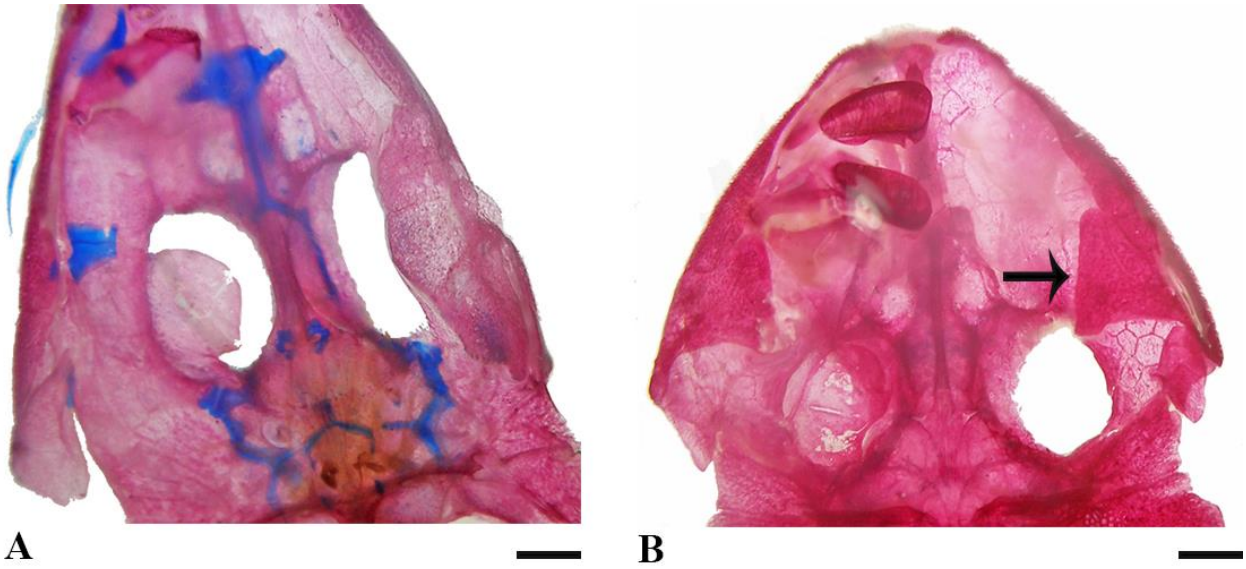

Figure 25. Shape of the canal plate (arrow), ventral view. A) Quadrangular or rectangular: *Limatulichthys griseus*, DZSJRP 13585, 133.4 mm SL. B) Triangular: *Harttia duriventris*, MZUSP 34226, 93.2 mm SL. Scale bar 1 mm.

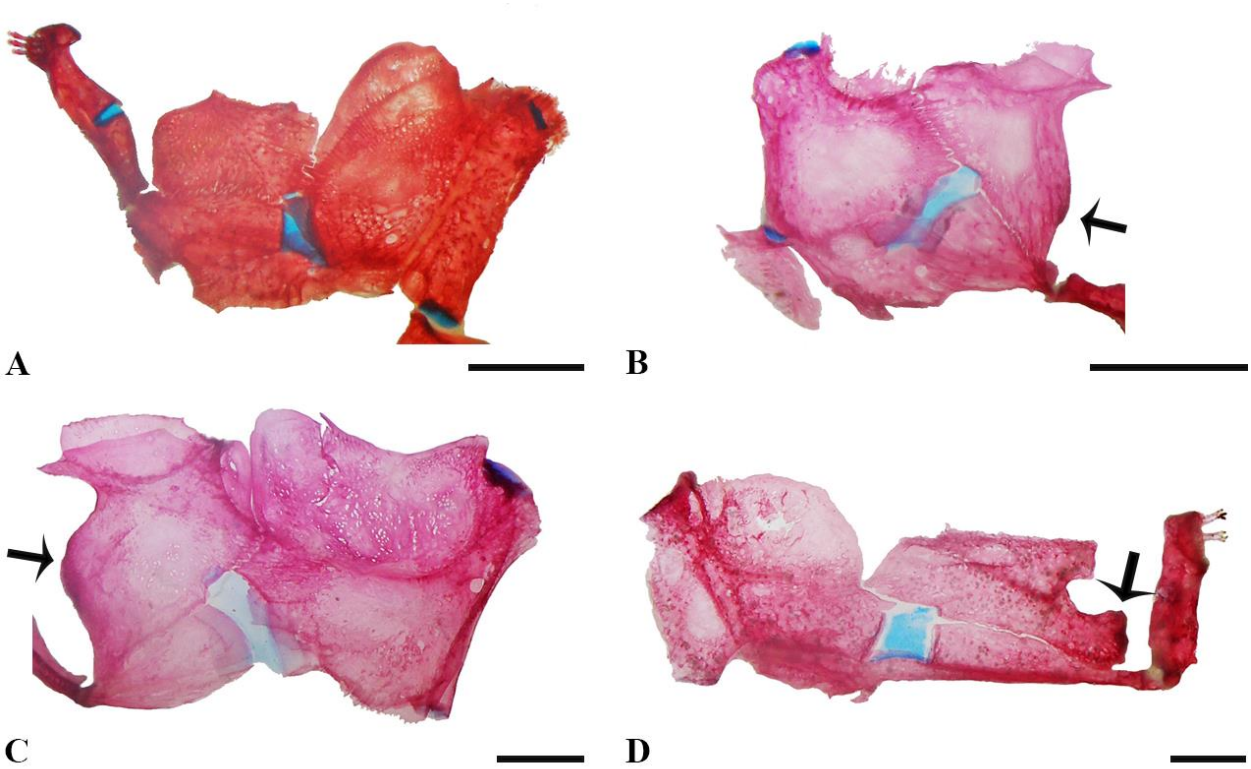

Figure 26. Anterior margin of the metapterygoid (arrow). A) With no expansion: *Apistoloricaria* sp., MZUSP 55629, 102.1 mm SL. B) With a developed expansion in the midanterior portion: *Harttia longipinna*, DZSJRP 3666, 51.5 mm SL, paratype. C) With an extremely developed expansion in the midanterior portion: *Harttia* cf. *fowleri*, INPA 7845, 105.3 mm SL. D) With an extremely developed expansion in the ventroanterior portion: *Furcodontichthys novaesi*, MZUSP 58191, 128.1 mm SL. Scale bar 1 mm.

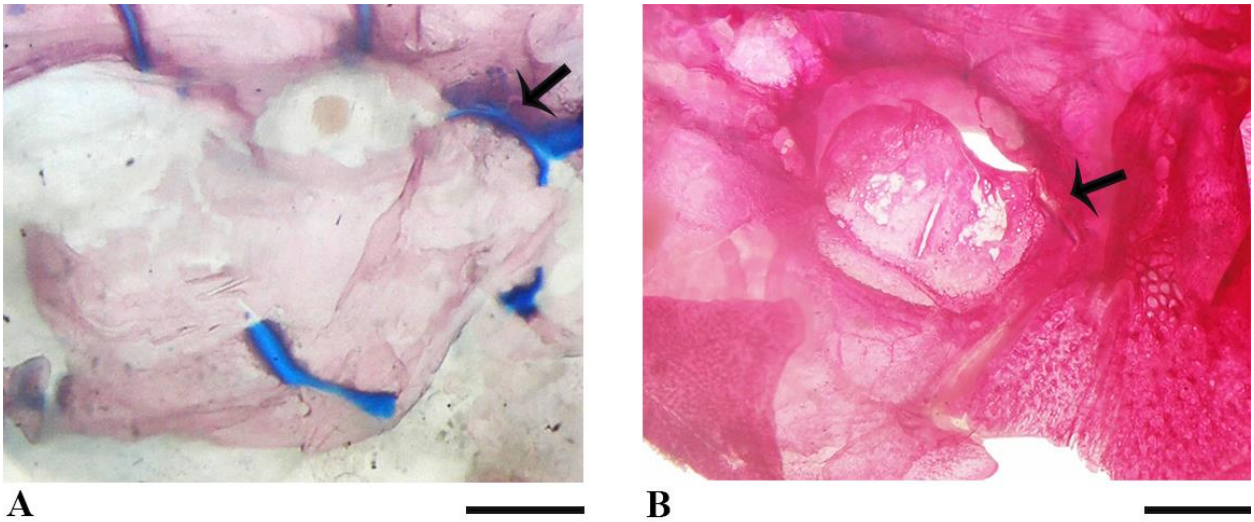

Figure 27. Extension of the hyomandibula condyle (arrow), ventral view. A) Long, the whole connection of hyomandibula to the skull through condyle: *Astroblepus* sp., MZUEL 13511, 47.5 mm SL. B) Media, about ⅔ of the connection performed by condyle: *Harttia duriventris*, MZUSP 34226, 93.2 mm SL. Scale bar 1 mm.

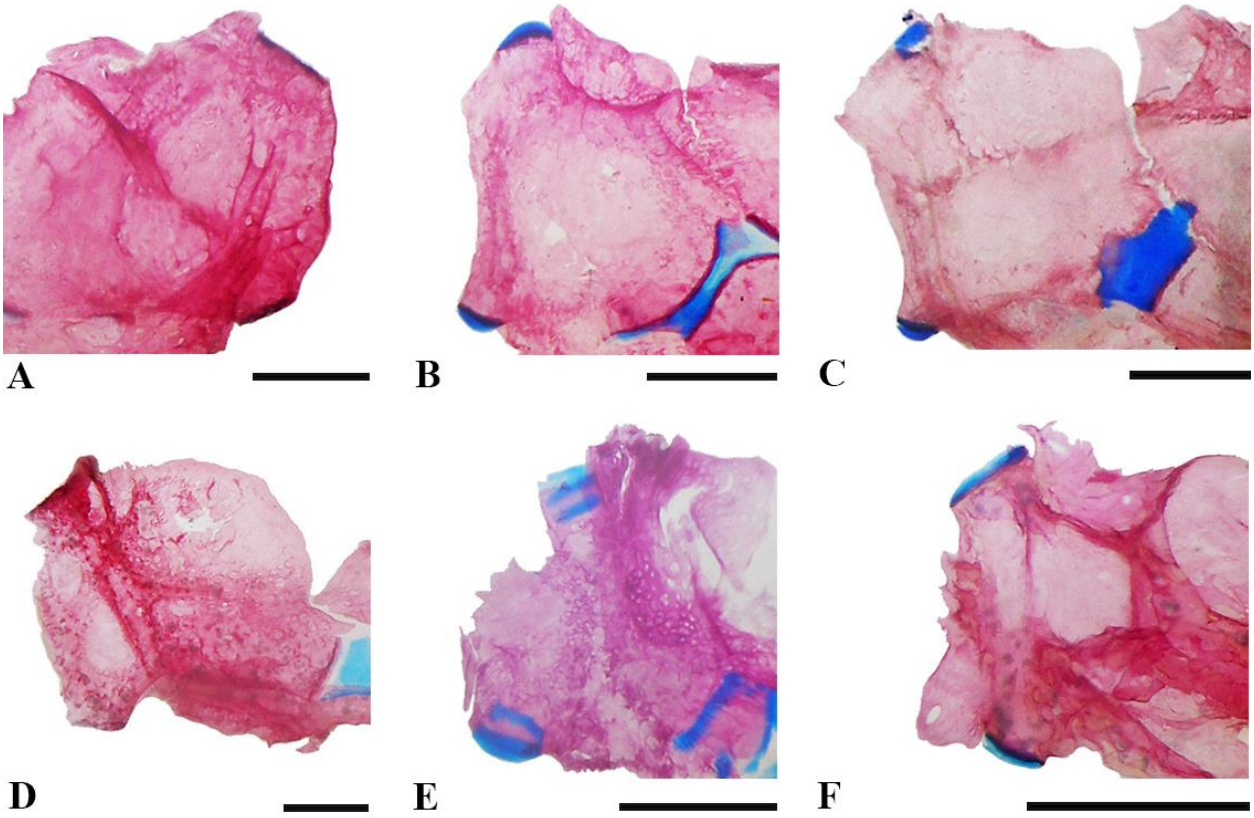

Figure 28. Margin of the hyomandibula in contact with the pterotic-supracleithrum. A) Straight: *Neoplecostomus microps*, DZSJRP 2144, 62.8 mm SL. B) With a small elevation near to the proximal condyle: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. C) With a large elevation near the proximal condyle: *Harttia absaberi*, MZUSP 85806, 60.5 mm SL, paratype. D) With a flap along the whole extension: *Furcodontichthys novaesi*, MZUSP 58191, 128.1 mm SL. E) With a very distinct process that makes part of the margin: *Hemiodontichthys acipenserinus*, DZSJRP 21189, 89.0 mm SL. F) With a very distinct process that do not make part of the margin: *Lithogenes wahari*, MZUSP 103074, 53.1 mm SL, paratype. Scale bar 1 mm.

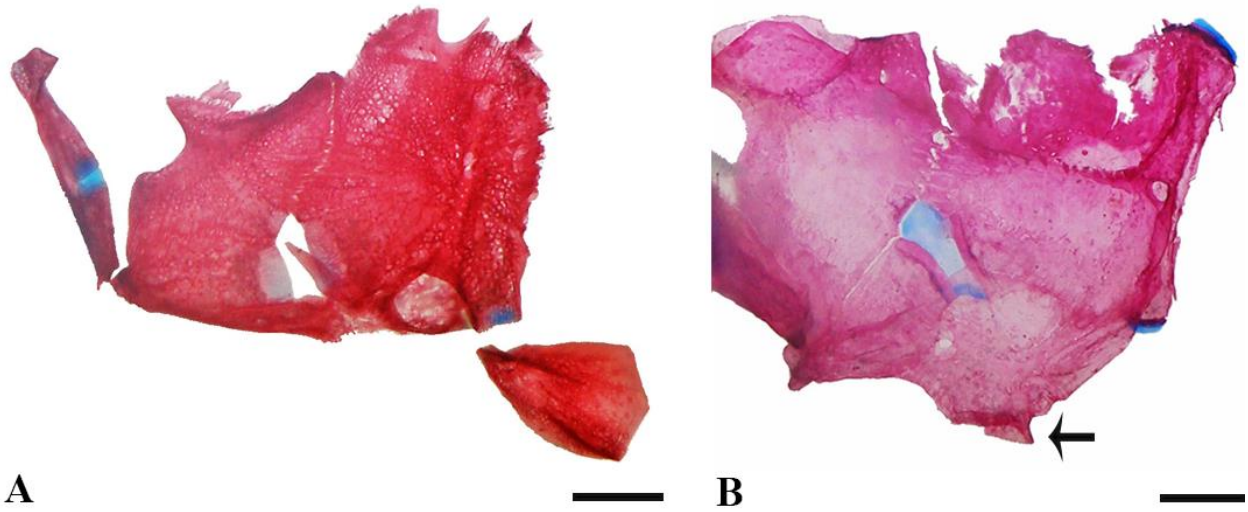

Figure 29. Ventral process of the preopercle (arrow), ventral view. A) Absent or inconspicuous: *Planiloricaria cryptodon*, MZUSP 56252, 93.1 mm SL. B) Well developed: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. Scale bar 1 mm.

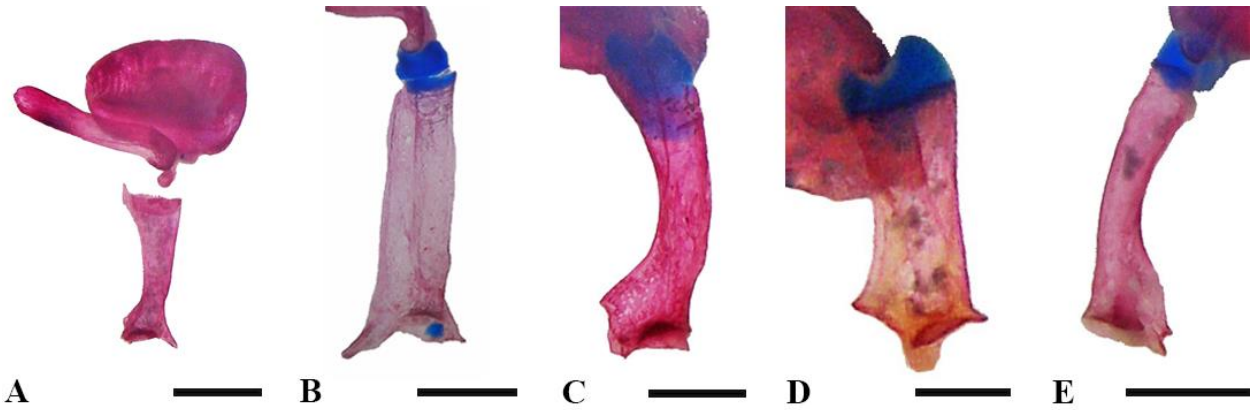

Figure 30. Shape of autopalatine. A) Rod-shaped, without lateral flap: *Harttia duriventris*, MZUSP 34226, 93.2 mm SL. B) Rectangular, with a lateral flap along the extension of the bone: *Limatulichthys griseus*, DZSJRP 13585, 133.4 mm SL. C) Rectangular with the distal portion more expanded, triangular lateral flap with distal portion forming an acute angle: *Harttia* cf. *fowleri*, INPA 7845, 105.3 mm SL. D) Elongated approximately rectangular, with well-developed lateral flap that covers 2/3 of the lateral extension of the bone in the distal portion: *Lithogenes wahari*, MZUSP 103074, 53.1 mm SL, paratype. E) Elongated with expanded base, well-developed flap that covers 1/3 of the length of the bone in the proximal portion: *Farlowella oxyrryncha*, DZSJRP 14759, 123.2 mm SL. Scale bar 1 mm.

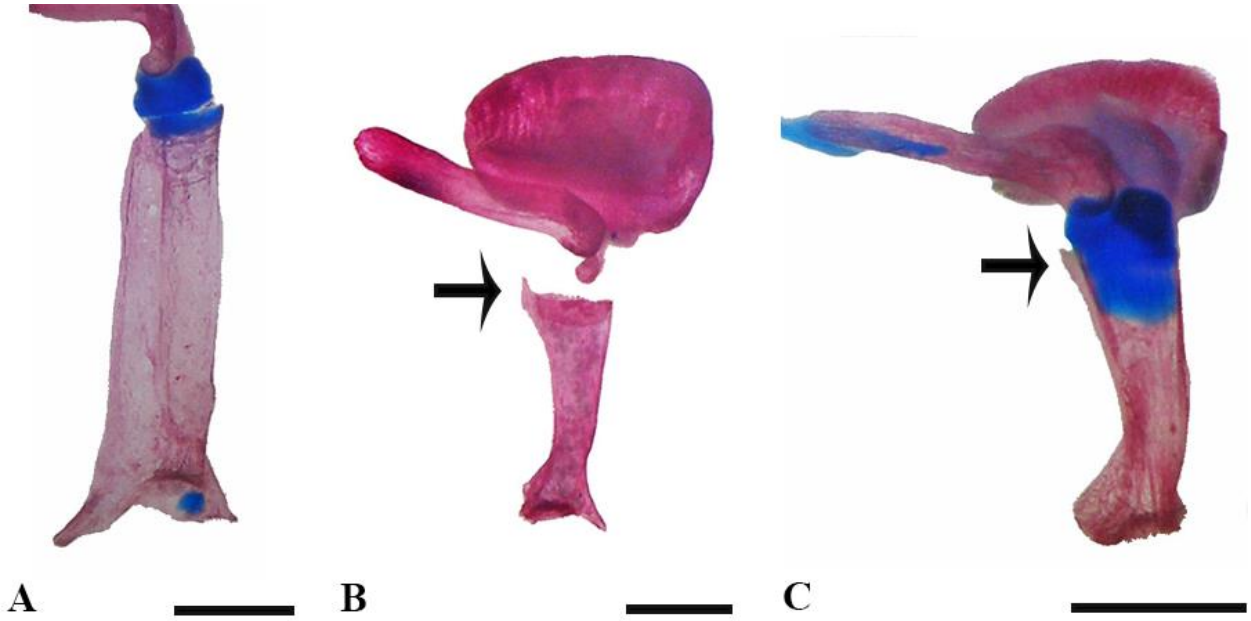

Figure 31. Anterior process of the autopalatine (arrow). A) Absent: *Limatulichthys griseus*, DZSJRP 13585, 133.4 mm SL. B) Present: *Harttia duriventris*, MZUSP 34226, 93.2 mm SL. C) Present: *Sturisoma robustum*, DZSJRP 4255, 102.9 mm SL. Scale bar 1 mm.

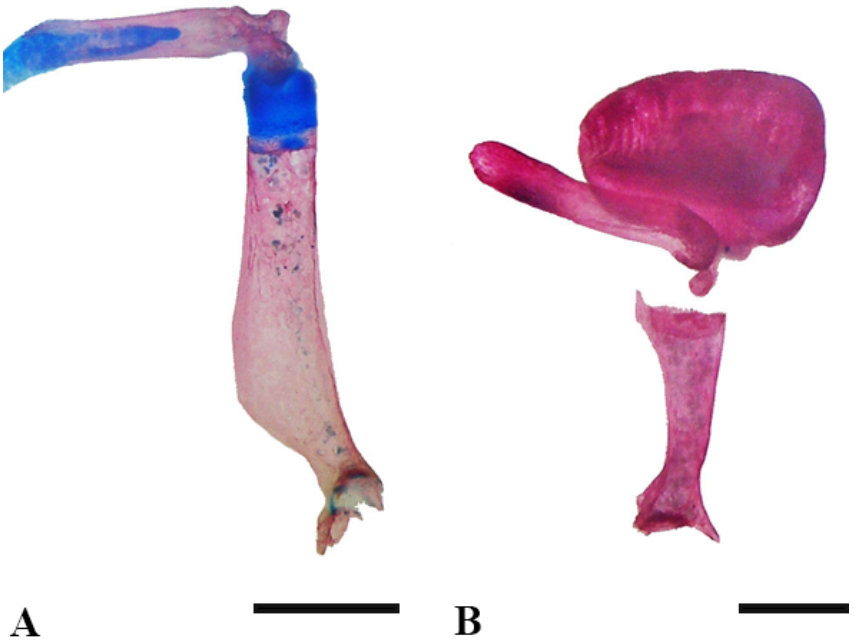

Figure 32. Median thickness of the maxillary in relation to the thickness of the autopalatine. A) Maxillary up to half of the thickness of the autopalatine: *Brochiloricaria* sp., DZSJRP 18893, 86.9 mm SL. B) Maxillary with approximately the same thickness as the autopalatine: *Harttia duriventris*, MZUSP 34226, 93.2 mm SL. Scale bar 1 mm.

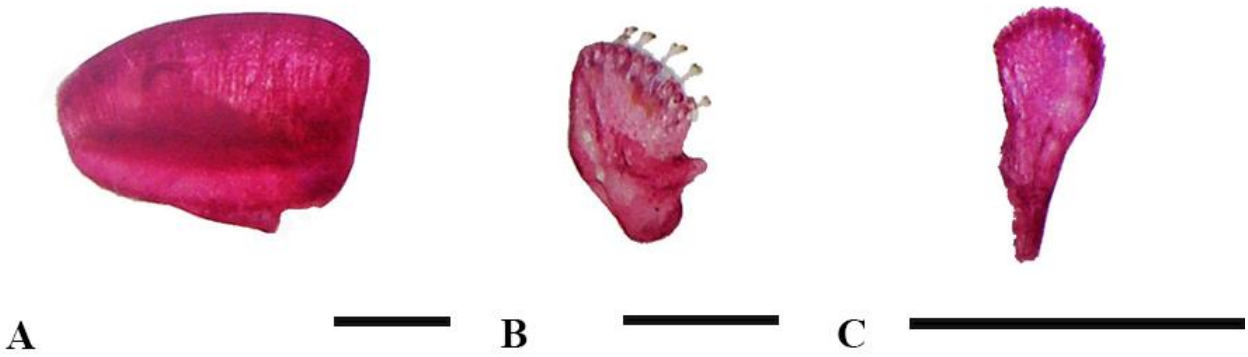

Figure 33. Position of the premaxilla condyle. A) Posterior: *Harttia duriventris*, MZUSP 34226, 93.2 mm SL. B) Lateral: *Limatulichthys griseus*, DZSJRP 13585, 133.4 mm SL. C) Mesial: *Loricariichthys castaneus*, DZSJRP 2313, 139.7 mm SL. Scale bar 1 mm.

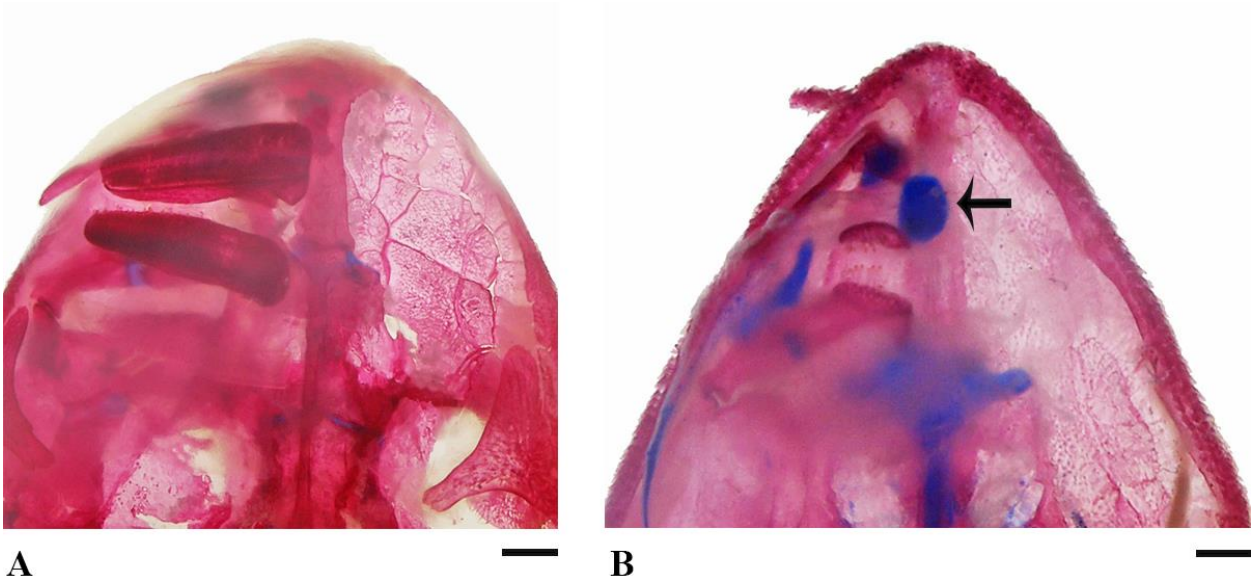

Figure 34. Mesethmoid cartilage (arrow), ventral view. A) Absent: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. B) Present: *Limatulichthys griseus*, DZSJRP 13585, 133.4 mm SL. Scale bar 1 mm.

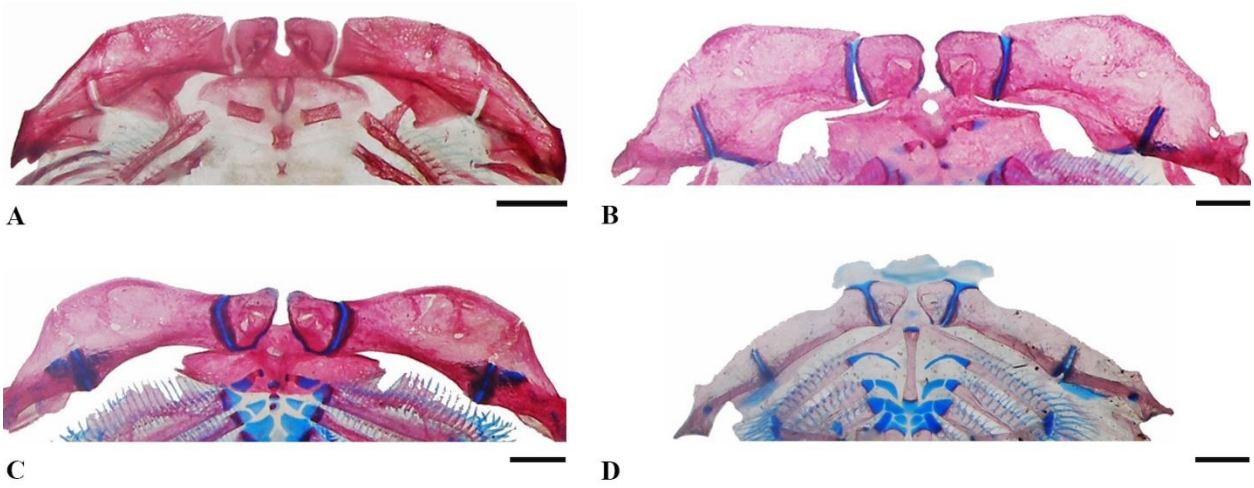

Figure 35. Anterior margin of the ceratohyal, dorsal view. A) Not expanded: *Metaloricaria paucidens*, INPA 5440, 73.7 mm SL. B) Expanded, but the hipohyal not expanded: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. C) As expanded as the hipohyal: *Harttia gracilis*, MZUSP 99678, 61.0 mm SL. D) Opposite expansion, inward: *Astroblepus* sp., MZUEL 13511, 47.5 mm SL. Scale bar 1 mm.

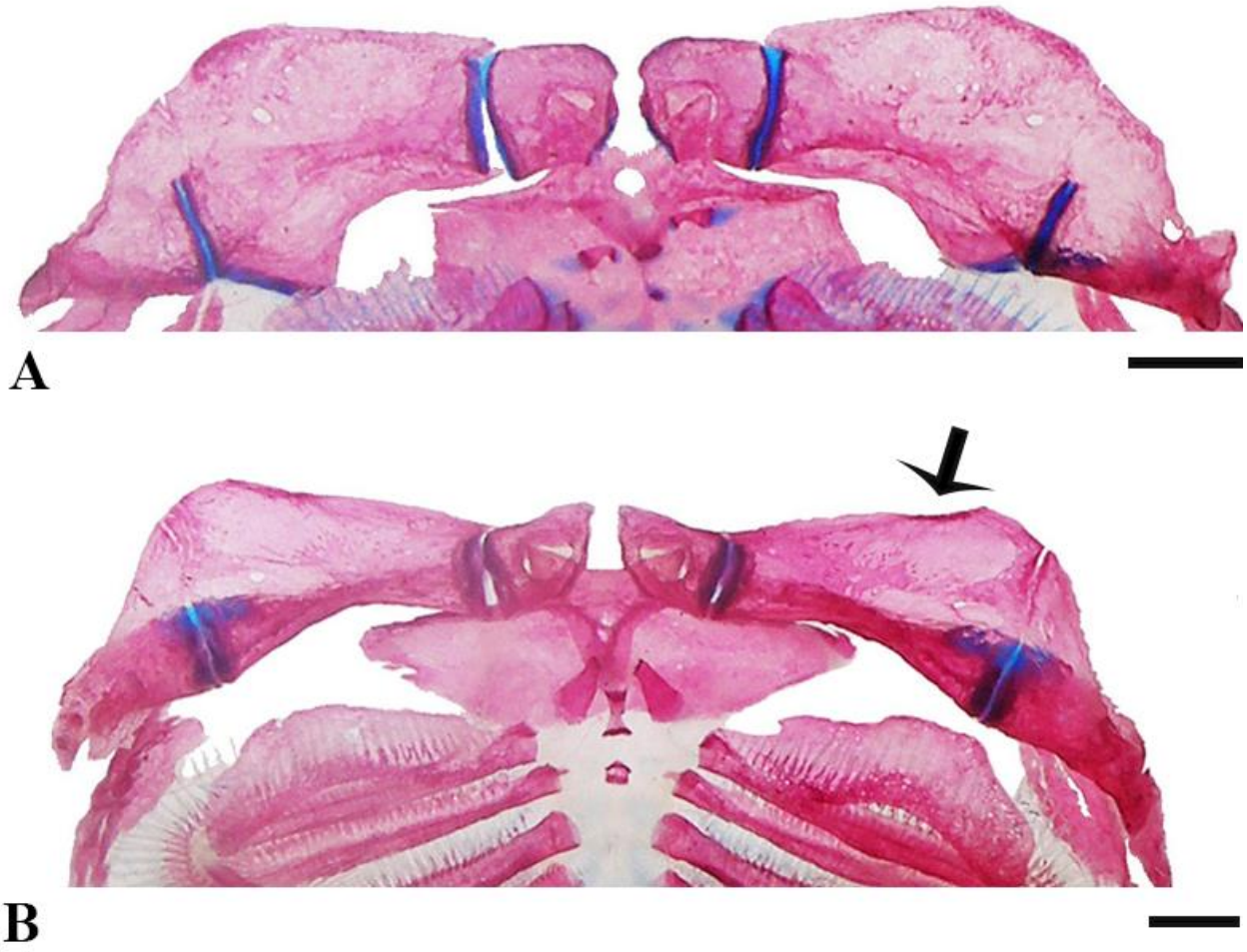

Figure 36. Ventral crest in the anterior margin of ceratohyal (arrow), dorsal view. A) Absent: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. B) Present: *Harttia* cf. *fowleri*, INPA 7845, 105.3 mm SL. Scale bar 1 mm.

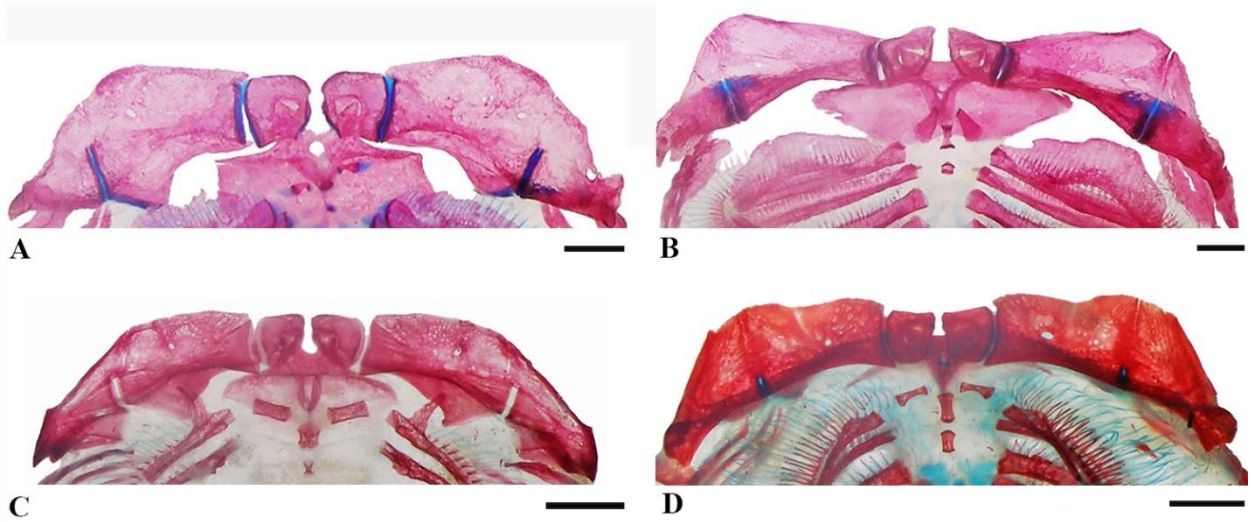

Figure 37. Shape of the first pair of hipobranchials, dorsal view. A) Fan: *Harttia leiopleura*, MZUSP 109373, 51.0 mm SL. B) Fan: *Harttia* cf. *fowleri*, INPA 7845, 105.3 mm SL. C) Rod: *Metaloricaria paucidens*, INPA 5440, 73.7 mm SL. D) Hourglass: *Apistoloricaria* sp., MZUSP 55629, 102.1 mm SL. Scale bar 1 mm.

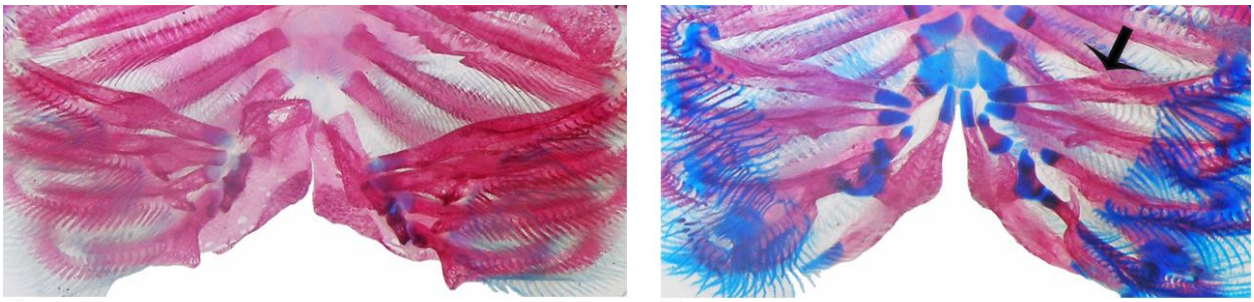

Figure 38. Anterior process of the first epibranchial (arrow), dorsal view. A) Absent or inconspicuous: *Harttia* cf. *fowleri*, INPA 7845, 105.3 mm SL. B) Conspicuous: *Harttia gracilis*, MZUSP 99678, 61.0 mm SL. Scale bar 1 mm.

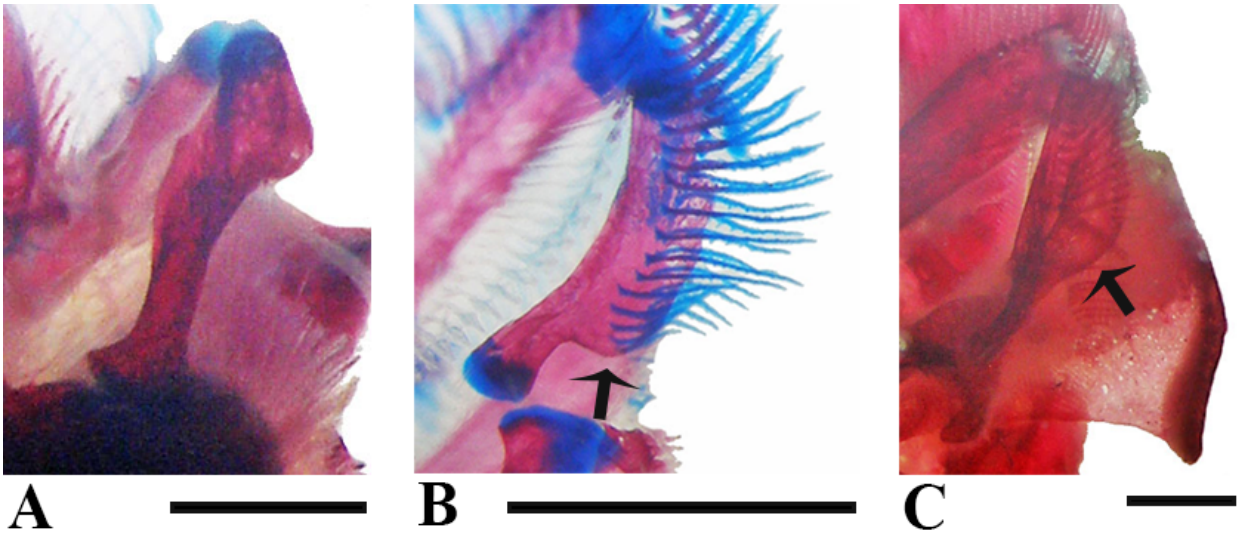

Figure 39. Shape of and rectangular flap (arrow) of the fourth epibranchial. A) Sinusoidal; Absent flap: *Crossoloricaria variegata*, MZUSP 103055, 100.3 mm. B) L-shaped bar; Present flap: *Harttia gracilis*, MZUSP 99678, 61.0 mm SL. C) Bar approximately straight; Present flap: *Lamontichthys llanero*, MZUSP 85799, 153.9 mm SL. Scale bar 1 mm.

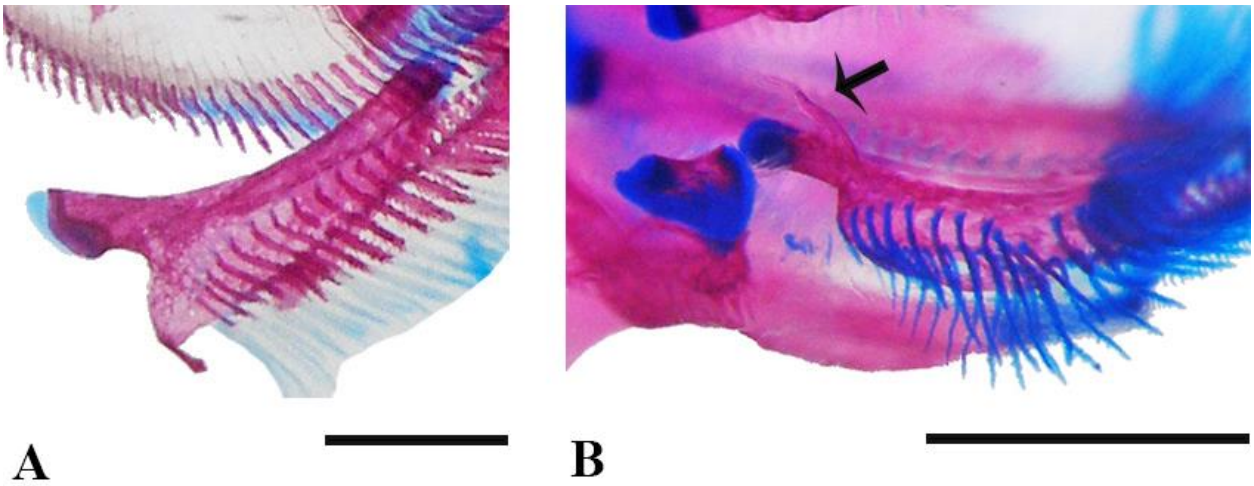

Figure 40. Posterior process of the fourth epibranchial (arrow). A) Absent: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. B) Present: *Harttia gracilis*, MZUSP 99678, 61.0 mm SL. Scale bar 1 mm.

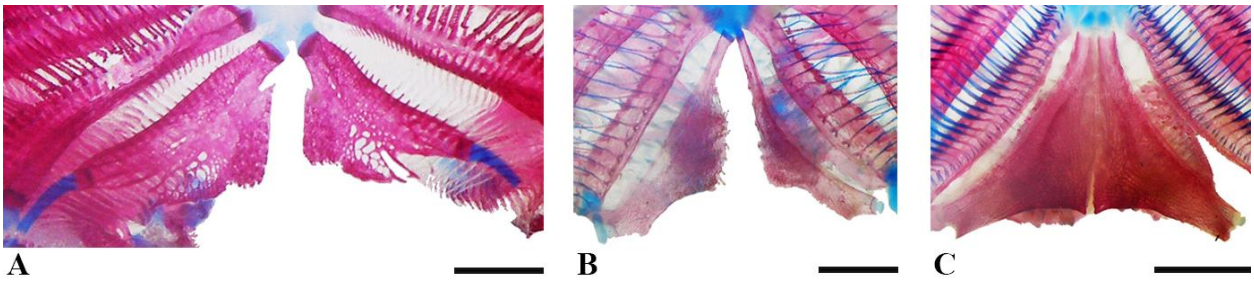

Figure 41. Shape and connection between lower pharyngeal tooth plates, ventral view. A) Two triangular and expanded plates; Absent connection: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. B) Two triangular and thin plates; Absent connection: *Limatulichthys griseus*, DZSJRP 13585, 133.4 mm SL. C) Plates joined together forming a large triangle; Present connection: *Loricaria cataphracta*, MZUSP 14106, 111.9 mm SL. Scale bar 1 mm.

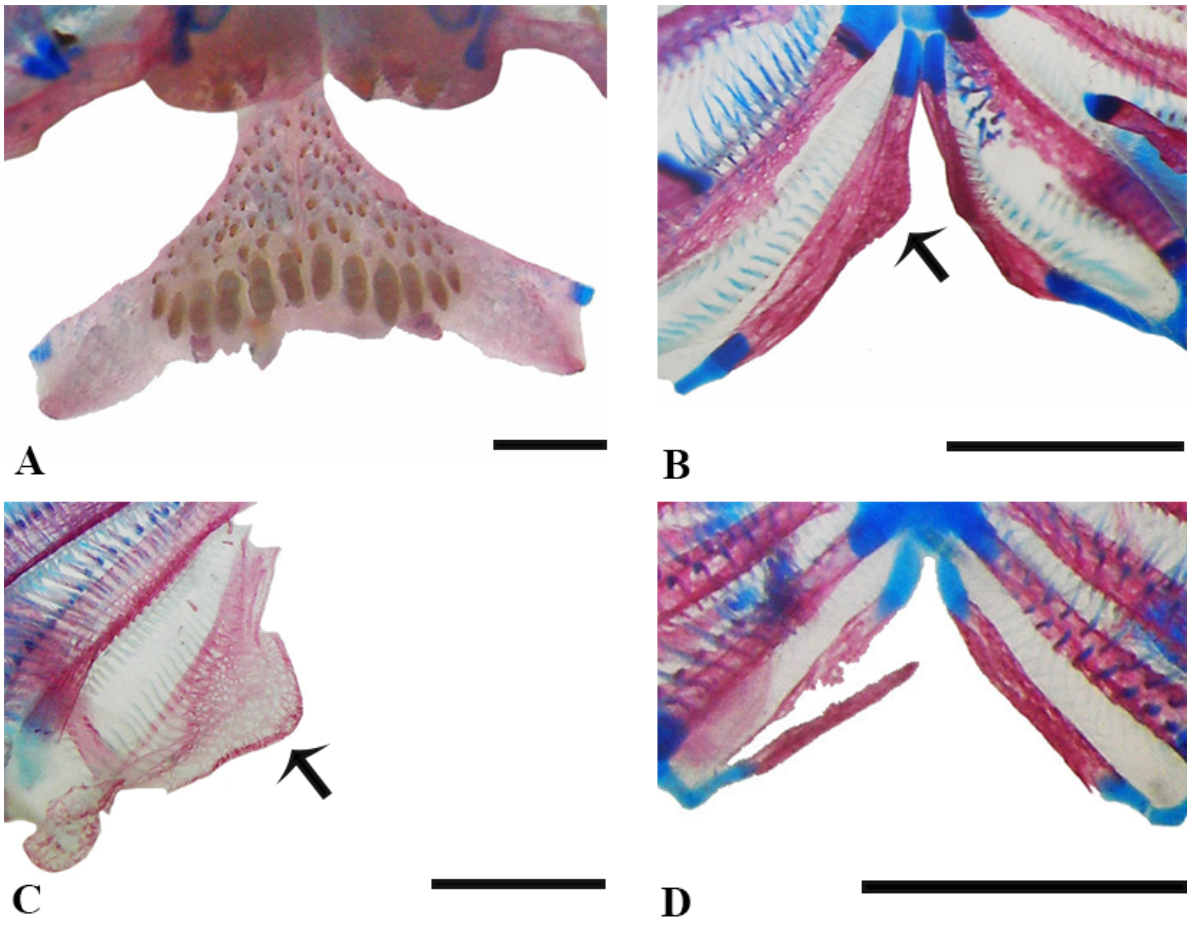

Figure 42. Teeth of lower pharyngeal tooth plates (arrow), ventral view. A) Cover almost the entire plate: *Brochiloricaria* sp., DZSJRP 18893, 86.9 mm SL. B) Restricted to a small mesial triangular area: *Harttia gracilis*, MZUSP 99678, 61.0 mm SL. C) Restricted to the posterior border: *Pterosturisoma* cf. *microps*, MZUSP 57469, 96.5 mm SL. D) Absent: *Harttiella crassicauda*, AUM 50401, 28.7 mm SL. Scale bar 1 mm.

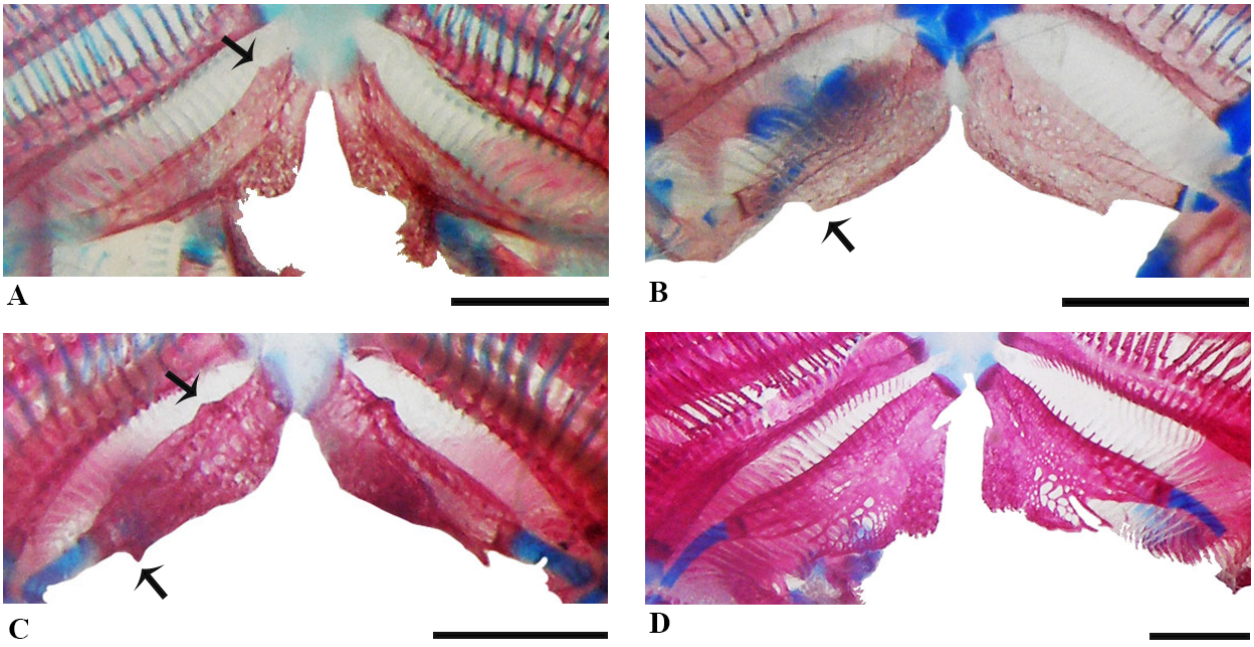

Figure 43. Processes of the lower pharyngeal tooth plates (arrow), ventral view. A) Present, in the anterior margin: *Harttia longipinna*, DZSJRP 3666, 51.5 mm SL, paratype. B) Present, in the posterior margin: *Harttia absaberi*, MZUSP 85806, 60.5 mm SL, paratype. C) Present, on both margins: *Pseudotocinclus tietensis*, LBP 2964, 53.3 mm SL. D) Absent: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. Scale bar 1 mm.

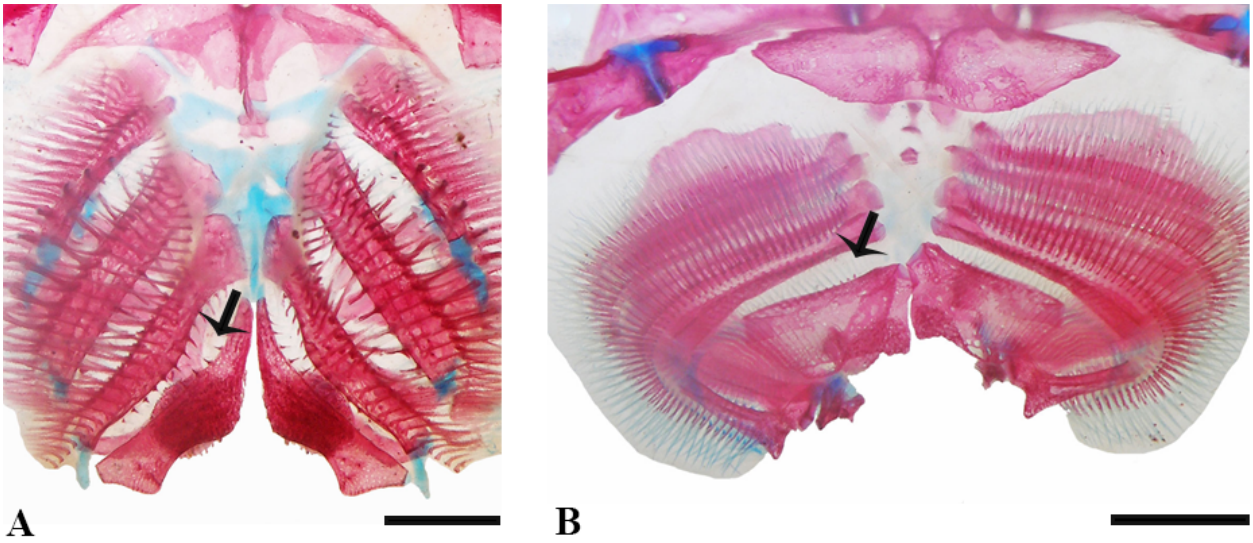

Figure 44. Branchial rakers (arrow), ventral view. A) Short and few in number: *Reganella depressa*, MZUSP 57729, 152.0 mm SL. B) Long and very numerous: *Harttia* cf. *fowleri*, INPA 7845, 105.3 mm SL. Scale bar 1 mm.

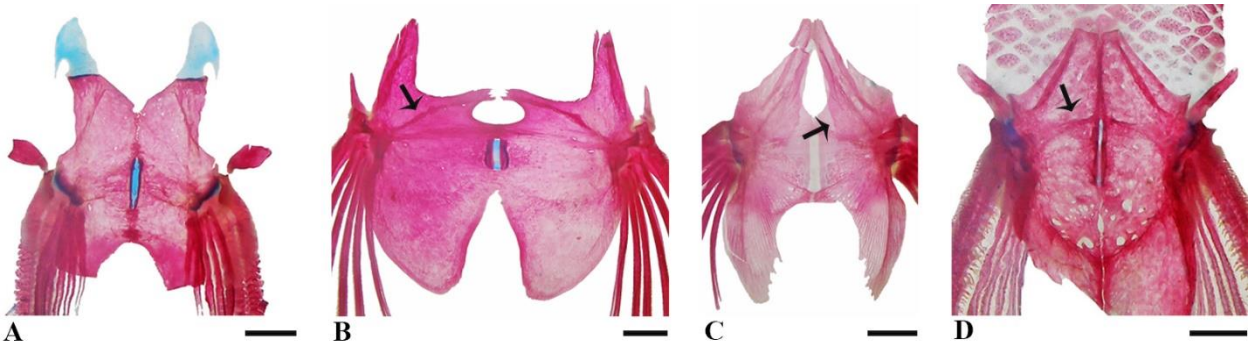

Figure 45. Arrector ventralis flaps (arrow). A) Absent or rudimentary: *Lithogenes wahari*, MZUSP 103074, 53.1 mm SL, paratype. B) Conspicuous crests, anteromesially oriented, connected in the midline, forming an inverted V: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. C) Very enlarged and folded crests, covering the main body of the basipterygium: *Loricaria cataphracta*, MZUSP 14106, 111.9 mm SL. D) Conspicuous crests, mesially oriented, meeting at the midline, forming a single transverse crest: *Pseudotocinclus tietensis*, LBP 2964, 53.3 mm SL. Scale bar 1 mm.

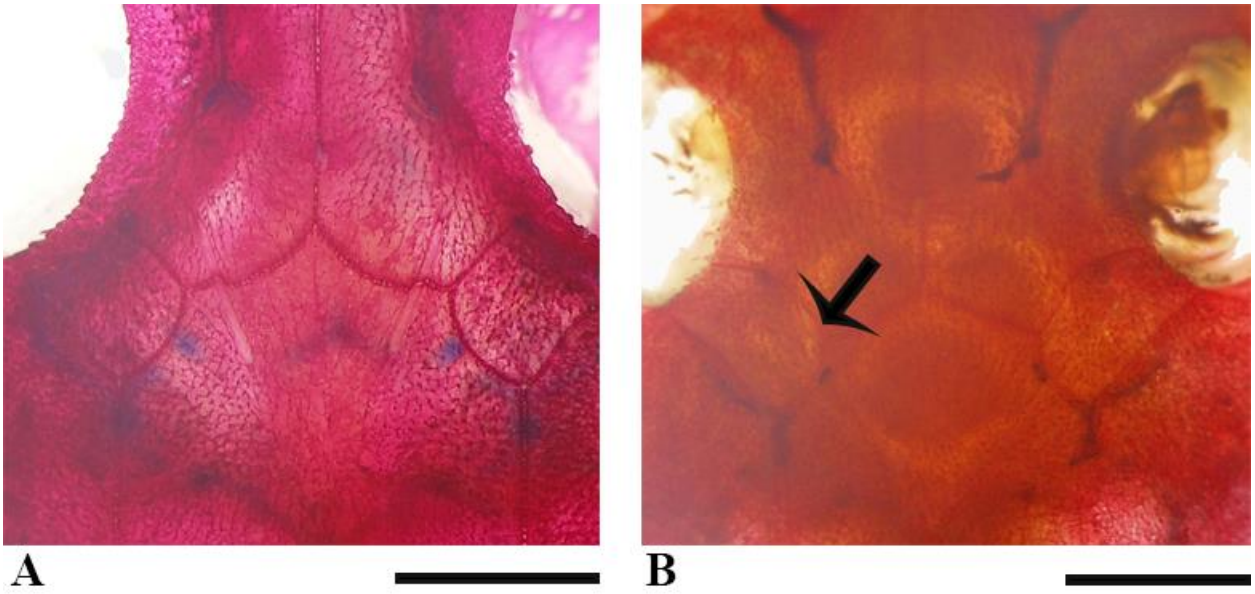

Figure 46. Space among sphenotic, pterotic and frontal (arrow), dorsal view. A) Absent: *Harttia* cf. *surinamensis*, MZUSP 34224, 104.7 mm SL. B) Present: *Harttia* tapajós sp. 1, MZUSP 97086, 93.4 mm SL. Scale bar 1 mm.

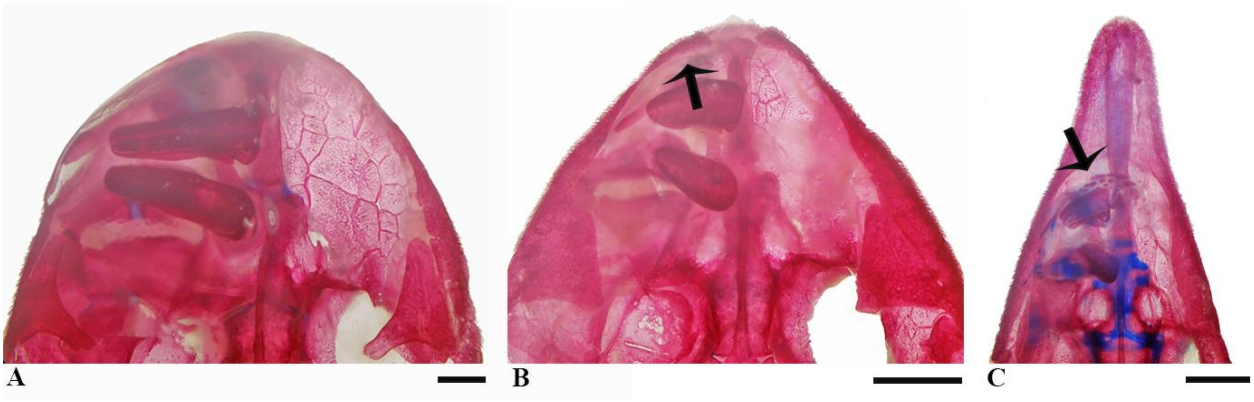

Figure 47. Lips, ventral view. A) Fleshy: *Harttia punctata*, MZUSP 96172, 92.7 mm SL. B) Bony plates over the lips (arrow): *Harttia duriventris*, MZUSP 34226, 93.2 mm SL. C) Bony plates over the lips (arrow): *Sturisoma robustum*, DZSJRP 4255, 102.9 mm SL. Scale bar 1 mm.

Figure 48. Strict consensus cladogram constructed from the 39 equally parsimonious trees found (2.119 steps; CI = 0.229; RI = 0.620). Upper numbers indicate clade number. Lower numbers indicate Bremer Support.

Appendix 1. Material Examined

The list of taxa is organized phylogenetically by family and subfamily (except Loricariinae), and posteriorly alphabetically for each terminal (except *Harttia*). Data are presented in the following order: species name, museum and catalog number, total number of specimens in that lot, in parentheses: number of cleared and stained (c&s) specimens followed by the respective standard length (cases in where specimens were measured after clearing and staining process, this number is also in parentheses), and locality (geographic coordinates are given only for species of *Harttia*). Brazil is the country when this information is not indicated.

Outgroup

PIMELODIDAE

Pimelodus maculatus: DZSJRP 8887, 10, (1 d&c, 47.0 mm), rio Paraná, reservatório de Ilha Solteira, Ilha Solteira, São Paulo.

TRICHOMYCTERIDAE

Trichomycterus cf. *mirissumba*: DZSJRP 8623, 38, (1 d&c, 59.9 mm), riacho em vicinal à esq. da MG347, sentido Carmo de Minas - Pedralva, antes km 62, Carmo de Minas, Minas Gerais.

Trichomycterus maracaya: DZSJRP 8570, (1 d&c, 59.8 mm), rio Baependi, BR267, acesso para Aiuruoca, Aiuruoca, Minas Gerais.

CALLICHTHYIDAE

Callichthys callichthys: DZSJRP 9849, 7, (1 d&c, 52.7 mm) riacho sem nome, afluente do Ribeirão Avanhandava, Monte Azul Paulista, São Paulo.

SCOLOPLACIDAE

Scoloplax sp.: DZSJRP 9196, 10, (1 d&c, 12.5 mm), rio Cristalino, drenagem do Tocantins Araguaia, fazenda Três Poderes, Cocalinho, Mato Grosso.

ASTROBLEPIDAE

Astroblepus sp.: MZUEL 13511, (1 de 2 d&c, 47.5 mm), rio qda La Florida, a 500 mts antes de la confluência com el río Uchibamba, bacia do rio Uchibamba, Pedro Ruíz, Peru.

LORICARIIDAE

Lithogeninae

Lithogenes wahari: MZUSP 103074, 2, (1 d&c, 53.1 mm), parátipos, caño Pawa, aprox.. 30 min by foot upstream from its mouth into rio Cuao, near Puerto Nuevo, Puerto Nuevo, Venezuela.

Delturinae

Hemipsilichthys nimius: DZSJRP 20430, 29, (1 d&c, 85.9 mm), rio Carrasquinho, afluente do rio Pereque-Açu, estrada Parati-Cunha, Parati, Rio de Janeiro.

Hypostominae

Ancistrus multipinnis: DZSJRP12499, 21, (1 d&c, 52.1 mm), riacho na fazenda Atlântica, a 100 m do centro de Tinguá, drenagem litorânea, Tinguá, Rio de Janeiro.

Hypostomus ancistroides: DZSJRP 13311, 26, (1 d&c, 54.1 mm), riacho afluente do rio Paranapanema, Teodoro Sampaio, São Paulo.

Neoplecostominae

Isbrueckerichthys duseni: DZSJRP 13670, (1 d&c, 48.3 mm), ribeirão das Areias, bacia do rio Ribeira de Iguape, Tapiraí, São Paulo. MZUSP 81586, 5, ribeirão afluente do Ribeirão dos Prestes, afluente do rio Ribeira, na localidade de Lagoa dos Ribas, Castro, Paraná.

Kronichthys heylandi: DJZSJRP 12498, 20, (1 d&c, 49.4 mm), riacho na fazenda Atlântica, a 100 m do centro de Tinguá, drenagem litorânea, Tinguá, Rio de Janeiro.

Neoplecostomus microps: DZSJRP 20421, 16, riacho após a estrada ecológica de Bananal, rio Paraíba do Sul, Bananal, São Paulo. DZSJRP 2144, 16, (1 d&c, 62.8mm), riacho Jardim do Paraíso, rodovia Cunha-Parati, afluente do rio Jacuí-Mirim, rio Paraíba do Sul, Cunha, São Paulo.

Pareiorhina rudolphi: LIRP 1966, 7 de 10, (1 d&c, (49.9 mm)), córrego Bem Fica, afluente do rio Piquete, drenagem do rio Paraíba do Sul, Piquete, São Paulo. MZUSP 45469, 1 d&c, cabeceiras do rio Piquete, afluente do rio Paraíba do Sul, 3 km acima da cidade de Piquete, Piquete, São Paulo.

Hypoptopomatinae

Hypoptopoma inexpectata: DZSJRP 15807, 50, (1 d&c, 64.4 mm), rio Cuiabá, drenagem do rio Paraguai, Poconé, Mato Grosso.

Plesioptopoma curvidens: DZSJRP 16133, (1 de 2 d&c, 51.4 mm), rio Paraopeba, ponte antiga, lateral à BR 040, aprox. 100m, drenagem do rio São Francisco, Cristiano Otoni, Minas Gerais. DZSJRP 20968, 3, rio Paraopeba, ponte antiga, paralela aquela na BR 040, drenagem do rio São Francisco, Cristiano Otoni, Minas Gerais.

Pseudotocinclus tietensis: DZSJRP 6940, 1 de 2, rio Paraitinga (Tietê), próx. à divisa de Salesópolis, Paraibuna, São Paulo. LBP 2964, (1 d&c, 53.3 mm), rio Paraitinga, bacia do rio Tietê, Salesópolis, São Paulo.

Loricariinae

Apistoloricaria sp.: MZUSP 55629, (1 d&c, (102.1 mm)), rio Solimões, 4,6 km abaixo de Caicara, drenagem do rio Solimões, Amazonas. MZUSP 56108, 1, rio Solimões, 8,5 km abaixo do Paraná do Taiacutuba, Amazonas.

Brochiloricaria sp.: DZSJRP 18893, 2, (1 d&c, 86.9 mm), rio Sepotuba, bacia do Paraguai, TSB-3, Tangará da Serra, Mato Grosso.

Crossoloricaria variegata: MZUSP 103055, (1 d&c, (100.3 mm)), rio Apure, ca. 10 km abajo de San Fernando de Apure, drenagem rio Apure, San Fernando de Apure, Venezuela.

Crossoloricaria sp.: MZUSP 48799, 1 de 4, rio Acre, entre Seringal Paraíso e lago Amapá. Acre.

Cteniloricaria platystoma: INPA 58231, 3 de 9, (1 d&c, 80.4 mm), rio Essequibo, pedral na margem direita, próximo a balsa para Kurupukari, Alto Demerara-Berbice Kurupukari, drenagem Essequibo, Guiana.

Farlowella oxyrryncha: DZSJRP 14759, 7, (1 d&c, 123.2 mm), ponto 13, bacia do rio Machado, drenagem do rio Madeira, Presidente Médici, Rondônia.

Furcodontichthys novaesi: MZUSP 58161, 1 de 2, 18,2 km abaixo do Lago Azul, rio Tapajós, Pará. MZUSP 58191, (1 d&c, (128.1 mm)), 5,4 Km abaixo do Anuma, rio Tapajós, Pará.

Harttiella crassicauda: AUM 50392, 1, unnamed tributary of creek in SUR 09-05, 5 km NNE Suralco base camp, Sipaliwini, Suriname. AUM 50401, 2, (1 d&c, 28.7 mm), unnamed tributary, 7.25 km E Suralco base camp, Nassau Mountain, Sipaliwini, Suriname.

Hemiodontichthys acipenserinus: DZSJRP 21189 (ex-ZUEC 14364), 3, (1 d&c, 89.0 mm), igarapé Timboteau, comunidade Timboteau, afluente do rio Marapanim, Marapanim, Pará.

Lamontichthys llanero: MZUSP 85799, (1 d&c, 153.9 mm), rio Orituco, drenagem Orenoco, Guarico, Venezuela.

Lamontichthys sp.: MZUSP 26838, 1, corredeira perto do lago do Banho, Gruta Matilde, Goiás.

Limatulichthys griseus: DZSJRP 13585, 3, (1 d&c, 133.4 mm), área urbana em frente à praia Quarto Crescente, rio Araguaia, Aragarças, Goiás.

Loricaria cataphracta: MZUSP 14106, 2 de 8, (1 d&c, 111.9 mm), rio Jauru, Cáceres, Mato Grosso.

Loricaria lentiginosa: DZSJRP 1561, 2, U.H.E. Porto Primavera-Ensecadeira, afluente do rio Paranapanema, Taquaruçu, São Paulo. DZSJRP 1562, (1 d&c, 178.0 mm), Ponte M. Lima, rio Grande.

Loricariichthys castaneus: DZSJRP 2313, 2, (1 d&c, 139.7 mm), rio Jacupiranga, km 461 da BR-116, fundos do CEDAVAL, afluente do rio Ribeira de Iguape, Pariquera-Açu, São Paulo.

Metaloricaria paucidens: INPA 5440, 2, (1 d&c, (73.7 mm)), rio Trombetas, cachoeira Vira-Mundo pedral margem direita, Oriximiná, Pará.

Paraloricaria vetula: MCP 13031, 2 de 5, rio Uruguai no porto de Santo Izidro, São Nicolau, Rio Grande do Sul. MCP 47143, (1 d&c, 143.8 mm), rio Ijui, junto à balsa de Roque Gonzales, drenagem Uruguai, Roque Gonzales, Rio Grande do Sul.

Planiloricaria cryptodon: MZUSP 56252, 2, (1 d&c, (93.1 mm)), rio Amazonas, 10 km abaixo do Furo de Urucuricaia, drenagem Amazonas, Pará.

Proloricaria prolixa: DZSJRP 6312, (1 d&c, 86.0 mm), rio Borá, entre Nova Aliança e Potirendaba, drenagem do Tietê, Nova Aliança, São Paulo. DZSJRP 12150, 1, córrego Mutum, propriedade do Sr. Jorge, Bonito, Mato Grosso do Sul.

Pseudohemiodon laticeps: NUP 3462, (1 d&c, (144.7 mm)), rio Cuiabá (Cb3), Santo Antônio de Leverger, Mato Grosso.

Pseudohemiodon platycephalus: MZUSP 90521, 1, rio Sepotuba, trecho médio, drenagem Paraguai, Cáceres, Mato Grosso.

Pseudoloricaria laeviuscula: INPA 21988, (1 d&c, (168.4 mm)), rio Parauana.

Pterosturisoma cf. *microps*: MZUSP 57469, 2, (1 d&c, 96.5 mm), rio Solimões, abaixo do Purus, Amazonas.

Reganella depressa: MZUSP 57729, (1 d&c, 152.0 mm), rio Tapajós, 14.3 km abaixo do lado Azul, drenagem do rio Tapajós, Pará. MZUSP 57936, 1 de 15, rio Tapajós, 10.2 km abaixo do lago Azul, Pará.

Rineloricaria daraha: MZUSP 31396, (1 d&c, (124.4 mm)), parátipo, rio Daraá, cachoeira do Aracu, drenagem rio Negro, Amazonas.

Rineloricaria lanceolata: DZSJRP 12206, 3, córrego Azul, próximo ao último assentamento do Sr Bigode, PARNA Serra da Bodoquena, bacia do Alto Paraguai, Bodoquena, Mato Grosso do Sul. DZSJRP 12408, (1 d&c, 64.8 mm), córrego Corrente na Faz Corrente I (MMX), drenagem do rio Paraguai, Dois Irmãos do Buriti, Mato Grosso do Sul.

Rineloricaria latirostris: DZSJRP 2769, (1 d&c, (95.8 mm)), rio Passa Cinco, afluente do rio Corumbataí, rio Tietê, estrada para Rio Claro, Ipeúna, São Paulo. DZSJRP 6352, 1, rio Borá, entre Nova Aliança e Potirendaba, drenagem do Tietê, Nova Aliança, São Paulo. DZSJRP 6368, 1, rio Borá, entre Nova Aliança e Potirendaba, drenagem do Tietê, Nova Aliança, São Paulo.

Rineloricaria pentamaculata: DZSJRP 10101, 3, (1 d&c, 88.1 mm), Ribeirão da Quinta, bacia do rio Paranapanema, Itatinga, São Paulo.

Spatuloricaria evansii: DZSJRP 13582, 1, rio Araguaia, área urbana (em frente à praia Quarto Crescente), Aragarcas, Goiás. DZSJRP 14726, 2, (1 d&c, 109.7 mm), ponto 11, bacia do rio Machado, drenagem do rio Madeira, Santa Luzia D'Oeste, Rondônia.

Sturisoma robustum: DZSJRP 4255, 3, (1 d&c, 102.9 mm), rio Miranda, Fazenda Remanso de Miranda, drenagem do rio Paraguai, Bonito, Mato Grosso do Sul.

Ingroup

Harttia

Harttia absaberi: MZUSP 85806, 7 de 36, (1 de 2 d&c, (60.5 mm)), parátipos, ribeirão São Mateus, afluente do rio Sucuriú, Três Lagoas, Mato Grosso do Sul. (20°45'04"S 51°40'42"W).

Harttia carvalhoi: MZUSP 44505, (1 d&c, (74.1 mm)), rio Pomba, afluente do Pirapitinga, bairro da Serrinha, na estrada que vai para o Camping Club do Brasil, Resende, Rio de Janeiro. (22°28'0.0"S 44°27'0.0°W). MZUSP 79367, 2, ribeirão Canjarana, bairro Ribeirão Grande, próximo a Fazenda São Sebastião do Ribeirão Grande, Pindamonhangaba, São Paulo. (22°46'41.0"S 45°27'56.0"W).

Harttia dissidens: INPA 7046, 3 de 20, (1 de 2 d&c, 109.2 mm), parátipos; rio Tapajós, Pimental, Pará. (4°35'22"S 56°15'16"W).

Harttia duriventris: MZUSP 34226, 5 de 26, (1 d&c, 93.2 mm), rio Itacaiunas, carreira comprida (poço de pedral), Marabá, Pará. (5°22'0.0"S 49°7'0.0"W). MZUSP 106199, 2 de 25, rio Tapirapé, Acampamento Cachoeirinha, a montante da base Bacaba da REBIO Tapirapé, Marabá, Pará. (5°32'2.0"S 50°40'4.0"W).

Harttia cf. *fowleri*: INPA 7845, 3 de 49, (1 d&c, 105.3 mm), não informado, rio Araguari, Porto Marcirio, Amapá.

Harttia garavelloi: MZUSP 42696, (1 d&c, (80.8 mm)), parátipo, rio Fanado, ponte na cidade de Minas Novas, Minas Novas, Minas Gerais. (17°16’0.0”S 42°39’0.0”W). MCP 49359, 18, rio Iranguá, afluente do rio Araçuai, estrada Itamarandiba- Sen. Modestino, aprox.. 30 km desde Itamarandiba, Itamarandiba, Minas Gerais. (17°54’38.0”S 43°7’7.0”W). MZUSP 94430, 3, rio Setubal, na Fazenda Onça Cana Brava, sob ponte de concreto da estrada para Barragem do Setubal, Jenipapo de Minas, Minas Gerais. (17°8’40.0”S 42°14’W).

Harttia gracilis: MZUSP 99678, 9 de 29, (1 d&c, 61.0 mm), ribeirão do Lajeado, afluente do rio Sapucaí, em São José da Rosa, SP-42, próx. da SP-050, São Bento do Sapucaí, São Paulo. (22°47’9.0”S 45°41’17.0”W).

Harttia guianensis: INPA 14985, 2, (1 d&c, 63.8mm), Rio Sinnamary, Guiana Francesa.

Harttia intermontana: DZSJRP 20978, 42, (1d&c, 56.6 mm), riacho florestado na vicinal de Cristiano Otoni à Santana Dos Montes, rio Doce, Santana dos Montes, Minas Gerais. (20°48'27" S 43°42'06"W).

Harttia kronei: MZUSP 42694, (1 de 2 d&c, (78.2 mm)), riacho afluente do rio Bananal, km 7 rod. Biguá-Iguape, Miracatu, São Paulo. (24°17’0.0”S 47°27’0.0”W). MZUSP 53811, 5 de 9, bairro da Serra, Iporanga, São Paulo. (24°34'48"S 48°35'24"W). MZUSP 100602, 2 de 12, rio Catas Altas, Barra do Chapéu, São Paulo. (24°50’0.0”S 49°11’0.0”W).

Harttia leiopleura: MZUSP 109373, 3, (1 d&c, 51.0 mm), córrego Maquiné, afluente ribeirão da Prata, afluente do rio das Velhas, Caeté, Minas Gerais. (20° 1’39.0”S 43°41’57.0”W). MZUSP 109426, 2 de 9, ribeirão da Prata, afluente do rio das Velhas, Ouro Preto, Minas Gerais. (20°23’36.0”S 43°54’28.0”W).

Harttia longipinna: DZSJRP 2819, 1, parátipo, rio Pará, ponte na rodovia BR-262 entre Nova Serrana e Pará de Minas, drenagem do rio São Francisco, Minas Gerais. (19°53’S 44°52’W). DZSJRP 3666, 6, (1 de 2 d&c, 51.5 mm), parátipos, rio Grande, Sítio Grande, rio São Francisco, São Desiderio, Bahia. (12°25’53”S 45°5’7”W). MZUSP 39145, 5 de 9, córrego Carapiá, afluente do rio São Francisco, Minas Gerais. (coordenada não informada).

Harttia loricariformis: MZUSP 2163, (1 d&c, (111.7 mm)), Cachoeira, Cachoeira, São Paulo. (22°40’0.0”S 45°1’0.0”W). MZUSP 80954, 4, rio Glória, afluente do rio Muriaé, Muriae, Minas Gerais. (21° 4’ 45.0”S 42°20’47.0”W).

Harttia novalimensis: MZUSP 37147, (1 de 2 d&c, 55.3 mm), parátipos, riacho afluente do córrego Mutuca, à direita da estrada Belo Horizonte – Nova Lima, km 20, bacia do rio das Velhas,

Nova Lima, Minas Gerais. (19°58’0.0”S 43°51’ 59”W). MZUSP 94481, 3 de 28, ribeirão dos Macacos, afluente do rio das Velhas, Nova Lima, Minas Gerais. (20°2’8.0”S 43°54’19.0”W).

Harttia panara: MZUSP 97088, (1 de 3 d&c, (85.6 mm)), parátipo, rio Curuá, bacia do Iriri, na ensecadeira da PCH Buriti, Novo Progresso, Pará. (8°46’09”S 54°57’02”W). MZUSP 118551, 1 de 2, parátipo, rio Curuá, na cachoeira do Curuá, próximo da vila da PCH Curuá, acima do salto de 40m, Novo Progresso, Pará. (8°44’9.5”S 54°57’46.5”W).

Harttia punctata: MZUSP 96172, 5 de 46, (1d&c, 92.7 mm), rio Bandeirinha, afluente do rio Paraná, ca 6 km do centro de Formosa em direção ao Salto do Itiquira, Formosa, Goiás. (15°28’52.0”S 47°20’35.0”W). MCP 15873, 2, rio Passa Três, próximo ao laticínio Gogó, afluente do rio Maranhão, rio Tocantins, Uruaçu, Goiás. (14°30’0.0”S 49°6’59.9”W).

Harttia rondoni: MZUSP 97083, (1 de 9 d&c, (85.0 mm)), parátipos, rio 13 de maio, afluente rio Curuá, bacia do Iriri, na ponte da BR 163, próximo a vila de Cachoeira da Serra, Novo Progresso, Pará. (8°38’53”S 55°1’41”W). MZUSP 97085, 2 de 9, rio Curuá, bacia do Iriri, na vila de Castelo dos Sonhos, Novo Progresso, Pará. (8°19’07”S 55°05’23”W).

Harttia cf. *surinamensis*: MZUSP 34224, 4 de 60, (1 d&c, 104.7 mm), rio Cupixi, ponte na estrada para a Serra do Navio (canal do rio), Amapá. (0°40’0.0”S 51°40’0.0”W).

Harttia torrenticola: MZUSP 42698, (1 d&c, (68.6 mm)), parátipos, ribeirão afluente do rio Paraopeba, Pedra Vermelha, km 10 da estrada BR-040 (abaixo das cachoeiras), Moeda, Minas Gerais. (20°20’0.0”S 44°2’0.0”W). MZUSP 94482, 2 de 3, ribeirão das Costas, Balneário Cachoeira do Moinho, afluente rio Paraopeba, Belo Vale, Minas Gerais. (20° 23’ 9.0”S 44°6’23.0”W).

Harttia trombetensis: INPA 3011, 3 de 109, (1 d&c, 90.7 mm), parátipos, rio Trombetas, cachoeira Porteira, drenagem Trombetas, Oriximiná, Pará. (1°05’31”S 57°04’19”W).

Harttia uatumensis: INPA 3239, 1 de 5, parátipo, rio Jatapú, cachoeira das Garças, drenagem Jatapú, Urucará, Amazonas. (10°40’48”S 58°35’08”W). INPA 12954, 2 de 4, parátipos, rio Pitinga, cachoeira do Travassão, drenagem Pitinga, Presidente Figueiredo, Amazonas. (2°02'04"S 60°01'30"W). MZUSP 107732, 3 de 11, (1 d&c, 123.6 mm), rio Marowjine (Maroni), Suriname, América do Sul, B. Malkin. (coordenada não informada).

Harttia villasboas: MZUSP 115485, 3 de 64, (1 de 9 d&c, 87.4 mm), parátipos, rio Curuá, bacia do Iriri, acima das duas grandes cachoeiras, próximo ao restaurante, Novo Progresso, Pará. (8°44’09”S 54°57’46”W).

Harttia sp. São Roque: DZSRJP 11585, 28, (1 d&c, 54.5 mm), córrego Lavra, entorno PARNA Serra da Canastra, propr. Sr. Vítor, à montante ponte, São Roque De Minas, Minas Gerais. (20°18’36”S 46°25’59”W).

Harttia tapajós sp. 1: MZUSP 97086, (1 de 2 d&c, (93.4 mm)), tributário do rio Braço Norte, afluente do rio Peixoto de Azevedo, bacia do Teles Pires, na ponte da BR-163, próximo a FAB, Novo Progresso, Pará. (9°28’20.0”S 54°52’W). MZUSP 116594, 2 de 22, igarapé afluente do rio Braço Norte, na BR 163, próximo à divisa de estado entre Pará e Mato Grosso, Altamira, Pará. (9°28'19"S 54°51'29"W).

Harttia tapajós sp. 2: MZUSP 97079, 3 de 81, (1 d&c, (120.6 mm)), rio Braço Norte, afluente rio Peixoto de Azevedo, bacia do Teles Pires, na ponta da BR-163, a montante da FAB, Novo Progresso, Pará. (9°15’34.0”S 54°50’2.0”W).

Appendix 2. Character state matrix (Characters 1 to 35).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
***Astroblepus* sp.**	0	0	0	0	0	0	0	1	0	0	-	0	0	0	-	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0
Lithogenes wahari	0	1	0	1	0	0	0	1	1	1	0	0	0	3	0	0	1	0	1	2	0	0	1	0	0	0	0	0	0	1	1	0	1	0	0
Hemipsilichthys nimius	0	1	0	1	0	0	0	1	1	1	0	0	1	3	0	0	1	0	1	2	0	0	1	0	0	0	0	1	0	3	1	0	3	0	0
Ancistrus multipinnis	0	0	0	1	0	0	0	1	1	1	1	0	0	1	1	0	1	1	1	2	0	0	1	0	0	0	1	0	0	1	0	0	4	0	1
Hypostomus ancistroides	0	0	1	1	0	0	0	1	1	0	-	0	0	1	1	0	1	1	1	2	0	0	1	0	1	-	1	2	0	1	0	0	4	0	1
Isbrueckerichthys duseni	0	1	0	1	1	0	0	1	1	0	-	0	1	3	0	0	0	0	1	2	0	0	1	0	0	0	1	0	1	1	1	0	3	0	1
Kronichthys heylandi	0	1	1	1	0	0	0	1	1	1	1	0	1	1	1	0	1	0	1	2	0	0	1	0	0	0	1	1	0	1	0	0	4	0	1
Neoplecostomus microps	0	1	0	1	0	0	0	0	1	1	1	0	1	1	1	0	1	0	1	1	0	0	1	0	0	0	0	0	1	1	1	0	1	0	0
Pareiorhina rudolphi	0	1	0	1	1	0	0	1	1	1	1	0	1	3	1	0	1	1	1	1	0	0	1	0	0	0	1	0	0	1	0	0	3	0	0
Hypoptopoma inexpectata	0	0	0	1	0	0	0	2	1	1	0	0	0	1	1	0	1	0	1	0	0	0	1	0	0	0	1	0	0	5	0	0	4	0	1
Plesioptopoma curvidens	0	1	0	0	1	0	0	1	1	1	1	0	1	1	1	0	0	0	1	2	0	0	1	0	0	0	1	0	0	1	1	0	4	0	1
Pseudotocinclus tietensis	0	1	0	1	1	0	0	1	1	1	1	0	1	1	1	0	0	0	1	2	0	0	1	0	0	0	1	1	0	1	1	0	3	0	0
***Apistoloricaria* sp.**	1	1	1	1	2	0	0	1	0	0	-	0	0	3	0	0	1	1	0	1	0	0	1	0	0	0	1	0	1	4	1	0	2	1	1
***Brochiloricaria* sp.**	1	1	1	1	0	0	0	1	0	0	-	0	0	3	0	0	1	1	0	1	0	0	1	0	0	1	0	1	0	2	1	0	1	1	1
***Crossoloricaria* spp.**	0	1	1	1	0	0	0	1	0	0	-	0	0	3	0	0	1	1	0	1	0	0	1	0	0	0	1	0	1	4	2	0	2	1	1
Cteniloricaria platystoma	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	1	1	0	1	2	0	0	1	0	0	0	0	1	0	2	1	1	4	0	1
Farlowella oxyrryncha	1	1	1	1	0	0	0	4	1	0	-	0	1	1	1	0	1	1	0	1	0	0	1	0	1	-	1	1	0	2	1	0	4	0	1
Furcodontichthys novaesi	0	1	1	1	0	0	0	0	0	0	-	0	0	3	0	1	1	1	0	1	0	0	1	1	0	1	0	1	0	4	2	0	2	1	1
Harttiella crassicauda	0	1	0	1	0	0	0	1	1	1	1	0	1	2	2	0	1	0	1	2	0	0	1	0	0	0	1	1	0	1	1	0	4	0	1
Hemiodontichthys acipenserinus	1	1	1	1	0	0	0	3	0	1	0	0	0	1	1	0	1	1	0	1	0	0	1	1	0	1	0	2	1	4	2	0	3	1	0
***Lamontichthys* spp.**	0	1	1	1	0	0	0	1	1	1	1	0	1	1	1	0	1	1	1	2	0	1	1	0	0	0	1	0	0	2	1	0	4	0	1
Limatulichthys griseus	0	1	1	1	0	0	0	1	0	0	-	0	0	3	0	0	1	1	0	1	0	0	1	1	0	1	0	1	0	4	3	0	2	1	1
Loricaria cataphracta	0	1	1	1	0	0	0	1	0	1	1	0	0	3	0	0	1	1	0	1	0	0	1	1	0	1	0	1	1	3	1	0	1	1	1
Loricaria lentiginosa	1	1	1	1	0	0	0	0	1	1	1	0	1	3	0	0	1	1	0	1	0	0	1	0	0	1	0	1	1	2	1	1	2	1	0
Loricariichthys castaneus	0	1	1	1	0	0	0	1	0	1	0	0	0	3	0	0	1	1	1	1	0	0	1	1	0	1	0	1	1	3	1	0	1	1	0
Metaloricaria paucidens	0	0	0	1	3	0	0	1	0	1	0	0	0	3	0	1	1	1	0	2	0	0	1	0	0	0	0	2	0	4	2	1	4	0	1
Paraloricaria vetula	0	1	1	1	0	0	0	0	0	1	0	0	1	3	0	0	1	1	0	1	0	0	1	0	0	0	1	0	1	5	0	0	1	1	1
Planiloricaria cryptodon	2	1	1	1	0	0	0	1	2	0	-	1	0	3	0	0	1	1	0	1	0	0	0	-	0	0	1	0	1	1	1	0	1	1	0
Proloricaria prolixa	1	1	1	1	0	0	0	0	0	1	0	0	0	3	0	1	1	1	0	1	0	0	1	1	0	0	0	1	1	1	1	0	4	1	0
***Pseudohemiodon* spp.**	0	1	1	1	0	0	0	2	0	0	-	1	0	3	0	0	1	1	0	1	0	0	1	0	0	0	0	0	0	4	1	0	2	1	1
Pseudoloricaria laeviuscula	0	0	1	1	3	0	0	0	0	0	-	0	0	3	0	1	1	1	0	1	0	0	1	1	0	0	0	0	1	4	3	1	1	1	0
Pterosturisoma* cf. *microps	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	1	1	1	1	1	0	0	1	0	0	0	1	0	1	1	1	0	4	0	1

Appendix 2 (continuation). Character state matrix (Characters 1 to 35).

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Reganella depressa	1	1	0	1	0	0	1	-	-	1	0	0	0	3	0	2	1	1	0	0	0	0	1	1	0	1	0	1	1	4	3	1	1	1	0
Rineloricaria daraha	1	1	1	1	0	0	0	1	1	0	-	0	0	3	0	0	1	1	0	2	0	0	1	1	0	0	0	2	1	2	1	1	3	1	1
Rineloricaria lanceolata	0	1	0	1	0	0	0	1	0	1	0	0	0	3	0	0	1	1	0	2	0	0	1	1	0	0	1	1	1	4	1	0	1	1	0
Rineloricaria latirostris	0	1	1	1	0	0	0	0	0	1	0	0	0	3	0	1	1	1	0	2	0	0	1	1	0	0	0	1	0	2	1	0	1	1	0
Rineloricaria pentamaculata	1	1	1	1	2	0	0	0	0	1	0	0	0	3	0	1	1	1	0	2	0	0	1	1	0	0	0	1	1	4	1	0	1	1	0
Spatuloricaria evansii	0	1	0	1	0	0	0	0	1	1	1	0	1	3	0	0	1	1	1	2	0	0	1	1	0	0	0	2	0	4	1	0	4	1	0
Sturisoma robustum	1	1	1	1	0	0	0	4	1	0	-	0	0	1	1	0	1	1	1	2	0	0	1	0	0	0	1	1	0	2	1	0	4	0	1
Harttia absaberi	1	1	1	1	2	1	0	2	1	0	-	0	1	2	2	0	1	0	1	2	0	0	1	0	0	0	0	1	0	3	1	0	4	0	1
Harttia carvalhoi	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	0	1	0	1	2	0	0	1	0	0	0	0	0	0	1	1	0	4	0	1
Harttia dissidens	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	0	1	0	1	0	0	1	1	0	0	0	0	2	0	2	1	0	4	0	1
Harttia duriventris	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	1	1	0	1	0	0	1	1	0	0	0	0	1	0	2	1	0	4	0	1
Harttia* cf. *fowleri	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	0	1	0	1	2	0	0	1	0	0	0	1	1	0	2	1	1	4	0	1
Harttia garavelloi	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	0	1	0	1	0	0	1	1	0	0	0	0	1	0	2	1	0	4	0	1
Harttia gracilis	0	1	1	0	1	0	0	1	1	0	-	0	1	1	1	0	1	0	1	2	0	0	1	0	0	0	1	0	0	2	1	0	4	0	1
Harttia guianensis	0	1	1	1	0	0	0	1	1	1	1	0	1	1	1	0	1	0	1	2	0	0	1	0	0	0	0	0	0	2	1	0	4	0	1
Harttia intermontana	0	1	0	1	1	0	0	1	1	0	-	0	1	2	2	0	1	0	1	2	0	0	1	0	0	0	1	1	0	1	1	0	4	0	1
Harttia kronei	1	1	1	1	2	0	0	1	1	0	-	0	1	1	1	1	1	0	1	2	0	0	1	0	0	0	1	0	0	1	1	0	4	0	1
Harttia leiopleura	0	1	1	1	0	0	0	1	1	0	-	0	1	2	1	0	1	0	1	2	0	0	1	0	0	0	0	0	0	0	1	1	0	4	0	1
Harttia longipinna	1	1	1	1	0	0	0	1	1	1	1	0	1	1	1	0	1	0	1	2	1	0	1	0	0	0	1	0	0	1	1	0	4	0	1
Harttia loricariformis	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	0	1	0	1	2	0	0	1	0	0	0	1	1	0	2	1	0	4	0	1
Harttia novalimensis	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	0	1	0	1	1	0	0	1	0	0	0	1	0	0	1	1	0	4	0	1
Harttia panara	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	0	1	0	1	2	0	0	1	0	0	0	1	1	0	2	1	0	4	0	1
Harttia punctata	2	1	1	1	0	0	0	1	1	0	-	0	1	1	1	1	1	0	1	2	0	0	1	0	0	0	1	0	0	2	1	0	4	0	1
Harttia rondoni	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	0	1	0	1	2	0	0	1	0	0	0	1	1	0	2	1	0	4	0	1
Harttia* cf. *surinamensis	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	1	1	0	1	2	0	0	1	0	0	0	0	1	0	2	1	1	4	0	1
Harttia torrenticola	0	1	1	1	1	0	0	1	1	0	-	0	1	1	1	0	1	0	1	2	0	0	1	0	0	0	1	0	0	1	1	0	4	0	1
Harttia trombetensis	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	1	1	0	1	2	0	0	1	0	0	0	0	1	0	2	1	1	4	0	1
Harttia uatumensis	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	1	1	0	1	2	0	0	1	0	0	0	0	0	0	2	1	1	4	0	1
Harttia villasboas	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	0	1	0	1	2	0	0	1	0	0	0	1	0	0	2	1	0	4	0	1
***Harttia* sp. São Roque**	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	0	1	0	1	2	0	0	1	0	0	0	1	0	0	1	1	0	4	0	1
***Harttia* sp. Tapajós 1**	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	0	1	0	1	1	0	1	1	0	0	0	0	0	0	2	1	0	4	0	1
***Harttia* sp. Tapajós 2**	0	1	1	1	0	0	0	1	1	0	-	0	1	1	1	0	1	0	1	2	0	0	1	0	0	0	1	0	0	2	1	0	4	0	1

Appendix 2 (continuation). Character state matrix (Characters 36 to 70).

	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
***Astroblepus* sp.**	0	0	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	-	0	0	0	0	0	0	0	0
Lithogenes wahari	0	1	0	1	0	0	0	0	0	0	1	0	1	2	1	0	1	5	0	0	0	0	0	0	0	0	-	0	0	1	0	2	-	0	0
Hemipsilichthys nimius	0	1	0	1	0	0	0	0	0	0	0	0	1	2	1	1	0	4	0	0	0	0	1	0	1	0	-	1	0	0	1	0	0	0	3
Ancistrus multipinnis	0	1	0	1	0	0	0	1	1	0	1	0	2	1	1	1	0	2	0	2	0	0	1	0	0	0	-	3	0	0	0	0	0	0	4
Hypostomus ancistroides	0	1	0	1	0	0	1	1	0	0	1	0	2	1	2	2	0	4	1	2	2	0	1	1	1	0	-	1	0	0	1	2	-	0	1
Isbrueckerichthys duseni	0	1	0	0	-	0	2	1	0	0	1	0	0	2	1	2	0	4	0	2	2	0	1	0	0	0	-	2	0	1	1	0	0	0	1
Kronichthys heylandi	0	1	0	0	-	0	1	0	0	0	1	1	0	1	1	1	0	1	0	2	0	0	1	0	2	0	-	3	1	0	0	2	-	0	0
Neoplecostomus microps	0	1	0	0	-	0	1	0	0	0	0	1	0	0	1	2	0	3	0	2	1	0	1	0	2	0	-	1	0	0	1	2	-	0	1
Pareiorhina rudolphi	0	1	0	0	-	0	0	1	0	0	1	0	0	1	1	1	0	2	0	2	2	0	2	0	2	0	-	2	0	0	0	2	-	0	4
Hypoptopoma inexpectata	0	1	0	0	-	1	0	1	1	0	1	0	2	1	1	2	2	-	0	2	2	0	2	0	0	0	-	4	0	0	0	2	-	0	4
Plesioptopoma curvidens	0	1	0	0	-	1	0	0	0	0	1	1	1	1	1	2	0	4	0	1	0	0	1	0	0	0	-	2	0	0	0	2	-	0	4
Pseudotocinclus tietensis	0	1	0	0	-	1	1	1	0	0	0	1	1	1	1	2	0	4	0	2	2	0	2	0	2	0	-	3	1	1	1	0	0	0	4
***Apistoloricaria* sp.**	0	1	1	0	-	0	0	1	0	0	1	2	1	1	2	0	1	3	0	2	0	0	2	0	3	1	0	3	2	1	1	1	1	0	3
***Brochiloricaria* sp.**	0	1	0	0	-	0	0	1	0	0	1	1	1	1	1	0	0	2	0	2	0	0	2	0	3	1	0	3	1	1	1	0	0	0	3
***Crossoloricaria* spp.**	0	1	1	1	0	0	0	1	0	0	1	2	1	1	1	0	1	2	0	2	0	0	2	0	3	1	0	3	2	1	1	2	-	0	3
Cteniloricaria platystoma	1	1	0	1	1	0	2	0	0	2	2	0	2	1	1	2	0	4	0	1	0	0	1	0	3	1	0	3	1	1	1	2	-	1	0
Farlowella oxyrryncha	0	1	0	0	-	0	0	1	1	0	1	3	1	1	1	0	1	3	0	2	2	1	2	1	3	1	1	3	2	1	1	0	0	0	4
Furcodontichthys novaesi	0	1	0	0	-	0	0	1	0	0	1	3	1	1	2	0	1	0	0	1	0	0	2	0	3	1	0	5	1	1	1	2	-	0	3
Harttiella crassicauda	1	1	0	1	0	0	0	0	1	0	2	1	0	2	1	1	0	4	0	0	0	0	2	0	0	0	-	1	0	1	1	2	-	0	0
Hemiodontichthys acipenserinus	0	2	0	0	-	0	0	1	0	1	1	1	1	0	1	0	1	2	0	2	0	0	2	0	3	1	0	4	1	1	1	2	-	0	3
***Lamontichthys* spp.**	0	1	0	1	0	0	1	0	0	0	1	0	0	1	1	1	0	4	0	1	1	0	2	0	3	1	0	2	2	1	1	2	-	0	1
Limatulichthys griseus	0	0	0	0	-	0	0	1	0	0	1	1	0	1	2	0	1	2	0	2	0	0	2	0	3	1	0	4	1	1	1	2	-	0	3
Loricaria cataphracta	0	0	0	1	0	0	0	0	0	0	1	2	1	1	2	1	1	2	0	2	0	0	2	0	3	1	0	3	3	1	1	0	0	0	3
Loricaria lentiginosa	0	1	1	1	0	0	1	1	0	0	1	0	2	1	1	1	1	2	0	2	0	0	2	0	3	1	0	3	2	1	1	0	0	0	3
Loricariichthys castaneus	0	0	0	0	-	0	0	0	0	0	1	2	1	1	2	0	1	2	0	2	0	0	2	0	3	1	0	4	3	1	1	2	-	0	3
Metaloricaria paucidens	0	2	0	1	0	0	2	1	0	0	1	1	1	1	2	0	0	3	0	1	0	0	2	0	3	1	0	2	2	1	1	0	0	0	1
Paraloricaria vetula	0	2	1	0	-	0	0	0	0	0	1	2	0	1	1	0	0	2	0	1	0	0	2	0	3	1	0	3	2	1	1	2	-	0	3
Planiloricaria cryptodon	0	1	0	0	-	0	0	1	0	0	0	2	1	1	2	0	1	4	0	2	2	0	2	0	3	1	0	1	3	1	1	1	1	0	3
Proloricaria prolixa	0	0	0	1	0	0	0	0	0	0	1	2	0	1	1	0	1	2	0	1	0	0	2	0	3	1	0	3	2	1	1	0	0	0	3
***Pseudohemiodon* spp.**	0	1	0	0	-	0	0	0	0	0	1	2	2	1	1	0	0	4	0	2	0	0	2	0	3	1	0	3	2	1	1	2	-	0	3
Pseudoloricaria laeviuscula	0	2	0	1	0	0	0	1	0	0	1	2	2	1	2	0	0	3	0	2	0	0	2	0	3	1	0	4	3	1	1	2	-	0	3
Pterosturisoma* cf. *microps	0	1	0	1	0	0	1	0	0	0	1	0	2	1	1	1	0	4	0	2	0	0	2	0	3	1	0	2	2	1	1	2	-	0	1

Appendix 2 (continuation). Character state matrix (Characters 36 to 70).

	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70
Reganella depressa	0	1	0	0	-	0	0	1	0	0	1	1	0	1	2	0	1	2	0	2	0	0	2	0	3	1	0	4	1	1	1	1	1	0	3
Rineloricaria daraha	0	1	0	1	0	0	1	1	0	0	1	1	2	1	2	1	0	3	0	2	1	0	2	0	3	1	0	3	2	1	1	2	-	0	3
Rineloricaria lanceolata	0	1	0	1	0	0	0	1	0	0	1	1	2	1	2	0	1	2	0	2	0	0	2	0	3	1	0	4	1	1	1	0	0	0	1
Rineloricaria latirostris	0	1	0	1	0	0	0	0	0	0	0	1	1	1	2	1	1	1	0	2	0	0	2	0	3	1	0	4	1	1	1	2	-	0	1
Rineloricaria pentamaculata	0	0	0	1	0	0	0	1	0	0	1	1	1	1	2	1	0	2	0	2	0	0	2	0	3	1	0	4	1	1	1	2	-	0	1
Spatuloricaria evansii	0	1	0	1	0	0	0	1	0	0	1	1	1	1	3	0	1	2	0	2	0	0	2	0	3	1	0	4	2	1	1	0	0	0	3
Sturisoma robustum	0	1	0	1	0	0	0	1	0	0	1	1	0	1	1	2	1	4	0	1	0	0	2	0	3	1	0	2	2	1	1	0	0	0	1
Harttia absaberi	1	1	0	1	1	0	2	1	0	0	2	0	0	1	1	1	0	4	0	1	0	0	2	0	3	1	0	2	1	1	0	2	-	0	1
Harttia carvalhoi	1	1	0	1	1	0	1	0	0	0	2	0	0	1	1	1	0	4	0	1	1	0	2	0	0	0	-	2	1	1	1	0	0	0	1
Harttia dissidens	1	1	0	1	1	0	1	0	0	0	2	0	0	1	1	2	0	4	0	1	0	0	2	0	3	1	0	2	1	1	1	2	-	1	1
Harttia duriventris	1	1	0	1	1	0	1	0	0	0	2	0	2	1	2	2	0	4	0	1	1	0	2	0	3	1	0	2	1	1	1	2	-	0	1
Harttia* cf. *fowleri	1	1	0	1	1	0	0	0	0	0	2	0	0	1	1	0	0	4	0	1	1	0	2	0	3	1	0	2	1	1	1	2	-	1	1
Harttia garavelloi	1	1	0	1	1	0	2	1	0	0	2	0	0	1	1	2	0	4	0	1	0	0	2	0	0	0	-	2	1	1	1	2	-	0	0
Harttia gracilis	1	1	0	1	1	0	2	0	0	0	2	0	0	1	1	2	0	4	0	1	0	0	2	0	0	0	-	2	1	1	1	2	-	0	0
Harttia guianensis	1	1	0	1	1	0	0	0	0	0	2	0	0	1	2	2	0	4	0	1	0	0	2	0	3	1	0	2	1	1	1	2	-	1	0
Harttia intermontana	1	1	0	1	1	0	1	0	0	0	2	0	0	1	1	1	0	4	0	1	1	0	2	0	0	0	-	2	0	1	1	0	0	0	2
Harttia kronei	1	1	0	1	1	0	1	0	0	0	2	0	0	1	1	1	0	4	0	1	0	0	2	0	0	0	-	2	1	1	1	0	0	0	0
Harttia leiopleura	1	1	0	1	1	0	0	1	0	0	2	0	0	1	2	0	0	4	0	0	0	0	2	0	0	0	-	2	0	1	0	2	-	0	0
Harttia longipinna	1	1	0	1	1	0	2	0	0	0	2	0	0	1	1	1	0	4	0	0	0	0	2	0	0	0	-	2	0	1	1	2	-	0	0
Harttia loricariformis	1	1	0	1	1	0	0	0	0	0	2	0	0	1	2	1	0	4	0	1	1	0	2	0	0	0	-	2	1	1	1	2	-	0	1
Harttia novalimensis	1	1	0	1	1	0	1	0	0	0	2	0	0	1	2	2	0	4	0	1	0	0	2	0	0	0	-	2	0	1	1	2	-	0	1
Harttia panara	1	1	0	1	1	0	1	0	0	0	2	0	2	1	1	0	0	4	0	1	1	0	2	0	3	1	0	2	1	1	1	0	0	0	1
Harttia punctata	1	1	0	1	1	0	1	0	0	0	2	0	0	1	1	2	0	4	0	1	0	0	2	0	3	1	0	2	1	1	1	0	0	0	1
Harttia rondoni	1	1	0	1	1	0	0	0	0	0	2	0	2	1	1	2	0	4	0	1	1	0	2	0	3	1	0	2	1	1	1	0	0	0	1
Harttia* cf. *surinamensis	1	1	0	1	1	0	0	0	0	0	2	0	0	1	1	0	0	4	0	2	1	0	2	0	3	1	0	2	1	1	1	0	0	1	1
Harttia torrenticola	1	1	0	1	1	0	2	0	0	0	2	0	0	1	1	1	0	4	0	1	1	0	2	0	0	0	-	2	1	1	1	2	-	0	0
Harttia trombetensis	1	1	0	1	1	0	0	0	0	0	2	0	2	1	1	2	0	4	0	2	1	0	2	0	3	1	0	2	1	1	1	2	-	1	1
Harttia uatumensis	1	1	0	1	1	0	1	0	0	0	2	0	2	1	1	2	0	4	0	1	1	0	2	0	3	1	0	2	1	1	1	2	-	1	1
Harttia villasboas	1	1	0	1	1	0	1	0	0	0	2	0	2	1	1	2	0	4	0	1	1	0	2	0	3	1	0	2	1	1	1	2	-	0	1
***Harttia* sp. São Roque**	1	1	0	1	1	0	0	1	0	0	2	0	0	1	1	1	0	4	0	1	0	0	2	0	3	1	0	2	1	1	1	0	0	0	1
***Harttia* sp. Tapajós 1**	1	1	0	1	1	0	0	1	0	0	2	0	2	1	1	0	0	4	0	1	1	0	2	0	3	1	0	2	1	1	1	2	-	0	1
***Harttia* sp. Tapajós 2**	1	1	0	1	1	0	0	1	0	0	2	0	2	1	1	2	0	4	0	1	1	0	2	0	3	1	0	2	1	1	1	2	-	0	1

Appendix (continuation). Character state matrix (Characters 71 to 105).

	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
***Astroblepus* sp.**	0	1	0	0	0	0	0	0	0	-	-	-	0	0	-	0	0	0	0	0	0	0	0	2	0	0	0	-	0	1	0	-	0	0	0
Lithogenes wahari	0	1	0	0	0	1	0	2	1	0	0	0	2	1	0	1	1	3	1	0	0	0	2	5	0	0	0	-	1	1	0	-	0	3	0
Hemipsilichthys nimius	0	0	2	0	0	1	1	4	1	0	1	0	1	1	2	0	0	1	1	1	0	0	1	0	0	0	0	0	0	2	0	3	2	0	0
Ancistrus multipinnis	0	1	0	0	1	-	-	-	0	-	-	-	0	1	0	1	2	1	1	1	1	0	2	4	0	0	0	0	1	0	0	3	0	2	0
Hypostomus ancistroides	0	0	0	0	1	-	-	-	1	0	1	1	1	1	0	1	2	1	1	0	1	0	2	1	0	0	0	0	1	3	0	3	1	0	0
Isbrueckerichthys duseni	0	2	3	0	0	1	1	3	1	1	1	0	1	1	2	1	2	1	1	1	1	0	1	1	0	1	0	0	1	0	0	0	2	0	0
Kronichthys heylandi	0	1	4	0	1	-	-	-	1	1	1	1	0	1	0	1	2	1	1	1	1	0	1	2	0	1	0	0	1	0	0	3	1	0	0
Neoplecostomus microps	0	0	0	0	0	0, 1	1	1, 2	1	1	0	0	0	1	0	1	1	1	1	0	1	0	1	0	0	0	0	0	1	2	0	0	1	0	0
Pareiorhina rudolphi	0	1	4	1	0	1	0	1	1	1	1	1	1	1	0	1	2	1	1	1	1	0	1	1	0	2	0	0	0	1	0	0	2	2	0
Hypoptopoma inexpectata	0	2	4	1	0	0	0	3	1	1	0	1	2	1	0	1	1	3	1	1	1	0	1	1	0	2	0	0	1	3	0	0	0	2	0
Plesioptopoma curvidens	0	0	1	0	0	1	1	3	1	1	0	0	0	1	0	1	2	1	1	1	1	0	1	1	0	1	0	0	1	2	0	3	2	0	0
Pseudotocinclus tietensis	0	0	3	1	0	1	1	3	1	1	0	0	2	1	0	1	2	1	1	0	1	0	2	1	0	1	0	0	1	2	0	0	2	0	0
***Apistoloricaria* sp.**	0	0	1	2	0	1	1	1	1	0	1	1	0	1	2	0	0	0	0	2	1	0	2	0	1	2	1	1	1	3	0	1	2	2	0
***Brochiloricaria* sp.**	0	2	1	0	0	1	1	1	1	0	1	1	0	1	2	0	0	1	0	2	1	0	2	0	1	1	0	1	0	0	0	0	3	2	0
***Crossoloricaria* spp.**	0	0	1	0	0	1	1	3	1	0	1	1	1	1	2	1	1	3	0	2	1	0	2	0	1	2	1	1	1	3	0	1	0	3	0
Cteniloricaria platystoma	0	0	0	1	0	1	0	1	1	1	0	0	0	1	0	1	2	1	1	0	1	0	1	1	1	1	0	0	1	2	1	0	0	0	1
Farlowella oxyrryncha	1	2	0	0	0	1	0, 1	0, 2	1	1	0	0	2	1	0	1	2	0	1	1	1	1	2	3	0	1	1	0	0	0	1	0	2	4	1
Furcodontichthys novaesi	0	0	3	0	0	1	1	3	1	0	1	1	2	1	2	1	1	3	2	2	1	0	2	3	1	1	1	0	0	2	0	0	2	1	0
Harttiella crassicauda	0	0	3	2	0	1	0	3	1	1	0	0	1	1	1	1	2	2	1	0	1	0	1	1	0	0	0	0	1	2	1	0	3	0	1
Hemiodontichthys acipenserinus	0	2	3	0	0	1	0	3	1	0	1	1	2	1	1	0	0	3	2	2	1	0	2	4	1	2	1	1	0	0	0	2	1	2	0
***Lamontichthys* spp.**	0	0	3	0	0	1	1	3	1	1	0	0	1	1	0	1	2	2	1	1	1	1	1	0	0	0	0	0	1	2	1	0	0	0	1
Limatulichthys griseus	0	0	3	0	0	0	1	1	1	0	1	1	2	1	2	1	1	1	0	2	1	0	1	3	1	1	1	0	0	2	0	0	2	1	0
Loricaria cataphracta	0	1	2	1	0	1	0	3	1	0	1	1	2	1	2	1	1	1	2	2	1	0	1	0	0	2	1	0	0	1	0	3	2	3	0
Loricaria lentiginosa	0	1	2	1	0	0	1	3	1	0	1	1	2	1	1	1	1	3	2	2	1	1	1	1	0	2	0	0	0	1	0	3	2	2	0
Loricariichthys castaneus	0	2	3	2	0	1	1	1	1	0	1	1	2	1	1	0	0	1	0	2	1	0	1	4	1	2	1	0	0	0	0	3	2	1	0
Metaloricaria paucidens	0	0	0	2	0	1	1	2	1	1	0	0	0	1	2	1	1	1	0	1	1	0	2	0	1	0	0	0	0	2	0	3	0	3	0
Paraloricaria vetula	0	1	2	1	0	1	1	3	1	0	1	1	2	1	1	1	1	3	0	2	1	0	1	0	1	0	1	0	0	1	0	0	2	0	0
Planiloricaria cryptodon	0	2	1	0	0	1	1	2	1	0	1	1	3	1	2	1	1	1	1	2	1	0	2	0	0	2	0	0	0	0	0	2	2	2	0
Proloricaria prolixa	0	1	2	1	0	0	1	2	1	0	1	1	2	1	2	1	1	0	2	2	1	0	2	1	1	2	1	0	0	1	0	0	2	2	0
***Pseudohemiodon* spp.**	0	0	1	1	0	0	1	0	1	0	1	1	1	1	2	1	1	3	0	0	1	0	2	1	1	2	0	1	1	3	0	1	2	2	0
Pseudoloricaria laeviuscula	0	0	1	1	0	0	1	2	1	0	1	1	2	1	2	0	0	2	0	0	1	0	2	1	1	2	1	0	0	2	0	0	2	0	0
Pterosturisoma* cf. *microps	0	1	3	1	0	1	1	3	1	1	0	0	0	1	0	1	2	1	1	0	1	0	1	1	0	0	0	0	1	1	1	0	3	4	1

Appendix 2 (continuation). Character state matrix (Characters 71 to 105).

	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104	105
Reganella depressa	0	0	3	0	0	1	1	1	1	0	1	0	2	1	1	0	0	1	0	1	1	1	2	0	1	2	0	0	1	2	0	1	2	1	0
Rineloricaria daraha	0	0	2	0	0	1	0, 1	0, 2	1	0	1	1	2	1	1	1	1	2	0	2	1	0	1	2	0	2	1	0	0	3	0	0	0	1	0
Rineloricaria lanceolata	0	1	2	0	0	1	1	3	1	0	1	1	2	1	1	0	0	2	0	0	1	0	1	3	0	2	1	0	0	1	0	3	0	2	0
Rineloricaria latirostris	0	1	2	2	0	1	1	3	1	0	1	1	2	1	1	1	1	3	2	0	1	0	1	3	0	0	1	0	0	1	0	3	0	0	0
Rineloricaria pentamaculata	0	1	2	0	0	1	1	4	1	0	1	1	2	1	1	1	1	3	2	0	1	0	1	3	1	2	1	0	0	1	0	0	0	1	0
Spatuloricaria evansii	0	1	2	0	0	1	1	2	1	0	1	1	2	1	2	1	1	3	1	2	1	0	1	3	1	1	1	0	0	1	0	0	3	3	0
Sturisoma robustum	0	0	3	0	0	1	1	3	1	1	0	0	2	1	0	1	2	1	0	0	1	0	1	1	1	0	1	0	1	2	1	0	1	4	1
Harttia absaberi	0	0	3	0	0	1	1	2	1	1	0	0	1	1	1	1	2	1	0	1	1	0	2	2	0	0	0	0	1	2	1	0	0	0	1
Harttia carvalhoi	0	0	3	0	0	1	0	3	1	1	0	0	1	1	0	1	2	1	1	1	1	0	1	1	0	1	0	0	1	2	1	0	0	0	1
Harttia dissidens	0	0	0	0	0	1	1	2	1	1	0	0	1	1	0	1	2	1	0	1	1	0	1	0	0	1	0	0	1	2	1	0	3	0	1
Harttia duriventris	0	0	3	0	0	1	1	2	1	1	0	0	1	1	0	1	2	1	0	1	1	0	1	1	0	0	0	0	1	2	1	0	0	0	1
Harttia* cf. *fowleri	0	0	3	2	0	1	1	2	1	1	0	0	0	1	0	1	2	2	0	1	1	0	1	2	1	1	0	0	1	2	1	0	0	2	1
Harttia garavelloi	0	0	0	0	0	1	0	3	1	1	0	0	1	1	0	1	2	1	1	1	1	0	1	0	0	0	0	0	1	2	1	0	0	0	1
Harttia gracilis	0	0	0	1	0	1	1	3	1	1	0	0	1	1	0	1	2	1	1	1	1	0	1	0	0	1	0	0	1	2	1	0	1	0	1
Harttia guianensis	0	0	0	1	0	1	1	2	1	1	0	0	1	1	0	1	2	1	0	1	1	0	1	0	0	1	0	0	1	2	1	0	0	4	1
Harttia intermontana	0	0	3	0	0	1	1	2	1	1	0	0	1	1	0	1	2	1	1	0	1	0	1	1	0	0	0	0	1	2	1	0	0	0	1
Harttia kronei	0	0	0	0	0	1	1	2	1	1	0	0	1	1	0	1	2	1	1	1	1	0	1	0	0	1	0	0	1	2	1	0	1	0	1
Harttia leiopleura	0	0	3	0	0	1	0	3	0	-	-	-	1	1	0	1	2	2	1	0	1	0	1	1	0	2	0	0	1	2	1	0	1	0	1
Harttia longipinna	0	0	0	0	0	1	1	3	1	1	0	0	1	1	0	1	2	1	1	0	1	0	1	1	0	2	0	0	1	2	1	0	0	0	1
Harttia loricariformis	0	0	0	2	0	1	0	3	1	1	0	0	1	1	0	1	2	2	1	1	1	0	1	1	0	1	0	0	1	2	1	0	0	0	1
Harttia novalimensis	0	0	0	1	0	1	0, 1	1	0	-	-	-	1	1	0	1	2	1	1	0	1	0	1	1	0	2	0	0	1	2	1	0	2	0	1
Harttia panara	0	0	0	0	0	1	1	1, 2	1	1	0	0	0	1	0	1	2	1	1	1	1	0	1	1	0	0	0	0	1	2	1	0	3	4	1
Harttia punctata	0	0	0	0	0	1	0	1	1	1	0	0	1	1	0	1	2	1	0	1	1	0	1	0	1	0	0	0	1	2	1	0	0	0	1
Harttia rondoni	0	0	0	0	0	1	1	2	1	1	0	0	0	1	0	1	2	1	1	1	1	0	1	1	1	0	0	0	1	2	1	0	0	4	1
Harttia* cf. *surinamensis	0	0	0	0	0	1	0	1	1	1	0	0	0	1	0	1	2	2	0	1	1	0	1	1	1	2	0	0	1	2	1	0	0	2	1
Harttia torrenticola	0	0	0	2	0	1	0, 1	1, 2	1	1	0	0	1	1	0	1	2	2	1	0	1	0	1	0	0	0	0	0	1	2	1	0	0	0	1
Harttia trombetensis	0	0	0	2	0	1	1	1	1	1	0	0	1	1	0	1	2	2	1	1	1	0	1	0	1	1	0	0	1	2	1	0	3	4	1
Harttia uatumensis	0	0	0	2	0	1	0, 1	1	1	1	0	0	1	1	0	1	2	2	0	1	1	0	1	0	0	1	0	0	1	2	1	0	0	4	1
Harttia villasboas	0	0	0	2	0	1	1	2	1	1	0	0	0	1	0	1	2	1	1	1	1	0	1	1	1	1	0	0	1	2	1	0	1	0	1
***Harttia* sp. São Roque**	0	0	0	0	0	1	0, 1	3	1	1	0	0	1	1	0	1	2	1	1	1	1	0	1	1	0	1	0	0	1	2	1	0	1	0	1
***Harttia* sp. Tapajós 1**	0	0	1	0	0	1	1	3	1	1	0	0	0	1	0	1	2	1	1	1	1	0	1	1	0	1	0	0	1	2	1	0	3	0	1
***Harttia* sp. Tapajós 2**	0	0	3	0	0	1	1	1	1	1	0	0	1	1	0	1	2	1	1	1	1	0	1	1	0	0	0	0	1	2	1	0	0	0	1

Appendix 2 (continuation). Character state matrix (Characters 106 to 135).

	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
***Astroblepus* sp.**	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lithogenes wahari	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	1	0	2	0	0	1
Hemipsilichthys nimius	2	1	0	1	1	1	0	1	0	0	0	0	0	2	1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1
Ancistrus multipinnis	2	1	1	1	1	1	1	1	0	0	0	0	0	2	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1
Hypostomus ancistroides	1	1	1	1	1	1	1	0	0	0	0	0	0	1	1	0	1	0	0	0	0	1	1	1	0	1	1	0	0	1
Isbrueckerichthys duseni	0	1	1	1	1	1	1	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	2	1	0	1
Kronichthys heylandi	0	1	1	1	1	1	1	0	0	0	0	0	0	1	1	0	1	0	0	1	-	-	-	1	0	1	3	0	0	1
Neoplecostomus microps	0	1	1	1	1	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	1	0	0	1	0	1	1	0	0	1
Pareiorhina rudolphi	0	1	1	1	1	1	1	0	0	0	0	0	0	2	1	0	1	0	0	0	0	1	1	1	0	0	2	1	0	1
Hypoptopoma inexpectata	0	1	1	1	1	1	1	1	1	0	0	0	0	1	1	0	1	0	0	0	1	0	0	2	0	0	1	0	0	1
Plesioptopoma curvidens	0	1	1	1	1	1	1	0	1	0	0	0	0	1	1	0	1	0	0	0	1	0	0	1	0	0	3	0	0	1
Pseudotocinclus tietensis	0	1	1	1	1	1	1	0	0	0	0	0	0	1	1	0	1	0	0	0	1	0	1	1	0	1	1	0	0	1
***Apistoloricaria* sp.**	2	2	2	0	1	1	1	0	2	1	-	-	3	3	2	1	2	1	0	0	0	1	0	2	0	1	1	0	0	2
***Brochiloricaria* sp.**	2	2	2	0	1	1	1	0	2	1	-	-	3	3	2	1	2	1	1	0	2	0	1	2	1	0	1	0	1	2
***Crossoloricaria* spp.**	2	2	2	0	1	1	1	0	2	1	-	-	3	3	2	1	2	1	0	0	0	1	0	2	0	1	3	0	1	2
Cteniloricaria platystoma	1	1	1	1	1	1	0	1	0	0	0	0	0	2	1	0	1	0	0	0	2	0	1	1	0	0	2	0	0	1
Farlowella oxyrryncha	2	1	1	1	1	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1
Furcodontichthys novaesi	2	2	1	0	1	1	1	0	1	0	1	0	1	4	2	1	0	1	0	0	2	0	1	2	0	0	1	0	1	1
Harttiella crassicauda	1	1	1	1	1	1	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	1	1	0	1
Hemiodontichthys acipenserinus	2	2	2	0	1	1	1	1	2	0	0	1	3	4	2	1	2	1	0	0	0	0	1	2	0	1	3	0	1	2
***Lamontichthys* spp.**	1	1	1	1	1	1	0	0	0	0	0	0	0	2	1	0	1	0	0	0	2	0	0	1	0	1	2	0	0	1
Limatulichthys griseus	2	1	2	0	1	1	1	1	2	0	1	1	1	3	2	1	2	1	1	0	0	0	0	2	0	0	1	0	1	1
Loricaria cataphracta	2	0	2	0	1	1	1	1	2	1	-	-	1	3	2	1	2	1	0	0	2	0	0	2	1	1	1	0	1	2
Loricaria lentiginosa	2	0	2	0	1	1	1	1	2	1	-	-	1	4	2	0	2	1	1	0	0	0	0	2	1	1	1	0	1	2
Loricariichthys castaneus	2	3	1	0	1	1	2	1	2	0	0	2	2	4	2	1	2	1	0	0	3	0	0	2	1	0	1	0	1	2
Metaloricaria paucidens	0	1	1	0	1	1	1	0	1	0	1	1	1	3	2	1	1	1	0	0	3	0	0	2	0	1	3	0	0	1
Paraloricaria vetula	2	1	2	0	1	1	1	0	2	1	-	-	1	4	2	0	2	1	0	0	0	0	0	2	1	1	1	0	0	2
Planiloricaria cryptodon	2	2	2	1	1	1	1	1	2	1	-	-	3	4	2	1	2	1	0	0	2	1	1	2	1	0	2	0	1	2
Proloricaria prolixa	2	2	2	0	1	1	1	1	2	1	-	-	2	4	2	1	2	1	1	0	3	0	1	2	0	1	1	0	1	2
***Pseudohemiodon* spp.**	2	0	2	0	1	1	1	1	2	1	-	-	3	3	2	1	2	1	1	0	4	1	0	2	1	0	1	0	1	2
Pseudoloricaria laeviuscula	2	0	2	0	1	1	1	0	2	0	1	1	1	2	2	1	2	1	1	0	0	0	0	2	0	1	1	0	1	1
Pterosturisoma* cf. *microps	1	1	1	1	1	1	1	0	0	0	0	0	0	2	1	0	1	0	0	0	2	0	0	1	0	1	1	0	0	1

Appendix 2 (continuation). Character state matrix (Characters 106 to 135).

	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135
Reganella depressa	2	2	2	0	1	2	1	0	0	1	-	-	3	4	2	1	0	1	1	0	1	2	1	2	1	1	1	0	1	2
Rineloricaria daraha	2	1	2	1	1	1	1	0	1	1	-	-	1	3	2	0	0	1	1	0	2	0	0	2	0	1	1	0	0	1
Rineloricaria lanceolata	2	1	2	0	1	1	1	0	1	1	-	-	1	1	2	0	0	1	1	0	2	0	1	2	0	1	1	0	0	1
Rineloricaria latirostris	2	1	2	0	1	1	1	0	1	1	-	-	1	2	2	1	0	1	1	0	0	0	1	2	0	1	1	0	1	1
Rineloricaria pentamaculata	2	1	2	0	1	1	1	1	1	1	-	-	1	3	2	1	2	1	0	0	2	0	1	2	0	1	1	0	1	1
Spatuloricaria evansii	2	1	2	1	1	1	1	1	2	0	2	1	1	3	2	0	0	1	1	0	3	0	0	2	0	1	1	0	0	1
Sturisoma robustum	1	1	1	1	1	1	1	0	0	0	0	0	0	2	1	0	1	0	0	0	1	0	1	2	0	0	1	0	0	1
Harttia absaberi	2	1	1	1	1	1	0	1	0	0	0	0	0	2	1	0	1	0	0	0	0	0	0	1	0	0	1	0	0	1
Harttia carvalhoi	0	1	1	1	1	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1
Harttia dissidens	0	1	1	1	1	1	0	1	0	0	0	0	0	2	1	0	1	0	0	0	2	0	0	1	0	0	2	1	0	1
Harttia duriventris	0	1	1	1	1	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	2	1	0	1
Harttia* cf. *fowleri	0	1	1	1	1	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	2	0	0	1	0	0	2	1	0	1
Harttia garavelloi	0	1	1	1	1	1	0	1	0	0	0	0	0	2	1	0	1	0	0	0	1	0	1	1	0	0	2	1	0	1
Harttia gracilis	0	1	1	1	1	1	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	1	1	0	0	2	1	0	1
Harttia guianensis	0	1	1	1	1	1	0	1	0	0	0	0	0	2	1	0	1	0	0	0	2	0	0	1	0	1	2	0	0	1
Harttia intermontana	1	1	1	1	1	1	0	0	0	0	0	0	0	2	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1
Harttia kronei	0	1	1	1	1	1	0	1	0	0	0	0	0	2	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1
Harttia leiopleura	0	1	1	1	1	1	0	0	0	0	0	0	0	2	1	0	1	0	0	0	0	0	0	1	0	1	1	0	0	1
Harttia longipinna	0	1	1	1	1	1	0	0	0	0	0	0	0	2	1	0	1	0	0	0	3	0	0	1	0	0	2	0	0	1
Harttia loricariformis	0	1	1	1	1	1	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1
Harttia novalimensis	1	1	1	1	1	1	0	0	0	0	0	0	0	2	1	0	1	0	0	0	0	0	1	1	0	0	2	1	0	1
Harttia panara	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1
Harttia punctata	1	1	1	1	1	1	0	1	0	0	0	0	0	2	1	0	1	0	0	0	0	0	0	1	1	0	2	0	0	1
Harttia rondoni	2	1	1	1	1	1	0	0	0	0	0	0	0	2	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1
Harttia* cf. *surinamensis	0	1	1	1	1	1	0	1	0	0	0	0	0	2	1	0	1	0	0	0	0	0	0	1	0	0	2	1	0	1
Harttia torrenticola	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1
Harttia trombetensis	0	1	1	1	1	1	0	1	0	0	0	0	0	2	1	0	1	0	0	0	2	0	0	1	0	0	2	0	0	1
Harttia uatumensis	2	1	1	1	1	1	0	1	0	0	0	0	0	2	1	0	1	0	0	0	0	0	0	1	0	0	2	1	0	1
Harttia villasboas	1	1	1	1	1	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1
***Harttia* sp. São Roque**	2	1	1	1	1	1	0	1	0	0	0	0	0	2	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1
***Harttia* sp. Tapajós 1**	0	1	1	1	1	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1
***Harttia* sp. Tapajós 2**	2	1	1	1	1	1	0	1	0	0	0	0	0	2	1	0	1	0	0	0	0	0	0	1	0	0	2	0	0	1

Appendix 2 (continuation). Character state matrix (Characters 136 to 165).

	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
***Astroblepus* sp.**	0	0	0	0	0	0	0	0	-	-	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lithogenes wahari	0	1	0	1	1	1	0	1	0	0	0	0	-	0	0	0	1	0	1	0	1	0	0	0	0	0	0	1	0	0
Hemipsilichthys nimius	1	1	0	1	0	2	0	1	1	0	0	1	0	2	1	0	1	1	0	1	0	1	0	0	0	1	1	0	1	1
Ancistrus multipinnis	1	0	0	0	0	0	0	1	1	0	0	1	0	3	2	0	1	0	1	0	0	1	1	0	1	1	1	0	1	1
Hypostomus ancistroides	1	1	0	0	0	4	1	0	-	-	0	1	0	3	2	0	1	0	0	1	0	1	1	0	1	1	1	1	1	1
Isbrueckerichthys duseni	1	0	0	0	0	0	1	0	-	-	0	1	1	3	1	0	1	0	1	0	0	1	1	0	1	1	1	0	1	1
Kronichthys heylandi	1	0	0	0	0	0	0	0	-	-	0	1, 2	0	3	1	0	1	0	0	1	0	1	1	0	1	1	1	0	1	1
Neoplecostomus microps	1	0	0	0	0	0	0	0	-	-	0	1	0	2	1	0	1	0	1	1	0	1	0	0	1	1	1	1	1	1
Pareiorhina rudolphi	1	0	0	0	0	0	0	0	-	-	0	1	0	2	1	0	1	0	0	1	0	1	1	0	1	1	1	0	1	1
Hypoptopoma inexpectata	1	0	0	0	0	0	1	1	1	0	0	1	0	2	1	0	1	0	1	1	0	1	1	0	1	1	1	0	1	1
Plesioptopoma curvidens	1	0	0	0	0	0	1	0	-	-	0	1	0	2	1	0	0	1	0	0	0	0	1	0	1	1	1	0	1	1
Pseudotocinclus tietensis	1	0	0	0	0	2	0	0	-	-	0	1	0	2	1	0	1	0	0	1	0	1	1	0	1	1	1	0	1	1
***Apistoloricaria* sp.**	0	1	0	1	1	0	0	1	3	1	0	1	2	1	0	1	1	1	1	0	1	0	0	1	0	0	2	0	0	1
***Brochiloricaria* sp.**	0	1	0	1	0	0	0	1	2	1	0	1	0	1	0	1	1	1	1	0	1	0	0	1	0	0	2	1	0	1
***Crossoloricaria* spp.**	0	1	0	1	1	1	0	1	2	1	0	1	0	0	0	1	1	1	1	0	1	0	0	1	0	0	2	0	0	1
Cteniloricaria platystoma	1	0	0	1	0	0	0	1	2	0	0	1	0	3	2	0	0	1	0	1	0	1	1	0	1	1	1	0	1	1
Farlowella oxyrryncha	1	0	1	1	1	0	0	1	2	0	0	1	0	2	1	0	0	1	0	1	1	1	1	0	0	1	1	0	1	1
Furcodontichthys novaesi	0	1	0	1	0	0	0	1	2	1	0	1	0	1	0	1	1	1	1	0	2	2	1	0	0	0	2	0	0	1
Harttiella crassicauda	1	0	0	1	0	0	0	1	1	0	0	0	-	3	2	0	0	1	0	1	0	1	1	0	1	0	1	0	1	2
Hemiodontichthys acipenserinus	2	1	0	1	0	0	0	1	2	1	1	1	0	0	0	1	1	0	0	2	2	2	0	0	0	0	2	0	0	1
***Lamontichthys* spp.**	1	0	0	1	0	2	0	1	2	0	0	1	0	3	1	0	0	0	1	1	0	1	2	0	1	0	1	0	0	1
Limatulichthys griseus	0	0	0	1	0	0	0	1	2	1	0	1	0	0	0	1	1	1	1	2	2	1	0	0	0	0	0	0	0	1
Loricaria cataphracta	2	1	0	1	0	0	0	1	3	1	0	1	0	0	0	1	1	1	1	0	1	0	0	1	0	0	2	1	0	1
Loricaria lentiginosa	2	1	0	1	0	0	0	1	2	1	0	1	0	0	0	1	1	1	1	0	1	0	0	1	0	0	2	0	0	1
Loricariichthys castaneus	2	1	0	1	0	0	0	1	2	1	0	1	0	1	0	1	1	0	1	2	2	1	0	0	0	0	0	0	0	1
Metaloricaria paucidens	1	0	0	1	1	0	0	1	2	1	0	1	1	2	1	1	1	0	1	1	1	0	2	0	1	0	1	0	1	1
Paraloricaria vetula	2	1	0	1	0	0	0	1	2	1	0	1	0	1	0	1	1	1	1	0	1	0	0	1	0	0	2	1	0	1
Planiloricaria cryptodon	0	1	0	1	1	1	0	1	3	0	0	1	0	1	0	1	1	1	1	0	1	0	0	1	0	0	2	0	0	1
Proloricaria prolixa	2	1	0	1	1	2	0	1	2	1	0	1	0	1	0	1	1	1	1	0	1	0	1	0	0	0	0	1	0	1
***Pseudohemiodon* spp.**	0	1	0	1	1	3	0	1	2	1	0	1	0	1	0	1	1	1	1	0	1	0	0	1	0	0	2	0	0	1
Pseudoloricaria laeviuscula	0	0	0	1	0	3	0	1	3	1	0	1	0	1	0	1	1	1	1	2	2	2	0	0	0	0	0	0	0	1
Pterosturisoma* cf. *microps	1	0	0	1	1	0	0	1	2	0	0	1	0	3	2	0	1	0	0	1	0	1	1	0	0	1	1	0	1	1

Appendix 2 (continuation). Character state matrix (Characters 136 to 165).

	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160	161	162	163	164	165
Reganella depressa	0	1	0	1	0	0	0	1	2	0	1	1	0	0	0	1	1	0	1	0	2	1	1	0	0	0	0	2	0	1
Rineloricaria daraha	1	1	0	1	1	0	0	1	3	1	0	1	0	1	0	1	1	1	1	0	2	2	0	0	0	0	0	0	0	1
Rineloricaria lanceolata	1	1	0	1	0	2	0	1	2	1	0	1	0	1	0	0	1	1	1	2	2	0	0	0	0	0	0	0	0	1
Rineloricaria latirostris	1	1	0	1	0	0	0	1	2	1	0	1	2	1	0	1	1	1	1	2	2	0	0	0	0	0	0	0	0	1
Rineloricaria pentamaculata	1	1	0	1	0	1	0	1	2	1	0	1	0	0	0	1	1	1	1	2	2	2	0	0	0	0	0	0	0	1
Spatuloricaria evansii	1	1	0	1	0	0	0	1	2	1	0	1	0	1	0	1	1	1	1	0	2	0	0	1	0	0	0	0	0	1
Sturisoma robustum	1	0	0	1	0	2	0	1	2	0	0	1	0	3	2	0	0	1	0	1	0	1	1	0	1	0	1	0	1	1
Harttia absaberi	1	0	0	1	0	0	0	1	2	1	0	1	0	3	2	0	0	1	0	1	0	1	1	0	0	1	1	1	1	1
Harttia carvalhoi	1	0	0	1	0	0	0	1	1	0	0	1	0	3	2	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1
Harttia dissidens	1	0	0	1	0	0	0	1	2	0	0	1	0	3	2	0	0	1	0	1	0	1	1	0	1	0	1	0	1	1
Harttia duriventris	1	0	0	1	0	1	0	1	2	0	0	1	0	3	2	0	0	0	0	1	0	1	1	0	1	0	1	0	1	1
Harttia* cf. *fowleri	1	0	0	1	0	0	0	1	2	0	0	1	0	3	2	0	0	1	0	1	0	1	1	0	1	0	1	0	1	1
Harttia garavelloi	1	0	0	1	0	1	0	1	2	0	0	1	0	2	1	0	1	0	0	1	0	1	1	0	1	0	1	1	1	1
Harttia gracilis	1	0	0	1	0	0	0	1	1	0	0	1	0	3	2	0	1	0	0	0	0	1	1	0	1	1	1	0	1	1
Harttia guianensis	1	0	0	1	0	0	0	1	2	0	0	1	0	3	2	0	0	1	0	1	0	1	1	0	1	0	1	0	1	1
Harttia intermontana	1	0	0	1	0	0	0	1	1	0	0	1	0	3	2	0	1	1	0	1	0	1	1	0	1	1	1	0	1	1
Harttia kronei	1	0	0	1	0	0	1	1	1	0	0	1	0	3	2	0	1	0	0	1	0	1	1	0	1	0	1	0	1	1
Harttia leiopleura	1	0	0	1	0	0	1	1	1	0	0	1	0	3	2	0	1	0	0	1	0	1	1	0	1	0	1	0	1	1
Harttia longipinna	1	0	0	0	0	0	1	1	1	0	0	1	0	3	2	0	1	0	0	1	0	1	1	0	1	0	1	0	1	1
Harttia loricariformis	1	0	0	1	0	2	0	1	2	0	0	1	0	3	2	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1
Harttia novalimensis	1	0	0	0	0	0	1	1	1	0	0	1	0	3	2	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1
Harttia panara	1	0	0	1	0	0	0	1	2	0	0	1	0	3	2	0	0	0	0	1	0	1	1	0	1	1	1	0	1	1
Harttia punctata	1	0	0	1	0	0	0	1	2	0	0	1	0	3	2	0	0	0	0	1	0	1	1	0	1	0	1	0	1	1
Harttia rondoni	1	0	0	1	0	3	0	1	2	0	0	1	0	3	2	0	0	1	0	1	0	1	1	0	1	0	1	0	1	1
Harttia* cf. *surinamensis	1	0	0	1	0	0	0	1	2	0	0	1	0	3	2	0	0	0	0	1	0	1	1	0	1	1	1	0	1	1
Harttia torrenticola	1	0	0	1	0	0	0	1	1	0	0	1	0	3	2	0	1	1	0	1	0	1	1	0	1	1	1	0	1	1
Harttia trombetensis	1	0	0	1	0	2	0	1	2	0	0	1	0	3	2	0	0	1	0	1	0	1	1	0	1	0	1	0	1	1
Harttia uatumensis	1	0	0	1	0	0	0	1	2	0	0	1	0	3	2	0	1	0	0	1	0	1	1	0	1	0	1	0	1	1
Harttia villasboas	1	0	0	1	0	0	0	1	2	0	0	1	0	3	2	0	1	0	0	0	0	1	1	0	1	1	1	0	1	1
***Harttia* sp. São Roque**	1	0	0	1	0	0	1	1	1	0	0	1	0	3	2	0	1	1	0	1	0	1	1	0	1	1	1	0	1	1
***Harttia* sp. Tapajós 1**	1	0	0	1	0	3	0	1	2	0	0	1	0	3	2	0	1	1	0	1	0	1	1	0	1	0	1	0	1	1
***Harttia* sp. Tapajós 2**	1	0	0	1	0	0	0	1	2	0	0	1	0	3	2	0	0	1	0	1	0	1	1	0	1	0	1	0	1	1

Appendix 2 (continuation). Character state matrix (Characters 166 to 195).

	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195
***Astroblepus* sp.**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lithogenes wahari	0	0	0	1	0	0	0	0	0	0	0	2	1	0	0	0	0	0	1	1	0	1	1	0	0	3	-	-	2	0
Hemipsilichthys nimius	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	0	0	0	1	0	3	2	3	1	2	0	0	1	2
Ancistrus multipinnis	1	1	0	1	0	0	0	1	0	0	1	1	1	0	1	0	1	0	0	2	0	3	1	2	0	2	0	0	1	1
Hypostomus ancistroides	1	1	0	1	0	0	3	0	0	0	1	1	1	0	2	0	1	0	0	2	0	3	0	2	0	2	0	2	0	1
Isbrueckerichthys duseni	0	1	0	1	0	0	3	0	0	0	1	1	1	0	2	0	1	0	0	0	0	3	1	3	0	0	0	0	0	1
Kronichthys heylandi	1	1	0	1	0	0	2	0	0	0	1	1	1	0	0	0	0	0	1	2	0	3	0	3	0	0	2	0	1	1
Neoplecostomus microps	0	1	0	1	0	0	2	1	0	0	0	1	1	0	2	0	1	0	0	0	0	3	1	3	0	1	0	0	0	1
Pareiorhina rudolphi	1	1	0	2	0	0	0	0	0	0	1	1	1	0	0	0	0	0	1	0	0	3	1	3	0	1	0	0	1	1
Hypoptopoma inexpectata	0	1	0	1	0	0	0	0	0	0	1	1	1	2	2	0	1	0	1	0	1	3	0	3	0	1	2	0	1	1
Plesioptopoma curvidens	0	1	0	1	0	0	0	0	0	0	1	0	1	0	2	0	0	1	0	2	0	3	0	3	0	1	0	0	0	1
Pseudotocinclus tietensis	0	1	0	3	-	0	2	0	0	0	1	1	1	1	1	0	0	0	0	1	1	3	0	3	0	3	-	-	0	1
***Apistoloricaria* sp.**	2	3	2	0	3	2	3	0	1	1	0	2	1	0	2	1	1	0	0	2	0	3	0	3	0	3	-	-	2	4
***Brochiloricaria* sp.**	2	3	2	0	3	2	3	1	1	1	0	2	1	0	2	1	0	1	0	0	0	3	1	3	0	3	-	-	2	3
***Crossoloricaria* spp.**	2	3	2	0	3	2	3	1	1	1	0	2	1	0	2	1	0	0	0	0	0	3	1	3	0	3	-	-	2	4
Cteniloricaria platystoma	1	1	0	1	0	0	0	1	0	0	1	1	1	0	2	0	1	1	0	1	0	3	2	1	1	2	1	0	3	2
Farlowella oxyrryncha	1	1	0	1	0	0	3	1	0	0	1	0	0	0	2	0	0	0	0	1	0	3	0	1	1	2	1	0	3	4
Furcodontichthys novaesi	0	0	1	0	3	1	3	0	0	0	0	2	1	0	2	1	1	1	1	0	0	3	1	1	1	2	2	1	1	4
Harttiella crassicauda	1	1	0	3	-	0	3	1	0	0	1	1	1	0	2	0	1	0	1	2	0	3	2	1	1	2	1	0	0	1
Hemiodontichthys acipenserinus	0	0	1	0	3	0	1	0	0	0	0	2	1	1	1	1	0	1	1	0	0	3	1	1	1	2	2	1	0	4
***Lamontichthys* spp.**	1	2	0	1	0	0	3	1	0	0	1	1	1	0	2	0	1	1	0	1	0	2	2	0	1	2	1	0	3	4
Limatulichthys griseus	0	0	1	0	3	0	1	0	0	0	0	2	1	0	1	1	1	1	1	2	0	3	1	2	1	2	2	0	1	4
Loricaria cataphracta	2	0	2	0	3	1	3	1	1	1	0	2	1	0	0	1	1	1	0	2	0	3	0	1	1	3	-	-	0	3
Loricaria lentiginosa	2	0	2	0	3	1	3	1	1	1	0	2	1	0	1	1	1	1	0	0	0	3	0	2	1	3	-	-	0	4
Loricariichthys castaneus	0	0	1	0	0	0	3	1	0	0	0	2	1	0	1	1	1	1	0	1	0	3	0	1	1	2	2	1	0	4
Metaloricaria paucidens	0	0	0	2	2	0	1	1	0	0	0	2	1	0	2	0	0	1	1	2	0	3	1	2	1	2	1	0	3	2
Paraloricaria vetula	2	3	2	0	3	1	3	0	1	1	0	2	2	0	0	1	1	1	0	0	0	3	0	1	1	2	2	0	1	4
Planiloricaria cryptodon	2	3	2	0	3	2	3	0	1	1	0	2	2	0	1	1	0	1	0	0	0	3	1	0	0	3	-	-	3	3
Proloricaria prolixa	0	0	2	0	3	1	3	1	1	1	0	2	1	0	0	1	1	1	1	0	0	3	0	1	1	3	-	-	0	4
***Pseudohemiodon* spp.**	2	3	2	0	3	2	3	0	1	1	0	2	2	0	2	1	0	1	1	0	0	3	2	3	0	3	-	-	2	4
Pseudoloricaria laeviuscula	0	0	1	0	3	0	1	0	0	0	0	2	1	0	1	1	1	1	0	2	0	3	1	2	1	2	2	1	1	4
Pterosturisoma* cf. *microps	1	1	0	2	1	0	3	0	0	0	1	1	1	0	2	0	0	1	0	2	0	3	2	1	1	2	1	0	3	2

Appendix 2 (continuation). Character state matrix (Characters 166 to 195).

	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195
Reganella depressa	0	0	1	0	3	0	1	0	1	0	0	2	3	0	2	1	1	1	0	2	0	3	1	1	1	2	2	1	0	4
Rineloricaria daraha	0	0	0	0	3	0	3	1	0	0	0	2	1	0	1	0	0	1	1	0	0	2	2	1	1	2	2	0	3	2
Rineloricaria lanceolata	0	0	0	0	3	0	3	0	0	0	0	2	1	0	1	0	0	1	1	0	0	3	2	1	1	2	2	1	2	2
Rineloricaria latirostris	0	0	0	0	3	0	3	1	0	0	0	2	1	0	0	0	0	1	1	0	0	3	2	1	1	2	2	0	1	2
Rineloricaria pentamaculata	0	0	0	0	3	0	3	1	0	0	0	2	1	0	1	0	1	1	1	0	0	3	2	1	1	2	2	0	2	2
Spatuloricaria evansii	2	0	1	0	3	0	1	1	1	1	0	2	1	0	0	0	1	1	0	2	0	3	0	1	1	2	1	0	1	3
Sturisoma robustum	1	2	0	2	1	0	1	1	0	0	1	0	0	0	2	0	0	0	0	1	0	3	1	1	1	2	1	1	3	2
Harttia absaberi	1	1	0	2	1	0	1	1	0	0	1	1	1	0	2	0	2	1	0	0	0	3	2	1	1	2	1	0	3	2
Harttia carvalhoi	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	0	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia dissidens	1	1	0	1	0	0	3	0	0	0	1	1	1	0	2	0	1	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia duriventris	1	1	0	1	0	0	3	0	0	0	1	1	1	0	2	0	1	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia* cf. *fowleri	1	1	0	1	0	0	3	0	0	0	1	1	1	0	0	0	0	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia garavelloi	1	1	0	1	0	0	3	1	0	0	1	1	1	0	2	0	0	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia gracilis	1	1	0	1	0	0	3	0	0	0	1	1	1	0	2	0	0	0	0	2	0	3	2	1	1	2	1	0	3	2
Harttia guianensis	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	1	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia intermontana	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	0	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia kronei	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	0	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia leiopleura	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	0	0	0	1	0	2	2	1	1	2	1	0	3	2
Harttia longipinna	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	0	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia loricariformis	1	1	0	1	0	0	3	0	0	0	1	1	1	0	2	0	0	0	0	2	0	3	2	1	1	2	1	0	3	2
Harttia novalimensis	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	0	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia panara	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	1	0	0	2	0	3	2	1	1	2	1	0	3	2
Harttia punctata	1	1	0	1	0	0	3	0	0	0	1	1	1	0	2	0	0	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia rondoni	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	1	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia* cf. *surinamensis	1	1	0	1	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia torrenticola	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	0	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia trombetensis	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	0	0	0	1	0	3	2	1	1	2	1	0	3	2
Harttia uatumensis	1	1	0	1	0	0	3	0	0	0	1	1	1	0	2	0	0	0	0	2	0	3	2	1	1	2	1	0	3	2
Harttia villasboas	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	1	0	0	1	0	3	2	1	1	2	1	0	3	2
***Harttia* sp. São Roque**	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	0	0	0	1	0	3	2	1	1	2	1	0	3	2
***Harttia* sp. Tapajós 1**	1	1	0	1	0	0	3	0	0	0	1	1	1	0	2	0	1	0	0	1	0	3	2	1	1	2	1	0	3	2
***Harttia* sp. Tapajós 2**	1	1	0	1	0	0	0	0	0	0	1	1	1	0	2	0	0	0	0	2	0	3	2	1	1	2	1	0	3	2

Appendix 2 (continuation). Character state matrix (Characters 196 to 225).

	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
***Astroblepus* sp.**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lithogenes wahari	0	1	1	0	1	1	0	1	0	0	0	1	1	1	0	0	0	0	0	1	0	0	0	0	1	0	0	1	1	0
Hemipsilichthys nimius	1	1	1	0	1	0	0	1	2	1	0	2	2	1	0	0	1	1	1	1	0	0	1	0	1	0	2	0	1	0
Ancistrus multipinnis	1	1	1	1	2	0	0	1	1	1	0	1	1	0	0	1	2	1	1	1	0	1	1	0	1	0	0	0	1	0
Hypostomus ancistroides	1	1	1	1	1	0	0	1	1	2	0	1	1	0	0	1	2	0	1	1	0	1	1	0	1	0	1	0	1	0
Isbrueckerichthys duseni	0	1	1	0	1	0	0	1	1	0	0	1	0	1	0	0	1	0	1	1	0	0	1	0	1	0	0	0	1	0
Kronichthys heylandi	0	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	0	0	1	0	0	1	0	1	0	1	0	1	0
Neoplecostomus microps	0	1	1	0	1	0	0	1	1	1	0	1	0	0	1	0	1	1	1	1	0	0	1	0	1	0	0	0	1	0
Pareiorhina rudolphi	1	1	1	0	1	0	0	1	1	1	0	1	1	0	1	0	1	1	1	0	0	0	1	0	1	0	0	0	1	0
Hypoptopoma inexpectata	3	1	1	0	1	0	0	1	1	0	0	1	1	1	0	0	1	1	3	0	0	0	1	0	1	0	1	0	1	0
Plesioptopoma curvidens	3	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	2	0	0	0	1	0	1	1	1	0	1	0
Pseudotocinclus tietensis	3	1	1	0	1	0	0	1	1	1	0	1	1	1	1	0	1	1	1	0	0	0	1	0	1	1	2	0	1	0
***Apistoloricaria* sp.**	1	0	1	0	1	2	0	1	1	0	1	1	1	2	1	0	1	1	3	0	1	2	2	1	0	0	1	0	1	2
***Brochiloricaria* sp.**	1	0	1	0	1	2	0	1	1	0	1	1	1	1	1	0	1	1	3	0	1	2	2	1	0	1	1	0	1	2
***Crossoloricaria* spp.**	1	0	1	0	1	2	0	1	1	0	1	1	1	2	1	0	1	1	3	0	1	2	2	1	0	1	1	0	1	2
Cteniloricaria platystoma	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	2	0	0	0	2	1	1	1	1	0	1	1
Farlowella oxyrryncha	1	1	1	0	2	0	0	0	0	0	1	0	1	0	3	0	2	2	3	0	1	0	2	1	0	1	2	0	1	2
Furcodontichthys novaesi	2	0	1	0	1	2	0	1	1	0	1	1	3	1	1	0	1	1	5	0	1	2	2	1	0	1	2	0	1	2
Harttiella crassicauda	1	1	1	1	1	0	0	1	1	0	0	1	0	1	1	0	1	0	1	0	0	0	2	1	1	1	1	0	1	0
Hemiodontichthys acipenserinus	1	0	1	0	1	2	0	1	1	0	1	1	2	1	1	0	1	2	4	0	1	2	2	1	0	1	1	0	1	2
***Lamontichthys* spp.**	1	1	1	0	1	1	0	1	1	1	0	1	3	1	0	0	1	1	2	0	1	2	2	1	0	1	1	0	1	1
Limatulichthys griseus	1	0	1	0	1	1	0	1	1	0	1	1	2	2	2	0	1	1	4	0	1	2	2	1	0	1	2	0	1	2
Loricaria cataphracta	2	0	1	0	2	0	0	1	1	0	1	1	2	2	1	0	1	1	3	0	1	2	2	1	0	1	1	0	1	2
Loricaria lentiginosa	2	0	2	0	2	0	0	1	1	0	1	1	2	2	1	0	1	1	3	0	1	2	2	1	0	1	1	0	1	2
Loricariichthys castaneus	1	0	1	0	2	0	0	1	1	0	1	1	2	1	1	0	1	1	3	0	1	0	2	1	0	1	1	0	1	2
Metaloricaria paucidens	1	0	1	1	1	0	0	1	1	1	1	1	3	1	0	0	2	2	2	0	0	0	2	0	2	2	0	0	1	0
Paraloricaria vetula	2	0	1	0	2	0	0	1	1	0	1	1	2	2	1	0	1	1	3	0	1	2	2	1	0	1	2	0	1	2
Planiloricaria cryptodon	2	0	1	0	1	2	0	1	1	0	1	1	3	2	0	0	1	1	1	0	1	2	2	1	0	0	1	0	1	2
Proloricaria prolixa	2	0	1	0	2	2	0	1	1	0	1	1	2	1	1	0	1	1	3	0	1	2	2	1	2	1	2	0	1	2
***Pseudohemiodon* spp.**	1	0	1	0	1	2	1	1	1	0	1	1	3	2	1	0	1	1	3	0	1	2	2	1	0	1	2	0	1	2
Pseudoloricaria laeviuscula	1	0	1	0	1	0	0	1	1	0	1	1	3	1	1	0	1	1	3	0	1	2	2	1	0	1	2	0	1	2
Pterosturisoma* cf. *microps	1	1	0	1	1	1	0	1	1	1	1	1	3	1	2	0	1	1	2	0	0	1	2	1	2	1	0	0	1	2

Appendix 2 (continuation). Character state matrix (Characters 196 to 225).

	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224	225
Reganella depressa	1	0	0	0	1	2	0	1	1	0	1	1	2	2	2	0	1	1	3	0	1	0	2	1	0	1	2	0	1	2
Rineloricaria daraha	1	0	1	0	1	0	0	1	1	1	1	1	2	0	0	0	1	1	3	0	1	2	2	1	0	0	1	0	1	2
Rineloricaria lanceolata	1	0	1	0	1	0	0	1	1	1	1	1	2	2	0	0	1	1	3	0	1	2	2	1	0	1	1	0	1	2
Rineloricaria latirostris	1	1	1	1	1	0	0	1	1	1	0	1	2	2	0	0	1	1	4	0	1	2	2	1	0	1	2	0	1	2
Rineloricaria pentamaculata	1	0	1	0	1	1	0	1	1	1	1	1	2	2	0	0	1	1	4	0	1	2	2	1	0	0	2	0	1	2
Spatuloricaria evansii	1	1	1	0	1	0	0	1	1	0	1	1	2	2	1	0	1	1	3	0	1	2	2	1	0	0	1	0	1	1
Sturisoma robustum	1	1	1	1	1	1	0	1	1	1	1	1	3	1	2	0	1	1	2	0	0	0	2	1	2	1	0	0	1	1
Harttia absaberi	1	1	1	1	1	0	0	1	1	1	1	1	1	1	2	0	1	1	2	0	1	0	2	1	0	1	1	0	1	1
Harttia carvalhoi	1	1	1	1	1	0	0	1	1	0	0	1	1	1	0	0	1	1	2	0	1	0	2	1	1	1	0	0	1	1
Harttia dissidens	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	2	0	0	0	2	1	1	1	1	0	1	1
Harttia duriventris	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	2	0	0	0	2	1	1	1	1	0	1	1
Harttia* cf. *fowleri	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	1	1	2	0	0	0	2	1	1	1	1	0	1	1
Harttia garavelloi	1	1	1	1	1	0	0	1	1	0	0	1	1	1	0	0	1	1	2	0	0	0	2	1	1	1	1	0	1	1
Harttia gracilis	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	2	0	1	0	2	1	1	1	0	0	1	1
Harttia guianensis	1	1	1	1	1	0	0	1	1	0	0	1	1	1	0	0	1	1	2	0	0	0	2	1	1	0	0	0	1	1
Harttia intermontana	1	1	1	1	1	0	0	1	1	0	0	1	1	0	0	0	1	1	2	0	1	0	2	1	1	1	0	0	1	1
Harttia kronei	1	1	1	1	1	0	0	1	1	0	0	1	1	1	0	0	1	1	2	0	0	0	2	1	1	1	0	0	1	1
Harttia leiopleura	1	1	1	1	1	0	0	1	1	0	0	1	1	1	0	0	2	1	2	0	0	0	2	1	1	0	0	0	1	1
Harttia longipinna	1	1	1	1	1	0	0	1	1	1	0	1	1	0	0	0	1	1	2	0	0	0	2	1	1	1	0	0	1	1
Harttia loricariformis	1	1	1	1	1	0	0	1	1	0	1	1	1	1	0	0	1	1	2	0	0	0	2	1	1	0	0	0	1	1
Harttia novalimensis	1	1	1	1	1	0	0	1	1	0	1	1	1	1	0	0	1	1	2	0	1	0	2	1	1	1	0	0	1	1
Harttia panara	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	2	0	0	0	2	1	1	0	1	0	1	1
Harttia punctata	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	2	0	0	0	2	1	1	1	0	0	1	1
Harttia rondoni	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	1	1	2	0	0	0	2	1	1	1	1	0	1	1
Harttia* cf. *surinamensis	1	1	1	1	1	0	0	1	1	1	1	1	1	1	0	0	1	1	2	0	0	0	2	1	1	1	0	0	1	1
Harttia torrenticola	1	1	1	1	1	0	0	1	1	0	1	1	1	0	0	0	1	1	2	0	0	0	2	1	1	1	1	0	1	1
Harttia trombetensis	1	1	1	1	1	0	0	1	1	0	0	1	1	1	0	0	1	1	2	0	0	0	2	1	1	1	0	0	1	1
Harttia uatumensis	1	1	1	1	1	0	0	1	1	0	0	1	1	1	0	0	1	1	2	0	0	0	2	1	1	1	1	0	1	1
Harttia villasboas	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	2	0	0	0	2	1	1	1	1	0	1	1
***Harttia* sp. São Roque**	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	2	0	1	0	2	1	1	0	0	0	1	1
***Harttia* sp. Tapajós 1**	1	1	1	1	1	0	0	1	1	0	0	1	1	1	0	0	1	1	2	0	0	0	2	1	1	0	1	0	1	1
***Harttia* sp. Tapajós 2**	1	1	1	1	1	0	0	1	1	1	0	1	1	1	0	0	1	1	2	0	0	0	2	1	1	1	1	0	1	1

Appendix 2 (continuation). Character state matrix (Characters 226 to 255).

	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
***Astroblepus* sp.**	0	-	-	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0, 1	3	0	0	0	0	0	0	0
Lithogenes wahari	2	-	-	0	3	0	1	0	1	0	0	0	0	0	0	1	4	0	0	0	1	0	0	1	0	0	1	0	0	0
Hemipsilichthys nimius	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Ancistrus multipinnis	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	3	1	1	0	1	1	0	1
Hypostomus ancistroides	1	0	0	0	0	0	1	0	1	0	0	0	0	1	1	1	0	1	0	0	1	0	3	1	1	0	1	1	0	1
Isbrueckerichthys duseni	1	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	0	0	0	1	0	3	0	1	0	1	3	0	1
Kronichthys heylandi	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	1	0	1	0	0	1	0	3	0	1	0	1	1	0	1
Neoplecostomus microps	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	1	0	1	0	1	1	1	1	0	1
Pareiorhina rudolphi	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	0	0	0	1	0	3	0	1	0	1	0	0	1
Hypoptopoma inexpectata	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	1	0	0	1	0	2	1	1	0	1	0	0	1
Plesioptopoma curvidens	1	0	0	0	0	0	1	0	1	0	0	0	0	1	0	1	0	1	0	0	1	0	3	0	1	0	1	1	0	1
Pseudotocinclus tietensis	0	0	0	0	0	0	1	0	1	0	0	0	0	1	1	1	0	1	0	0	1	0	2	0	1	0	1	1	0	1
***Apistoloricaria* sp.**	2	1	1	3	1	1	2	0	0	2	0	0	0	2	0	2	1	2	1	1	2	1	1	1	0	2	0	2	0	1
***Brochiloricaria* sp.**	2	1	1	3	1	1	2	1	0	1	0	0	0	2	0	2	1	2	1	1	2	1	0	1	0	2	0	2	0	1
***Crossoloricaria* spp.**	2	1	1	3	1	1	2	1	0	2	0	0	0	2	0	2	1	2	1	1	2	1	1	2	0	2	0	2	0	1
Cteniloricaria platystoma	2	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Farlowella oxyrryncha	2	1	1	2	2	1	1	0	1	2	0	0	0	0	1	1	0	1	0	0	1	0	3	0	1	0	1	1	0	1
Furcodontichthys novaesi	2	1	1	3	1	1	1	1	0	2	0	0	0	2	0	1	1	0	1	1	1	2	1	0	0	2	0	3	0	1
Harttiella crassicauda	0	2	1	1	0	0	0	0	1	0	0	0	0	0	1	1	0	1	0	0	1	0	3	0	1	0	1	1	0	1
Hemiodontichthys acipenserinus	2	1	1	3	2	1	1	1	0	1	1	1	0	2	0	1	1	1	0	0	3	-	2	3	0	2	0	0	0	1
***Lamontichthys* spp.**	2	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Limatulichthys griseus	2	1	1	3	1	1	2	1	0	2	0	0	0	2	0	1	1	0	0	0	2	0	2	1	0	2	0	4	0	1
Loricaria cataphracta	2	0	1	3	1	1	1	1	0	2	0	0	0	2	0	2	1	2	1	1	2	0	1	2	0	2	0	2	0	1
Loricaria lentiginosa	2	1	1	3	1	0	1	1	0	2	0	1	1	2	0	2	1	2	1	1	2	0	1	2	0	2	0	2	0	1
Loricariichthys castaneus	2	1	1	3	1	1	1	1	0	2	0	0	0	2	0	0	1	0	0	0	2	0	-	-	-	2	0	0	0	1
Metaloricaria paucidens	2	0	1	1	1	0	1	0	0	1	0	0	0	0	0	1	1	1	0	0	1	0	2	1	0	2	0	1	1	1
Paraloricaria vetula	2	1	1	3	1	0	1	0	0	2	0	0	0	2	0	2	1	2	1	1	2	3	0	2	0	2	0	0	0	1
Planiloricaria cryptodon	2	1	1	3	0	1	1	0	1	0	0	0	0	2	0	2	3	2	1	1	3	-	0	3	0	2	0	1	0	1
Proloricaria prolixa	2	1	1	3	1	1	0	1	0	2	1	0	0	2	0	2	1	2	1	1	2	3	0	0	0	2	0	2	0	1
***Pseudohemiodon* spp.**	2	1	1	3	1	1	2	1	0	1	0	0	0	2	0	2	1	2	1	1	2	1	2	0	0	2	0	2	0	1
Pseudoloricaria laeviuscula	2	1	1	3	1	1	1	1	0	0	0	0	0	0	0	1	1	0	1	1	1	0	2	2	0	2	0	1	0	1
Pterosturisoma* cf. *microps	2	1	1	1	0	1	1	0	1	0	0	0	0	2	1	1	0	1	0	0	1	0	3	0	1	0	1	1	0	1

Appendix 2 (continuation). Character state matrix (Characters 226 to 255).

	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255
Reganella depressa	2	1	1	3	2	1	2	1	0	2	0	0	0	2	0	1	0	2	0	0	3	-	2	3	0	2	0	0	0	1
Rineloricaria daraha	2	1	1	3	1	0	0	1	0	2	0	1	0	2	0	1	2	2	0	0	2	0	0	1	0	2	0	0	0	1
Rineloricaria lanceolata	2	1	1	3	0	1	1	0	0	2	0	1	0	2	0	1	2	2	0	0	2	0	0	1	0	2	0	0	0	1
Rineloricaria latirostris	2	1	1	3	0	0	0	0	0	1	0	1	0	2	0	1	2	2	0	0	1	0	0	1	0	2	0	0	0	1
Rineloricaria pentamaculata	2	1	1	3	1	0	0	0	0	2	0	1	0	2	0	1	2	2	0	0	2	0	0	1	0	2	0	0	0	1
Spatuloricaria evansii	2	1	1	3	1	0	1	1	0	2	0	0	0	1	0	1	2	2	0	0	2	0	0	2	0	2	0	5	1	1
Sturisoma robustum	2	0	1	1	2	1	0	0	1	0	0	0	0	0	1	1	0	1	0	0	1	0	3	0	1	0	1	1	0	1
Harttia absaberi	2	0	1	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia carvalhoi	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia dissidens	2	0	1	1	0	0	1	0	0	2	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia duriventris	2	0	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia* cf. *fowleri	2	0	1	1	0	0	1	0	0	2	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia garavelloi	2	0	1	1	0	0	0	0	0	2	0	0	0	0	0	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia gracilis	2	1	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia guianensis	2	0	1	1	0	0	1	0	0	2	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia intermontana	2	1	1	1	0	0	0	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia kronei	2	0	1	1	0	0	1	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia leiopleura	0	0	1	1	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia longipinna	0	2	1	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia loricariformis	2	0	1	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia novalimensis	0	0	1	1	0	0	0	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia panara	2	0	1	1	0	0	1	0	1	2	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia punctata	2	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia rondoni	2	0	1	1	0	0	1	0	0	2	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia* cf. *surinamensis	2	0	1	1	0	0	1	0	0	2	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia torrenticola	2	1	1	1	0	0	1	0	1	2	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia trombetensis	2	0	1	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia uatumensis	2	0	1	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
Harttia villasboas	2	0	1	1	0	0	0	0	1	2	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
***Harttia* sp. São Roque**	0	1	1	1	0	0	0	0	1	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
***Harttia* sp. Tapajós 1**	2	0	1	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1
***Harttia* sp. Tapajós 2**	2	0	1	1	0	0	1	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	3	0	1	0	1	1	0	1

Appendix 2 (continuation). Character state matrix (Characters 256 to 275).

	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275
***Astroblepus* sp.**	-	-	-	-	-	-	0	-	-	0	-	-	0	0	-	-	-	0	0	0
Lithogenes wahari	-	-	-	-	-	-	0	-	-	0	-	-	1	0	-	-	-	0	0	0
Hemipsilichthys nimius	0	0	0	0	0	0	0	-	-	2	0	0	2	0	0	0	0	0	0	0
Ancistrus multipinnis	0	0	0	0	0	0	0	-	-	1	0	0	2	1	0	1	0	0	0	0
Hypostomus ancistroides	0	0	1	0	0	0	2	1	0	1	0	0	0	1	0	1	0	0	0	0
Isbrueckerichthys duseni	0	0	0	0	0	0	1	0	0	0	0	0	2	0	0	0	0	0	0	0
Kronichthys heylandi	0	0	1	0	1	0	0	-	-	1	0	0	1	0	0	1	0	0	0	0
Neoplecostomus microps	0	0	0	0	0	0	2	1	0	0	0	0	1	0	0	0	0	0	0	0
Pareiorhina rudolphi	0	0	1	0	1	0	0	-	-	2	0	0	1	0	0	1	0	0	2	0
Hypoptopoma inexpectata	0	0	0	0	0	0	2	4	1	0	0	0	1	0	1	2	0	0	0	0
Plesioptopoma curvidens	0	0	0	0	0	0	0	-	-	0	0	0	1	0	0	0	0	0	0	0
Pseudotocinclus tietensis	0	0	0	0	0	0	2	2	0	0	0	0	1	0	0	5	0	0	2	0
***Apistoloricaria* sp.**	1	1	1	1	1	0	1	2	1	0	1	6	2	1	1	3	1	0	1	2
***Brochiloricaria* sp.**	1	1	0	1	1	0	1	2	1	0	1	3	2	0	1	3	1	0	1	0
***Crossoloricaria* spp.**	1	1	1	1	1	0	1	2	1	0	1	6	2	1	1	3	1	0	1	2
Cteniloricaria platystoma	0	0	0	0	0	0	1	2	0	1	1	6	2	1	1	2	1	1	0	0
Farlowella oxyrryncha	0	1	0	1	0	0	2	3	1	1	2	4	1	0	1	2	1	0	0	2
Furcodontichthys novaesi	1	1	1	1	1	0	0	-	-	1	2	2	2	1	1	2	1	0	1	1
Harttiella crassicauda	0	0	0	0	0	0	0	-	-	1	1	4	0	1	0	5	1	0	0	0
Hemiodontichthys acipenserinus	2	1	1	1	1	1	2	3	1	0	2	2	1	0	1	2	1	0	1	0
***Lamontichthys* spp.**	0	1	0	0	0	0	2	2	0	1	1	5	2	1	1	2	1	1	0	2
Limatulichthys griseus	0	1	0	1	1	0	2	2	0	2	1	3	1	0	1	3	1	0	1	1
Loricaria cataphracta	1	1	1	1	1	1	2	2	0	0	1	6	2	1	1	3	1	0	1	1
Loricaria lentiginosa	1	1	1	1	1	0	1	0	0	0	1	6	2	1	1	3	1	0	1	0
Loricariichthys castaneus	1	1	0	1	1	0	2	3	0	0	1	4	1	0	1	2	1	0	1	0
Metaloricaria paucidens	0	0	0	1	1	0	2	2	0	2	1	3	1	0	1	2	1	0	0	0
Paraloricaria vetula	1	1	1	1	1	0	1	0	0	0	1	6	2	1	1	3	1	0	1	2
Planiloricaria cryptodon	1	1	0	1	1	0	2	2	0	0	1	6	0	1	1	3	1	0	1	2
Proloricaria prolixa	1	1	1	1	1	1	1	0	0	0	1	6	1	1	1	3	1	0	1	0
***Pseudohemiodon* spp.**	1	1	0	1	1	1	2	2	0	0	1	4	2	1	1	3	1	0	1	1
Pseudoloricaria laeviuscula	0	1	0	1	1	0	1	2	0	2	1	5	1	1	1	3	1	0	1	1
Pterosturisoma* cf. *microps	0	0	0	0	1	0	2	2	0	1	1	4	1	1	1	4	1	0	0	2

Appendix 2 (continuation). Character state matrix (Characters 256 to 275).

	256	257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275
Reganella depressa	0	1	0	1	1	0	2	2	1	1	1	2	1	0	1	2	1	0	0	1
Rineloricaria daraha	0	0	0	1	1	0	1	2	0	1	1	5	1	1	1	5	1	0	0	2
Rineloricaria lanceolata	1	1	0	1	1	0	2	2	0	1	1	6	2	1	1	2	1	0	0	1
Rineloricaria latirostris	1	0	0	1	1	0	2	2	0	1	1	4	1	0	1	5	1	0	0	1
Rineloricaria pentamaculata	1	0	0	1	1	0	2	2	0	1	1	5	1	0	1	2	1	0	0	1
Spatuloricaria evansii	1	1	1	1	1	0	1	0	0	0	1	4	1	1	1	3	1	0	1	2
Sturisoma robustum	0	0	0	0	1	0	2	3	1	1	2	5	2	1	1	2	1	0	0	0
Harttia absaberi	0	0	0	0	0	0	2	2	0	1	1	4	2	1	1	2	1	1	0	0
Harttia carvalhoi	0	0	0	0	0	0	0	-	-	2	1	2	1	1	0	5	1	0	0	0
Harttia dissidens	0	0	0	0	0	0	2	2	0	1	1	6	2	1	1	2	1	1	0	0
Harttia duriventris	0	0	0	0	0	0	2	2	0	1	1	6	2	1	1	2	1	1	0	0
Harttia* cf. *fowleri	0	0	0	0	0	0	2	2	0	1	1	6	2	1	1	2	1	1	0	0
Harttia garavelloi	0	0	0	0	0	0	0	-	-	1	1	3	2	1	0	2	1	0	0	0
Harttia gracilis	0	0	0	0	0	0	0	-	-	1	1	1	2	1	1	2	1	0	0	0
Harttia guianensis	0	0	0	0	0	0	0	-	-	1	1	6	2	1	1	2	1	1	0	0
Harttia intermontana	0	0	0	0	0	0	0	-	-	2	1	2	2	1	0	3	1	0	0	0
Harttia kronei	0	0	0	0	0	0	0	-	-	1	1	2	2	1	0	5	1	0	0	0
Harttia leiopleura	0	0	0	0	0	0	0	-	-	0	0	0	2	1	0	2	1	0	0	0
Harttia longipinna	0	0	0	0	0	0	1	2	0	1	1	3	2	1	1	2	1	1	0	0
Harttia loricariformis	0	0	0	0	0	0	0	-	-	1	1	3	2	1	1	2	1	0	0	0
Harttia novalimensis	0	0	0	0	0	0	0	-	-	1	1	1	2	1	0	2	1	0	0	0
Harttia panara	0	0	0	0	0	0	2	2	0	1	1	6	2	1	1	2	1	0	0	0
Harttia punctata	0	0	0	0	0	0	1	2	0	2	1	6	2	1	1	2	1	1	0	0
Harttia rondoni	0	0	0	0	0	0	1	2	0	1	1	5	2	1	1	2	1	1	0	0
Harttia* cf. *surinamensis	0	0	0	0	0	0	2	2	0	1	1	6	2	1	1	2	1	1	0	0
Harttia torrenticola	0	0	0	0	0	0	0	-	-	2	1	1	2	1	1	2	1	0	0	0
Harttia trombetensis	0	0	0	0	0	0	0	-	-	1	1	6	2	1	1	2	1	1	0	0
Harttia uatumensis	0	0	0	0	0	0	0	-	-	1	1	5	2	1	1	2	1	1	0	0
Harttia villasboas	0	0	0	0	0	0	2	2	0	1	1	6	2	1	1	2	1	0	0	0
***Harttia* sp. São Roque**	0	0	0	0	0	0	0	-	-	2	1	2	2	1	1	2	1	0	0	0
***Harttia* sp. Tapajós 1**	0	0	0	0	0	0	2	2	0	1	1	6	2	1	1	2	1	0	0	0
***Harttia* sp. Tapajós 2**	0	0	0	0	0	0	2	2	0	1	1	6	1	1	1	2	1	1	0	0

Appendix 3. List of autapomorphies for each terminal and list of synapomorphies for each clade.

***Astroblepus* sp.:**

No autapomorphies

***Lithogenes wahari*:**

Char. 52: 0 --> 1
Char. 65: 0 --> 1
Char. 87: 0 --> 1
Char. 104: 0 --> 3
Char. 130: 0 --> 1
Char. 140: 0 --> 1
Char. 141: 0 --> 1
Char. 154: 0 --> 1
Char. 156: 0 --> 1
Char. 163: 0 --> 1
Char. 184: 0 --> 1
Char. 194: 0 --> 2
Char. 201: 0 --> 1
Char. 223: 0 --> 1
Char. 224: 0 --> 2
Char. 230: 0 --> 3
Char. 242: 0 --> 4
Char. 248: 3 --> 0
Char. 249: 0 --> 1

***Hemipsilichthys nimius*:**

Char. 28: 0 --> 1
Char. 30: 1 --> 3
Char. 60: 0 --> 1
Char. 70: 0 --> 3
Char. 81: 0 --> 1
Char. 85: 0 --> 2
Char. 106: 0 --> 2
Char. 113: 0 --> 1
Char. 119: 1 --> 2
Char. 141: 0 --> 2
Char. 153: 0 --> 1
Char. 194: 0 --> 1
Char. 207: 1 --> 2
Char. 208: 1 --> 2
Char. 246: 1 --> 0
Char. 265: 0 --> 2

***Ancistrus multipinnis*:**

Char. 44: 0 --> 1
Char. 67: 2 --> 0
Char. 79: 1 --> 0
Char. 94: 1 --> 4
Char. 104: 0 --> 2
Char. 113: 0 --> 1
Char. 119: 1 --> 2
Char. 132: 1 --> 2
Char. 143: 0 --> 1
Char. 154: 0 --> 1
Char. 155: 1 --> 0
Char. 173: 0 --> 1
Char. 180: 2 --> 1
Char. 188: 0 --> 1
Char. 200: 1 --> 2
Char. 232: 1 --> 0
Char. 246: 1 --> 0

***Hypostomus ancistroides*:**

Char. 10: 1 --> 0
Char. 25: 0 --> 1
Char. 28: 0 --> 2
Char. 50: 1 --> 2
Char. 51: 1 --> 2
Char. 54: 0 --> 1
Char. 56: 0 --> 2
Char. 59: 0 --> 1
Char. 60: 0 --> 1
Char. 63: 3 --> 1
Char. 66: 0 --> 1
Char. 70: 4 --> 1
Char. 72: 1 --> 0
Char. 90: 1 --> 0
Char. 127: 0 --> 1
Char. 128: 0 --> 1
Char. 137: 0 --> 1
Char. 141: 0 --> 4
Char. 142: 0 --> 1
Char. 163: 0 --> 1
Char. 172: 0 --> 3
Char. 193: 0 --> 2
Char. 194: 1 --> 0
Char. 205: 1 --> 2
Char. 239: 0 --> 1
Char. 240: 0 --> 1
Char. 262: 0 --> 2

***Isbrueckerichthys duseni*:**

Char. 10: 1 --> 0
Char. 14: 1 --> 3
Char. 15: 1 --> 0
Char. 42: 1 --> 2
Char. 47: 1 --> 0
Char. 72: 0 --> 2
Char. 81: 0 --> 1
Char. 85: 0 --> 2
Char. 100: 2 --> 0
Char. 113: 0 --> 1
Char. 126: 1 --> 0
Char. 132: 1 --> 2
Char. 133: 0 --> 1
Char. 142: 0 --> 1

Char. 148: 0 --> 1
Char. 149: 2 --> 3
Char. 155: 1 --> 0
Char. 172: 2 --> 3
Char. 191: 1 --> 0
Char. 205: 1 --> 0
Char. 213: 1 --> 0
Char. 243: 1 --> 0
Char. 253: 1 --> 3
Char. 262: 2 --> 1
Char. 268: 1 --> 2

***Kronichthys heylandi*:**

Char. 28: 0 --> 1
Char. 47: 0 --> 1
Char. 53: 24 --> 1
Char. 60: 0 --> 2
Char. 64: 0 --> 1
Char. 70: 4 --> 0
Char. 94: 1 --> 2
Char. 125: 0 --> 1
Char. 132: 1 --> 3
Char. 172: 0 --> 2
Char. 180: 2 --> 0
Char. 192: 0 --> 2
Char. 196: 1 --> 0
Char. 214: 1 --> 0
Char. 260: 0 --> 1

***Neoplecostomus microps*:**

Char. 5: 1 --> 0
Char. 8: 1 --> 0
Char. 17: 0 --> 1
Char. 20: 2 --> 1
Char. 27: 1 --> 0
Char. 33: 3 --> 1
Char. 53: 4 --> 3
Char. 56: 2 --> 1
Char. 63: 2 --> 1
Char. 78: 3 --> 12
Char. 87: 2 --> 1
Char. 94: 1 --> 0
Char. 96: 1 --> 0
Char. 103: 2 --> 1
Char. 112: 1 --> 0
Char. 158: 1 --> 0
Char. 163: 0 --> 1
Char. 173: 0 --> 1
Char. 176: 1 --> 0
Char. 209: 1 --> 0
Char. 232: 1 --> 0
Char. 248: 3 --> 1
Char. 251: 0 --> 1

***Pareiorhina rudolphi*:**

Char. 5: 0 --> 1
Char. 14: 1 --> 3
Char. 18: 0 --> 1
Char. 33: 4 --> 3
Char. 35: 1 --> 0
Char. 60: 0 --> 2
Char. 78: 3 --> 1
Char. 99: 1 --> 0
Char. 119: 1 --> 2
Char. 127: 0 --> 1
Char. 128: 0 --> 1
Char. 132: 1 --> 2
Char. 133: 0 --> 1
Char. 169: 1 --> 2
Char. 180: 2 --> 0
Char. 188: 0 --> 1
Char. 209: 1 --> 0
Char. 210: 0 --> 1
Char. 240: 0 --> 1
Char. 243: 1 --> 0
Char. 260: 0 --> 1
Char. 265: 0 --> 2
Char. 274: 0 --> 2

***Hypoptopoma inexpectata*:**

Char. 2: 1 --> 0
Char. 8: 1 --> 2
Char. 11: 1 --> 0
Char. 13: 1 --> 0
Char. 30: 1 --> 5
Char. 41: 0 --> 1
Char. 44: 0 --> 1
Char. 51: 1 --> 2
Char. 52: 0 --> 2
Char. 63: 2 --> 4
Char. 72: 1 --> 2
Char. 76: 1 --> 0
Char. 87: 2 --> 1
Char. 88: 1 --> 3
Char. 113: 0 --> 1
Char. 114: 0 --> 1
Char. 126: 0 --> 1
Char. 129: 1 --> 2
Char. 142: 0 --> 1
Char. 143: 0 --> 1
Char. 154: 0 --> 1
Char. 166: 1 --> 0
Char. 179: 0 --> 2
Char. 182: 0 --> 1
Char. 186: 0 --> 1
Char. 192: 0 --> 2
Char. 196: 1 --> 3
Char. 205: 1 --> 0
Char. 214: 1 --> 3
Char. 231: 0 --> 1
Char. 232: 1 --> 0

Char. 248: 3 --> 2
Char. 249: 0 --> 1
Char. 262: 0 --> 2
Char. 270: 0 --> 1
Char. 271: 1 --> 2

***Plesioptopoma curvidens*:**
Char. 4: 1 --> 0
Char. 55: 2 --> 1
Char. 114: 0 --> 1
Char. 132: 1 --> 3
Char. 142: 0 --> 1
Char. 152: 1 --> 0
Char. 153: 0 --> 1
Char. 155: 1 --> 0
Char. 157: 1 --> 0
Char. 177: 1 --> 0
Char. 183: 0 --> 1
Char. 214: 1 --> 2

***Pseudotocinclus tietensis*:**
Char. 28: 0 --> 1
Char. 58: 1 --> 2
Char. 63: 2 --> 3
Char. 64: 0 --> 1
Char. 74: 0 --> 1
Char. 83: 01 --> 2
Char. 93: 1 --> 2
Char. 128: 0 --> 1
Char. 141: 0 --> 2
Char. 169: 1 --> 3
Char. 179: 0 --> 1
Char. 180: 2 --> 1
Char. 186: 0 --> 1
Char. 191: 1 --> 3
Char. 240: 0 --> 1
Char. 248: 3 --> 2
Char. 271: 0 --> 5
Char. 274: 0 --> 2

***Harttia absaberi*:**
Char. 1: 0 --> 1
Char. 5: 0 --> 2
Char. 6: 0 --> 1
Char. 8: 1 --> 2
Char. 14: 1 --> 2
Char. 15: 1 --> 2
Char. 28: 0 --> 1
Char. 30: 2 --> 3
Char. 43: 0 --> 1
Char. 66: 1 --> 0
Char. 85: 0 --> 1
Char. 89: 1 --> 0
Char. 93: 1 --> 2
Char. 94: 1 --> 2
Char. 145: 0 --> 1
Char. 161: 0 --> 1
Char. 163: 0 --> 1
Char. 172: 3 --> 1
Char. 182: 1 --> 2
Char. 185: 1 --> 0

***Harttia carvalhoi*:**
Char. 27: 1 --> 0
Char. 234: 1 --> 0
Char. 268: 2 --> 1
Char. 271: 2 --> 5

***Harttia dissidens*:**
Char. 20: 2 --> 0
Char. 22: 0 --> 1
Char. 28: 0 --> 2
Char. 42: 0 --> 1
Char. 48: 2 --> 0
Char. 56: 1 --> 0
Char. 69: 0 --> 1
Char. 89: 1 --> 0
Char. 94: 1 --> 0
Char. 103: 0 --> 3
Char. 126: 0 --> 2
Char. 133: 0 --> 1
Char. 235: 0 --> 2

***Harttia duriventris*:**
Char. 16: 0 --> 1
Char. 20: 2 --> 0
Char. 22: 0 --> 1
Char. 28: 0 --> 1
Char. 42: 0 --> 1
Char. 50: 1 --> 2
Char. 73: 0 --> 3
Char. 89: 1 --> 0
Char. 113: 1 --> 0
Char. 119: 2 --> 1
Char. 133: 0 --> 1
Char. 141: 0 --> 1
Char. 153: 1 --> 0
Char. 232: 1 --> 0

***Harttia* cf. *fowleri*:**
Char. 16: 1 --> 0
Char. 27: 0 --> 1
Char. 73: 0 --> 3
Char. 78: 1 --> 2
Char. 113: 1 --> 0
Char. 119: 2 --> 1

***Harttia garavelloi*:**
Char. 20: 2 --> 0
Char. 22: 0 --> 1
Char. 27: 1 --> 0

Char. 28: 0 --> 1
Char. 43: 0 --> 1
Char. 96: 1 --> 0
Char. 126: 0 --> 1
Char. 141: 0 --> 1
Char. 149: 3 --> 2
Char. 150: 2 --> 1
Char. 163: 0 --> 1
Char. 173: 0 --> 1
Char. 222: 0 --> 1
Char. 235: 0 --> 2
Char. 240: 1 --> 0

***Harttia gracilis*:**

Char. 4: 1 --> 0
Char. 5: 0 --> 1
Char. 74: 0 --> 1
Char. 119: 2 --> 1
Char. 155: 1 --> 0
Char. 161: 0 --> 1
Char. 185: 1 --> 2
Char. 205: 0 --> 1
Char. 216: 0 --> 1
Char. 227: 0 --> 1
Char. 267: 3 --> 1

***Harttia guianensis*:**

Char. 10: 0 --> 1
Char. 48: 2 --> 0
Char. 50: 1 --> 2
Char. 56: 1 --> 0
Char. 69: 0 --> 1
Char. 70: 1 --> 0
Char. 74: 0 --> 1
Char. 89: 1 --> 0
Char. 94: 1 --> 0
Char. 104: 0 --> 4
Char. 126: 0 --> 2
Char. 131: 0 --> 1
Char. 172: 3 --> 0
Char. 205: 1 --> 0
Char. 221: 1 --> 0
Char. 222: 1 --> 0
Char. 235: 0 --> 2
Char. 262: 2 --> 0

***Harttia intermontana*:**

Char. 3: 1 --> 0
Char. 14: 1 --> 2
Char. 15: 1 --> 2
Char. 28: 0 --> 1
Char. 64: 1 --> 0
Char. 271: 2 --> 3

***Harttia kronei*:**

Char. 1: 0 --> 1
Char. 5: 0 --> 2
Char. 16: 0 --> 1
Char. 78: 3 --> 2
Char. 94: 1 --> 0
Char. 232: 0 --> 1
Char. 271: 2 --> 5

***Harttia leiopleura*:**

Char. 14: 1 --> 2
Char. 27: 1 --> 0
Char. 43: 0 --> 1
Char. 50: 1 --> 2
Char. 51: 1 --> 0
Char. 66: 1 --> 0
Char. 73: 0 --> 3
Char. 79: 1 --> 0
Char. 88: 1 --> 2
Char. 131: 0 --> 1
Char. 132: 2 --> 1
Char. 187: 3 --> 2
Char. 212: 1 --> 2
Char. 221: 1 --> 0
Char. 240: 1 --> 0
Char. 265: 1 --> 0
Char. 266: 1 --> 0

***Harttia longipinna*:**

Char. 1: 0 --> 1
Char. 10: 0 --> 1
Char. 21: 0 --> 1
Char. 42: 0 --> 2
Char. 126: 0 --> 3
Char. 139: 1 --> 0
Char. 205: 0 --> 1
Char. 209: 1 --> 0
Char. 227: 0 --> 2
Char. 234: 1 --> 0
Char. 262: 0 --> 1
Char. 270: 0 --> 1
Char. 273: 0 --> 1

***Harttia loricariformis*:**

Char. 28: 0 --> 1
Char. 50: 1 --> 2
Char. 74: 0 --> 2
Char. 88: 1 --> 2
Char. 119: 2 --> 1
Char. 141: 0 --> 2
Char. 185: 1 --> 2
Char. 206: 0 --> 1
Char. 221: 1 --> 0

***Harttia novalimensis*:**

Char. 20: 2 --> 1
Char. 42: 0 --> 1

Char. 50: 1 --> 2
Char. 51: 1 --> 2
Char. 55: 0 --> 1
Char. 70: 0 --> 1
Char. 74: 0 --> 1
Char. 78: 3 --> 1
Char. 79: 1 --> 0
Char. 106: 0 --> 1
Char. 128: 0 --> 1
Char. 133: 0 --> 1
Char. 139: 1 --> 0
Char. 153: 0 --> 1
Char. 206: 0 --> 1
Char. 216: 0 --> 1
Char. 267: 03 --> 1

***Harttia panara*:**

Char. 28: 0 --> 1
Char. 51: 2 --> 0
Char. 67: 2 --> 0
Char. 104: 0 --> 4
Char. 185: 1 --> 2
Char. 221: 1 --> 0

***Harttia punctata*:**

Char. 1: 0 --> 2
Char. 16: 0 --> 1
Char. 42: 0 --> 1
Char. 48: 2 --> 0
Char. 56: 1 --> 0
Char. 67: 2 --> 0
Char. 77: 1 --> 0
Char. 78: 2 --> 1
Char. 89: 1 --> 0
Char. 94: 1 --> 0
Char. 95: 0 --> 1
Char. 106: 0 --> 1
Char. 130: 0 --> 1
Char. 153: 1 --> 0
Char. 182: 1 --> 0
Char. 222: 1 --> 0
Char. 232: 1 --> 0
Char. 240: 1 --> 0
Char. 262: 2 --> 1
Char. 265: 1 --> 2

***Harttia rondoni*:**

Char. 28: 0 --> 1
Char. 67: 2 --> 0
Char. 83: 1 --> 0
Char. 95: 0 --> 1
Char. 104: 0 --> 4
Char. 106: 0 --> 2
Char. 113: 1 --> 0
Char. 141: 0 --> 3
Char. 172: 3 --> 0
Char. 206: 0 --> 1
Char. 235: 0 --> 2
Char. 262: 2 --> 1
Char. 267: 6 --> 5

***Harttia* cf. *surinamensis*:**

Char. 55: 1 --> 2
Char. 67: 2 --> 0
Char. 74: 2 --> 0
Char. 77: 1 --> 0
Char. 96: 1 --> 2
Char. 153: 1 --> 0
Char. 161: 0 --> 1
Char. 222: 1 --> 0

***Harttia torrenticola*:**

Char. 42: 1 --> 2
Char. 67: 0 --> 2
Char. 74: 0 --> 2
Char. 88: 1 --> 2
Char. 94: 1 --> 0
Char. 206: 0 --> 1
Char. 216: 1 --> 0
Char. 222: 0 --> 1
Char. 232: 0 --> 1
Char. 235: 0 --> 2
Char. 267: 2 --> 1
Char. 270: 0 --> 1

***Harttia trombetensis*:**

Char. 53: 1 --> 2
Char. 103: 0 --> 3
Char. 141: 0 --> 2
Char. 222: 1 --> 0

***Harttia uatumensis*:**

Char. 28: 1 --> 0
Char. 42: 0 --> 1
Char. 95: 1 --> 0
Char. 106: 0 --> 2
Char. 152: 0 --> 1
Char. 153: 1 --> 0
Char. 185: 1 --> 2
Char. 267: 6 --> 5

***Harttia villasboas*:**

Char. 74: 0 --> 2
Char. 95: 0 --> 1
Char. 152: 0 --> 1
Char. 155: 1 --> 0
Char. 232: 1 --> 0

***Harttia* sp. São Roque:**

Char. 43: 0 --> 1
Char. 60: 0 --> 3

Char. 61: 0 --> 1
Char. 106: 0 --> 2
Char. 205: 0 --> 1
Char. 221: 1 --> 0
Char. 270: 0 --> 1

***Harttia* sp. Tapajós 1:**
Char. 20: 2 --> 1
Char. 22: 0 --> 1
Char. 43: 0 --> 1
Char. 51: 2 --> 0
Char. 73: 0 --> 1
Char. 78: 2 --> 3
Char. 83: 1 --> 0
Char. 103: 0 --> 3
Char. 113: 1 --> 0
Char. 119: 2 --> 1
Char. 141: 0 --> 3
Char. 152: 0 --> 1
Char. 205: 1 --> 0
Char. 221: 1 --> 0
Char. 232: 1 --> 0
Char. 238: 0 --> 1
Char. 273: 1 --> 0

***Harttia* sp. Tapajós 2:**
Char. 43: 0 --> 1
Char. 73: 0 --> 3
Char. 78: 2 --> 1
Char. 106: 0 --> 2
Char. 172: 3 --> 0
Char. 182: 1 --> 0
Char. 185: 1 --> 2
Char. 268: 2 --> 1

***Apistoloricaria* sp.:**
Char. 1: 0 --> 1
Char. 5: 0 --> 2
Char. 50: 1 --> 2
Char. 74: 0 --> 2
Char. 86: 1 --> 0
Char. 87: 1 --> 0
Char. 134: 1 --> 0
Char. 144: 2 --> 3
Char. 148: 0 --> 2
Char. 182: 0 --> 1
Char. 185: 0 --> 2
Char. 188: 1 --> 0
Char. 221: 1 --> 0
Char. 233: 1 --> 0

***Brochiloricaria* sp.:**
Char. 1: 0 --> 1
Char. 52: 1 --> 0
Char. 64: 2 --> 1
Char. 72: 0 --> 2
Char. 86: 1 --> 0
Char. 87: 1 --> 0
Char. 96: 2 --> 1
Char. 103: 2 --> 3
Char. 113: 1 --> 0
Char. 128: 0 --> 1
Char. 195: 4 --> 3
Char. 209: 2 --> 1
Char. 264: 0 --> 1
Char. 267: 6 --> 3
Char. 269: 1 --> 0

***Crossoloricaria* spp.:**
Char. 31: 1 --> 2
Char. 39: 0 --> 1
Char. 78: 1 --> 3
Char. 103: 2 --> 0
Char. 104: 2 --> 3
Char. 132: 1 --> 3
Char. 149: 1 --> 0
Char. 173: 0 --> 1

***Cteniloricaria platystoma*:**
Char. 42: 0 --> 2
Char. 45: 0 --> 2
Char. 56: 1 --> 0
Char. 58: 2 --> 1
Char. 63: 2 --> 3
Char. 70: 1 --> 0
Char. 77: 1 --> 0
Char. 83: 1 --> 0
Char. 90: 1 --> 0
Char. 106: 0 --> 1
Char. 128: 0 --> 1
Char. 161: 0 --> 1
Char. 173: 0 --> 1
Char. 183: 0 --> 1
Char. 232: 1 --> 0

***Farlowella oxyrryncha*:**
Char. 20: 2 --> 1
Char. 25: 0 --> 1
Char. 39: 1 --> 0
Char. 44: 0 --> 1
Char. 47: 1 --> 3
Char. 56: 0 --> 2
Char. 57: 0 --> 1
Char. 59: 0 --> 1
Char. 62: 0 --> 1
Char. 63: 2 --> 3
Char. 70: 1 --> 4
Char. 71: 0 --> 1
Char. 72: 0 --> 2
Char. 88: 1 --> 0
Char. 92: 0 --> 1

Char. 96: 0 --> 1
Char. 100: 2 --> 0
Char. 103: 0 --> 2
Char. 112: 1 --> 0
Char. 138: 0 --> 1
Char. 161: 0 --> 1
Char. 169: 2 --> 1
Char. 188: 1 --> 0
Char. 195: 2 --> 4
Char. 200: 1 --> 2
Char. 203: 1 --> 0
Char. 204: 1 --> 0
Char. 205: 1 --> 0
Char. 207: 1 --> 0
Char. 208: 3 --> 1
Char. 209: 1 --> 0
Char. 222: 0 --> 2
Char. 229: 1 --> 2
Char. 257: 0 --> 1
Char. 260: 1 --> 0

***Furcodontichthys novaesi*:**

Char. 16: 0 --> 1
Char. 31: 3 --> 2
Char. 33: 1 --> 2
Char. 47: 1 --> 3
Char. 53: 2 --> 0
Char. 55: 2 --> 1
Char. 63: 4 --> 5
Char. 78: 1 --> 3
Char. 89: 0 --> 2
Char. 96: 2 --> 1
Char. 108: 2 --> 1
Char. 113: 1 --> 0
Char. 114: 2 --> 1
Char. 117: 1 --> 0
Char. 122: 2 --> 0
Char. 124: 1 --> 0
Char. 126: 0 --> 2
Char. 128: 0 --> 1
Char. 131: 1 --> 0
Char. 155: 2 --> 0
Char. 158: 0 --> 1
Char. 162: 0 --> 2
Char. 171: 0 --> 1
Char. 172: 1 --> 3
Char. 180: 1 --> 2
Char. 184: 0 --> 1
Char. 185: 2 --> 0
Char. 196: 1 --> 2
Char. 208: 2 --> 3
Char. 214: 3 --> 5
Char. 247: 0 --> 2
Char. 248: 2 --> 1
Char. 249: 12 --> 0
Char. 253: 01 --> 3
Char. 258: 0 --> 1
Char. 262: 12 --> 0
Char. 265: 02 --> 1
Char. 266: 1 --> 2
Char. 268: 1 --> 2
Char. 271: 3 --> 2

***Harttiella crassicauda*:**

Char. 14: 1 --> 2
Char. 15: 1 --> 2
Char. 28: 0 --> 1
Char. 44: 0 --> 1
Char. 47: 0 --> 1
Char. 74: 0 --> 2
Char. 85: 0 --> 1
Char. 88: 1 --> 2
Char. 106: 0 --> 1
Char. 113: 0 --> 1
Char. 133: 0 --> 1
Char. 147: 1 --> 0
Char. 152: 1 --> 0
Char. 153: 0 --> 1
Char. 165: 1 --> 2
Char. 169: 1 --> 3
Char. 172: 0 --> 3
Char. 173: 0 --> 1
Char. 182: 0 --> 1
Char. 184: 0 --> 1
Char. 208: 1 --> 0
Char. 210: 0 --> 1
Char. 213: 1 --> 0
Char. 227: 0 --> 2

***Hemiodontichthys acipenserinus*:**

Char. 14: 3 --> 1
Char. 15: 0 --> 1
Char. 28: 1 --> 2
Char. 31: 3 --> 2
Char. 33: 1 --> 3
Char. 37: 1 --> 2
Char. 45: 0 --> 1
Char. 49: 1 --> 0
Char. 50: 2 --> 1
Char. 77: 1 --> 0
Char. 78: 1 --> 3
Char. 89: 0 --> 2
Char. 98: 0 --> 1
Char. 103: 2 --> 1
Char. 104: 1 --> 2
Char. 132: 1 --> 3
Char. 154: 1 --> 0
Char. 162: 0 --> 2
Char. 179: 0 --> 1
Char. 182: 1 --> 0

Char. 184: 0 --> 1
Char. 185: 2 --> 0
Char. 213: 1 --> 2
Char. 214: 3 --> 4
Char. 235: 2 --> 1
Char. 236: 0 --> 1
Char. 237: 0 --> 1
Char. 243: 0 --> 1
Char. 256: 01 --> 2
Char. 258: 0 --> 1
Char. 261: 0 --> 1
Char. 266: 1 --> 2

***Lamontichthys* spp.:**

Char. 10: 0 --> 1
Char. 22: 0 --> 1
Char. 88: 1 --> 2
Char. 92: 0 --> 1
Char. 94: 1 --> 0
Char. 141: 0 --> 2
Char. 150: 2 --> 1
Char. 154: 0 --> 1
Char. 158: 1 --> 2
Char. 164: 1 --> 0
Char. 167: 1 --> 2
Char. 187: 3 --> 2
Char. 189: 1 --> 0
Char. 195: 2 --> 4
Char. 199: 1 --> 0
Char. 217: 0 --> 2
Char. 232: 1 --> 0
Char. 257: 0 --> 1
Char. 267: 4 --> 5

***Limatulichthys griseus*:**

Char. 33: 1 --> 2
Char. 37: 1 --> 0
Char. 48: 1 --> 0
Char. 76: 1 --> 0
Char. 93: 2 --> 1
Char. 96: 2 --> 1
Char. 107: 2 --> 1
Char. 131: 1 --> 0
Char. 137: 1 --> 0
Char. 149: 1 --> 0
Char. 184: 0 --> 1
Char. 189: 1 --> 2
Char. 193: 1 --> 0
Char. 201: 02 --> 1
Char. 209: 1 --> 2
Char. 210: 1 --> 2
Char. 214: 3 --> 4
Char. 232: 1 --> 2
Char. 253: 01 --> 4
Char. 267: 2 --> 3
Char. 269: 1 --> 0

***Loricaria cataphracta*:**

Char. 8: 0 --> 1
Char. 11: 0 --> 1
Char. 50: 1 --> 2
Char. 51: 0 --> 1
Char. 64: 2 --> 3
Char. 77: 1 --> 0
Char. 95: 1 --> 0
Char. 102: 0 --> 3
Char. 104: 2 --> 3
Char. 119: 4 --> 3
Char. 124: 1 --> 0
Char. 144: 2 --> 3
Char. 149: 1 --> 0
Char. 185: 0 --> 2
Char. 195: 4 --> 3
Char. 227: 1 --> 0
Char. 248: 0 --> 1
Char. 261: 0 --> 1
Char. 262: 1 --> 2
Char. 263: 0 --> 2
Char. 275: 02 --> 1

***Loricaria lentiginosa*:**

Char. 1: 0 --> 1
Char. 9: 0 --> 1
Char. 11: 0 --> 1
Char. 13: 0 --> 1
Char. 32: 0 --> 1
Char. 33: 1 --> 2
Char. 35: 1 --> 0
Char. 38: 0 --> 1
Char. 42: 0 --> 1
Char. 43: 0 --> 1
Char. 47: 2 --> 0
Char. 48: 01 --> 2
Char. 51: 0 --> 1
Char. 76: 1 --> 0
Char. 85: 2 --> 1
Char. 92: 0 --> 1
Char. 94: 0 --> 1
Char. 95: 1 --> 0
Char. 97: 1 --> 0
Char. 102: 0 --> 3
Char. 121: 1 --> 0
Char. 149: 1 --> 0
Char. 163: 1 --> 0
Char. 180: 0 --> 1
Char. 189: 1 --> 2
Char. 198: 1 --> 2
Char. 231: 1 --> 0
Char. 237: 0 --> 1
Char. 238: 0 --> 1
Char. 248: 0 --> 1

***Loricariichthys castaneus*:**

Char. 19: 0 --> 1
Char. 30: 4 --> 3
Char. 31: 3 --> 1
Char. 37: 1 --> 0
Char. 43: 1 --> 0
Char. 47: 1 --> 2
Char. 64: 1 --> 3
Char. 74: 0 --> 2
Char. 93: 2 --> 1
Char. 107: 2 --> 3
Char. 108: 2 --> 1
Char. 112: 1 --> 2
Char. 117: 1 --> 2
Char. 118: 3 --> 2
Char. 126: 0 --> 3
Char. 131: 1 --> 0
Char. 170: 3 --> 0
Char. 172: 1 --> 3
Char. 173: 0 --> 1
Char. 185: 2 --> 1
Char. 188: 1 --> 0
Char. 200: 1 --> 2
Char. 241: 1 --> 0
Char. 267: 2 --> 4

***Metaloricaria paucidens*:**

Char. 2: 1 --> 0
Char. 3: 1 --> 0
Char. 5: 0 --> 3
Char. 16: 0 --> 1
Char. 31: 1 --> 2
Char. 32: 0 --> 1
Char. 37: 1 --> 2
Char. 42: 0 --> 2
Char. 52: 1 --> 0
Char. 74: 0 --> 2
Char. 83: 2 --> 0
Char. 94: 3 --> 0
Char. 97: 1 --> 0
Char. 102: 0 --> 3
Char. 106: 2 --> 0
Char. 121: 0 --> 1
Char. 132: 1 --> 3
Char. 148: 0 --> 1
Char. 153: 1 --> 0
Char. 189: 1 --> 2
Char. 219: 1 --> 0
Char. 221: 1 --> 2
Char. 225: 2 --> 0
Char. 227: 1 --> 0
Char. 235: 2 --> 1
Char. 254: 0 --> 1
Char. 265: 1 --> 2
Char. 267: 4 --> 3
Char. 275: 2 --> 0

***Paraloricaria vetula*:**

Char. 13: 0 --> 1
Char. 27: 0 --> 1
Char. 28: 1 --> 0
Char. 31: 1 --> 0
Char. 37: 01 --> 2
Char. 38: 0 --> 1
Char. 39: 1 --> 0
Char. 52: 1 --> 0
Char. 55: 2 --> 1
Char. 67: 0 --> 2
Char. 85: 2 --> 1
Char. 89: 2 --> 0
Char. 96: 2 --> 0
Char. 104: 2 --> 0
Char. 107: 02 --> 1
Char. 113: 1 --> 0
Char. 121: 1 --> 0
Char. 124: 1 --> 0
Char. 134: 1 --> 0
Char. 167: 0 --> 3
Char. 173: 1 --> 0
Char. 178: 1 --> 2
Char. 191: 3 --> 2
Char. 194: 0 --> 1
Char. 222: 1 --> 2
Char. 231: 1 --> 0
Char. 233: 1 --> 0
Char. 247: 0 --> 3
Char. 253: 2 --> 0

***Planiloricaria cryptodon*:**

Char. 1: 0 --> 2
Char. 9: 0 --> 2
Char. 23: 1 --> 0
Char. 30: 4 --> 1
Char. 35: 1 --> 0
Char. 46: 1 --> 0
Char. 50: 1 --> 2
Char. 56: 0 --> 2
Char. 63: 3 --> 1
Char. 64: 2 --> 3
Char. 72: 0 --> 2
Char. 78: 1 --> 2
Char. 83: 01 --> 3
Char. 89: 0 --> 1
Char. 95: 1 --> 0
Char. 98: 1 --> 0
Char. 102: 1 --> 2
Char. 109: 0 --> 1
Char. 119: 3 --> 4
Char. 128: 0 --> 1
Char. 132: 1 --> 2
Char. 144: 2 --> 3

Char. 145: 1 --> 0
Char. 180: 2 --> 1
Char. 189: 3 --> 0
Char. 194: 2 --> 3
Char. 195: 4 --> 3
Char. 196: 1 --> 2
Char. 210: 1 --> 0
Char. 214: 3 --> 1
Char. 221: 1 --> 0
Char. 230: 1 --> 0
Char. 232: 2 --> 1
Char. 233: 1 --> 0
Char. 234: 0 --> 1
Char. 235: 12 --> 0
Char. 242: 1 --> 3
Char. 246: 2 --> 3
Char. 249: 12 --> 3
Char. 253: 2 --> 1
Char. 268: 2 --> 0

***Proloricaria prolixa*:**

Char. 1: 0 --> 1
Char. 16: 0 --> 1
Char. 33: 1 --> 4
Char. 35: 1 --> 0
Char. 55: 2 --> 1
Char. 76: 1 --> 0
Char. 78: 3 --> 2
Char. 88: 13 --> 0
Char. 93: 1 --> 2
Char. 94: 0 --> 1
Char. 118: 1 --> 2
Char. 126: 02 --> 3
Char. 128: 0 --> 1
Char. 130: 1 --> 0
Char. 140: 0 --> 1
Char. 141: 0 --> 2
Char. 158: 0 --> 1
Char. 159: 1 --> 0
Char. 162: 2 --> 0
Char. 166: 2 --> 0
Char. 184: 0 --> 1
Char. 201: 0 --> 2
Char. 209: 2 --> 1
Char. 220: 0 --> 2
Char. 222: 1 --> 2
Char. 232: 1 --> 0
Char. 236: 0 --> 1
Char. 247: 0 --> 3
Char. 249: 2 --> 0
Char. 261: 0 --> 1
Char. 268: 2 --> 1

***Pseudohemiodon* spp.:**

Char. 8: 1 --> 2
Char. 43: 1 --> 0
Char. 48: 1 --> 2
Char. 52: 1 --> 0
Char. 74: 0 --> 1
Char. 76: 1 --> 0
Char. 78: 1 --> 0
Char. 90: 2 --> 0
Char. 94: 0 --> 1
Char. 107: 2 --> 0
Char. 126: 02 --> 4
Char. 141: 01 --> 3
Char. 184: 0 --> 1
Char. 188: 1 --> 2
Char. 202: 0 --> 1
Char. 222: 1 --> 2
Char. 248: 0 --> 2
Char. 249: 12 --> 0
Char. 261: 0 --> 1
Char. 267: 6 --> 4
Char. 275: 2 --> 1

***Pseudoloricaria laeviuscula*:**

Char. 2: 1 --> 0
Char. 5: 0 --> 3
Char. 16: 0 --> 1
Char. 26: 1 --> 0
Char. 28: 1 --> 0
Char. 32: 0 --> 1
Char. 35: 1 --> 0
Char. 37: 1 --> 2
Char. 39: 0 --> 1
Char. 47: 1 --> 2
Char. 48: 1 --> 2
Char. 52: 1 --> 0
Char. 53: 2 --> 3
Char. 64: 1 --> 3
Char. 73: 3 --> 1
Char. 74: 0 --> 1
Char. 76: 1 --> 0
Char. 78: 1 --> 2
Char. 86: 1 --> 0
Char. 87: 1 --> 0
Char. 88: 13 --> 2
Char. 90: 2 --> 0
Char. 94: 3 --> 1
Char. 104: 1 --> 0
Char. 107: 2 --> 0
Char. 113: 1 --> 0
Char. 119: 34 --> 2
Char. 137: 1 --> 0
Char. 141: 0 --> 3
Char. 144: 2 --> 3
Char. 189: 1 --> 2
Char. 208: 2 --> 3
Char. 235: 2 --> 0
Char. 239: 2 --> 0

Char. 267: 2 --> 5

***Pterosturisoma* cf. *microps*:**

Char. 16: 0 --> 1
Char. 20: 2 --> 1
Char. 29: 0 --> 1
Char. 30: 2 --> 1
Char. 48: 0 --> 2
Char. 72: 0 --> 1
Char. 74: 0 --> 1
Char. 100: 2 --> 1
Char. 103: 0 --> 3
Char. 152: 0 --> 1
Char. 161: 0 --> 1
Char. 173: 1 --> 0
Char. 185: 1 --> 2
Char. 198: 1 --> 0
Char. 217: 0 --> 1
Char. 239: 0 --> 2
Char. 271: 2 --> 4

***Reganella depressa*:**

Char. 3: 1 --> 0
Char. 7: 0 --> 1
Char. 16: 0 --> 2
Char. 20: 1 --> 0
Char. 32: 0 --> 1
Char. 48: 1 --> 0
Char. 67: 2 --> 1
Char. 82: 1 --> 0
Char. 90: 2 --> 1
Char. 92: 0 --> 1
Char. 94: 4 --> 0
Char. 97: 1 --> 0
Char. 99: 0 --> 1
Char. 111: 1 --> 2
Char. 113: 1 --> 0
Char. 114: 2 --> 0
Char. 115: 0 --> 1
Char. 122: 2 --> 0
Char. 126: 0 --> 1
Char. 127: 0 --> 2
Char. 145: 1 --> 0
Char. 155: 2 --> 0
Char. 158: 0 --> 1
Char. 163: 0 --> 2
Char. 174: 0 --> 1
Char. 178: 1 --> 3
Char. 180: 1 --> 2
Char. 198: 1 --> 0
Char. 209: 1 --> 2
Char. 210: 1 --> 2
Char. 232: 1 --> 2
Char. 242: 1 --> 0
Char. 243: 0 --> 2
Char. 265: 0 --> 1
Char. 274: 1 --> 0

***Rineloricaria daraha*:**

Char. 1: 0 --> 1
Char. 30: 4 --> 2
Char. 32: 0 --> 1
Char. 42: 0 --> 1
Char. 52: 1 --> 0
Char. 56: 0 --> 1
Char. 63: 4 --> 3
Char. 94: 3 --> 2
Char. 100: 1 --> 3
Char. 144: 2 --> 3
Char. 157: 0 --> 2
Char. 187: 3 --> 2
Char. 209: 2 --> 0
Char. 221: 1 --> 0
Char. 271: 2 --> 5

***Rineloricaria lanceolata*:**

Char. 3: 1 --> 0
Char. 27: 0 --> 1
Char. 86: 1 --> 0
Char. 87: 1 --> 0
Char. 104: 1 --> 2
Char. 119: 3 --> 1
Char. 141: 0 --> 2
Char. 151: 1 --> 0
Char. 173: 1 --> 0
Char. 193: 0 --> 1
Char. 231: 0 --> 1
Char. 257: 0 --> 1
Char. 267: 45 --> 6
Char. 268: 1 --> 2

***Rineloricaria latirostris*:**

Char. 29: 1 --> 0
Char. 30: 4 --> 2
Char. 43: 1 --> 0
Char. 46: 1 --> 0
Char. 53: 2 --> 1
Char. 74: 0 --> 2
Char. 96: 2 --> 0
Char. 104: 1 --> 0
Char. 119: 3 --> 2
Char. 126: 2 --> 0
Char. 148: 0 --> 2
Char. 180: 1 --> 0
Char. 194: 2 --> 1
Char. 197: 0 --> 1
Char. 199: 0 --> 1
Char. 206: 1 --> 0
Char. 235: 2 --> 1
Char. 246: 2 --> 1
Char. 271: 2 --> 5

***Rineloricaria pentamaculata*:**

Char. 1: 0 --> 1
Char. 5: 0 --> 2
Char. 37: 1 --> 0
Char. 52: 1 --> 0
Char. 78: 3 --> 4
Char. 95: 0 --> 1
Char. 113: 0 --> 1
Char. 122: 0 --> 2
Char. 124: 1 --> 0
Char. 141: 0 --> 1
Char. 149: 1 --> 0
Char. 157: 0 --> 2
Char. 182: 0 --> 1
Char. 201: 0 --> 1
Char. 221: 1 --> 0

***Spatuloricaria evansii*:**

Char. 3: 1 --> 0
Char. 11: 0 --> 1
Char. 13: 0 --> 1
Char. 19: 0 --> 1
Char. 35: 1 --> 0
Char. 50: 2 --> 3
Char. 72: 0 --> 1
Char. 89: 0 --> 1
Char. 96: 2 --> 1
Char. 116: 1 --> 2
Char. 188: 1 --> 0
Char. 197: 0 --> 1
Char. 221: 1 --> 0
Char. 225: 2 --> 1
Char. 239: 2 --> 1
Char. 253: 01 --> 5
Char. 254: 0 --> 1
Char. 258: 0 --> 1
Char. 263: 2 --> 0

***Sturisoma robustum*:**

Char. 103: 0 --> 1
Char. 128: 0 --> 1
Char. 141: 0 --> 2
Char. 167: 1 --> 2
Char. 193: 0 --> 1
Char. 227: 1 --> 0
Char. 232: 1 --> 0
Char. 267: 4 --> 5
Char. 275: 2 --> 0

Node 65:

No synapomorphies

Node 66:

Char. 13: 0 --> 1
Char. 51: 0 --> 1
Char. 58: 0 --> 1
Char. 72: 1 --> 0
Char. 100: 1 --> 2
Char. 107: 0 --> 1
Char. 109: 0 --> 1
Char. 110: 0 --> 1
Char. 111: 0 --> 1
Char. 129: 0 --> 1
Char. 136: 0 --> 1
Char. 147: 0 --> 1
Char. 149: 0 --> 2
Char. 150: 0 --> 1
Char. 155: 0 --> 1
Char. 157: 0 --> 1
Char. 162: 0 --> 1
Char. 164: 0 --> 1
Char. 165: 0 --> 1
Char. 166: 0 --> 1
Char. 167: 0 --> 1
Char. 176: 0 --> 1
Char. 180: 0 --> 2
Char. 189: 0 --> 3
Char. 196: 0 --> 1
Char. 212: 0 --> 1
Char. 213: 0 --> 1
Char. 214: 0 --> 1
Char. 218: 0 --> 1
Char. 243: 0 --> 1
Char. 250: 0 --> 1
Char. 251: 0 --> 1
Char. 255: 0 --> 1

Node 67:

Char. 2: 1 --> 0
Char. 13: 1 --> 0
Char. 18: 0 --> 1
Char. 39: 0 --> 1
Char. 93: 1 --> 2
Char. 150: 1 --> 2
Char. 182: 0 --> 1
Char. 189: 3 --> 2
Char. 209: 1 --> 0
Char. 211: 0 --> 1
Char. 212: 1 --> 2
Char. 217: 0 --> 1
Char. 249: 0 --> 1
Char. 269: 0 --> 1

Node 68:

Char. 63: 2 --> 3
Char. 75: 0 --> 1
Char. 149: 2 --> 3
Char. 215: 0 --> 1
Char. 265: 0 --> 1

Node 69:

Char. 31: 1 --> 0

Char. 72: 0 --> 1
Char. 82: 0 --> 1
Char. 194: 0 --> 1
Char. 271: 0 --> 1

Node 70:

Char. 39: 1 --> 0
Char. 55: 0 --> 2
Char. 70: 0 --> 4
Char. 112: 0 --> 1
Char. 139: 1 --> 0
Char. 143: 1 --> 0

Node 71:

Char. 11: 0 --> 1
Char. 14: 3 --> 1
Char. 15: 0 --> 1
Char. 27: 0 --> 1
Char. 35: 0 --> 1
Char. 80: 0 --> 1
Char. 87: 0 --> 2
Char. 91: 0 --> 1
Char. 108: 0 --> 1
Char. 158: 0 --> 1
Char. 160: 0 --> 1

Node 72:

Char. 29: 0 --> 1
Char. 70: 4 --> 1
Char. 154: 0 --> 1
Char. 182: 0 --> 1
Char. 188: 0 --> 1
Char. 196: 3 --> 0
Char. 208: 1 --> 0
Char. 215: 0 --> 1

Node 73:

Char. 33: 4 --> 3
Char. 42: 0 --> 1
Char. 56: 0 --> 2
Char. 172: 0 --> 2
Char. 262: 0 --> 2

Node 74:

Char. 5: 0 --> 1
Char. 17: 1 --> 0
Char. 47: 0 --> 1
Char. 51: 1 --> 2
Char. 126: 0 --> 1
Char. 166: 1 --> 0
Char. 196: 1 --> 3

Node 75:

Char. 56: 0 --> 2
Char. 58: 1 --> 2
Char. 74: 0 --> 1
Char. 96: 01 --> 2
Char. 104: 0 --> 2
Char. 253: 1 --> 0

Node 76:

Char. 48: 2 --> 0
Char. 51: 2 --> 1
Char. 73: 0 --> 3
Char. 173: 0 --> 1
Char. 183: 0 --> 1
Char. 220: 1 --> 0
Char. 267: 6 --> 4

Node 77:

Char. 48: 0 --> 2
Char. 60: 0 --> 3
Char. 61: 0 --> 1
Char. 78: 3 --> 2

Char. 152: 1 --> 0
Char. 182: 0 --> 1
Char. 205: 0 --> 1
Char. 222: 0 --> 1
Char. 262: 0 --> 2
Char. 267: 3 --> 6
Char. 273: 0 --> 1

Node 78:

Char. 56: 0 --> 1
Char. 70: 0 --> 1
Char. 153: 0 --> 1
Char. 232: 0 --> 1

Node 79:

Char. 30: 1 --> 2
Char. 142: 1 --> 0
Char. 172: 0 --> 3
Char. 234: 1 --> 0

Node 80:

Char. 55: 0 --> 1
Char. 64: 0 --> 1
Char. 90: 0 --> 1
Char. 96: 2 --> 1
Char. 113: 0 --> 1

Node 81:

Char. 3: 0 --> 1
Char. 10: 1 --> 0
Char. 40: 0 --> 1
Char. 96: 0 --> 2
Char. 119: 1 --> 2
Char. 132: 1 --> 2
Char. 142: 0 --> 1
Char. 194: 0 --> 3
Char. 214: 1 --> 2

Char. 225: 0 --> 1
Char. 246: 1 --> 0

Node 82:

Char. 36: 0 --> 1
Char. 58: 1 --> 2
Char. 65: 0 --> 1
Char. 101: 0 --> 1
Char. 105: 0 --> 1
Char. 149: 2 --> 3
Char. 150: 1 --> 2
Char. 189: 3 --> 1
Char. 192: 0 --> 1
Char. 218: 1 --> 2
Char. 219: 0 --> 1
Char. 228: 0 --> 1
Char. 229: 0 --> 1
Char. 232: 1 --> 0
Char. 240: 0 --> 1
Char. 265: 0 --> 1
Char. 266: 0 --> 1
Char. 269: 0 --> 1
Char. 272: 0 --> 1

Node 83:

Char. 56: 0 --> 1
Char. 113: 1 --> 0
Char. 142: 1 --> 0

Node 84:

Char. 153: 0 --> 1
Char. 216: 0 --> 1
Char. 227: 0 --> 1
Char. 265: 1 --> 2

Node 85:

Char. 67: 2 --> 0

Node 86:

Char. 48: 2 --> 0
Char. 51: 2 --> 0
Char. 83: 1 --> 0
Char. 104: 4 --> 2
Char. 180: 2 --> 0
Char. 206: 0 --> 1
Char. 235: 0 --> 2

Node 87:

Char. 88: 1 --> 2
Char. 104: 0 --> 4
Char. 182: 1 --> 0

Node 88:

Char. 16: 0 --> 1
Char. 28: 0 --> 1
Char. 32: 0 --> 1
Char. 69: 0 --> 1
Char. 78: 2 --> 1
Char. 95: 0 --> 1

Node 89:

Char. 42: 0 --> 2
Char. 94: 1 --> 0
Char. 128: 0 --> 1
Char. 133: 0 --> 1

Node 90:

Char. 5: 0 --> 1
Char. 78: 3 --> 2
Char. 90: 1 --> 0
Char. 96: 1 --> 0
Char. 106: 0 --> 1
Char. 209: 1 --> 0

Node 91:

Char. 42: 0 --> 1
Char. 83: 1 --> 0
Char. 106: 0 --> 1
Char. 113: 1 --> 0
Char. 119: 2 --> 1
Char. 153: 1 --> 0
Char. 161: 0 --> 1
Char. 172: 3 --> 0
Char. 234: 0 --> 1
Char. 235: 0 --> 2
Char. 273: 1 --> 0

Node 92:

Char. 38: 0 --> 1
Char. 97: 0 --> 1
Char. 113: 1 --> 0
Char. 130: 1 --> 0
Char. 131: 0 --> 1
Char. 183: 1 --> 0
Char. 248: 0 --> 1
Char. 258: 0 --> 1
Char. 264: 0 --> 1

Node 93:

Char. 28: 1 --> 0
Char. 67: 0 --> 12
Char. 68: 0 --> 1
Char. 102: 0 --> 1
Char. 127: 0 --> 1
Char. 140: 0 --> 1
Char. 173: 1 --> 0

Node 94:

Char. 73: 2 --> 1
Char. 97: 1 --> 0
Char. 98: 0 --> 1
Char. 118: 1 --> 3

Char. 131: 1 --> 0
Char. 167: 0 --> 3
Char. 182: 1 --> 0
Char. 189: 1 --> 3
Char. 190: 1 --> 0
Char. 232: 1 --> 2
Char. 247: 0 --> 1

Node 95:

Char. 50: 2 --> 1
Char. 63: 4 --> 3
Char. 94: 3 --> 0
Char. 115: 0 --> 1
Char. 130: 0 --> 1
Char. 135: 1 --> 2
Char. 156: 2 --> 1
Char. 162: 0 --> 2
Char. 168: 1 --> 2
Char. 185: 2 --> 0
Char. 191: 2 --> 3
Char. 241: 1 --> 2
Char. 253: 01 --> 2
Char. 268: 1 --> 2

Node 96:

Char. 20: 2 --> 1
Char. 78: 2 --> 1
Char. 107: 1 --> 2
Char. 121: 0 --> 1
Char. 122: 0 --> 2
Char. 134: 0 --> 1
Char. 136: 1 --> 0
Char. 181: 0 --> 1
Char. 231: 0 --> 1

Node 97:

Char. 113: 0 --> 1
Char. 114: 1 --> 2
Char. 168: 0 --> 1
Char. 182: 0 --> 1
Char. 194: 3 --> 1
Char. 205: 1 --> 0
Char. 210: 0 --> 1
Char. 257: 0 --> 1
Char. 265: 1 --> 0
Char. 271: 2 --> 3
Char. 274: 0 --> 1

Node 98:

Char. 24: 0 --> 1
Char. 34: 0 --> 1
Char. 63: 2 --> 4
Char. 73: 0 --> 2
Char. 80: 1 --> 0
Char. 81: 0 --> 1
Char. 82: 0 --> 1
Char. 90: 1 --> 2
Char. 96: 0 --> 2
Char. 100: 2 --> 1
Char. 108: 1 --> 2
Char. 122: 1 --> 0
Char. 124: 0 --> 1
Char. 137: 0 --> 1
Char. 149: 2 --> 1
Char. 150: 1 --> 0
Char. 155: 1 --> 0
Char. 156: 1 --> 2
Char. 162: 1 --> 0
Char. 164: 1 --> 0
Char. 169: 2 --> 0
Char. 208: 3 --> 2
Char. 209: 1 --> 2
Char. 217: 0 --> 2
Char. 222: 0 --> 1
Char. 229: 1 --> 3
Char. 239: 0 --> 2
Char. 243: 1 --> 2
Char. 246: 1 --> 2

Node 99:

Char. 14: 1 --> 3
Char. 15: 1 --> 0
Char. 27: 1 --> 0
Char. 30: 2 --> 4
Char. 50: 1 --> 2
Char. 85: 0 --> 2
Char. 87: 2 --> 1
Char. 101: 1 --> 0
Char. 105: 1 --> 0
Char. 114: 0 --> 1
Char. 116: 0 --> 1
Char. 117: 0 --> 1
Char. 118: 0 --> 1
Char. 120: 1 --> 2
Char. 123: 0 --> 1
Char. 145: 0 --> 1
Char. 151: 0 --> 1
Char. 152: 0 --> 1
Char. 154: 0 --> 1
Char. 157: 1 --> 0
Char. 166: 1 --> 0
Char. 167: 1 --> 0
Char. 176: 1 --> 0
Char. 177: 0 --> 2
Char. 185: 1 --> 2
Char. 197: 1 --> 0
Char. 230: 2 --> 1
Char. 231: 1 --> 0
Char. 234: 1 --> 0
Char. 240: 1 --> 0
Char. 249: 0 --> 1

Char. 250: 1 --> 0
Char. 251: 0 --> 2
Char. 252: 1 --> 0

Node 100:

Char. 19: 1 --> 0
Char. 48: 0 --> 1
Char. 53: 4 --> 3
Char. 73: 3 --> 0
Char. 78: 3 --> 2
Char. 94: 1 --> 3
Char. 99: 1 --> 0
Char. 106: 1 --> 2
Char. 149: 3 --> 2
Char. 150: 2 --> 1
Char. 156: 0 --> 1
Char. 201: 1 --> 0
Char. 235: 0 --> 2
Char. 259: 0 --> 1

Node 101:

Char. 28: 0 --> 1
Char. 43: 0 --> 1
Char. 47: 0 --> 1
Char. 52: 0 --> 1
Char. 67: 2 --> 0
Char. 97: 0 --> 1
Char. 177: 1 --> 0
Char. 188: 2 --> 1
Char. 230: 0 --> 2

Node 102:

Char. 104: 0 --> 4
Char. 112: 0 --> 1
Char. 182: 1 --> 0
Char. 222: 1 --> 0
Char. 231: 0 --> 1
Char. 234: 0 --> 1
Char. 246: 0 --> 1
Char. 260: 0 --> 1
Char. 273: 1 --> 0

Node 103:

Char. 18: 0 --> 1
Char. 36: 1 --> 0
Char. 40: 1 --> 0
Char. 46: 2 --> 1
Char. 64: 1 --> 2
Char. 78: 2 --> 3
Char. 113: 1 --> 0
Char. 201: 0 --> 1
Char. 208: 1 --> 3
Char. 227: 0 --> 1
Char. 275: 0 --> 2

Node 104:

Char. 31: 1 --> 3
Char. 64: 2 --> 1
Char. 67: 0 --> 2
Char. 73: 2 --> 3
Char. 100: 1 --> 2
Char. 155: 0 --> 2
Char. 157: 0 --> 12
Char. 173: 1 --> 0
Char. 193: 0 --> 1
Char. 209: 2 --> 1
Char. 222: 1 --> 2
Char. 243: 2 --> 0
Char. 248: 0 --> 2

Node 105:

Char. 10: 0 --> 1
Char. 35: 1 --> 0
Char. 85: 2 --> 1
Char. 86: 1 --> 0
Char. 87: 1 --> 0
Char. 94: 3 --> 4
Char. 116: 1 --> 0
Char. 118: 1 --> 3
Char. 135: 1 --> 2
Char. 153: 1 --> 0
Char. 194: 1 --> 0
Char. 249: 12 --> 3
Char. 269: 1 --> 0
Char. 271: 3 --> 2

Node 106:

Char. 43: 1 --> 0
Char. 72: 0 --> 1
Char. 74: 0 --> 1
Char. 78: 1 --> 3
Char. 89: 0 --> 2
Char. 136: 0 --> 2
Char. 188: 1 --> 0
Char. 196: 1 --> 2
Char. 200: 1 --> 2
Char. 258: 0 --> 1
Char. 263: 2 --> 0

Node 107:

Char. 85: 2 --> 1
Char. 115: 0 --> 1
Char. 185: 2 --> 0
Char. 188: 1 --> 2
Char. 237: 0 --> 1

Node 108:

Char. 35: 1 --> 0
Char. 64: 2 --> 1
Char. 72: 0 --> 1
Char. 78: 2 --> 3

Char. 90: 2 --> 0

Char. 128: 0 --> 1

Char. 155: 0 --> 2

Char. 194: 3 --> 2

Char. 275: 2 --> 1

Node 109:

Char. 8: 1 --> 0

Char. 16: 0 --> 1

Char. 89: 0 --> 2

Char. 121: 0 --> 1

Char. 134: 0 --> 1

Char. 214: 3 --> 4

Char. 222: 1 --> 2

Char. 269: 1 --> 0

CHAPTER 2

Molecular phylogeny of *Harttia* Steindachner, 1877 (Siluriformes: Loricariidae: Loricariinae)

ARIELI M. CHEROBIM 1, OSVALDO T. OYAKAWA 2, FRANCISCO LANGEANI 1 & RAPHAËL COVAIN 3

1 UNESP—Universidade Estadual Paulista, Departamento de Zoologia e Botânica, Laboratório de Ictiologia, Instituto de Biociências, Letras e Ciências Exatas, Rua Cristóvão Colombo, 2265, 15054-000, São José do Rio Preto, SP, Brazil.
2 MZUSP—Museu de Zoologia da Universidade de São Paulo, P.O. Box 42694, 04299-970, São Paulo, SP, Brazil.
3 MHNG — Muséum d'Histoire Naturelle, Département d'Herpétologie et d'Ichtyologie, route de Malagnou 1, case postale 6434, CH-1211 Genève 6, Switzerland.
E-mail: amcherobim@gmail.com, oyakawa@usp.br, francisco.langeani@unesp.br, raphael.covain@ville-ge.ch.

Abstract

The second largest subfamily of the Neotropical catfish family Loricariidae is Loricariinae, with 32 genera and 254 species. Among its genera, *Harttia* is the second with the highest species richness, encompassing 27 valid species. Over the years, several studies have investigated the subfamily and the genus, but the phylogenetic history of *Harttia* remains discussed. Thus, increasing the number of genetic markers compared to previous studies, including 12S, 16S, *f-rtn4r*, COI, RAG1 and RAG2, we seek a greater understanding of the evolutionary history of the genus. The Bayesian analysis recovered *Harttia* as paraphyletic, as a consequence of the inclusion of *Cteniloricaria* among *Harttia* species, but three monophyletic groups were well supported: one group with species from the Guiana Shield (sister of *Cteniloricaria*), other with species from the southeastern portion of the Brazilian Shield, and another with species from the right bank of the Amazon River plus *H. fowleri*. We provide inferences about the biogeography history of its species, and suggest *Cteniloricaria* as a probably junior synonym of *Harttia*.

Keywords: biogeography, Amazon basin, Guianas Shield, southeastern Brazilian basins, catfishes.

Introduction

Loricariinae is considered the second largest subfamily of the Neotropical catfish family Loricariidae, consisting of 32 genera and 254 species (COVAIN & FISCH-MULLER, 2007, RODRIGUEZ *et al*., 2011, COVAIN *et al*., 2016, FRICKE *et al.*, 2021). Members of this group are characterized by a long and depressed caudal peduncle, and absence of an adipose fin (COVAIN & FISCH-MULLER, 2007). They are widely distributed in drainages of South and Central America, from Costa Rica to northern Argentina, with the greatest diversity in the Amazon region (OYAKAWA *et al*., 2013). The genus *Harttia* Steindachner, 1877 has the second highest intrageneric diversity of the subfamily, comprising 27 valid species (OYAKAWA *et al*., 2018; OLIVEIRA & OYAKAWA, 2019; FRICKE *et al.*, 2021). The diagnostic features of its representatives are the absence of keels along the lateral plates, rounded snout, large plates around the anal opening and abrupt narrowing of the caudal peduncle (OYAKAWA *et al*., 2013). They are found in the Guiana Shield, in the southeastern Brazil and in the Amazon region, with a wide distribution in South America, encompassing Brazil, Venezuela, Suriname, and French Guiana (OYAKAWA *et al*., 2018).

Molecular analyses have been conducted for both the subfamily and the genus over the years. The first phylogenetic analysis of the Loricariidae was proposed by Montoya-Burgos *et al*. (1998), based on partial sequences of the 12S and 16S mitochondrial genes. The results confirmed Loricariinae as a monophyletic group, and *Harttia* was considered the sister genus of the other genera of the subfamily. After one decade, Covain *et al*. (2008) presented a molecular phylogeny for Loricariinae based on the 12S and 16S mitochondrial genes, including 14 genera and 20 species. The subtribe Harttiini was restricted to a single genus, *Harttia*, which occupied the sister position to the other Loricariinae in the phylogeny. Another phylogenetic analysis based on molecular data among the genera of Loricariinae was carried out by Silva (2009), but this time with emphasis on *Harttia*. This reconstruction used complete sequences of the 12S, Valine transport RNA and 16S mitochondrial genes, and part of the F-Reticulon-4 nuclear gene, and recovered Harttiini in sister position to other Loricariinae, harboring only the genus *Harttia*. Still,

the nuclear gene F-reticulon-4 and the mitochondrial gene Cytochrome Oxidase subunit I (COI) were sequenced for 10 valid species of *Harttia* and 6 possible new ones. The genus was divided into two large clades: a group with species from basins of the southeastern Brazilian plus *H. guianensis*, and another with the species that occur in streams of the right bank of the Amazon River. The conclusion was that species from southeastern basins of Brazil are more closely related to species from the Guianas region, and this large clade is related to Amazonian species, despite of the low support values of the southeastern species branch. Then, Covain *et al.* (2016) published the most robust molecular phylogeny known for Loricariinae including 350 representatives, based on the 12S and 16S mitochondrial genes and the F-reticulon-4 nuclear gene. The tribe Harttiini, as classically defined, constituted a paraphyletic group, and was therefore restricted to three genera: *Harttia*, *Cteniloricaria*, and *Harttiella*. Thus, according to Covain *et al.* (2016), species of *Harttia* from southeastern Brazilian are more related to species from the Amazon region, and this clade is related to species from the Guianas. Each one of these lineages shows high support values, but the relationships among them are not well supported. Finally, the first combined phylogenetic analysis of the Loricariinae with emphasis on Harttiini and Farlowellini has been recently proposed by Londoño-Burbano & Reis (2021), including 196 morphological characters and seven molecular markers (Cytb, nd2, 12S, 16S, MyH6, RAG1, and RAG2). Harttiini was recovered with the same genera assigned by Covain *et al*. (2016): *Harttiella*, *Cteniloricaria*, and *Harttia*. However, in this case, species from southeastern Brazil represent the sister group of the species from the right and left bank of the Amazon River plus *H. fowleri*, and this clade is related to species from the Guianas region.

Due to conflicting analyses regarding the representatives of the genus, the aim of this work was to carry out a molecular phylogenetic analysis of the species of *Harttia*, increasing the number of genetic markers compared to previous studies.

Material and Methods

The molecular phylogeny was reconstructed with some taxa present in Rodriguez *et al*. (2011) and Covain *et al*. (2016), additionally including other terminals and totaling 129 sequences (68 from species of *Harttia*, 10 from species of *Cteniloricaria*, 25 from species of *Harttiella*, 24 from other genera of Loricariinae, one from *Ancistrus cirrhosus* (Hypostominae), and one from

Pseudorinelepis genibarbis (Rhinelepinae). The list of the material used is available in Table 1. The tissue samples were from the following institutions: ANSP, Academy of Natural Sciences of Drexel University in Philadelphia, United States; DZSJRP, Coleção de Peixes do Departamento de Zoologia e Botânica do Instituto de Biociências, Letras e Ciências Exatas, Universidade Estadual Paulista, São José do Rio Preto, São Paulo, Brazil; LBP, Laboratório de Biologia de Peixes, Instituto de Biociências, Universidade Estadual Paulista, Botucatu, São Paulo, Brazil; and MHNG, Muséum d'Histoire Naturelle de la Ville de Genève, Switzerland. The sequences are deposited in the GenBank.

Tissue samples were preserved in 70% ethanol and stored at -20°C, consisting of muscle tissue or parts of fins. Total genomic DNA was extracted with the E.Z.N.A. ® Tissue DNA Kit, from Omega Bio-Tek, according to the manufacturer's instructions. The markers chosen were the 12S and 16S mitochondrial genes, and the Fish Reticulon-4 receptor (*f-rtn4r*) nuclear gene, since they were used by Rodriguez *et al*. (2011) and Covain *et al*. (2016), with addition of: mitochondrial gene cytochrome c oxidase subunit 1 (COI), nuclar recombination-activating gene 1 (RAG1) and nuclear recombination-activating gene 2 (RAG2), totaling six markers.

PCR amplifications were performed with the Taq PCR Core Kit (Qiagen) in a total volume of 50 µl, containing 5 µl of 10x reaction buffer, 1 µl of dNTP mix at 10 mM each, 1 µl of each primer at 10 µM, 0.2 µl of Taq DNA Polymerase equivalent to 1 unit of Polymerase per tube, and 1 µl of DNA. Cycles of amplification were programmed with the following profile: (1) 5 min. at 94°C (initial denaturing), (2) 30 s. at 94°C, (3) 40 s. at the annealing temperature of the corresponding primer, (4) 50 s. at 72°C, and (5) 10 min at 72°C (final elongation). Steps 2–4 were repeated 38–44 times. To amplify 12S and 16S mitochondrial genes in a single long fragment, a Nested PCR protocol was used. The external round was carried out using the pair of primers Phe-L941 (ROXO *et al.*, 2014) and H3059 (ALVES-GOMES *et al*., 1995), with the annealing temperature of 51°C and 41 cycles. The internal round was carried out using the pair of primers An12S-1D and iH3059 (COVAIN *et al*., 2016), with the annealing temperature of 54°C and 41 cycles. Another Nested PCR was also performed for *f-rtn4* nuclear gene following Chiachio *et al*. (2008). The external round was carried out using the pair of primers Freticul4-D and Freticul4-R, with the annealing temperature of 53°C and 40 cycles. The internal round was carried out using the pair of primers Freticul4-D2 (CHIACHIO *et al*., 2008) and Freticul4-R2 (ROXO *et al.*, 2014), with the annealing temperature of 54°C and 38 cycles. For the complete sequence of the long

fragment, two internal primers were used: Freticul4-iD2 (COVAIN *et al*., 2016) and Freticul4-iR (ROXO *et al.*, 2014). Two combinations of pairs of primers were used to amplify the COI mitochondrial gene: the pairs of primers Fish F1 and Fish R1 (WARD *et al*., 2005) with annealing temperature of 52°C and 41 cycles, or the pair of primers COIF and COIR2 (FISCH-MULLLER *et al.*, 2018) with annealing temperature of 53°C and 41 cycles. To amplify the RAG1 gene, two sets of pair of primers were needed: for the 5'-extremity, LorRag1D and LorRag1R (This study) with annealing temperature of 60°C and 42 cycles, and for the 3'-extremity, Lor2Rag1D and Lor2Rag1R (This study) with annealing temperature of 57°C and 40 cycles. To amplify the RAG2 gene, only one set of pair of primers were used: MHF1 and MHR1 (HARDMAN, 2004) with annealing temperature of 58°C and 44 cycles. PCR products were sent to Macrogen Inc. (Amsterdam, the Netherlands).

The DNA sequences were edited with BioEdit 7.0.1 (HALL, 1999), aligned with ClustalW (THOMPSON *et al*., 1994) and final alignment optimized by eye. Gaps were considered as missing data, and regions that could not be amplified or sequenced were coded as ambiguities (N).

The phylogenetic reconstruction was performed in MEGA version 10.0.5 (KUMAR *et al*., 2018) for Maximum Likelihood (ML) and MrBayes version 3.1.2 (HUELSENBECK & RONQUIST, 2001) for Bayesian Inference (BI). For Maximum Likelihood (ML) and General Time Reversible model (NEI & KUMAR, 2000), initial tree(s) for the heuristic search were obtained automatically by applying Neighbor-Join and BioNJ algorithms to a matrix of pairwise distances estimated using the Maximum Composite Likelihood (MCL) approach, and then selecting the topology with superior log likelihood value. A discrete Gamma distribution was used to model evolutionary rate differences among sites (5 categories (+G, parameter = 1.0166)). The rate variation model allowed for some sites to be evolutionarily invariable ([+I], 28.38% sites). All positions with less than 95% site coverage were eliminated, *i.e.*, fewer than 5% alignment gaps, missing data, and ambiguous bases were allowed at any position (partial deletion option). The bootstrap test was performed with 1.000 replicates (FELSENSTEIN, 1985), and branches corresponding to partitions reproduced in less than 50% bootstrap replicates are collapsed. For Bayesian Inference (BI), the model of nucleotide substitutions was specified by MEGA and the equivalency with MrBayes was applied, resulted in lset command with nst = 6 (General Time Reversible = GTR) and rates = invgamma (Gamma Distributed with Invariant Sites (G+I)). The analysis was run (command mcmc) with maximum of 1.000.000 generations (ngen = 1.000.000),

running four independent chains (nchains = 4), and temperature for heating the chains to 0.25 (temp = 0.2). For the mentioned methods, the choice of parameters was based on Hall (2011).

Results

The alignment of the concatened genes resulted in sequences with a total length of 10.493 bp. The 12S and 16S mitochondrial genes corresponded to 2.535 bp, the Fish Reticulon-4 receptor (*f-rtn4r*) nuclear gene to 4.424 bp, the mitochondrial gene cytochrome c oxidase subunit 1 (COI) to 614 bp, the nuclear recombination-activating gene 1 (RAG1) to 2.000 bp, and the nuclear recombination-activating gene 2 (RAG2) to 920 bp.

The ML phylogenetic reconstruction (Appendix 1) shows slight differences in topology compared to the Bayesian (BI) tree. However, because of the better result regarding the relationships and the more robustness of the analysis, our focus from now on will be on the BI tree (Figure 1).

The root is formed by *Ancistrus cirrhosus* (Hypostominae) and *Pseudorinelepis genibarbis* (Rhinelepinae), splitting Loricariinae from the other subfamilies. The basal split within the Loricariinae (1 Posterior Probability (PP)) results in two highly supported lineages: the Loricariini (1 PP) and the Harttiini (1 PP).

The tribe Loricariini was separated into two strongly supported nested groups: the Farlowellina (1 PP) and the Loricariina (1 PP). The subtribe Farlowellina was composed of *Lamontichthys*, *Sturisoma*, *Sturisomatichthys*, and *Farlowella* (1 PP in all clade dichotomies). Within the subtribe Loricariina, the first split leads to *Metaloricaria paucidens* (1 PP), the second to *Dasyloricaria latiura* (1 PP), the third to *Fonchiiloricaria nanodon* and all other Loricariina (0.62 PP). The remaining Loricariina gave rise to two groups (0.98 PP): the *Rineloricaria* group (*R. lanceolata*, *R. osvaldoi*, and *R. platyura*; 1 PP in the two dichotomies) and another group consisting of the *Loricariichthys* group + *Loricaria-Pseudohemiodon* group. The representatives of the *Loricariichthys* group are *Loricariichthys*, *Limatulichthys*, and *Hemiodontichthys* (1 PP in all clade dichotomies), while the *Loricaria-Pseudohemiodon* group is composed of *Spatuloricaria*, *Loricaria*, *Planiloricaria*, and *Crossoloricaria*.

The tribe Harttiini formed a monophyletic group consisting of the genus *Harttiella*, *Harttia*, and *Cteniloricaria* with high statistical support (both 1 PP). *Harttiella* was recovered monophyletic

and included six species: *H. crassicauda* (type species), *H. parva*, *H. pilosa*, *H. longicauda*, *H. intermedia* (within *H. longicauda*), and *H. lucifer*. *Harttia* was not recovered as a monophyletic group because the clade composed of *Cteniloricaria* was nested inside the species of *Harttia*. However, the clade encompassing all species of *Harttia* + *Cteniloricaria* did not show a high support value, being the posterior probability equal to 0.7. Regarding the species of *Harttia*, three groups are well defined and have high statistical support: Amazonian species (1 PP), Guianese species plus *Cteniloricaria* (0.85 PP) and southeast Brazilian species (1 PP). Within the Amazonian clade, the first split leads to *H. fowleri* (Guianese) (1 PP). The second division (0.97 PP) gives rise to two clades: one composed of *Harttia* sp. Tocantins plus *H. punctata* (1 PP) and other with the remaining species. In this larger clade, the basal split leads to *H. duriventris* (1 PP). Then, there are two groups (0.82 PP): one with *Harttia* sp. Tapajós (non-monophyletic) plus *H. dissidens* (0.98 PP), and other with representatives of the Xingu basin (*H. rondoni*, *H. panara*, and *H. villasboas*) and a nested *Harttia* sp. MCP (Tapajós basin) (0.62 PP). Within the Guianese clade, there are two subclades: one composed of the species of *Harttia*, and another composed of the two species of *Cteniloricaria*. In the subclade of *Harttia*, the first split leads to *H. guianensis*, the second to *H. tuna*, and the third to *H. fluminensis* and *H. surinamensis* as sister groups (1 PP in almost all clade dichotomies). In the subclade of *Cteniloricaria*, *C. platystoma* was recovered as sister group of *C. napova* (nearly 1 PP in almost all clade dichotomies). Within the southeast Brazilian representatives, the first split leads to *H. kronei* and the second to *H. loricariformis*. Then, there is a division into two large groups. One of them is composed of *H. gracilis* plus *Harttia* sp. São Francisco on one side, and *Harttia* sp. Serra do Cipó closely related to *Harttia longipinna* plus *Harttia* sp. Três Marias on the other side. The second large group is composed of *H. leiopleura* plus *H. novalimensis* on one side, and on the other side, *H. carvalhoi* diverging first, followed by other two groups: one composed of only *Harttia intermontana*, and another composed of *Harttia* sp. São Francisco and a nested *H. torrenticola*. We believe that the paraphyletic *Harttia* sp. São Francisco is due to some error during the process of the samples or during the analysis. The tissue corresponding to *Harttia* sp. São Francisco 224.14, 224.15, and 244.16 are from three specimens under the same catalog number (DZSJRP 20180). Thus, the positioning of *Harttia* sp. São Francisco 244.15 as sister group of *H. gracilis* should be disregarded. In conclusion, the Guianese species were recovered as sister group of *Cteniloricaria* (0.85 PP), and this clade as a sister group

of the southeast Brazilian species (0.99 PP), and all of them as sister group of the Amazonian species (0.7 PP).

Discussion

The phylogeny confirms the monophyly of the subfamily Loricariinae, and its splitting in two tribe-level clades: Loricariini and Harttiini (Fig. 1). For many years, the most accepted classification of the Loricariinae was proposed by Isbrücker (1980), that considered *Harttiella*, *Harttia*, *Cteniloricaria*, *Lamontichthys*, *Pterosturisoma*, *Sturisomatichthys*, and *Sturisoma* members of Harttiini. However, our results agree with the two most recent papers: the molecular phylogeny proposed to Loricariinae by Covain *et al*. (2016) and the combined molecular and morphological phylogeny of the Loricariinae with emphasis on Harttiini and Farlowellini proposed by Londoño-Burbano & Reis (2021). Thus, the subfamily Harttiini is restricted to the genera *Harttiella*, *Harttia* and *Cteniloricaria*, but the relationships within Harttiini proved to be different from that recovered in these two works.

The genus *Harttiella* was recovered as a monophyletic clade, being sister group of the two other genera of the Harttiini, *Harttia* and *Cteniloricaria* (Fig. 1). According to Covain *et al.* (2012), *Harttiella* encompasses species with very limited distribution, the smallest distribution of all Hartiinni within the Guianas, whose evolution was oriented to adaptations for a specific type of biotope. These fishes have small eyes, broader, longer and deeper head, and shorter, broader and thicker caudal peduncle, representing dwarf forms of Harttiini. These morphological characteristics match the type of environment where they are found: mountainous forest creeks, characterized by cool water due to altitude and tree shade, abundant dissolved organic matter from the decomposition of fallen dead leaves and greater conductivity because of the small size of the streams. All species of *Harttiella* form monophyletic groups, except for the nested position of *H. intermedia* inside *H. longicauda*. According to Covain *et al.* (2016), *H. intermedia* represents a recent vicariant form of *H. longicauda*. This pattern of paraphyletic grouping is usually found in species that show rapid morphological evolution, but which are not genetically distinct yet, since not enough time passed to accumulate mutations at the molecular level (COVAIN *et al.*, 2016).

The next splitting in the phylogeny leads to a clade composed of the genus *Harttia* as a paraphyletic group, and *Cteniloricaria* as a monophyletic group. In contrast to *Harttiella*, *Harttia*

and *Cteniloricaria* have a wider distribution, with *Harttia* occurring in the Guianas, in the Amazon basin, and in the southeastern portion of the Brazilian Shield, and with *Cteniloricaria* occurring on east and west sides of the Guiana Shield. According to Covain *et al.* (2012), *Harttia* and *Cteniloricaria* are found in the main streams, areas strongly exposed to the sunlight. The morphological adaptations related with this environment are increase in size of the eye, being more active during the day; increase in size of the caudal peduncle, implying better abilities for swimming; and increase in the number of plates, giving protection in rocky and turbulent habitats. When both genera are sympatric the occurence of *Cteniloricaria* is relative scarcer than *Harttia* probably due to competitive exclusion (COVAIN *et al.*, 2012).

The phylogenetic reconstruction recovered three monophyletic groups of *Harttia*: one group encompassing species from the right bank of the Amazon River plus *H. fowleri*, a Guiana Shield species; other with species from the Guiana Shield (sister group of *Cteniloricaria*); and another with species from the southeastern portion of the Brazilian Shield. The lineage represented by the Amazonian species from the right bank plus *H. fowleri* diverged independently from these other two. The closest relationship is between the last two groups represented by species from the Guianas and the southeastern region of Brazil. Our results are different from the hypothesis proposed by Covain *et al.* (2016), in which *Cteniloricaria* represented the most basal group of Harttiini, and *Harttiella* formed the sister group of *Harttia*. They recovered the monophyly of the genus *Harttia*, with the species from the Guianas region diverging first, followed by the species from the right bank of the Amazon River plus *H. fowleri* as the sister group of the species from southeastern Brazil. However, in none of these analyses the species from the left bank of the Amazon River were included due to the absence of tissue samples. Based on the results of the morphological phylogeny (chapter 1), we should expect a close relationship between the species of *Harttia* from the left side of the Amazon River with the species of *Harttia* from the Guianas Shield and *Cteniloricaria*. Thus, the constant change in positioning of *Harttia* and *Cteniloricaria* in the molecular phylogeny of different studies, and the low bootstrap values supporting these relationships, reinforce that further investigations are need to clarify the phylogenetic history of *Harttia* in the molecular level too. Another interesting species is *H. merevari*, known from the top of Salto Pará waterfalls at Caura River, Orinoco basin, and described from only eight specimens, but tissue samples were also not available to include in this analysis.

According to Lima & Ribeiro (2011), "a better approach to understand the historical biogeography of freshwater fish fauna in South America is to identify distribution patterns of monophyletic taxa, and then to seek historical and/or contemporary evidence that might explain the identified pattern". The combination of the phylogenetic results presented here with the distribution pattern of the species of *Harttia* allows us to draw some biogeographical inferences. From this point on, we will analyze more in depth the relationships within each monophyletic group of *Harttia* (plus *Cteniloricaria*) that were recovered with high boostrap values.

Firstly, the clade composed of the species of *Harttia* from the Amazon basin plus *H. fowleri* (Fig. 1). The sister group of all other species is represented by *H. fowleri*, that occurs in the Oyapock basin and represents the extreme eastern limit of distribution in the Guianas. It was recovered as more related to the species of *Harttia* from the Amazon basin than to the species from the Guianas. The results of Lemopoulos & Covain (2019) indicate an ancient possible connection between Oyapock and Amazon basins due to faunal similarity, but these relationships are still unclear, demonstrating the need of further investigations in the eastern border of the French Guiana. In addition, based on analysis of *Guyanancistrus* species, Fisch-Muller *et al.* (2018) hypothesized the vicariance of Oyapock River from the rest of the Guianas to explain occurences of *G. niger* and *G. longispinis* + 1 subspecies of *G. brevispinis*. Then, we found *H. punctata* plus *Harttia* sp. Tocantins on one branch, and *H. duriventris* in the next branch, all from the Tocantins basin. According to Dagosta & de Pinna (2017), Tocantins River basin is an area considered more stable compared to others Amazon basins and was recovered as more derived than Xingu and Tapajós River basins, contrary to the phylogenetic position found here. Lastly, we have a monophyletic clade composed of the species from the Tapajós basin (*H. dissidens* plus *Harttia* sp. Tapajós) and another from species of the Curuá River, a tributary of Iriri River, Xingu basin (*H. rondoni*, *H. panara* and *H. villasboas*), including a nested species from the Tapajós basin (*Harttia* sp. MCP). The results of Dagosta & de Pinna (2017) show that Iriri River is more closely related to the Rivers of the Tapajós basin (Jamanxim, Juruena and Teles Pires) than with Rivers of the Xingu basin, forming a clade corresponding to the Serra do Cachimbo and surrounding regions. These authors also hypothesized that the most likely explanation in cases where tributaries are unrelated to their mother basins is due to biotic dispersal in form of stream capture and consequent mixture of fauna. As demonstrate by Dagosta & de Pinna (2019), the entire Amazon basin does not encompass a single historical unit, indeed "each hydrographic drainage in the Amazon basin

participates simultaneously in various biogeographical patterns", as "reticulate areas that received portions of their biotas at different ages, under the influence of disjunct events".

The next monophyletic group comprises the species from the Guianas region, where there is a split between *Cteniloricaria* and *Harttia* (Fig. 1, Annex 1). *Cteniloricaria* was recovered as a monophyletic group with *C. platystoma* (type species) as sister group of *C. napova*. The first is a widespread species distributed in almost all Atlantic coastal drainages from Essequibo in Guyana to Sinnamary in French Guiana, the only representative of Harttiinii encompassing the two main biogeographical units of the Guianas described by Lemopoulos & Covain (2019). The second is known from upper Paru de Oeste River in southern Suriname, and also a new record in the Cuminapanema River, a tributary to the Curuá River, within Brazilian territory, both localities draining to the Amazon basin (COVAIN *et al*., 2012, LONDOÑO-BURBANO *et al*., 2021). In relation to the group of species of *Harttia* from the Guianas (1 PP), the sister lineage of all other species is represented by *H. guianensis*, the species with the widest distribution within this group, occurring in coastal drainages of French Guiana and Suriname, from the Approuague River to the Maroni/Marowijn River. The next branch leads to *H. tuna*, known from the upper Paru de Oeste River, and then to *H. surinamensis*, restricted to the Suriname River, as sister group of *H. fluminensis*, only known from the Coppename River drainage. These results are congruent with some aspects of the biogeography of the freshwater fishes of the Guianas proposed by Lemopoulos & Covain (2019). These authors highlight two main biogeographical units: one to the east, encompassing from the Maroni to the Oyapock Rivers, and other to the west, ranging from the Essequibo to the Commewijne Rivers (Annex 2). The eastern biogeographic unit matchs the distribution pattern of *H. guianensis*, whereas the western biogeographic unit fits the distribution of *H. fluminensis* and *H. surinamensis*. A close relationship is reported between the Coppename and the Suriname Rivers, as the sister group relationship recovered to *H. fluminensis* and *H. surinamensis*. The headwaters of the Paru de Oeste River are very close to the headwaters of the Corantijn River, making *H. tuna* also a part of the western biogeographical unit, and these three species are closer to each other than to *H. guianensis*, corroborating the result of our molecular phylogeny.

Finally, the last monophyletic group comprises the species of *Harttia* from the southeastern portion of the Brazilian Shield (Fig. 1). The first to split is *H. kronei* from the Ribeira de Iguape basin, followed by *H. loricariformis* (type species) from the Paraíba do Sul basin. According to

Ribeiro (2006), some ancient groups are found in the coastal drainages, while more recent groups occur in the upland crystalline shield, although none of the patterns described by the author fits perfectly in the case of *Harttia*. Going deeper into the phylogeny, we have a clade composed of *H. gracilis*, described from the upper Paraná basin (Grande drainage), and *Harttia* sp. São Francisco, *H. longipinna*, *Harttia* sp. Três Marias, and *Harttia* sp. Serra do Cipó, all from the São Francisco basin. According to Buckup (2011), the faunal similarity between the upper Paraná, particularly the Grande drainage, and the São Francisco is well documented throughout history, suggesting the possibility of a geologically recent connection between the two basins. An interesting observation that reinforces this hypothesis is that "while mountain divides in the southeast often involve differences of more than a 1,000 m of altitude between the headwaters and the adjacent main River course, most barriers between the upper Paraná and the São Francisco are less than 200 m high, and often involve marshes on an almost flat terrain". Last of all, there is a clade formed by *H. leiopleura* plus *H. novalimensis*, both from the São Francisco basin, as a sister group of another clade composed of *H. intermontana* from the Doce basin, *H. torrenticola* and *Harttia* sp. São Francisco from the São Francisco basin, and *H. carvalhoi* from the Paraíba do Sul basin. The phylogenetic relationship among these species correlated to their geographic distribution pattern demonstrates the complexity of this area, since no simple explanation applies to this result. Both Buckup (2011) and Ribeiro (2006) highlight the biogeographic discontinuity of the southeastern portion of the Brazilian Shield. This region is characterized by ancient activities, such as the presence of many faults from the time of Gondwana breakup, but also recent ones, as tectonic stress and differential erosion can lead to stream captures. Thus, the intense exchange of fauna among these basins was probably due to the continuity of these processes throughout history.

In conclusion, the present geographical distribution of a taxa is resulted of a complex combination that includes biogeography history, phylogenetic history, ecological constrains, and dispersal abilities. Even the absence can have several interpretations: the species never dispersed toward the region, the species colonized a region and subsequently disappeared from part or all of it, the species has not been captured until the present, or the species has been misidentified (LEMOPOULOS & COVAIN, 2019). Thus, the results presented here are simply hypotheses that can be modified in light of new data or new evidence. In the future, we hope to include a time-

scale analysis and also species of the genus that were not included until this point. Sometimes question marks are often more productive than end points.

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Table 1. Taxa list, specimens and sequence data analyzed in this study. The sequences obtained in this study will be registered in GenBank.

Species	Catalog number	Field number	Locality	mt 12S + 16S bases + GenBank No.	Ref.	F-RTN4 bases + GenBank No.	Ref.	COI bases	RAG-1 (5´) bases	RAG-1 (3´) bases	RAG-2 bases
Harttia carvalhoi	MHNG 2587.027	BR 1236	Brazil, Paraíba do Sul River	2432 KR477891	Covain et al. (2016)	2046 KR478225	Covain et al. (2016)	This study	This study	NA	NA
Harttia carvalhoi	LBP 2115	LBP 21352	Brazil, Paraíba do Sul River	2433 KR477890	Covain et al. (2016)	2046 KR478224	Covain et al. (2016)	This study	NA	NA	NA
Harttia carvalhoi	MHNG 2587.032	BR 1240	Arroio Macaquinho, affluent of Paraitinga River , 5 km SE of "Bairro dos Macacos"		This study		This study	This study	NA	This study	NA
Harttia dissidens	LBP 5859	LBP 28331	Brazil, Tapajós River	2435 KR477892	Covain et al. (2016)	1955 KR478226	Covain et al. (2016)	This study	This study	This study	NA
Harttia dissidens	LBP 5863	LBP 28339	Brazil, Tapajós River	2435 KR477914	Covain et al. (2016)	1954 KR478248	Covain et al. (2016)	This study	This study	This study	NA
Harttia duriventris	LBP 7505	LBP 34804	Brazil, Tapajós River	2432 KR477915	Covain et al. (2016)	1951 KR478249	Covain et al. (2016)	NA	NA	NA	NA
Harttia fluminensis	MHNG 2690.013	SU01 445	Suriname, Coppename River	2435 KR477884	Covain et al. (2016)	2092 KR478218	Covain et al. (2016)	This study	This study	This study	This study
Harttia fluminensis	MHNG 2690.012	SU01 431	Coppename River, Raleighvallen		This study		This study	This study	This study	NA	NA
Harttia fluminensis	not catalogued	SU18 379	Coppename River 1		This study		This study	This study	This study	This study	This study
Harttia fluminensis	not catalogued	SU18 489	Coppename River 2		This study		This study	This study	This study	This study	This study
Harttia fowleri	MHNG 2643.022	GF99 202	French Guiana, Oyapock River	2442 KR477880	Covain et al. (2016)	2086 KR478214	Covain et al. (2016)	This study	This study	This study	NA

Table 1 (continuation). Taxa list, specimens and sequence data analyzed in this study. The sequences obtained in this study will be registered in GenBank.

Species	Catalog number	Field number	Locality	mt 12S + 16S bases + GenBank No.	Ref.	F-RTN4 bases + GenBank No.	Ref.	COI bases	RAG-1 (5´) bases	RAG-1 (3´) bases	RAG-2 bases
Harttia fowleri	MHNG 2681.068	GF06 149	Oyapock: Saut Wakarayou, St. Georges-Oyapok		This study		This study	This study	This study	This study	NA
Harttia fowleri	MHNG 2682.038	GF06 282	Camopi: Oyapock: A la sortie de la crique face à Roche Mon Père à environ 1h. de pirogue en aval de Camopi et à 15 min. en aval de la crique Sikini, St. Georges-Oyapok		This study		This study	This study	This study	This study	NA
Harttia gracilis	LBP 6331	LBP 29819	Brazil, Paraná River	2433 KR477916	Covain et al. (2016)	2041 KR478250	Covain et al. (2016)	This study	This study	NA	This study
Harttia guianensis	MHNG 2662.091	GF03 160	French Guiana, Approuague River	2438 KR477885	Covain et al. (2016)	2092 KR478219	Covain et al. (2016)	This study	This study	This study	This study
Harttia guianensis	MHNG 2680.053	RV 21	French Guiana, Sinnamary River	2443 KR477886	Covain et al. (2016)	2092 KR478220	Covain et al. (2016)	This study	This study	NA	NA
Harttia guianensis	not catalogued	GWF15 25			This study		This study	This study	NA	NA	NA
Harttia intermontana	DZSJRP 20978	DZSJRP 20978-1	Brazil, Minas Gerais, Santana dos Montes, Doce River		This study		This study	This study	NA	NA	NA
Harttia intermontana	DZSJRP 20978	DZSJRP 20978-2	Brazil, Minas Gerais, Santana dos Montes, Doce River		This study		This study	This study	NA	NA	NA
Harttia intermontana	DZSJRP 20978	DZSJRP 20978-3	Brazil, Minas Gerais, Santana dos Montes, Doce River		This study		This study	This study	NA	NA	NA
Harttia intermontana	DZSJRP 20978	DZSJRP 20978-4	Brazil, Minas Gerais, Santana dos Montes, Doce River		This study		This study	This study	NA	NA	NA

Table 1 (continuation). Taxa list, specimens and sequence data analyzed in this study. The sequences obtained in this study will be registered in GenBank.

Species	Catalog number	Field number	Locality	mt 12S + 16S bases + GenBank No.	Ref.	F-RTN4 bases + GenBank No.	Ref.	COI bases	RAG-1 (5´) bases	RAG-1 (3´) bases	RAG-2 bases
Harttia intermontana	DZSJRP 20978	DZSJRP 20978-5	Brazil, Minas Gerais, Santana dos Montes, Doce River		This study		This study	This study	NA	NA	NA
Harttia intermontana	DZSJRP 16150	DZSJRP 16150-1	Brazil, Minas Gerais, Santana dos Montes, Doce River		This study		This study	This study	This study	NA	NA
Harttia intermontana	DZSJRP 16150	DZSJRP 16150-2	Brazil, Minas Gerais, Santana dos Montes, Doce River		This study		This study	This study	This study	NA	NA
Harttia intermontana	DZSJRP 16150	DZSJRP 16150-3	Brazil, Minas Gerais, Santana dos Montes, Doce River		This study		This study	This study	This study	NA	NA
Harttia intermontana	DZSJRP 20069	DZSJRP 20069-1	Brazil, Minas Gerais, Santana dos Montes, Doce River		This study		This study	This study	This study	NA	NA
Harttia intermontana	DZSJRP 20069	DZSJRP 20069-2	Brazil, Minas Gerais, Santana dos Montes, Doce River		This study		This study	This study	This study	NA	NA
Harttia intermontana	DZSJRP 20069	DZSJRP 20069-3	Brazil, Minas Gerais, Santana dos Montes, Doce River		This study		This study	This study	This study	NA	NA
Harttia kronei	MHNG 2586.058	BR 1166	Brazil, Ribeira de Iguape River	2424 KR477900	Covain et al. (2016)	2081 KR478234	Covain et al. (2016)	This study	This study	NA	NA
Harttia kronei	LBP 2661	LBP 17427	Brazil, Ribeira de Iguape River	2426 KR477894	Covain et al. (2016)	2083 KR478228	Covain et al. (2016)	This study	This study	NA	NA
Harttia kronei	LBP 2883	LBP 18609	Brazil, Ribeira de Iguape River	2425 KR477895	Covain et al. (2016)	2080 KR478229	Covain et al. (2016)	This study	This study	NA	NA
Harttia leiopleura	LBP 6847	LBP 31528	Brazil, São Francisco River	2435 KR477918	Covain et al. (2016)	2068 KR478252	Covain et al. (2016)	This study	This study	NA	NA

Table 1 (continuation). Taxa list, specimens and sequence data analyzed in this study. The sequences obtained in this study will be registered in GenBank.

Species	Catalog number	Field number	Locality	mt 12S + 16S bases + GenBank No.	Ref.	F-RTN4 bases + GenBank No.	Ref.	COI bases	RAG-1 (5´) bases	RAG-1 (3´) bases	RAG-2 bases
Harttia leiopleura	LBP 6492	LBP 31545	Brazil, São Francisco River	2436 KR477917	Covain et al. (2016)	2068 KR478251	Covain et al. (2016)	This study	This study	NA	NA
Harttia longipinna	DZSJRP 2819	BR98 747	Brazil, São Francisco River	2429 KR477903	Covain et al. (2016)	2072 KR478237	Covain et al. (2016)	This study	This study	NA	NA
Harttia loricariformis	LBP 2121	LBP 21362	Brazil, Paraíba do Sul River	2435 KR477896	Covain et al. (2016)	2041 KR478230	Covain et al. (2016)	NA	NA	NA	NA
Harttia novalimensis	LBP 5836	LBP 28348	Brazil, São Francisco River	2429 KR477897	Covain et al. (2016)	2060 KR478231	Covain et al. (2016)	NA	NA	NA	NA
Harttia panara	LBP 5860	LBP 28333	Brazil, Xingu River	2432 KR478245	Covain et al. (2016)	1973 KR478246	Covain et al. (2016)	This study	This study	This study	NA
Harttia punctata	MHNG 2645.053	BR 1051	Brazil, Tocantins River	2430 KR477905	Covain et al. (2016)	2084 KR478239	Covain et al. (2016)	This study	NA	This study	NA
Harttia punctata	MHNG 2645.059	BR 995	Brazil, Tocantins River	2431 KR477893	Covain et al. (2016)	2084 KR478227	Covain et al. (2016)	This study	This study	This study	NA
Harttia rondoni	DZSJRP 21411	DZSJRP 21411-1	Brazil, Pará, Novo Progresso, Xingu River		This study		This study	This study	This study	This study	NA
Harttia rondoni	LBP 5845	LBP 28327	Brazil, Xingu River	2433 KR477907	Covain et al. (2016)	1971 KR478241	Covain et al. (2016)	This study	This study	NA	NA
Harttia surinamensis	MHNG 2674.042	SU05 001	Suriname, Suriname River	2438 KR477883	Covain et al. (2016)	2438 KR477883	Covain et al. (2016)	This study	This study	This study	NA

Table 1 (continuation). Taxa list, specimens and sequence data analyzed in this study. The sequences obtained in this study will be registered in GenBank.

Species	Catalog number	Field number	Locality	mt 12S + 16S bases + GenBank No.	Ref.	F-RTN4 bases + GenBank No.	Ref.	COI bases	RAG-1 (5´) bases	RAG-1 (3´) bases	RAG-2 bases
Harttia surinamensis	MHNG 2736.075	GFSU12 542	Bakaoboto: Saut du fleuve affluent de la rivière Suriname (CFM 13), bassin Suriname, Sipaliwini, Suriname		This study		This study	This study	This study	This study	This study
Harttia surinamensis	MHNG 2737.047	GFSU12e 131	Grand Rio: Rapid Awadan affluent de la Suriname, bassin Suriname, Suriname		This study		This study	This study	NA	This study	NA
Harttia surinamensis	not catalogued	SU18-178			This study		This study	This study	This study	This study	This study
Harttia torrenticola	LBP 5835	LBP 28346	Brazil, São Francisco River	2433 KR477913	Covain et al. (2016)	2054 KR478247	Covain et al. (2016)	This study	NA	NA	NA
Harttia tuna	MHNG 2704.029	SU07 644	Brazil, Paru de Oeste River	2437 KR477909	Covain et al. (2016)	2092 KR478243	Covain et al. (2016)	This study	This study	This study	NA
Harttia tuna	MHNG 2704.029	SU07 648	Brazil, Paru de Oeste River	NA			This study	This study	NA	NA	This study
Harttia tuna	MHNG 2704.029	SU07 649	Brazil, Paru de Oeste River		This study		This study	This study	NA	NA	This study
Harttia villasboas	DZSJRP 21410	DZSJRP 21410-1	Brazil, Pará, Altamira, Xingu River drainage	NA			This study	This study	NA	This study	NA
Harttia villasboas	DZSJRP 21412	DZSJRP 21412-1	Brazil, Pará, Altamira, Xingu River drainage		This study		This study	This study	NA	NA	NA
Harttia villasboas	DZSJRP 21413	DZSJRP 21413-1	Brazil, Pará, Novo Progresso, Xingu River drainage		This study		This study	This study	NA	This study	NA
Harttia villasboas	DZSJRP 21414	DZSJRP 21414-1	Brazil, Pará, Novo Progresso, Xingu River drainage		This study		This study	This study	NA	This study	NA

Table 1 (continuation). Taxa list, specimens and sequence data analyzed in this study. The sequences obtained in this study will be registered in GenBank.

Species	Catalog number	Field number	Locality	mt 12S + 16S bases + GenBank No.	Ref.	F-RTN4 bases + GenBank No.	Ref.	COI bases	RAG-1 (5´) bases	RAG-1 (3´) bases	RAG-2 bases
Harttia villasboas	LBP 5861	LBP 28335	Brazil, Xingu River	2436 KR477908	Covain et al. (2016)	1973 KR478242	Covain et al. (2016)	This study	This study	This study	NA
Harttia sp. MCP	DZSJRP 21428	DZSJRP 21428-1	Brazil, Pará, Rurópolis, Tapajós River drainage	NA			This study	This study	NA	NA	NA
Harttia sp. MCP	DZSJRP 21427	DZSJRP 21427-1	Brazil, Pará, Itaituba, Tapajós River drainag		This study		This study	This study	NA	NA	NA
Harttia sp. São Francisco	DZSJRP 16126	DZSJRP 16126-1	Brazil, Minas Gerais, Cristiano Otoni, São Francisco River		This study		This study	This study	This study	This study	NA
Harttia sp. São Francisco	DZSJRP 16126	DZSJRP 16126-2	Brazil, Minas Gerais, Cristiano Otoni, São Francisco River		This study		This study	This study	This study	This study	NA
Harttia sp. São Francisco	DZSJRP 20180	DZSJRP 20180-1	Brazil, Minas Gerais, São Roque de Minas, São Francisco River		This study		This study	This study	This study	NA	NA
Harttia sp. São Francisco	DZSJRP 20180	DZSJRP 20180-2	Brazil, Minas Gerais, São Roque de Minas, São Francisco River		This study		This study	This study	This study	NA	NA
Harttia sp. São Francisco	DZSJRP 20180	DZSJRP 20180-3	Brazil, Minas Gerais, São Roque de Minas, São Francisco River		This study		This study	This study	This study	NA	NA
Harttia sp. Serra do Cipó	LBP 6528	LBP 31652	Brazil, São Francisco River	2431 KR477919	Covain et al. (2016)	2061 KR477919	Covain et al. (2016)	This study	This study	NA	NA
Harttia sp. Tapajós	DZSJRP 21415	DZSJRP 21415-1	Brazil, Pará, Novo Progresso, Tapajós River drainage		This study		This study	This study	NA	This study	NA
Harttia sp. Tapajós	DZSJRP 21416	DZSJRP 21416-1	Brazil, Pará, Novo Progresso, Tapajós River drainage		This study		This study	This study	This study	This study	NA

Table 1 (continuation). Taxa list, specimens and sequence data analyzed in this study. The sequences obtained in this study will be registered in GenBank.

Species	Catalog number	Field number	Locality	mt 12S + 16S bases + GenBank No.	Ref.	F-RTN4 bases + GenBank No.	Ref.	COI bases	RAG-1 (5´) bases	RAG-1 (3´) bases	RAG-2 bases
Harttia sp. Tapajós	DZSJRP 21417	DZSJRP 21417-1	Brazil, Pará, Novo Progresso, Tapajós River drainage		This study		This study	This study	NA	NA	NA
Harttia sp. Tapajós	LBP 5857	LBP 28329	Brazil, Tapajós River	2436 KR477906	Covain et al. (2016)	1968 KR478240	Covain et al. (2016)	This study	NA	NA	NA
Harttia sp. Tocantins	LBP 5850	LBP 28367	Brazil, Tocantins River	2433 KR477901	Covain et al. (2016)	2085 KR478235	Covain et al. (2016)	This study	This study	This study	NA
Harttia sp. Três Marias	LBP 5838	LBP 28351	Brazil, São Francisco River	2429 KR477920	Covain et al. (2016)	2061 KR478254	Covain et al. (2016)	This study	NA	NA	NA
Harttiella crassicauda	MHNG 2679.098	MUS 306	Suriname, Nassau Mountains	2418 KR478145	Covain et al. (2016)	2026 KR478474	Covain et al. (2016)	This study	NA	NA	NA
Harttiella crassicauda	MHNG 2674.051	MUS 221	Suriname, Nassau Mountains	2417 KR478146	Covain et al. (2016)	2026 KR478475	Covain et al. (2016)	This study	NA	NA	NA
Harttiella crassicauda	MHNG 2674.051	MUS 231	Suriname, Nassau Mountains	2418 KR478131	Covain et al. (2016)	2026 KR478460	Covain et al. (2016)	This study	NA	NA	NA
Harttiella intermedia	MHNG 2713.087	MUS 650	French Guiana, Trinité Mountains	2418 KR478164	Covain et al. (2016)	2021 KR478490	Covain et al. (2016)	This study	NA	NA	NA
Harttiella intermedia	MHNG 2713.087	MUS 651	French Guiana, Trinité Mountains	2418 KR478165	Covain et al. (2016)	2022 KR478491	Covain et al. (2016)	This study	NA	NA	NA
Harttiella intermedia	MHNG 2713.087	MUS 652	French Guiana, Trinité Mountains	2418 KR478135	Covain et al. (2016)	2022 KR478464	Covain et al. (2016)	This study	NA	NA	NA
Harttiella longicauda	MHNG 2723.094	MUS 470	French Guiana, Balenfois Mountains	2418 KR478136	Covain et al. (2016)	2005 KR478465	Covain et al. (2016)	This study	NA	NA	NA

Table 1 (continuation). Taxa list, specimens and sequence data analyzed in this study. The sequences obtained in this study will be registered in GenBank.

Species	Catalog number	Field number	Locality	mt 12S + 16S bases + GenBank No.	Ref.	F-RTN4 bases + GenBank No.	Ref.	COI bases	RAG-1 (5´) bases	RAG-1 (3´) bases	RAG-2 bases
Harttiella longicauda	MHNG 2723.094	MUS 463	French Guiana, Balenfois Mountains	2419 KR478159	Covain et al. (2016)	2005 KR478485	Covain et al. (2016)	This study	This study	This study	NA
Harttiella longicauda	MHNG 2723.094	MUS 456	French Guiana, Balenfois Mountains	2418 KR478133	Covain et al. (2016)	2005 KR478462	Covain et al. (2016)	This study	This study	This study	NA
Harttiella longicauda	MHNG 2699.070	GF07 026	French Guiana, Trinité Mountains	2418 KR478144	Covain et al. (2016)	2022 KR478473	Covain et al. (2016)	This study	This study	This study	NA
Harttiella longicauda	MHNG 2699.070	GF07 111	French Guiana, Trinité Mountains	2418 KR478139	Covain et al. (2016)	2022 KR478468	Covain et al. (2016)	This study	This study	This study	NA
Harttiella lucifer	MHNG 2721.088	GF10 034	French Guiana, Lucifer Mountains	2414 KR478153	Covain et al. (2016)	2152 KR478479	Covain et al. (2016)	This study	This study	This study	NA
Harttiella lucifer	MHNG 2721.088	GF10 043	French Guiana, Lucifer Mountains	2414 KR478154	Covain et al. (2016)	2149 KR478480	Covain et al. (2016)	This study	This study	This study	NA
Harttiella lucifer	MHNG 2721.088	GF10 037	French Guiana, Lucifer Mountains	2414 KR478155	Covain et al. (2016)	2152 KR478481	Covain et al. (2016)	This study	This study	This study	NA
Harttiella lucifer	MHNG 2721.091	GF10 051	French Guiana, Lucifer Mountains	2414 KR478156	Covain et al. (2016)	2152 KR478482	Covain et al. (2016)	This study	This study	This study	NA
Harttiella lucifer	MHNG 2721.091	GF10 053	French Guiana, Lucifer Mountains	2414 KR478158	Covain et al. (2016)	2152 KR478484	Covain et al. (2016)	This study	This study	This study	NA
Harttiella lucifer	MHNG 2721.091	GF10 055	French Guiana, Lucifer Mountains	2414 KR478157	Covain et al. (2016)	2148 KR478483	Covain et al. (2016)	This study	This study	This study	NA
Harttiella lucifer	MHNG 2712.085	MUS 592	French Guiana, Crique Limonade	2414 KR478478	Covain et al. (2016)	NA	-	This study	NA	NA	NA

Table 1 (continuation). Taxa list, specimens and sequence data analyzed in this study. The sequences obtained in this study will be registered in GenBank.

Species	Catalog number	Field number	Locality	mt 12S + 16S bases + GenBank No.	Ref.	F-RTN4 bases + GenBank No.	Ref.	COI bases	RAG-1 (5´) bases	RAG-1 (3´) bases	RAG-2 bases
Harttiella lucifer	MHNG 2712.085	MUS 593	French Guiana, Crique Limonade	2414 KR478151	Covain et al. (2016)	NA	-	This study	NA	NA	NA
Harttiella parva	MHNG 2723.093	MUS 606	French Guiana, Atachi Bakka Mountains	2416 KR478147	Covain et al. (2016)	2026 KR478476	Covain et al. (2016)	This study	NA	NA	NA
Harttiella parva	MHNG 2723.093	MUS 607	French Guiana, Atachi Bakka Mountains	2416 KR478148	Covain et al. (2016)	2026 KR478477	Covain et al. (2016)	This study	NA	NA	NA
Harttiella parva	MHNG 2723.093	MUS 611	French Guiana, Atachi Bakka Mountains	2416 KR478477	Covain et al. (2016)	2026 KR478478	Covain et al. (2016)	This study	NA	NA	NA
Harttiella pilosa	MHNG 2682.055	GF06 344	French Guiana, Tortue Mountains	2417 KR478132	Covain et al. (2016)	2026 KR478461	Covain et al. (2016)	This study	This study	NA	NA
Harttiella pilosa	MHNG 2682.055	GF06 343	French Guiana, Tortue Mountains	2417 KR478137	Covain et al. (2016)	2026 KR478466	Covain et al. (2016)	This study	This study	NA	NA
Harttiella pilosa	MHNG 2724.002	GF03 033	French Guiana, Tortue Mountains	2419 KR478138	Covain et al. (2016)	2026 KR478467	Covain et al. (2016)	This study	NA	NA	NA
Cteniloricaria napova	MHNG 2704.030	SU07 650	Brazil, Paru de Oeste River	2440 KR477882	Covain et al. (2016)	2086 KR478216	Covain et al. (2016)	This study	This study	This study	NA
Cteniloricaria napova	MHNG 2704.030	SU07 663	Brazil, Paru de Oeste River		This study		This study	This study	NA	NA	NA
Cteniloricaria napova	MHNG 2704.030	SU07 664	Brazil, Paru de Oeste River		This study		This study	This study	NA	NA	NA
Cteniloricaria platystoma	MHNG 2672.067	SU05 340	Suriname, Corantijn River	2439 KR477888	Covain et al. (2016)	2091 KR478222	Covain et al. (2016)	This study	NA	This study	NA

Table 1 (continuation). Taxa list, specimens and sequence data analyzed in this study. The sequences obtained in this study will be registered in GenBank.

Species	Catalog number	Field number	Locality	mt 12S + 16S bases + GenBank No.	Ref.	F-RTN4 bases + GenBank No.	Ref.	COI bases	RAG-1 (5´) bases	RAG-1 (3´) bases	RAG-2 bases
Cteniloricaria platystoma	MHNG 2674.003	SU05 039	Suriname, Suriname River	2441 KR477889	Covain et al. (2016)	2090 KR478223	Covain et al. (2016)	This study	NA	This study	NA
Cteniloricaria platystoma	MHNG 2650.082	GY04 336	Guyana, Essequibo River	2437 KR477881	Covain et al. (2016)	2090 KR478215	Covain et al. (2016)	This study	NA	NA	NA
Cteniloricaria platystoma	MHNG 2700.054	GF07 265	French Guiana, Mana River	2437 KR477902	Covain et al. (2016)	2089 KR478236	Covain et al. (2016)	This study	NA	NA	NA
Cteniloricaria platystoma	MHNG 2643.015	GF00 352	French Guiana, Marouini River	2439 KR477887	Covain et al. (2016)	2089 KR478221	Covain et al. (2016)	This study	NA	This study	NA
Cteniloricaria platystoma	not catalogued	SU18 383	Coppename River		This study		This study	This study	NA	This study	NA
Cteniloricaria platystoma	not catalogued	SU18 949	Coppename River		This study		This study	This study	NA	This study	NA
Crossoloricaria venezuelae	INHS 35467	VZ 049	Venezuela, Santa Rosa River	2416 EU310444	Covain et al. (2008)	1994 HM623647	Rodriguez et al. (2011)	This study	NA	This study	NA
Dasyloricaria latiura	MHNG 2674.052	PA00 012	Panama, Ipeti River	2416 EU310445	Covain et al. (2008)	2005 HM623639	Rodriguez et al. (2011)	NA	NA	This study	NA
Farlowella amazona	MHNG 2601.065	BR98 052	Brazil, Acara River	2432 KR477937	Covain et al. (2016)	2299 KR478271	Covain et al. (2016)	This study	This study	This study	This study
Farlowella curtirostra	MER95T-13	43	Venezuela, Motatan River	2435 KR477938	Covain et al. (2016)	2301 KR478272	Covain et al. (2016)	This study	This study	This study	This study
Farlowella oxyrryncha	MHNG 2601.095	BR98 118	Brazil, Guamá River	2440 KR477958	Covain et al. (2016)	2240 KR477958	Covain et al. (2016)	This study	This study	This study	This study

Table 1 (continuation). Taxa list, specimens and sequence data analyzed in this study. The sequences obtained in this study will be registered in GenBank.

Species	Catalog number	Field number	Locality	mt 12S + 16S bases + GenBank No.	Ref.	F-RTN4 bases + GenBank No.	Ref.	COI bases	RAG-1 (5´) bases	RAG-1 (3´) bases	RAG-2 bases
Farlowella taphorni	VZ-89	48	Venezuela, Mayupa River	2433 KR477946	Covain et al. (2016)	2168 KR478280	Covain et al. (2016)	This study	This study	This study	This study
Fonchiiloricaria nanodon	MHNG 2710.060	PE08 336	Peru, Aucayacu River	2429 HM592627	Rodriguez et al. (2011)	2015 HM623657	Rodriguez et al. (2011)	This study	NA	This study	NA
Hemiodontichthys acipenserinus	MHNG 2651.012	GY04 15	Guyana, Rupununi River	2419 EU310448	Covain et al. (2008)	2246 HM623645	Rodriguez et al. (2011)	This study	This study	This study	NA
Lamontichthys stibaros	MHNG 2677.039	MUS 208	Peru, aquarium trade, Itaya River	2430 EU310449	Covain et al. (2008)	2038 HM623648	Rodriguez et al. (2011)	This study	This study	This study	This study
Limatulichthys griseus	MHNG 2651.013	GY04 18	Guyana, Rupununi River	2423 EU310450	Covain et al. (2008)	1959 HM623644	Rodriguez et al. (2011)	This study	This study	This study	NA
Loricaria clavipinna	MHNG 2640.044	PE98 002	Peru, Putumayo River	2424 EU310451	Covain et al. (2008)	1964 HM623653	Rodriguez et al. (2011)	This study	This study	This study	NA
Loricaria cataphracta	MHNG 2749.022	GF98 044	French Guiana, Kourou River	2428 KR478057	Covain et al. (2016)	1943 KR478391	Covain et al. (2016)	This study	NA	NA	NA
Loricariichthys maculatus	MHNG 2621.042	SU01 56	Surinam, Sarramacca River	2425 EU310453	Covain et al. (2008)	2221 HM623642	Rodriguez et al. (2011)	This study	This study	This study	NA
Loricariichthys microdon	MHNG 2650.054	GY04 12	Guyana, Rupununi River	2424 EU310454	Covain et al. (2008)	1949 HM623643	Rodriguez et al. (2011)	This study	This study	This study	NA
Metaloricaria paucidens	MHNG 2677.086	GF00 083	French Guiana, Marouini River	2435 EU310455	Covain et al. (2008)	2073 HM623637	Rodriguez et al. (2011)	This study	This study	This study	This study
Planiloricaria cryptodon	MHNG 2677.038	MUS 211	Peru, aquarium trade, Itaya River	2415 EU310456	Covain et al. (2008)	2006 HM623646	Rodriguez et al. (2011)	This study	This study	This study	NA

Table 1 (continuation). Taxa list, specimens and sequence data analyzed in this study. The sequences obtained in this study will be registered in GenBank.

Species	Catalog number	Field number	Locality	mt 12S + 16S bases + GenBank No.	Ref.	F-RTN4 bases + GenBank No.	Ref.	COI bases	RAG-1 (5´) bases	RAG-1 (3´) bases	RAG-2 bases
Rineloricaria platyura	MHNG 2651.009	GY04 83	Guyana, Rupununi River	2420 EU310458	Covain et al. (2008)	2219 HM623641	Rodriguez et al. (2011)	This study	This study	This study	This study
Rineloricaria lanceolata	MHNG 2588.059	PE96 011	Peru, Tambopata River	2420 EU310457	Covain et al. (2008)	2226 HM623640	Rodriguez et al. (2011)	This study	This study	This study	NA
Rineloricaria osvaldoi	UFRJ batch 6–EF4	BR 1114	Brazil, Maranhão River	2424 EU310459	Covain et al. (2008)	2023 HM623652	Rodriguez et al. (2011)	This study	This study	This study	This study
Spatuloricaria sp. Ireng	ANSP 182372	T2361	Guyana, Ireng River	2423 KR478047	Covain et al. (2016)	1978 KR478381	Covain et al. (2016)	NA	NA	NA	NA
Spatuloricaria sp. Magdalena 2	IAvHP	6635	Colombia, Magdalena River, Honda	2418 KR478048	Covain et al. (2016)	1960 KR478382	Covain et al. (2016)	This study	This study	This study	NA
Sturisoma nigrirostrum	MHNG 2588.055	PE96 001	Peru, de las Piedras River	2437 EU310460	Covain et al. (2008)	2556 HM623636	Rodriguez et al. (2011)	This study	This study	This study	This study
Sturisoma monopelte	MHNG 2651.033	GY04 187	Guyana, Sawarab River	2436 EU310461	Covain et al. (2008)	1980 HM623651	Rodriguez et al. (2011)	This study	This study	This study	This study
Sturisomatichthys citurensis	MHNG 2676.004	PA97 032	Panama, Tuyra River	2435 EU310462	Covain et al. (2008)	2268 HM623635	Rodriguez et al. (2011)	This study	This study	This study	This study
Ancistrus cirrhosus	MHNG 2645.037	MUS 202	Argentina, Uruguay River	2420 EU310442	Covain et al. (2008)	1809 HM623638	Rodriguez et al. (2011)	This study	This study	This study	NA
Pseudorinelepis genibarbis	MHNG 2588.079	PE96 040	Peru, Ucayali River	2434 HM592623	Rodriguez et al. (2011)	1926 HM623634	Rodriguez et al. (2011)	This study	NA	This study	NA

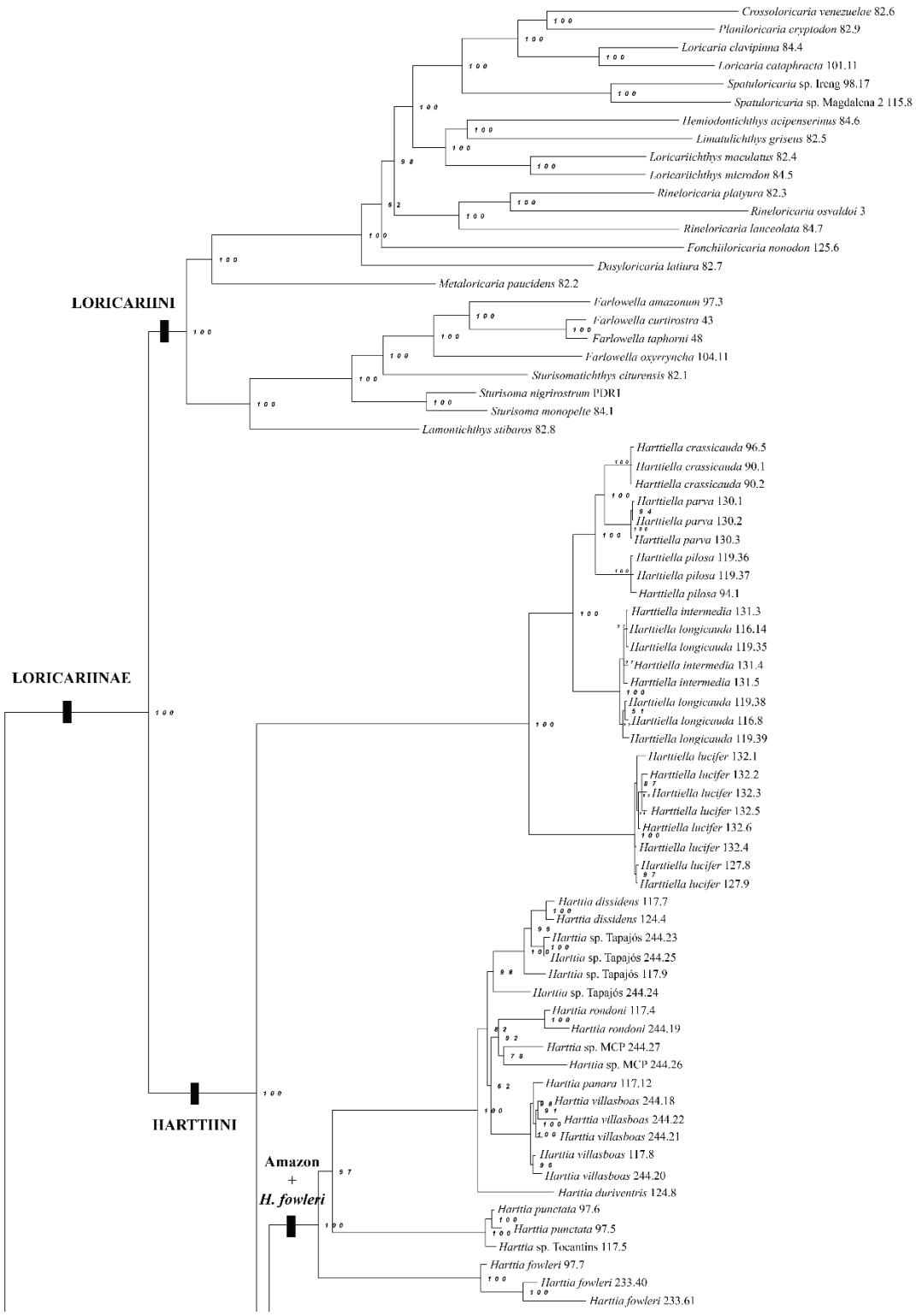


Figure 1 (part 1). Bayesian Inference tree reconstructed from concatenate sequences of 12S and 16S mitochondrial genes, *f-rtn4r* nuclear gene, COI mitochondrial gene, RAG1 nuclear gene and RAG2 nuclear gene. Numbers indicate posterior probabilities. Scale indicates the number of substitutions per site as expected by the model.

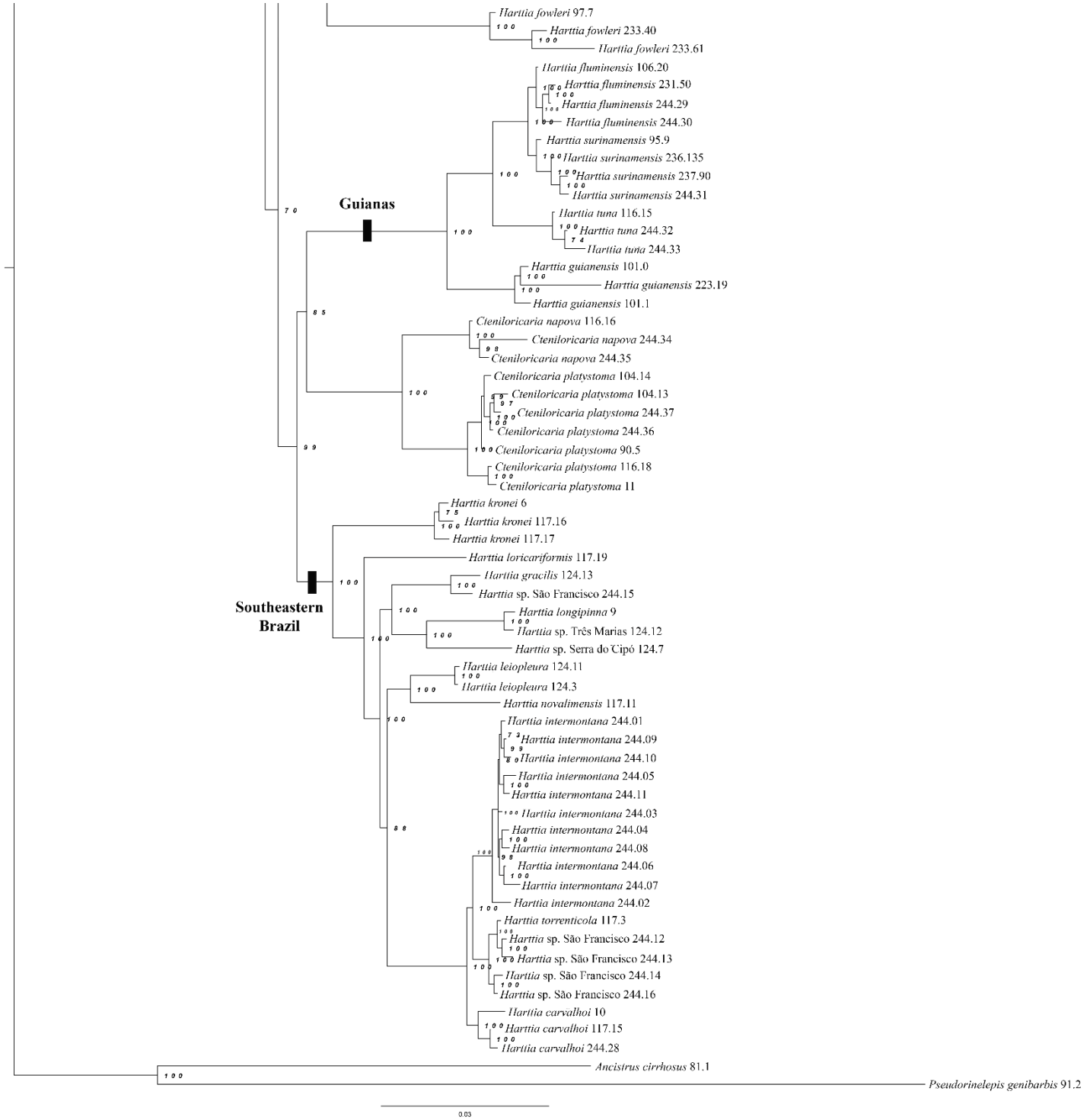
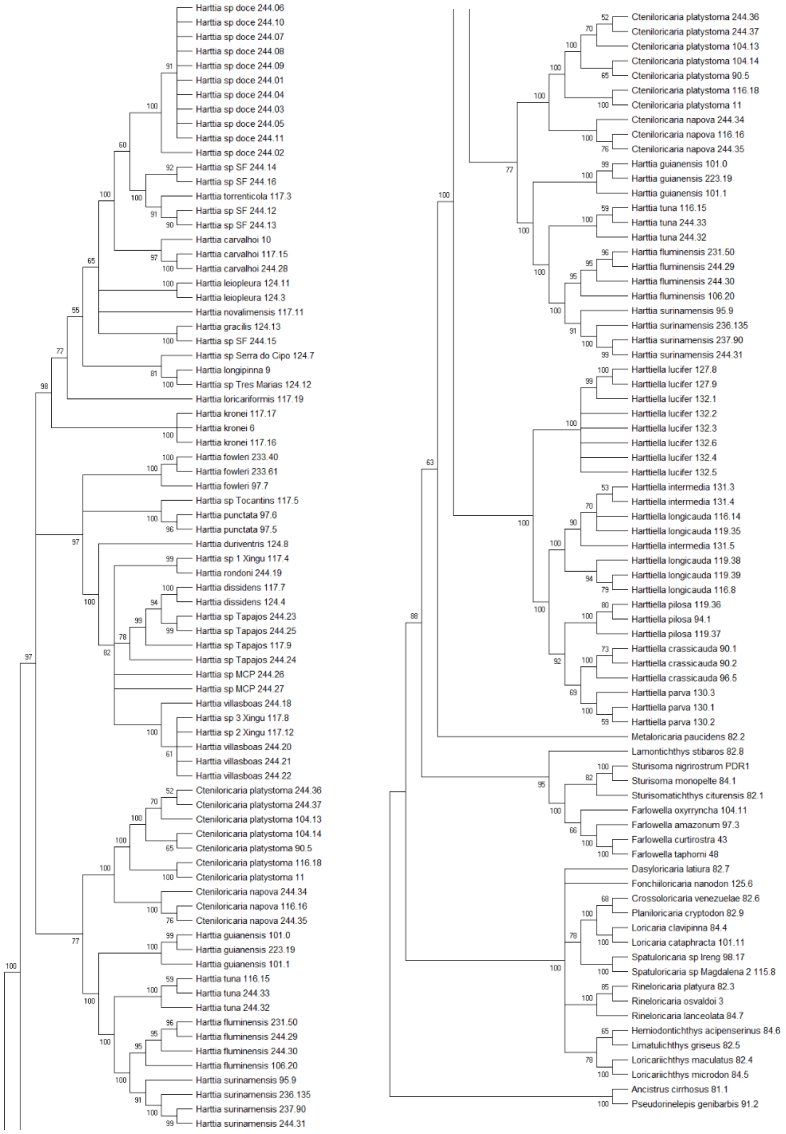
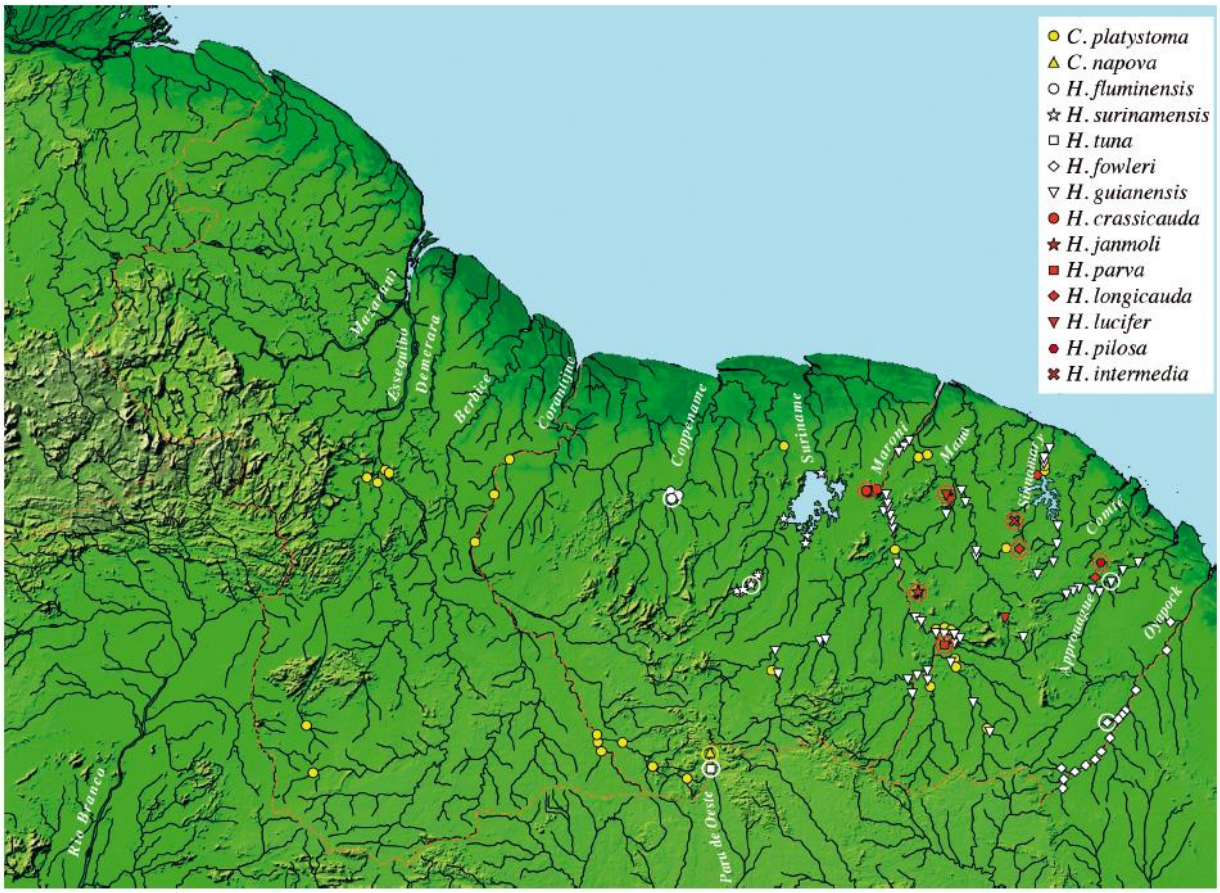


Figure 1 (part 2). Bayesian Inference tree reconstructed from concatenate sequences of 12S and 16S mitochondrial genes, *f-rtn4r* nuclear gene, COI mitochondrial gene, RAG1 nuclear gene and RAG2 nuclear gene. Numbers indicate posterior probabilities. Scale indicates the number of substitutions per site as expected by the model.

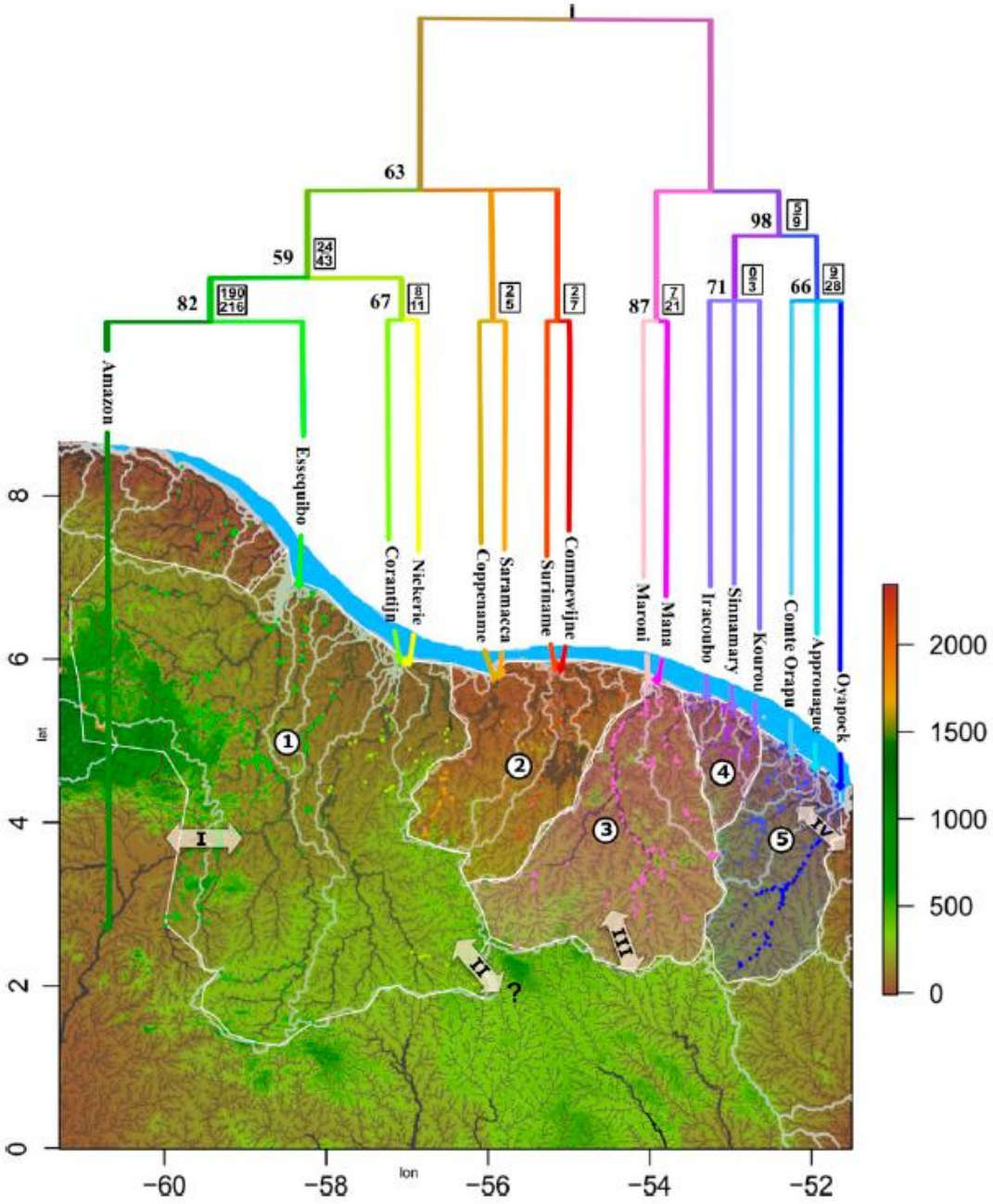
Appendix 1. The evolutionary history was inferred by using the Maximum Likelihood method and General Time Reversible model (NEI & KUMAR, 2000). The bootstrap consensus tree inferred from 1000 replicates (FELSENSTEIN, 1985) is taken to represent the evolutionary history of the taxa analyzed (FELSENSTEIN, 1985). Branches corresponding to partitions reproduced in less than 50% bootstrap replicates are collapsed. The percentage of replicate trees in which the associated taxa clustered together in the bootstrap test (1000 replicates) are shown next to the branches (FELSENSTEIN, 1985). Initial tree(s) for the heuristic search were obtained automatically by applying Neighbor-Join and BioNJ algorithms to a matrix of pairwise distances estimated using the Maximum Composite Likelihood (MCL) approach, and then selecting the topology with superior log likelihood value. A discrete Gamma distribution was used to model evolutionary rate differences among sites (5 categories (+G, parameter = 1.0166)). The rate variation model allowed for some sites to be evolutionarily invariable ([+I], 28.38% sites). This analysis involved 129 nucleotide sequences. All positions with less than 95% site coverage were eliminated, i.e., fewer than 5% alignment gaps, missing data, and ambiguous bases were allowed at any position (partial deletion option). There were a total of 4343 positions in the final dataset. Evolutionary analyses were conducted in MEGA X (KUMAR *et al*., 2018).



Annex 1. Geographic distribution of Guianese Harttiini; circled symbols refer to type localities. From Covain *et al*. (2012).



Annex 2. Partitioned Parsimony Analysis of Endemicity of the Guianas Rivers using three parsimony models and the Amazon as outgroup. From Lemopoulos & Covain (2019).



GENERAL CONCLUSION

The morphological phylogeny presented the chapter 1 recovers the monophyly of the subfamily Loricariinae, but nor the composition of the tribe Harttiini sensu Rapp Py-Daniel or the tribes Harttiini and Farlowellini sensu Londoño-Burbano & Reis (2021). The genus *Harttia*, the main purpose of this work, is recovered as polyphyletic, contrary to its monophyly supported in previous studies. The species of *Harttia* are recovered as lineages that evolved independently, with the species from southeastern Brazil diverging first, followed by the species from the Amazon basin and Guianas Shield. The phylogenetic positioning of *H. absaberi* indicates that the species probably belongs to a different lineage than its congeners, and *Cteniloricaria* as probably the same lineage of the other species of *Harttia*.

The molecular phylogeny presented in chapter 2 recovers the monophyly of the subfamily Loricariinae and also the tribe Harttiini, being the later composed of the genus *Harttiella*, *Harttia*, and *Cteniloricaria*, as indicated before by Covain *et al*. (2016) and Londoño-Burbano & Reis (2021). *Harttia* was also recovered polyphyletic, but the relationship among its species is better resolved, recovering three monophyletic groups well supported: one encompassing species from the right bank of the Amazon River plus *H. fowleri* (a Guiana Shield species); other with species from the Guiana Shield (sister group of *Cteniloricaria*); and another with species from the southeastern portion of the Brazilian Shield. As also indicated by the morphological phylogeny, *Cteniloricaria* Isbrücker & Nijssem, 1979 was recovered nested inside the species of *Harttia* Steindachner, 1877, and therefore is a probably junior synonym of the later. Unfortunately, the tissue samples we got from *Harttia absaberi* did not allow for DNA extraction or amplification, so, the positioning of that species in the molecular phylogeny remains open.

Thus, despite of presenting two phylogenetic reconstructions, we know that the evolutionary history of a group is only one, regardless of whether it is recovered through morphological or molecular data. In the future, we hope to continue investigating the evolutionary history of the genus *Harttia*, in order to propose a more cohesive hypothesis that includes molecular data from *H. absaberi* and the species from the left bank of the Amazon river, and also propose synapomorphies to diagnose the recovered groups, based on a better understand of the evolution of morphological features.

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UNIVERSIDADE ESTADUAL PAULISTA
"JÚLIO DE MESQUITA FILHO"
Campus de São José do Rio Preto

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