PONTIFÍCIA UNIVERSIDADE CATÓLICA DO RIO GRANDE DO SUL

FACULDADE DE BIOCIÊNCIAS

PROGRAMA DE PÓS-GRADUAÇÃO EM ZOOLOGIA

RELAÇÕES FILOGENÉTICAS DAS ESPÉCIES DA FAMÍLIA CALLICHTHYIDAE (OSTARIOPHYSI, SILURIFORMES)

Héctor Samuel Vera-Alcaraz

PONTIFÍCIA UNIVERSIDADE CATÓLICA DO RIO GRANDE DO SUL

Av. Ipiranga 6681 - Caixa Postal 1429

Fone: (051) 3320-3500 - Fax: (051) 339-1564

CEP 90619-900 Porto Alegre - RS

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Orientador: Dr. Roberto E. Reis

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SUMÁRIO

RELAÇÃO DE FIGURAS

RELAÇÃO DE TABELAS

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RESUMO

A filogenia da família Callichthyidae (Siluriformes) foi estudada realizando uma análise de Parcimônia Cladística sob uma abordagem de Evidência Total. Caracteres explorados foram principalmente baseados em osteologia e dados moleculares de genes nucleares e mitocondriais. O grupo interno incluiu 131 terminais representando 111 espécies; o grupo externo incluiu 13 terminais representando 13 espécies e incluindo *Copionodon* como o terminal de enraizamento da topologia. A análise filogenética resultou em 89 árvores mais parcimoniosas que foram resumidas em um cladograma de consenso estrito; com base nessa topologia, se propõe e discute uma nova classificação filogenética para Callichthyidae. A análise filogenética de Evidência Total corroborou o monofiletismo da família Callichthyidae, subfamílias Callichthyinae e Corydoradinae, gêneros *Callichthys*, *Dianema*, *Lepthoplosternum*, *Megalechis* e *Scleromystax*. No entanto, os gêneros *Aspidoras*, *Corydoras* e *Hoplosternum* foram recuperados não-monofiléticos. Para conciliar esta situação, se propõe a revalidação dos gêneros *Hoplisoma* e *Gastrodermus* para acomodar a maioria das espécies atualmente reconhecidas em *Corydoras*. *Aspidoras virgulatus* e *Corydoras lacerdai* foram transferidas para *Scleromystax* e assim conceber esses gêneros como monofiléticos. Por outro lado, as espécies de *Hoplosternum* foram recuperadas como parafiléticas. No entanto, decidiu-se não fazer mudanças taxonômicas no momento até concluir a coleta de dados moleculares para este grupo, o qual é reconhecido temporariamente como "*Hoplosternum*". Sinapomorfias para cada clado recuperado e proposto na classificação filogenética são aqui mostrados, enfatizando seus caracteres morfológicos diagnósticos. Inter-relações entre as espécies e clados são discutidas e comparadas com estudos taxonômicos e hipóteses filogenéticas anteriores. Adicionalmente, a taxonomia de *Hoplisoma nattereri* foi revisada a fim de elucidar sua sinonímia e investigar a presença de diversidade críptica sob este nome. *Hoplisoma nattereri* e *H. triseriatus* são consideradas espécies válidas. A distribuição geográfica para cada espécie é reportada. *Corydoras juquiaae* é removida da sinonímia de *Hoplisoma nattereri* e transferida para *Scleromystax juquiaae*, nova combinação. *Scleromystax prionotos* é considerada um sinônimo júnior de *S. juquiaae*. Todas estas espécies são ilustradas neste artigo. Também, a figura original de *Corydoras juquiaae* preparada, mas nunca publicada, por Rudolph von Ihering é aqui reproduzida. As relações filogenéticas de *Hoplisoma nattereri* e *H. triseriatus* foram discutidas como assim a sua morfometría e a distância genética de algumas das populações amostradas.

PHYLOGENETIC SYSTEMATICS OF ARMORED CATFISHES OF THE FAMILY CALLICHTHYIDAE (SILURIFORMES, LORICARIODEA)

ABSTRACT

The phylogeny of the family Callichthyidae (Siluriformes) was investigated performing a Cladistic parsimony analysis under a Total Evidence approach. Characters explored are mainly based in osteology and molecular data of nuclear and mitochondrial genes. The ingroup included 131 terminals representing 111 species, the outgroup included 13 terminals representing 13 species including *Copionodon* as the rooting taxa. The phylogenetic analysis resulted in 89 most parsimonious trees which are summarized in a strict consensus cladogram; a new phylogenetic classification and the discussion of this paper are addressed based in this topology. The Total Evidence phylogenetic analysis corroborated the monophyly of the family Callichthyidae, subfamilies Callichthyinae and Corydoradinae, genera *Callichthys*, *Dianema*, *Lepthoplosternum*, *Megalechis*, and *Scleromystax*. However, the genera *Aspidoras*, *Corydoras*, and *Hoplosternum* are recovered non-monophyletic. To reconcile this situation, a revalidation of the genera *Hoplisoma* and *Gastrodermus* is proposed to accommodate most species currently recognized in *Corydoras*. *Aspidoras virgulatus* and *Corydoras lacerdai* are transferred to *Scleromystax* to conceive their currently containing genera monophyletic. On the other hand, *Hoplosternum* is recovered paraphyletic. However, it was decided to hold making taxonomic changes at this moment until molecular dataset is completed for this genus, which is referred temporarily as "*Hoplosternum*". Synapomorphies for each clade recovered and ranked in the phylogenetic classification are reported here, emphasizing their morphological diagnoses. Interrelationships between species and clades are discussed and compared with previous taxonomic and phylogenetic hypotheses. In addition, the taxonomy of *Hoplisoma nattereri* was reviewed in order to elucidate its synonymy and investigate the presence of cryptic diversity under this name. *Hoplisoma nattereri* and *H. triseriatus* are considered valid species. Geographic distribution for each species is also reported. *Corydoras juquiaae* is removed from the synonymy of *Hoplisoma nattereri* and transferred to *Scleromystax juquiaae*, new combination. *Scleromystax prionotos* is considered a junior synonym of *S. juquiaae*. All these species are illustrated in this paper. In addition, the original figure of *S. juquiaae* prepared but never published by Rudolph von Ihering is reproduced here. Phylogenetic relationships of *Hoplisoma nattereri* and *H. triseriatus* are discussed and also the morphometric and genetic distance of some of the populations sampled.

APRESENTAÇÃO

Diversidade de Callichthyidae

Os representantes da família Callichthyidae são bagres neotropicais facilmente reconhecidos por apresentar o corpo coberto por duas series de placas dérmicas (Bonaparte, 1838). Outros caracteres diagnósticos são: dentes pequenos ou totalmente ausentes (Günther, 1864); bexiga natatória aberta externamente mediante aberturas parciais no pterótico composto (Eigenmann & Eigenmann, 1890); serie infraorbital exposta externamente como ossos laminares, com expansões internas que dão suporte aos olhos (Regan, 1911); serie infraorbital reduzida a dois ossos, linha lateral do corpo reduzida com um até seis canais tubulares, cintura peitoral com o cleitro e escapulo-coracoides suturados nos processos posteriores (Reis, 1998).

Representantes desta família são chamados comumente de “tamuatás” ou “cascudos” devido às placas que cobrem seu corpo. A área de distribuição da família ocupa desde o Panamá até a Argentina, incluindo os rios do Golfo de Panamá, rios Atrato e Magdalena, bacias dos rios Orinoco, Amazonas, Tocantins, São Francisco, La Plata, Ilha de Trinidad e Tobago, e rios costeiros do Atlântico desde as Guianas até os tributários da Laguna Merín no Uruguai.

Os peixes desta família são pequenos ou de tamanho médio, com indivíduos que atingem aproximadamente desde 21 mm (ex. *Corydoras hastatus* Eigenmann & Eigenmann, 1888 ou *C. pygmaeus* Knaack, 1966) até 196 mm de comprimento padrão [ex. *Hoplosternum littorale* (Hancock, 1828)]. Os tamuatás geralmente são peixes de fundo, mas alguns representantes como *Dianema*, *Corydoras hastatus*, e *C. pygmaeus* nadam na coluna de água (Burgess, 1989). A importância econômica destes peixes como carne de consumo humano é escassa, unicamente tendo destaque *Hoplosternum* na pesca artesanal de subsistência. Não obstante, são bastante populares na aquariofilia tendo especial destaque os representantes do gênero *Corydoras*.

Taxonomia atual de Callichthyidae

Os representantes da família Callichthyidae constituem atualmente 200 espécies válidas classificadas em duas subfamílias. Os gêneros atualmente reconhecidos detalhando o numero total de espécies validas para cada um são: *Aspidoras* (20 espécies), *Callichthys* (quatro espécies), *Corydoras* (159 espécies incluindo uma extinta), *Dianema* (duas espécies), *Hoplosternum* (três espécies), *Lepthoplosternum* (seis espécies), *Megalechis* (duas espécies), e *Scleromystax* (quatro espécies) (Reis, 1998; Britto, 2003; Reis, 2003; Ferraris, 2007; Knaack, 2007; Britto *et al*., 2007, Britto *et al*., 2009; Calviño & Alonso, 2010; Tencatt *et al*., 2013).

A continuação se apresenta a classificação taxonômica atual da família, veja a Tabela 1 para uma lista detalhada dos gêneros incluindo nomes sinônimos e espécies tipo.

Família Callichthyidae Bonaparte, 1838

Subfamília Callichthyinae Bonaparte, 1838

Callichthys Scopoli, 1777

Lepthoplosternum Reis, 1997

Megalechis Reis, 1997

Dianema Cope, 1871

Hoplosternum Gill, 1858

Subfamília Corydoradinae Hoedeman, 1952

Tribo Corydoradini Hoedeman, 1952

Corydoras La Cépède, 1803

Tribo Aspidoradini Hoedeman, 1952

Aspidoras Ihering, 1907

Scleromystax Günther, 1864

Sistemática de Callichthyidae

Reis (1998) examinou as relações filogenéticas da família Callichthyidae incluindo todos os gêneros e alguns grupos de espécies, totalizando 10 representantes no grupo interno. A análise baseada em 72 caracteres principalmente morfológicos resultou numa única arvore mais parcimoniosa, que corroborou o monofiletismo da família, das subfamílias Callichthyinae e Corydoradinae, e de todos os gêneros reconhecidos como válidos nessa data exceto *Corydoras*.

As relações filogenéticas de Corydoradinae foram estudadas por Britto (2003), quem corroborou o monofiletismo da subfamília, a divisão desta nas tribos Aspidoradini e Corydoradini, e o não-monofiletismo do gênero *Corydoras*. Este autor encontrou alguns representantes de *Corydoras* mais relacionados com *Aspidoras* e outros mais relacionados com *Brochis*. Para resolver esta situação propôs uma nova classificação ressuscitando o gênero *Scleromystax* para alocar algumas espécies de *Corydoras* e sinonimizando o gênero *Brochis* a *Corydoras*. Neste estudo foram examinadas 63 espécies no grupo interno, que incluiu três espécies de *Scleromystax*, sete de *Aspidoras*, e 52 de *Corydoras* (incluindo *Brochis*), além de serem levantados 83 caracteres principalmente morfológicos. A análise resultou num total de 1,403 árvores mais parcimoniosas que foram sumarizadas num cladograma de consenso estrito. Em base a essa topologia, é possível observar que as relações dos Corydoradini foram pobremente resolvidas, sendo que um dos agrupamentos resultou numa grande politomia que contêm 15 espécies e seis clados monofiléticos.

Shimabukuro-Dias *et al*. (2004) examinaram as relações filogenéticas da família mediante uma análise molecular de sequências parciais dos genes mitocondriais *12S rRNA*, *16S rRNA*, e *ND4* ARNt *ser* e sequências completas do ARNt *his*. O grupo interno estava formado por 24 representantes que incluíam 11 espécies de *Corydoras*, três *Scleromystax*, duas *Aspidoras*, duas *Dianema*, um *Hoplosternum*, um *Callichthys*, duas *Lepthoplosternum*, e duas *Megalechis*. Os dados moleculares foram analisados pelos métodos de Máxima Parcimônia (MP) e Máxima Verossimilhança (ML). Estas análises evidenciaram resultados similares entre elas, os quais corroboraram o monofiletismo da família e das subfamílias como foi sugerido previamente pelos estudos morfológicos. Não obstante, as relações entre os gêneros resultaram diferentes a aqueles sugeridos por Reis (1998) e Britto (2003).

Alexandrou *et al*. (2011) estudou a estrutura de comunidades das espécies de Corydoradinae e elaborou uma filogenia molecular para determinar a homologia dos padrões de coloração entre as diferentes linhagens. Estes autores identificaram a presença de nove grandes linhagens e concluíram que grande parte dos casos de padrão de coloração compartilhada são resultados de convergências. Eles realizaram diferentes análises filogenéticas usando sequências mitocondriais (*12S rRNA*, *16S rRNA*, *ND4*, *Cytb*) e sequências nucleares (*Rag1* e *F-Reticulon 4*) de 425 terminais que representaram aproximadamente 226 espécies. Não obstante, este estudo foi baseado principalmente nos dados mitocondriais analisados mediante Máxima Verossimilhança. Estes autores reportaram o gênero *Corydoras* como polifilético, sendo um grande agrupamento de *Corydoras* irmão de *Scleromystax*, este clado irmão de *Aspidoras*, e este clado irmão de um pequeno agrupamento de *Corydoras*.

Objetivos da tese

O objetivo principal da tese consistiu em estudar as relações filogenéticas a nível específico da família Callichthyidae baseadas no estudo de caracteres anatômicos e caracteres moleculares. O método Cladístico foi escolhido sob uma abordagem de Evidência Total. Caracteres fenotípicos previamente propostos por Reis (1998) e Britto (2003) foram re-avaliados em base aos terminais aqui analisados e novos caracteres foram procurados durante esta análise. Os genes explorados por Shimabukuru-Dias *et al*. (2004) e Alexandrou *et al*. (2011) foram incluídas na análise gerando novas sequências para os terminais aqui analisados. Dados disponíveis no GenBank gerados por estes autores foram utilizados para os *voucher* aqui analisados. Uma análise filogenética exaustiva que examine simultaneamente a maioria das sinapomorfias morfológicas atualmente propostas para as subfamílias Callichthyinae e Corydoradinae é ainda necessária. A mesma situação acontece para os dados moleculares. Além disto, estudos filogenéticos prévios são incongruentes nos arranjos genéricos e específicos propostos, demonstrando ser necessária uma nova análise tentando explicar as evidências disponíveis no momento.

O estudo taxonômico de *Corydoras nattereri* Steindachner, 1876 também foi abordado durante a tese. Uma análise previa dos sinônimos desta espécie indicou como necessária uma reavaliação destas sinonímias. Além disso, esta espécie apresenta uma distribuição ampla no Brasil e a presença de diversidade críptica sob este nome foi analisada. Com base nestas considerações e na análise filogenética principal foram realizadas a análise dos espécimes tipo dos nomes atualmente sinônimos, estudo morfológico, merístico, e de distância genética das populações amostradas.

Estrutura formal da tese

Esta tese esta estruturada no formato básico de artigos científicos, formato recomendado pelo Programa de Pós-graduação em Biociências da PUCRS. Dois artigos são apresentados como capítulos independentes e redigidos em inglês. Os artigos foram preparados de acordo às normas para submissão à Neotropical Ichthyology, revista da Sociedade Brasileira de Ictiologia. As instruções para submissão de artigos a este jornal foram fornecidas aos membros da banca de avaliação como documentos separados à tese. No final da tese são apresentadas as conclusões gerais de ambos os capítulos.

Capítulo I: **Phylogenetic systematics of armored catfishes of the family Callichthyidae (Siluriformes, Loricariodea)**

Este capítulo reporta os resultados do estudo da filogenia de Callichthyidae em base a uma análise Cladística sob uma abordagem de Evidência Total. Foram avaliados caracteres morfológicos, principalmente osteologia, e caracteres moleculares, incluindo genes nucleares e mitocondriais. Todos os caracteres morfológicos foram descritos no texto, e alguns deles ilustrados em base a fotografias. A matriz morfológica foi apresentada como tabela anexa, assim também todo o material analisado e a lista das transformações dos estados de caráter para cada nó recuperado. Resultados da análise filogenética foram sumarizados em um cladograma de consenso estrito. Em base a estes resultados, foi proposta uma nova classificação taxonômica para a família Callichthyidae. Sinapomorfias para cada táxon arranjado nessa classificação foram reportadas dando ênfase nos caracteres morfológicos diagnósticos. Estes resultados foram discutidos e comparados com estudos taxonômicos e filogenéticos prévios.

Capitulo II: **Taxonomic review of *Hoplisoma nattereri* Steindachner, 1876 (Siluriformes: Callichthyidae)**

Este capítulo reporta os resultados do estudo da taxonomia de *Hoplisoma nattereri* com base na análise filogenética prévia, estudo morfológico externo e interno, análise morfométrica e merística, e análise de distância genética das populações amostradas. Como resultado deste estudo se reconhece *Hoplisoma nattereri* (Steindachner, 1876) e *H. triseriatus* (Ihering, 1911) como espécies válidas. Estas espécies foram diagnosticadas, descritas, e ilustradas. Resultados das análises morfométricas e de distância genética foram reportadas na forma de tabelas e gráficos. A espécie *Corydoras juquiaae* Ihering, 1907 foi removida da sinonímia de *Hoplisoma nattereri* e transferida para o gênero *Scleromystax*. *Corydoras prionotos* Nijssen & Isbrücker, 1980 foi considerada como sinônimo júnior de *Scleromystax juquiaae* (Ihering, 1907), nova combinação.

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CHAPTER I:

Phylogenetic systematics of armored catfishes of the family Callichthyidae (Siluriformes, Loricariodea)

The phylogeny of the family Callichthyidae is investigated performing a Cladistic parsimony analysis under a Total Evidence approach. Characters explored are mainly based in osteology and molecular data; it additionally includes characters related to external morphology, soft organs, coloration pattern, and behavior allied to swimming and reproduction. Molecular data analyzed include one nuclear (*Rag1*) and four mitochondrial (*12S rRNA*, *16S rRNA*, *ND4*, and *Cytb*) genes. The ingroup included 131 terminals representing 111 species; the outgroup included 13 terminals representing 13 species and including *Copionodon* as the rooting taxa. The phylogenetic analysis resulted in 89 most parsimonious trees which are summarized in a strict consensus cladogram; discussion and phylogenetic classification are addressed based in this topology. The Total Evidence phylogenetic analysis corroborated the monophyly of the family Callichthyidae, subfamilies Callichthyinae and Corydoradinae, genera *Callichthys*, *Dianema*, *Lepthoplosternum*, *Megalechis*, and *Scleromystax*. However, the genera *Aspidoras*, *Corydoras*, and *Hoplosternum* are recovered non-monophyletic. To reconcile this situation, a revalidation of the genera *Hoplisoma* and *Gastrodermus* is proposed to accommodate most species currently recognized in *Corydoras*. *Aspidoras virgulatus* and *Corydoras lacerdai* are transferred to *Scleromystax* to conceive their currently containing genera monophyletic. On the other hand, *Hoplosternum* is recovered paraphyletic. However, it is decided to hold making taxonomic changes at this moment until molecular dataset is completed for this genus, which is referred temporarily as “*Hoplosternum*”. Applying these modifications, interrelationships indicate that the newly restricted *Corydoras* is the sister group of remaining corydoradines. *Aspidoras* and *Scleromystax* are sister taxa, both close allied to *Hoplisoma*, and this clade sister to *Gastrodermus*. *Hoplisoma* is the largest clade among Corydoradinae; it contains the highest diversity of the group related to body forms and number of species. Two major groups are recovered among callichthyines and ranked with a tribe status, Callichthyini and Hoplosternini. Among the Callichthyini, *Callichthys* is the sister group of *Lepthoplosternum* plus *Megalechis*. Hoplosternini contains "*Hoplosternum*" and *Dianema*. Synapomorphies for each clade recovered and ranked in the phylogenetic classification are reported here, emphasizing their morphological diagnoses. Interrelationships between species and clades are discussed and compared with previous taxonomic and phylogenetic hypotheses.

A filogenia da família Callichthyidae foi estudada realizando uma análise de Parcimônia Cladística sob uma abordagem de Evidência Total. Caracteres explorados foram principalmente baseados em osteologia e dados moleculares, mas ainda incluiu caracteres relacionados à morfologia externa, órgãos moles, padrão de coloração, e comportamento aliado à natação e reprodução. Dados moleculares incluiram fragmentos de um gene nuclear (*Rag1*) e fragmentos de quatro genes mitocondriais (*12S rRNA*, *16S rRNA*, *ND4* e *Cytb*). O grupo interno incluiu 131 terminais representando 111 espécies; o grupo externo incluiu 13 terminais representando 13 espécies e incluindo *Copionodon* como o terminal de enraizamento da topologia. A análise filogenética resultou em 89 árvores mais parcimoniosas que foram resumidas em um cladograma de consenso estrito; com base nessa topologia, foi proposta e discutida uma nova classificação filogenética para Callichthyidae. A análise filogenética de Evidência Total corroborou o monofiletismo da família Callichthyidae, subfamílias Callichthyinae e Corydoradinae, gêneros *Callichthys*, *Dianema*, *Lepthoplosternum*, *Megalechis* e *Scleromystax*. No entanto, os gêneros *Aspidoras*, *Corydoras* e *Hoplosternum* foram recuperados não-monofiléticos. Para conciliar esta situação, se propõe a revalidação dos gêneros *Hoplisoma* e *Gastrodermus* para acomodar a maioria das espécies atualmente reconhecidas em *Corydoras*. *Aspidoras virgulatus* e *Corydoras lacerdai* foram transferidas para *Scleromystax* e assim conceber esses gêneros como monofiléticos. Por outro lado, *Hoplosternum* foi recuperado como parafilético. No entanto, decidiu-se não fazer mudanças taxonômicas no momento até concluir a coleta de dados moleculares para este grupo, o qual é reconhecido temporariamente como "*Hoplosternum*". Aplicando as modificações taxonômicas, as inter-relações indicaram que o recém-restrito *Corydoras* é o grupo irmão dos restantes corydoradines. *Aspidoras* e *Scleromystax* são táxons irmãos, ambos próximos à *Hoplisoma*, e todo este clado irmão de *Gastrodermus*. *Hoplisoma* é o maior clado dos Corydoradinae, o qual contém a maior diversidade do grupo referente à forma corporal e número de espécies. Dois grandes grupos foram recuperados em Callichthyinae e classificados com o *status* tribo, Callichthyini e Hoplosternini. Entre os Callichthyini, *Callichthys* é o grupo irmão de *Lepthoplosternum* mais *Megalechis*. Hoplosternini contém "*Hoplosternum*" e *Dianema*. Sinapomorfias para cada clado recuperado e proposto na classificação filogenética são aqui relatados, enfatizando seus caracteres morfológicos diagnósticos. Inter-relações entre as espécies e clados são discutidas e comparadas com estudos taxonômicos e hipóteses filogenéticas anteriores.

Key words: Morphological characters, molecular characters, Parsimony, Total Evidence, *Corydoras*.

Introduction

Catfish diversity

The Siluriformes Cuvier, 1816 is a group of ostariophysian fishes of cosmopolitan geographic distribution; the diversity of this order attains more than 3,000 valid species arranged into 36 families, being most of their representatives primarily from freshwater environments, and some from estuarine and marine environments (Ferraris, 2007). Among the Siluriformes, the superfamily Loricarioidea Rafinesque, 1815 is composed of about 1,300 species, which is nearly 40% of all catfishes of the world, and constitutes a monophyletic clade formed by the Nematogenyidae Bleeker, 1862; Trichomycteridae Bleeker, 1858; Callichthyidae Bonaparte, 1838; Scoloplacidae Bailey & Baskin, 1976; Loricariidae Rafinesque, 1815; and Astroblepidae Bleeker, 1862. The monophyly of this superfamily was proposed by the studies of Howes (1983), Schaefer (1990), de Pinna (1998), and Diogo (2004) based in the analysis of anatomical data, and from the studies of Hardman (2005) and Sullivan *et al*. (2006) based in the analysis of molecular data, mitochondrial and nuclear respectively. A cladogram showing the interrelationships of the Loricarioidea are shown on Fig. 1. According to Diogo (2004), some of the synapomorphies supporting this clade are: angulo-articular little exposed laterally, covered by postero-lateral expansions of the dentary (character 408); and dermal odontodes present on body (character 437).

Armored catfish diversity

Armored catfishes of the family Callichthyidae currently comprise 200 valid species arranged in two subfamilies and eighth genera: a) Callichthyinae: *Callichthys* (four species), *Dianema* (two species), *Hoplosternum* (three species), *Lepthoplosternum* (six species), *Megalechis* (two species), and b) Corydoradinae: *Aspidoras* (20 species), *Corydoras* (159 species, including one fossil), and *Scleromystax* (four species) (Reis, 1998a; Britto, 2003; Reis, 2003; Ferraris, 2007; Knaack, 2007; Britto *et al*., 2007, Britto *et al*., 2009; Calviño & Alonso, 2010; Tencatt *et al*., 2013). Callichthyids were recognized as a natural group since early fish classifications by having two series of dermal plates covering each lateral side of the body (Bonaparte, 1838). The taxonomic arrangement with a family status for the callichthyids was first established by Bleeker (1862), and subsequent ichthyologist added the following external characters to its distinction: teeth minute or entirely absent (Günther, 1864); air bladder externally opened by means of slits in the compound pterotic (Eigenmann & Eigenmann, 1890); infraorbital series externally exposed as laminar bones, with inner expansions supporting the eyes (Regan, 1911); infraorbital series reduced to two bones, lateral line of the body reduced to one to six canals, and pectoral girdle with the cleithrum and scapulocoracoids sutured on its posterior processes (Reis, 1998).

Callichthyids are Neotropical fishes distributed from Panama to Argentina, with the exception of Chile. These fishes inhabit the main South American river systems: Orinoco, Amazonas, Tocantins, São Francisco, and La Plata. Rivers draining to the Pacific Ocean in Panama. The Atrato and Magdalena rivers which drain to the Caribbean Sea in Colombia. Rivers from Trinidad and Tobago. Coastal rivers draining to the Atlantic Ocean from the Guiana shield to the tributaries to the Laguna Merín in Uruguay. Representative species are small to medium sized fishes with specimens ranging from 20 mm (*Corydoras hastatus*) to 200 mm (*Hoplosternum* *littorale*) in total length. These fishes are of little economic importance as a human resource food, *Hoplosternum* being only used in the wild fisheries. However, their popularity is noticeable in the aquarium trade, which is largely based in the use of *Corydoras* species.

Armored catfishes are usually bottom dweller fishes, but some representatives swim in the water column (*Dianema*, *Corydoras hastatus*, and *C. pygmaeus*) (Burgess, 1989). The segregation in Müllerian mimetic communities is known among several Corydoradinae species belonging to evolutionarily distinct lineages, with the exception of *Aspidoras* species, and frequently found between species of *Corydoras* displaying short, intermediate, and long snouts which present dietary resource partitioning (Alexandrou *et al*., 2011). Members of the Callichthyinae have reproductive behavior involving parental care, it consist in the construction of floating foam nests and vegetable materials and the protection of the nest and later fry by the male (Hoedeman, 1952). Members of the Corydoradinae also present reproductive behavior involving a previous complex mating procedure. Nijssen (1970) described this process for the *Corydoras* species, where males swim around the female striking her body with their snout, afterwards one of the males pinches the head of the female with his pectoral spines and the female purses her ventral fins together to catch the fertilized eggs. Finally, the female place her adhesive eggs on leaves and the bottom substrate. According to fossil estimations of the age of †*Corydoras revelatus* was hypothesized that the lineage containing *Aspidoras* and *Corydoras* groups was already differentiated by the late Paleocene, about 58.5 million years ago (Reis, 1998b).

Armored catfish taxonomy

I will mention briefly some taxonomic publications regarding the Callichthyidae, for a more extended summary see Britto (2003). The Table 1 lists the currently valid genera with their synonymies. Ellis (1913) summarized a list with 10 genera and 51 species known by that date, identification keys for *Corydoras* and *Decapogon*, photographs and drawings for some species. Gosline (1940) compiled 43 species in nine genera, provided schematic drawings of the different kinds of mouth barbels in the family, proposed a phylogenetic hypothesis about its generic interrelationships, generic identification key, generic synonymy list, and identification key for the species of *Brochis*, *Corydoras*, *Dianema*, and *Hoplosternum*. Hoedeman (1952) proposed suprageneric arrangements for the family, establishing two subfamilies and five tribes: Callichthyinae: Callichthyini (containing *Callichthys* and *Hoplosternum*), Cascadurini (containing *Cascadura*), Dianemini (containing *Dianema* and *Cataphractops*); and Corydoradinae: Aspidoradini (containing *Aspidoras*) and Corydoradini (containing *Corydoras* and *Brochis*). This author also presented an identification key for his new taxonomic arrangement, description, and synonymy list for the species of *Callichthys* and *Hoplosternum*. Miranda Ribeiro (1959) proposed the subfamily Hoplosterninae (containing *Hoplosternum*). Nijssen (1970) revised the *Corydoras* species from Suriname, including original descriptions and drawings of 16 species, commentaries about some taxonomic characters and species groups, biogeography, ecology, and ethology. Other revisionary studies were done by Nijssen & Isbrücker (1980, 1983, 1986), which included neotype and lectotype designations, validity of several species previously recognized as synonyms, and the original description of several species (more than 30% of the *Corydoras* species were described by these or one of these authors); they also proposed phenetic groupings, identification keys, photographs, and drawings of several species including their characteristic structures. Nijssen & Isbrücker (1970) revised the genus *Brochis*, including original descriptions, drawings, and a synonymy list. Nijssen & Isbrücker (1976) revised the genus *Aspidoras*, including descriptions, photographs, and identification key for 13 species. Reis (1997) revised the genus *Hoplosternum*, proposed as new genera *Lepthoplosternum* and *Megalechis*, including descriptions, photographs, and identification key for the species of Callichthyinae.

Armored catfish systematics

Hypotheses about phylogenetic relationships using explicit phylogenetic methods regarding the Callichthyidae and related taxa started with Schaefer (1990), who performed a phlylogenetic analysis of the Scoloplacidae and some Loricariodea establishing Nematogenyidae and Trichomycteridae unresolved a priori and also as rooting taxa. This author proposed Callichthyidae as the sister group of a clade composed of (Scoloplacidae (Astroblepidae + Loricariidae)), and found as an autapomorphic character for the Callichthyidae that the *adductor mandibulae* is subdivided in two portions, one of them with antero-dorsal fibers approaching the premaxilla but not directly inserted to it (character 62).

Reis (1998a) examined the phylogenetic relationships of the family Callichthyidae including all valid genera known by that date and three species of *Hoplosternum*, totaling 10 terminals in the ingroup. The analysis was based in 72 anatomical characters, mainly osteological, which resulted in a single most parsimonious tree that proposed as monophyletic clades the Callichthyinae and Corydoradinae, and also all genera with the exception of *Corydoras*. This author also presented a detailed description of the osteology of *Callichthys callichthys* in comparison with remaining genera of the family. This study proposed 28 synapomorphic characters for the Callichthyidae, 12 synapomorphic characters for the Callichthyinae, and 14 synapomorphic characters for the Corydoradinae; Fig. 2a shows the resulting cladogram. Reis (1998b) proposed the phylogenetic relationships of the genus *Lepthoplosternum* based in the analysis of six morphological characters; the resulting cladogram is shown on Fig. 2b.

Britto (2003) studied the phylogenetic relationships of the Corydoradinae, who corroborated the monophyly of the subfamily, tribes Aspidoradini and Corydoradini, and the paraphyly of the genus *Corydoras*. This author also proposed some *Corydoras* species to be more closely related to *Aspidoras*, and other *Corydoras* species more closely related to *Brochis*. To solve this situation the author proposed a new classification, which included the revalidation of the genus *Scleromystax* to allocate some *Corydoras* species and the synonymizing of *Brochis* to *Corydoras*. This study examined 63 species in the ingroup, which included three *Scleromystax*, seven *Aspidoras*, and 52 *Corydoras* (incluinding *Brochis*) species, and examined 83 morphological characters, mainly osteological. This analysis resulted in 1,403 most parsimonious trees, where 25 synapomorphies support the monophyly of the subfamily, five synaphomorphies for Aspidoradini, and four synaphomorphies for Corydoradini. The Fig. 3 shows the strict consensus of the resulted cladograms, where one of the Corydoradini clades were poorly resolved in a polytomy of 15 species and six monophyletic clades.

Shimabukuro-Dias *et al*. (2004) studied the phylogenetic relationships of the Callichthyidae based on the analysis of molecular data of sequences of mitochondrial genes *12S rRNA*, *16S rRNA*, and *ND4*. The ingroup was formed by 24 species, which included 11 *Corydoras*, three *Scleromystax*, two *Aspidoras*, two *Dianema*, one *Hoplosternum*, one *Callichthys*, two *Lepthoplosternum*, and two

Megalechis species. The molecular data was analyzed employing the maximum likelihood method with GTR (Fig. 4a) and HKY85 (Fig. 4b) models, and employing the parsimony method (Fig. 5a). These three analyses resulted in cladograms with similar generic arrangements and corroborated the monophyly of the Callichthyidae, Callichthyinae, and Corydoradinae. However, the interrelationships among the *Corydoras* species were not congruent in those three analyses. These authors also performed a combined analysis of their molecular data with the anatomical data of Reis (1998a). The combined analysis was performed employing the parsimony method with three types of datasets: equally weighted morphological and molecular data (Fig. 5b), morphological data five times heavier than molecular data, and morphological data ten times heavier than molecular data. Equally weighted result was highly similar to those obtained by the molecular data alone. However, the results of the differential weighting approach changed drastically from those obtained by the molecular data alone, but remain different from the morphology topology obtained by Reis (1998a) in the case of the callichthyines.

Alexandrou *et al*. (2011) studied the community structure of the Corydoradinae species and constructed a molecular phylogeny in order to determine the homology of color pattern among distinct clades. These authors identified the existence of nine major lineages among the Corydoradinae and proposed that most cases of shared coloration pattern are the result of convergences. They performed different phylogenetic analyses using sequences of mitochondrial (*12S rRNA*, *16S rRNA*, *ND4*, and *Cytb*) and nuclear genes (*Rag1* and *F-Reticulon 4*) of 425 terminals that represent about 226 species. This study relayed primarily on the mitochondrial dataset alone of 2,668 base pairs analyzed under maximum likelihood using GTR+G and GTR+I+G models; the phylogram pruned to 221 terminals is shown on Figs. 6 and 7. This result was compared with topologies obtained by maximum likelihood and Bayesian inference using different combination of datasets.

The main objective of this paper is to investigate the phylogenetic relationships of the Callichthyidae in order to arrange the species analyzed in a phylogenetic system. A comprehensive phylogenetic analysis that examines simultaneously most of the morphological synapomorphies already proposed for the callichthyines and corydoradines is still lacking for the family. The same situation involves the molecular data. Moreover, previous phylogenetic studies are incongruent in the generic and species arrangements among the Callichthyidae. The phylogenetic study performed by Reis (1998a) based in the analysis of anatomical data suggest *Callichthys* as the sister group of remaining callichthyines composed by (*Lepthoplosternum* (*Megalechis* (*Dianema* + *Hoplosternum*))). However, phylogenies based in the analysis of molecular data performed by Shimabukuru-Dias *et al*. (2004) suggest *Lepthoplosternum* as paraphyletic and *Dianema* as the primitive taxa sister group of (*Hoplosternum* (*Callichthys* (*Lepthoplosternum tordilho* (*L. altamazonicum* + *Megalechis*)))). A similar situation was found among the Corydoradinae. The phylogenetic study performed by Britto (2003) based in the analysis of anatomical data suggest *Corydoras* as a large monophyletic clade and the following arrangement for the corydoradines: (*Corydoras* (*Aspidoras* + *Scleromystax*)). However, phylogenies based in the analysis of molecular data performed by Shimabukuru-Dias *et al*. (2004) suggest *Scleromystax* as paraphyletic and the following arrangement for the corydoradines: ((*Scleromystax* + *Corydoras*) (*Aspidoras* (*A. poecilus* + *S. macropterus*)). A combined analysis using anatomical and molecular data were also performed by Shimabukuru-Dias *et al*. (2004) and similar results to those based in the analysis of molecular data alone were found. Notwithstanding, changes in the topology arrangement for the callichthyines were found only when morphology data was treated as five or ten times heavier than molecular data, and these results were proximate but not the same to those found by morphology alone. The molecular phylogeny of the Corydoradinae performed by Alexandrou *et al*. (2011) also suggest discordant arrangements with previous phylogenies, proposing *Corydoras* as polyphyletic and the following topology for the corydoradines: (small *Corydoras* clade (*Aspidoras* (*Scleromystax* + large *Corydoras* clade))). All these issues are addressed in this work under a Total Evidence approach.

Material and Methods

Phylogenetic inference method

The objectives of phylogenetic systematics are the investigation of the appropriate degrees of phylogenetic relationship within a given group of species and the expression of the results of this research in the form of diagrams of phylogenetic trees, naming of monophyletic groups, and the arrangement of species in a phylogenetic system (Hennig, 1965). In the evolutionary system, the objective is to place organisms in such a way as to describe their patristic and cladistic relationships as completely as possible (Farris, 1967). According to this author, phylogenetic hypotheses are compound explanations of patristic relationships (changes in characters along the phyletic line connecting terminals) and cladistic relationships (cladogenetic events or splitting along the phyletic line connecting terminals). Therefore, we must choose a method to achieve those objectives. In Evolutionary Biology is common the practice of two kinds of methods, those relying in character congruence (Cladistic parsimony) and those relying in models (Maximum likelihood and Bayesian inference). The phylogenetic method favored in this Dissertation thesis is Cladistic parsimony and classification and interrelationships of the Callichthyidae are formulated and discussed on the resulting cladograms of this phylogenetic inference method.

Cladistic parsimony is a research program that attempts to maximize the scientific principles of explanatory power and severity of the test. Most parsimonious hypotheses are achieved by minimizing the patristic events in the topology with the solely background knowledge of descent with modification and avoiding the addition of auxiliary claims to explain these hypotheses (Kluge & Grant, 2006). According to these authors, cladistic parsimony maximizes explanatory power by appealing to the anti-superfluity principle. Statistical approaches to phylogenetic inference (Likelihood and Bayesian) require evolutionary models, an additional parameter that amounts to the superfluity of the method. Differential weighted-parsimony methods also suffer from superfluity by requiring additional assumptions about the importance of some classes of data in the expense of other data from the character matrix. By requiring counterfactual and unnecessary additional parameters or assumptions to the background knowledge these methods render as explanatorily superfluous and thus have a decreased explanatory power. The cladistic analysis applied here is under a Character congruence or Total evidence approach as proposed by Kluge (1989). According to this author, each synapomorphy of the character matrix is assumed to count as a separate piece of evidence which has the potential to confirm, or disconfirm, phylogenetic relationships independent of all other synapomorphies considered. Preference for a total evidence method relies in its ability to implement the scientific principle of severity of the test. Kluge (1997) explored cladistics in terms of Popperian testability and concluded that the resultant hypothesis of a simultaneous analysis of all available relevant evidence (the multiple tests) is less probable, and accordingly more severe, than an analysis of partitioned evidence (some of the test or component test).

Ingroup Selection

Selection of the ingroup taxa intended to include most of the diversity currently known for the Callichthyidae. For the Callichthyinae 17 terminals representing 16 species were included in the analysis (17 current valid species are known). However, the diversity of the Corydoradinae is higher, 183 current valid species are known for this subfamily where most of its diversity is concentrated in the genus *Corydoras* (the largest siluriform genus with 159 current valid species, including one fossil). Considering this high diversity and the limitations of time and resources of this research, selection of terminals is driven attempting to explore most of the morphological diversity of this subfamily, especially within *Corydoras* species. Priority are given to terminals having available both tissue samples and cleared and stained material. The phylogenetic analysis included 131 terminals in the ingroup, representing 111 species composed of 10 *Aspidoras*, three *Callichthys*, 81 *Corydoras*, two *Dianema*, three *Hoplosternum*, six *Lepthoplosternum*, two *Megalechis*, and four *Scleromystax*.

Outgroup Selection

The application of cladistic parsimony with inclusion of the outgroup roots the topology and polarize the transformation series. According to Farris (1982): “As parsimony analysis attributes character states to the hypothetical stem species of the tree, fixing the position of the root determines the direction of character transformations, and so the relative plesiomorphy of feature". Outgroup members are selected on the basis of possession of more inclusive synapomorphies shared with the ingroup, and the unconstrained analysis of these terminals test the monophyly of the ingroup (Nixon & Carpenter, 1993). Accordingly, more inclusive synapomorphies are found in the closest relative members of the ingroup. Comparison between ingroup and outgroup helps delimitation of the character-states of the transformation series here proposed, and the optimization of these characters in the final topology determines the patristic and cladistic relationships.

Selection of the outgroup taxa is based following papers dealing with phylogenetic analyses within Loricarioidea. According to the phylogenetic analyses of Diogo (2004, see Fig. 1a) and Sullivan *et al*. (2006, see Fig. 1b), the sister group of Callichthyidae is constituted by Scoloplacidae (Astroblepidae + Loricariidae). However, these papers are discordant in the interrelationships of the aforementioned families with remaining Loricarioidea, proposing as their sister group Nematogenyidae + Trichomycteridae (Diogo, 2004) or just Trichomycteridae (Sullivan *et al*., 2006). However, only trichomycterids were included as outgroup taxa because cleared and stained material for *Nematogenys* is not available for this research. This analysis included 13 terminals as outgroup taxa, including *Copionodon* as the root. Trichomycteridae included four species: *Copionodon* sp., *Trichogenes longipinnis*, *Trichomycterus areolatus*, and *Trichomycterus balios*. Scoloplacidae included two species: *Scoloplax empousa* and *S. distholotrix*. Astroblepidae included three morphospecies delimited by Schaefer *et al*. (2011): *Astroblepus* spB, *Astroblepus* spC, and *Astroblepus* spF. Loricariidae included two species of Delturinae: *Hemipsilichthys gobio* and *H. nimius*, and two species of Loricariinae: *Harttia kronei* and *Rineloricaria microlepidogaster*.

Sources of evidence

Character-states are parts of a heritable transformation series (= character) that resulted from an historical event (Grant & Kluge, 2004). According to these authors: "Phylogenetic systematics seeks to provide ideographic explanations of the heritable variation observed among lineages related through phylogeny by discovering the series of necessarily unique historical transformation events that occurred during their evolution, where phylogenetic hypotheses are chosen on the basis of the number of independent transformation events (patristic distance) required by the competing propositions." In order to improve the severity of the test, extensive sample of characters is intentional in this research. Characters were observed in different levels, mainly using DNA sequences and osteology, but also other sources as coloration pattern, behavior, external morphology, and soft organs.

Anatomical characters

The transformation series previously reported in Reis (1998) and Britto (2003) are the main source of the anatomical data analyzed in this paper, some of the characters proposed by those authors were modified, and some characters are newly reported here as novel results of my work. Specimens were obtained by loan from the museum institutions listed in Table 2. External morphology and coloration were studied based in alcohol preserved specimens. Bone and cartilage were studied based in double stained and cleared specimens according to the techniques of Taylor and Van Dyke (1985).

Molecular characters

Deoxyribonucleic acid (DNA) sequences were chosen based on Shimabukuro-Dias *et al*. (2004) and Alexandrou *et al*. (2011); these papers dealt with callichthyid phylogeny and made available several mitochondrial and nuclear data. The nuclear gene used corresponds to the Recombination activating gene 1 (*Rag1*). Mitochondrial genes used are: Mitochondrially encoded 12S rRNA (*12S rRNA*), Mitochondrially encoded 16S rRNA (*16S rRNA*), Mitochondrially encoded NADH dehydrogenase 4 (*ND4*), and Mitochondrially encoded cytochrome b (*Cytb*).

Tissues were fixed in absolute ethanol and stored in freezer. Samples were obtained from museum specimens and only included if their voucher specimen were analyzed in this research. References for molecular data including museum samples used are listed in Table 3. Some tissue samples were obtained from wild specimens caught by ornamental fish exporters; voucher specimens from these samples are stored at MCP. Total DNA was obtained from tissue samples using DNeasy Blood and Tissue kit (Qiagen) and following manufacturer protocols. Molecular fragments were amplified by Polymerase Chain Reaction (PCR) in a total reaction volume of 25 ul composed of DNA template (2-4 ul), primers detailed in Table 4 (1.25 ul), PCR Master Mix 2X (Fermentas) (8-12 ul), and completed with nuclease-free water. Cycles of amplification were programmed following the conditions recommended by the Taq DNA polymerase manufacturer; the annealing temperatures are shown in Table 4. A small sample of the PCR products were colored with GelRed/BlueJuice (Invitrogen) and loaded in agarose gel to run an electrophoresis. Success of the DNA amplification was corroborated by visual observation in the electrophoresis gel of the colored fragments using ultraviolet light box; these fragments were compared with standard sizes of the Low DNA Mass Ladder (Invitrogen). PCR-products were sequenced by Macrogen Inc. (Korea) following their laboratory protocols. Forward and reverse contigs were assembled and edited using Sequencher 4.5 (GeneCodes Corporation). The GenBank data used in the phylogenetic analysis were selected giving priority to those sequences that have the identification of their voucher specimens corroborated in this research, accession numbers of the sequences used are listed in Table 3. Sequences of each gene were aligned using the MUSCLE algorithm (Edgar, 2004) with default parameters as implemented in the software MEGA (version 5) of Tamura *et al*. (2011).

Tree searching methods and Software

The computational techniques commonly used to find most parsimonious trees are Wagner trees and the branch swapping method of Tree Bisection and Reconnection (TBR). Large datasets usually tends to have suboptimal trees very close in topology and length to the optimal trees; this region of the tree space is known as local optima or island. According to Nixon (1999), if a dataset exhibit composite optima the branch swapping by TBR usually get bogged down in large tree islands, collecting trees of equal length that differ only by minor rearrangements. A strategy that makes the TBR algorithm more efficient is the use of multiple starting points when creating Wagner trees, this method is known as Multiple Random Addition Sequence (RAS). According to Goloboff (2002), large numbers of RAS + TBR generally work well in exploring islands for datasets of 50 to 150 taxa. The Parsimony Ratchet is a strategy that avoids getting stuck in one island and allows the examination of many islands from the tree space in a short time. This method maximize the number of starting points and reduces the amount of time spent in the search from a particular starting point, it additionally retains the optimal tree structure found at each round while works in the improvement of other areas of the tree (Nixon, 1999).

The aligned DNA sequence matrix and the morphology matrix were combined in a single matrix using the software Mesquite 2.75 (Maddison & Maddison, 2011), this matrix was exported as TNT file. The final matrix were analyzed by Cladistic parsimony in the software TNT (Tree analysis using New technology, version 1.1) of Goloboff *et al*. (2008), gaps were treated as missing data and all characters treated as equal weights. TNT implements the ratchet method, and the following search parameters were used: 0 Random seed, 100 Random addition sequences, stop perturbation phase when 18 substitutions or 99% of swaps completed, perturbation phase with 25% Up-weighting and 25% Down-weighting probabilities allowing alternate equal weights, number of iterations of 200 with 0 auto-constrained iterations. Additional trees were found in other rounds of ratchet with the same parameters and using trees from RAM as starting points; however, no differences in tree structure were observed in the strict consensus suggesting stability. Despite of collecting few optimal trees, the ratchet is an effective approach in estimating the real consensus because the trees are sampled from many islands with greater difference in topology that collapses more strictly (Nixon, 1999). A strict consensus of the most parsimonious trees found was generated in order to resume the phylogenetic hypotheses. Bremer support values were calculated in TNT by searching suboptimal trees by means of TBR from the existing trees, the values are shown below branches of the Figs. 20 and 21.

Conventions and abbreviations

Most of the osteological nomenclature follows Reis (1998). Terminology of head skeleton follows Arratia (2003) and includes the following structures: parietal instead of frontal, postparieto-supraoccipital instead of supraoccipital, and autopalatine instead of palatine. Other terminology includes: scapulocoracoid instead of coracoids according to Lundberg (1970), pterotic branch instead of postero-lateral branch according to Arratia & Gayet (1995), compound pterotic instead of pterotic plus post-temporo-supracleithrum according to Aquino & Schaefer (2002), angular complex instead of angulo-articular according to Hyusentruyt & Adriaens (2005), coronomaxillar cartilage according to Datovo & Bockmann (2010). Terminology of mouth barbels follows Britto & Lima (2003), maxillary barbel refers to the structure associated to the maxilla, and mental barbels include the fleshy structures associated to the dentary. Nomenclature of lateral-line system follows Webb (1989). It includes the following canals on the head and trunk: the supraorbital (contained in the nasal, lateral ethmoid, and parietal), infraorbital (contained in the antorbital, lacrimal, and infraorbital series), preopercular (suprapreopercle and preopercle), otic (contained in the sphenotic), postotic and temporal (contained in the compound pterotic), and trunk canals (free ossicles in the body or ossicles contained in the dermal lateral plates of the body). The Siluriformes lacks the supratemporal canal (Lekander, 1949), and most Loricarioidea (except Nematogenyidae) lost the mandibular canal (Schaefer, 1990).

Museum acronyms are: AMNH (American Museum of Natural History, United States of America), ANSP (Academy of Natural Sciences, Philadelphia, United States of America) CAS (California Academy of Sciences, United States of America), CI-FML (Colección Ictiológica, Fundación Miguel Lillo, Argentina), CZCEN (Colección Zoológica de la Facultad de Ciencias Exactas y Naturales, Paraguay), INPA (Instituto Nacional de Pesquisas da Amazônia, Brazil), LBP (Laboratório de Biologia e Genética de Peixes, Brazil), MCP (Museu de Ciências da Pontifícia Universidade Católica do Rio Grande do Sul, Brazil), MHNG (Museum d'Histoire Naturelle, Genève, Switzerland), MNRJ (Museu Nacional, Rio de Janeiro, Brazil), MPEG (Museu Paraense, Emilio Goeldi, Brazil), MUSM (Museo de la Universidad Nacional Mayor de San Marcos, Peru), MZUSP (Museu de Zoologia, Universidade de São Paulo, Brazil), NRM (Naturhistoriska Riksmuseet, Sweden), NUP (Coleção Ictiológica do Núcleo de Pesquisas em Limnologia, Ictiologia e Aqüicultura, Brazil), SU (Stanford University, United States of America), UF (University of Florida, Florida Museum of Natural History, United States of America), UFRGS (Departamento de Zoologia, Instituto de Biociências, Universidade Federal do Rio Grande do Sul, Brazil), UMMZ (University of Michigan Museum of Zoology, United States of America), USNM (Smithsonian Institution National Museum of Natural History, United States of America).

Results

Character description

Morphological characters

The morphological data include 214 characters composed of 43 transformation series from cranial bones, 14 from autopalatine and upper and lower jaws, 18 from suspensorium, 12 from bones of the infraorbital series, 10 from bones of the opercular series, 18 from hyod arch and branchial arches, 17 from the lateral line system, 13 from the Webberian apparatus and the axial squeleton, 13 from the dorsal-fin bone elements, 4 from the anal-fin bone elements, one from the caudal fin, 17 from the pectoral girdle and fin, 11 from the pelvic girdle and fin, 13 from dermal plates and soft external organs, and 10 from coloration pattern.

Cranium

0. Mesethmoid, size of its lateral cornua: (0) Large, well developed. (1) Small, poorly developed. (2) Extremely small or absent.

The mesethmoid is thin and long in Trichomycteridae, bearing on its anterior portion well developed lateral cornua, with a long and thin shape (state 0). The mesethmoid of Astroblepidae and Loricariidae is wide and long, with the lateral cornua present but highly reduced and roughly rounded in shape (state 1). Some *Corydoras* species also exhibit the anterior condition. However, most Callichthyidae exhibit the anterior portion of mesethmoid with highly reduced lateral cornua or totally lacking any lateral expansion, ending as a sharp point (state 2). Scoloplacidae and *Rineloricaria microlepidogaster* also shares the anterior condition. This character was analyzed in Schaefer, 1990 (character 3); Reis, 1998 (character 3); and Britto, 2003 (character 3).

1. Mesethmoid, size of its anterior portion: (0) Long, about half bone length or larger. (1) Short, evidently smaller than half bone length.

The mesethmoid of Loricarioidea is heavily sutured to other cranial bones on its posterior portion. However, its anterior portion does not articulate with other cranial elements on its lateral margin. Trichomycteridae, Callichthyidae, Loricaricariidae, and Astroblepidae possess a long anterior portion, sized about 50% of the bone length or larger (state 0, Fig. 8a). However, some *Corydoras* species and the Scolopacidae display an evident reduction of the anterior portion, its measure about 30% of the bone length (state 1, Fig. 8b). This character was analyzed in Britto, 2003 (character 1).

2. Mesethmoid, width of its posterior margin: (0) Narrow, smaller than its width at the internal medial process. (1) Wide, equal to its width at the internal medial process. (2) Extremely wide, larger than its width at the internal medial process.

The mesethmoid possess on its middle lateral margin an internal medial pointed process articulated to the anterior portion of the lateral ethmoid and to the autopalatine. The posterior margin of the mesethmoid is sutured to the parietals, and the width of this margin is variable among Callichthyidae. In Callichthyinae and some Corydoradinae the posterior margin is narrow, not much expanded laterally, its size smaller than the width of the mesethmoid on its internal medial process (state 0, Fig. 8a). Most Corydoradinae possess a wide posterior margin, its size equals the width of the mesethmoid on its internal medial process (state 1, Fig. 8b). However, most *Aspidoras* and some *Corydoras* species possess an extremely wide posterior margin, evidently expanded laterally, its size larger than the width of the mesethmoid on its internal medial process (state 2, Fig. 8c). This character was analyzed in Britto, 2003 (character 2).

3. Mesethmoid, length of its postero-lateral process that articulates to lateral ethmoid: (0) Very small or absent. (1) Short, not surpassing nasal. (2) Long, surpassing nasal.

The posterior portion of the mesethmoid is sutured to the lateral ethmoid on its lateral margin in Loricarioidea. In most Corydoradinae, the postero-lateral margin of the mesethmoid develops a process projected laterally that articulates dorsally to the lateral ethmoid and also serves as the antero-lateral wall of the nasal cavity. This process is long, surpassing nasal in some representatives (state 2, Figs. 8b, 8c); or short, reaching or not surpassing the nasal in other representatives (state 1). In the Callichthyinae, some *Corydoras* species, some *Scleromystax* species, and remaining Loricarioidea this postero-lateral process is very small or absent (state 0, Fig. 8a).

4. Mesethmoid, exposition of its posterior portion: (0) Absent. (1) Present.

Loricarioidea and several Callichthyidae possess the mesethmoid entirely covered by a thick layer of skin (state 0, Fig. 8a). However, some callichthyids shown the posterior portion externally exposed, usually restricted to the posterior margin and sometimes extended to the middle of the bone (state 1, Fig. 8d).

5. Nasal capsule, bone elements composing nasal cavity: (0) Various elements. (1) Three elements: lateral ethmoid, parietal, and mesethmoid. (2) Single element: entirely composed by the lateral ethmoid. (3) Nasal capsule absent.

The typical condition in Trichomycteridae and Astroblepidae is a nasal not encapsulated by cranial bones and bordered by various elements, as the lateral ethmoid, parietal, mesethmoid, lachrimal-antorbital, and autopalatine (state 0). However, the nasal of Corydoradinae and Loricariidae is mainly encapsulated by the lateral ethmoid, but also the parietal and the postero-lateral process of the mesethmoid in a minor degree (state 1, Figs. 8b, 8c, 8d). In Callichthyinae, the nasal is displaced laterally and the nasal capsule is entirely delimited by the lateral ethmoid (state 2, Fig. 8a). The nasal capsule is absent in the Scoloplacidae (state 3). This character was analyzed in Reis, 1998 (character 4).

6. Lateral ethmoid, shape: (0) Long, its length equal or greater than its width. (1) Wide, its length smaller than its width.

The lateral ethmoid of Loricarioidea is variable in shape, being elongate or compact. In order to assess the shape of this bone I compared its length in relation to its width, this evaluation included the distalmost tip of its anterior, posterior, external, and internal margins. *Copionodon* and *Trichogenes* display a developed postero-lateral projection that limits the anterior wall of the eye, this structure gives a wide shape to the lateral ethmoid (state 0). Members of the Callichthyinae and some Corydoradinae also display a compact bone, wider than longer (Fig. 9a). However, *Trichomycterus*, Scoloplacidae, Astroblepidae, and Loricariidae display a bone longer than wider (state 1). Most Corydoradinae species also displays a long lateral ethmoid (Fig. 8e). This character was analyzed in Britto, 2003 (character 4).

7. Lateral ethmoid, length of the portion anterior to nasal capsule: (0) Short. (1) Long.

The lateral ethmoid of some Corydoradinae (long and intermediate snouted *Corydoras* and some *Scleromystax*) possess a long portion anterior to the nasal capsule, its measure equal or larger than half size entire bone length (state 1, Fig. 8e). In species with the lateral etmoid entirely enclosing the nasal capsule, the portion anterior to the nasal cavity is developed towards the internal medial process of the mesethmoid and serves as the attaching point to the autopalatine. However, the typical condition found in Loricariinae and most Corydoradinae is a short portion anterior to the nasal capsule, its measure evidently smaller than the anterior condition, usually equal or lesser than 33% entire bone length (state 0, Figs. 8a, 8b, 8c, 8d). The nasal capsule of the Callichthyinae is displaced laterally and the portion of the lateral ethmoid anterior to the nasal cavity is not developed towards the autopalatine, this character was coded as inapplicable for these taxa. The nasal capsule of remaining members of the Loricarioidea is not delimited entirely by the lateral ethmoid, usually extended anteriorly and giving participation to the autopalatine as its ventral floor. Outgroup members sharing this condition are Trichomycteridae, Astroblepidae, and *Hemipsiliichthys* and this character was coded as inapplicable for these taxa. Scoloplacidae lacks nasal capsule and this character was also coded as inapplicable for this family.

8. Lateral ethmoid, development of its antero-lateral margin: (0) Weakly developed. (1) Strongly developed, with a rounded projection.

The lateral ethmoid of the Callichthyinae is strongly developed antero-laterally, with a rounded projection containing the nasal capsule (state 1, Fig. 8a). Despite the presence of a nasal capsule, antero-lateral margin of the lateral ethmoid is weakly developed in Loricarioidea and Corydoradinae (state 0, Figs. 8b, 8c, 8d, 8e).

9. Lateral ethmoid, antero-dorsal projection that sutures postero-lateral margin of mesethmoid: (0) Not projected. (1) Projected, reaching around middle of bone. (2) Projected, reaching internal margin of bone.

The lateral ethmoid of Trichomycteridae has a concavity on its anterior margin that serves as the posterior wall and the ventral floor of the nasal capsule; the anterior portion is consequently opened anteriorly and lack any antero-dorsal projection directed towards the postero-lateral margin of mesethmoid (state 0). The lateral ethmoid of Callichthyinae and Loricariidae entirely contains the nasal capsule but also lacks an antero-dorsal projection expanded towards the dorsal surface that encloses this cavity and were coded as the anterior condition (Fig. 8a). The lateral ethmoid of Corydoradinae entirely contains the nasal capsule and develops an antero-dorsal projection that sutures the postero-lateral margin of mesethmoid. However, this projection might reach the middle of the bone (state 1, Figs. 8b, 8c, 8d) or reach the internal magin of the bone (state 2, Fig. 8e). The lateral ethmoid of Scolopacidae and Astroblepidae lack a concavity that contains the nasal capsule and this character was coded as inapplicable for these taxa.

10. Lateral ethmoid, width of the postero-lateral margin of nasal capsule: (0) Thin. (1) Thick.

The lateral ethmoid of some Loricarioidea encloses partially or totally the nasal capsule. In *Copionodon*, *Dianema*, *Hoplosternum* (except *H. littorale*), and *Hemipsiliichthys* the postero-lateral margin of the nasal capsule is thick, its size being about 50% or greater the bone length (state 0). However, the typical condition found in Trichomycteridae, Callichthyidae, and Loricariinae is a thin postero-lateral margin of the nasal capsule, its size being smaller than half size the bone length, usually about 33% or smaller (state 1). The lateral ethmoid of Scolopacidae and Astroblepidae lack a concavity that contains the nasal capsule and this character was coded as inapplicable for these taxa.

11. Lateral ethmoid, degree of external exposition: (0) Absent, entirely covered by skin or demal plates. (1) Small area, restricted on its postero-lateral region. (2) Large area, restricted on its entire lateral region. (3) Large area, restricted on its postero-dorsal region.

The dorsal surface of the lateral ethmoid of Loricarioidea is typically covered by a layer of skin or by dermal plates (state 0). However, some *Corydoras* species present a small area externally exposed, which is restricted on its postero-lateral region (state 1). Other *Corydoras* species and Scoloplacidae show a larger area of external exposition, which is restricted on its entire lateral region (state 2). In Callichthyinae the area of external exposition is also largely developed, but it is restricted on its postero-dorsal region (state 3).

12. Lateral ethmoid, location of its postero-ventral process: (0) Latero-posteriorly, on distal corner. (1) Latero-medially. (2) Absent.

The lateral ethmoid of most Loricarioidea including Callichthyidae has on its ventral surface a process located towards its postero-lateral portion (state 0, Fig. 9a). In *Corydoras* and Scoloplacidae this process is located towards its latero-medial portion (state 1, Fig. 9b). In *Trichomycterus* the process is absent (state 2).

13. Lateral ethmoid, shape of its postero-ventral process: (0) Laminar. (1) Acuminate.

The shape of the postero-ventral process of the lateral ethmoid is variable in Loricarioidea. In *Copionodon*, *Trichogenes*, most Callichthyidae, Astroblepidae, and Loricariidae the process is laminar in shape (state 0, Fig. 9a). In *Corydoras*, *Scleromystax*, some *Aspidoras*, and Scoloplacidae the process is acuminate in shape (state 1, Fig. 9b). *Trichomycterus* species lacks postero-ventral process as inapplicable for this genus.

14. Lateral ethmoid, size of its laminar postero-ventral process: (0) Small. (1) Large.

The postero-ventral process of the lateral ethmoid, when laminar in shape, is typically small or short in most Loricarioidea including Callichthyidae (state 0). However, in *Dianema* and *Hemipsiliichthys* the laminar process is large, extended to the middle of the bone (state 1). In *Trichomycterus* (where the process is absent) and in most Corydoradinae and Scoloplacidae (where the process is acuminate, not laminar) this character was coded as inapplicable.

15. Lateral ethmoid, location of the internal-surface foramen: (0) Absent. (1) Towards posterior margin. (2) Towards middle of bone.

The lateral ethmoid of Callichthyidae has on its ventral surface a small sized foramen, probably associated to the passage of nerves to the nasal capsule. The location of the foramen is variable in the ingroup, being usually located towards middle of bone in most Callichthyinae and Scoloplacidae (state 2, Fig. 9a), and towards posterior margin of bone in *Dianema* and Corydoradinae (state 1, Fig. 9b). This foramen is absent in remaining loricarioids analyzed (state 0).

16. Parietal, length of its anterior portion: (0) Short, 33% bone length or smaller. (1) Long, little smaller than half bone length. (2) Extremely long, half bone length or larger.

The anterior portion of the parietal of most Loricarioidea is bordered by the mesethmoid and lateral ethmoid. The anterior portion of the parietal in the Corydoradinae is bordered by the mesethmoid, nasal, and lateral ethmoid. To evaluate the length of the parietal anterior portion, comparison was done between the portion starting at suture with lateral ethmoid on its lateral margin and the parietal entire length. The anterior portion length is relatively short in most Loricarioidea including Callichthyidae, its measure equal or smaller than 33% of the bone length (state 0, Figs. 8a, 8b, 8d, 8e). However, in some *Aspidoras* species the anterior portion is a little larger, its measure about 40% of the bone length (state 1, Fig. 8c). The anterior portion of the Loricariidae is more developed, its measure equal or larger than 50% of the bone length (state 2). This character was analyzed in Britto, 2003 (character 5).

17. Parietal, ventral process on its antero-lateral margin: (0) Absent. (1) Present.

The typical condition found in loricarioids is a parietal without a ventral process on its antero-lateral margin (state 0). However, all Callichthyidae displays an acuminate ventral process on the antero-lateral margin of the parietal (state 1). This process is sutured to the posterior margin of the lateral ethmoid and delimits the antero-dorsal wall of the orbital cavity. This character was modified from Britto, 2003 (character 7), who proposed an acuminated antero-dorsal process as a synapomorphy for some *Corydoras* species. However, all callichthyids displays an acuminated process on its antero-dorsal margin.

18. Parietal, width of its middle portion: (0) Intermediate, about half bone length. (1) Thin, 33% bone length or smaller. (2) Wide, about equal to bone length.

Copionodon, *Trichogenes*, most Corydoradinae, *Rineloricaria*, and *Scoloplax* possess a parietal of intermediate width, its measure about 50% bone length (state

0, Figs. 8b, 8c, 8d). However, there are two other conditions of this feature among the Callichthyidae. A thin parietal, its measure 33% of bone length or smaller was observed in some *Corydoras*, *Aspidoras psammatides*, some *Scleromystax* species, and remaining loricarioids (state 1, Fig. 8e). A wide parietal, about equal size bone length was observed in the Callicthyinae (state 2, Fig. 8a). This character was analyzed in Britto, 2003 (character 6).

19. Parietal, size of the fontanels: (0) Extremely large, posterior and anterior openings large. (1) Large, posterior opening large and anterior opening reduced. (2) Large, posterior opening large but slightly perforated and anterior opening reduced. (3) Small, posterior and anterior openings reduced. (4) Large, posterior opening reduced and anterior opening large. (5) Small, posterior opening reduced and anterior opening small. (6) Extremely reduced or absent.

The parietals delimit on their mesial margins two openings separated around the middle of the bone by the epiphyseal bar, which are known as the anterior and posterior parietal fontanels. Parietal fontanels are of variable size among loricarioids and the degree of development of one of these openings determines whether the fontanel extension is large or reduced. The fontanel extension is extremely large in Trichomycteridae, *Dianema*, and *Hoplosternum littorale*; where the posterior fontanel is extended to the middle of postparieto-supraoccipital and the anterior fontanel is extended near the posterior portion of mesethmoid (state 0, Fig. 8a). However, there is a reduction of the fontanel size in remaining loricarioids. The fontanel extension is large in some *Corydoras* species and *Scleromystax*; where the posterior fontanel is extended to the postparieto-supraoccipital (and perforates its anterior margin) but the anterior fontanel is evidently smaller (state 1, Figs. 8b, 8e). The fontanel extension is also large is most *Corydoras* species and *Aspidoras psammatides*; where the posterior fontanel is usually extended to the postparieto-supraoccipital as a depression in the bone surface (but its perforation is reduced ending just at the anterior magin) and the anterior fontanel is usually closed or extremely small (state 2, Fig. 8d). The fontanel is small in most *Aspidoras* species, but the posterior and anterior fontanels are opened and extremely small (state 3, Fig. 8c). The fontanel extension is also large in most *Lepthoplosternum* species, *Megalechis picta*, and *Hoplosternum punctatum*; where the posterior fontanel is extremely small or usually closed and the anterior fontanel is opened and extended towards the posterior margin of mesethmoid (state 4). The fontanel extension is small in *Callichthys*, *Hoplosternum magdalenae*, *Lepthoplosternum ucamara*, and *Megalechis thoracatha*; where the posterior fontanel is closed and the anterior fontanel is opened but extremely small (state 5). An extreme reduction of the fontanel is observed in Scoloplacidae, Astroblepidae, and Loricariidae; where the fontanel is reduced to a small depression in the middle of parietals (state 6). This character was analyzed in Reis, 1998 (character 2) and Britto, 2003 (character 8).

20. Postparieto-supraoccipital, small circular fossa on center: (0) Absent. (1) Present.

The postparieto-supraoccipital of most Loricarioidea is sometimes carved anteriorly by the parietal posterior fontanel. However, the typical condition is a bone without openings besides the parietal fontanel (state 0). Nevertheless, most *Aspidoras* species bear a small circular fossa on center which is sometimes partially closed (state 1). This character was analysed in Reis, 1998 (character 1) and Britto, 2003 (character 10).

21. Postparieto-supraoccipital, length of its posterior process: (0) Short, about 30% bone length. (1) Long, about 50% bone length. (2) Very long, 70% bone length or greater.

The postparieto-supraoccipital of most Loricarioidea, Callichthyinae, and most *Aspidoras* is typically a short bone with a posterior process poorly developed, its measure about 30% bone length (state 0). In order to assess the size of this bone the posterior process was delimited as the region without sutural contact with other cranial bones on its lateral margins externally exposed. Most Corydoradinae, Scoloplacidae, and some *Astroblepus* species have a long posterior process, which measure about half size bone length (state 1). Some *Scleromystax* species possess a very long posterior process, its measure 70% of bone length or greater (state 2).

22. Postparieto-supraoccipital, shape of its posterior process: (0) Wide, roughly squared. (1) Acuminate, triangular or rounded. (2) Pointed, extremely slim.

The shape of the posterior process of the postparieto-supraoccipital is variable among loricarioids, where exists a laminar expansion that ends posteriorly as a squared tip in *Copionodon*, *Trichomycterus*, and Callichthyinae (state 0), or as an acuminate tip in most Corydoradinae, Scoloplacidae, and Loricariidae (state 1). However, a posterior process extremely slim with a pointed tip without laminar expansions was observed in Astroblepidae (state 2).

23. Sphenotic, shape: (0) Compact. (1) Elongate.

The shape of the sphenotic of Loricarioidea and Corydoradinae is usually compact, its length equal or sligthly longer that its width (state 0, Figs. 11a, 11b, 11c). However, in Callichthyinae the sphenotic is evidently elongated, its length twice times longer than its width (state 1, Fig. 11d, 11e).

24. Compound pterotic, keel on its postero-dorsal margin: (0) Small or absent. (1) Large.

The compound pterotic covers the gas bladder capsule by expansions of its postero-dorsal margin. However, in Callichthyidae the postero-dorsal margin has interdigitations covered by a layer of skin and offering a partial opening to the exterior to the gas bladder capsule. In most Corydoradinae the dorsalmost keel is absent or extremely small, not reaching the gas bladder opening (state 0, Figs. 11a, 11b, 11c). In Callichthyinae the dorsalmost keel is large, reaching the gas blader opening (state 1, Figs. 11d, 11e). In remaining loricarioids this structure is absent (state 0).

25. Compound pterotic, shape of its posterior expansion covering gas bladder capsule: (0) Absent. (1) Pointed. (2) Dentate. (3) Wide.

The compound pterotic is an elongated bone of variable shape in advanced Loricarioidea. In Trichomycteridae this bone is homologue to the pterotic, post-temporo-supracleithrum, and ossified Baudelot’s ligament. Moreover, the posterior expansion of the post-temporo-supracleithrum is fused to the gas bladder capsule and participates as its anterior wall, leaving the capsule opened (state 0). Scoplacidae develops a pointed process on its posterior margin, covering the capsule only on its upper side (state 1). Callichthyidae develops a posterior process somewhat dentate in shape, covering the capsule on the middle and leaving the upper and lower sides partially opened (state 2, Figs. 11a-e). Loricariidae and Astroblepidae develop a wide laminar expansion on its posterior margin, covering the gas bladder laterally and leaving its opening in a ventral location (state 3). This character was analyzed in Reis, 1998 (character 47).

26. Compound pterotic, shape of the ventral margin: (0) Pointed around middle. (1) Straight or somewhat rounded.

Most loricarioids, including trichomycterids with separate elements and most Corydoradinae with fused elements, displays a ventral margin strongly curved with a pointed projection around the middle of the bone, just anterior to the posteriormost branch of the sensory canal entering compound pterotic (state 0, Figs. 11a, 11b, 11c). However, the compound pterotic of Callichthyinae and some *Aspidoras* species display a straight ventral margin or a somewhat rounded projection just anterior to the posteriormost branch of the sensory canal entering this bone (state 1, Figs. 11d, 11e).

27. Compound pterotic, shape of its ventro-medial process: (0) Thin and long. (1) Thin and short. (2) Roughly square and short. (3) Wide and short. (4) Plain and short.

The ventral surface of the posttemporo-supracleithrum of Trichomycteridae and of the compound pterotic of advanced Loricarioidea displays a medial process near the area of insertion of the dorsal tip of the pectoral girdle. Trichomycteridae have the Baudelot’s ligament associated to this process, but in advanced Loricarioidea this process is articulated to the basioccipital (which is a complex bone result of the fusion several elements according to Arratia, 2003). However, depending on the development that this structucte might achieve its general shape varies within loricarioids. In Trichomycteridae the ventro-medial process of the post-temporo-supracleithrum displays a thin and long appearence, which is markedly expanded ventrally (state 0). A similar condition was observed in Loricariidae; however, the process is located in the compound pterotic. In advanced Loricarioidea the compound pterotic is a wide bone expanded towards the basioccipital, probably due to the fusion of the epiotics to the compound bone, and the degree of ventral expansion of this process reflects its thin or wide appearance. In *Dianema* and *Hoplosternum* the ventro-medial process displays a thin and short appearance, which is markedly expanded ventrally (state 1, Fig. 12b). In Corydoradinae and Scoloplacidae the ventro-medial process is somewhat expanded, roughly square and short in appearance, which is markedly expanded ventrally (state 2, Figs. 12c, 12d). In *Callichthys*, *Lepthoplosternum*, and *Megalechis* the ventro-medial process displays a wide and short appearance, which is slightly expanded ventrally (state 3, Fig. 12a). In Astroblepidae the ventro-medial process is not developed ventrally, being totally plain and short (state 4).

28. Parasphenoid, length of its anterior portion: (0) Short, about equal size posterior portion or little larger. (1) Long, about twice size posterior portion or little smaller.

The parasphenoid is an elongated bone located at midventral line of the skull, range from the lateral ethmoid to the basioccipital and has lateral wings (its greater width) near the region of suture between orbitosphenoid and prootic. The parasphenoid of some loricarioids shows some variation in length of its anterior portion, which is delimited as the region anterior to the lateral wing. The typical condition found in most Loricarioidea is an anterior portion evidently longer than its posterior portion, about two times greater or slightly smaller (state 1). However, in *Copionodon*, *Trichogenes*, some *Corydoras* and *Aspidoras* species, and some Scoloplacidae the length of the anterior portion is equal or slightly larger than its posterior portion (state 0).

29. Parasphenoid, lateral compression of its anterior portion: (0) Not compressed, plain bone. (1) Compressed, forming a thin midline bridge. (2) Compressed, forming a very narrow midline bridge.

The parasphenoid possess a plain surface on its anterior portion in Trichomycteridae, Callichthyinae, and Scoloplacidae (state 0). However, the anterior portion of the parasphenoid is laterally compressed forming a thin midline bridge in most *Aspidoras* species, Astroblepidae, and Loricariidae (state 1); or forming a very narrow bridge in *Corydoras* and *Scleromystax* (state 2).

30. Parasphenoid, width of its anterior portion: (0) Wide. (1) Narrow.

In Trichomycteridae, most Callichthyinae, and Scoloplacidae the anterior portion of parasphenoid is characteristically wide, its measure about half size or almost equal to the region possessing the lateral wings (state 0). However, the typical condition observed in Corydoradinae, *Dianema*, *Hoplosternum*, Astroblepidae, and Loricariidae is an evidently slender anterior portion, its measure about 30% the region possessing the lateral wing (state 1).

31. Orbitosphenoid, shape: (0) Elongate, expanded longitudinally. (1) Wide, expanded laterally.

The orbitosphenoid of most Loricarioidea is typically a rectangular shaped bone, longitudinally elongate, its length greater or nearly equal to its width (state 0). Callichthyinae also displays an elongate orbitosphenoid and were coded as the anterior condition, but its lateral margin is typically rounded giving a triangular shape to this bone. However, in Corydoradinae the orbitosphenoid is typically wide, expanded laterally, its length smaller than its width (state 1).

32. Orbitosphenoid, articulation with lateral ethmoid: (0) Synchondral. (1) Synchondral with a suture laterally. (2) Alternately synchondral and sutural.

The orbitosphenoid is articulated to the lateral ethmoid on its anterior margin. In Trichomycteridae and most Callichthyinae the articulation is entirely synchondral (state 0). In some Callichthyinae, Scoloplacidae, Astroblepidae, and Loricariidae the articulation is synchondral but with a sutural contact located laterally; however, the sutural area in callichthyids is smaller (state 1). In most Corydoradinae the articulation is alternately synchondral and sutural among its whole extension (state 2).

33. Orbitosphenoid, development of a longitudinal ridge on middle: (0) Absent. (1) Weak. (2) Strong.

The orbitosphenoid possess a smooth surface in Trichomycteridae, Callichthyidae, and Astroblepidae (state 0). However, the orbitosphenoid of some Trichomycteridae, some *Corydoras*, some *Aspidoras*, and Scoloplacidae display a weak longitudinal ridge located on middle of the bone, between the compound trigeminofacial and optic foramen and the lateral ethmoid foramen (state 1). In Loricariidae the longitudinal ridge is strongly developed, and is associated to the lateral ethmoid ridge of suture with the metapterygoid (state 2).

34. Orbitosphenoid, degree of participation as the anterior wall of the compound foramen: (0) Large. (1) Small. (2) Absent.

The posterior margin of the orbitosphenoid delimits the anterior wall of the optic foramen or the anterior wall of the compound trigemino-facial and optic foramen in most Loricarioidea and the degree of participation varies among its members. There is a large participation of the orbitosphenoid in most Trichomycteridae, most Corydoradinae, and Loricariinae; where the posterior margin usually displays a conspicuous concavity (state 0). However, there is a small participation of the orbitosphenoid in Callichthyinae and Delturinae, where the posterior margin is usually straight (state 1). In *Trichomycterus balios*, Scolopacidae, and Astroblepidae the participation of the orbitosphenoid as the anterior wall of the nerve foramen is absent, being delimited by other bone elements (state 2).

35. Orbitosphenoid, elevation of the anterior wall of the compound foramen: (0) Absent. (1) Present.

In some *Aspidoras* species the posterior margin of the orbitosphenoid that serves as the anterior wall of the compound foramen is conspicuously projected ventrally, displaying an elevation in the ventral surface of this bone (state 1). However, most Loricarioidea including the Callichthyidae display a smooth surface in the area that serves as the anterior wall of the nerve foramen (state 0). In *Trichomycterus balios*, Scolopacidae, and Astroblepidae the orbitosphenoid do not participate in the delimitation of the nerve foramen and this character was coded as inapplicable for these taxa.

36. Pterosphenoid, cavity for articulation of the antero-dorsal process of hyomandibula: (0) Absent. (1) Present.

The dorsal surface of the hyomandibula is synchondrally articulated to the neurocranium. Anterior to the face for articulation with the neurocranium, the hyomandibula develops a pointed process which articulates with the pterosphenoid in most Loricarioidea. In Corydoradinae, the pterosphenoid exhibit a cavity for the articulation of the hyomandibular process that reinforces the attachment of the mandibular arc to the cranium (state 1). Moreover, the hyomandibular dorsal process of Corydoradinae is more developed than those of remaining Loricarioidea. However, the pterospenoid cavity is absent and the process of the hyomandibula joints a smooth surface of the pterosphenoid in remaining Loricarioidea including the Callichthyinae (state 0). In *Trichomycterus* the sphenotic, prootic, and pterosphenoid are entirely fused in a compound structure (Bockmann *et al*., 2004); however, the hyomandibular process is articulated to the complex bone in a position similar to that of remaining Loricarioidea and were coded as the anterior condition. However, the hyomandibular process of Astroblepidae is displaced laterally and does not contact the pterosphenoid, so this character was coded as inapplicable.

37. Compound trigemino-facial and optic foramen, size: (0) Trigemino-facial and optic foramina separated. (1) Large. (2) Small. (3) Divided, optic nerve separated by expansions of the prootic.

The trigemino-facial and optic nerves are separated in two foramina in Trichomycteridae, Scoloplacidae, Astroblepidae, and *Rineloricaria microlepidogaster*. These taxa have a trigemino-facial foramen usually larger and delimited by the prootic, pterotic, and orbitosphenoid (only prootic in *Scoloplax*), and an optic foramen usually smaller and delimited entirely by the orbitosphenoid (state 0). However, in Corydoradinae and *Harttia kronei* the optic nerve is located in a large compound foramen together with the trigemino-facial nerve; this foramen is delimited by the parasphenoid, orbitosphenoid, pterosphenoid, and prootic (state 1, Fig. 10a). The participation of the prootic in the delimitation of the compound foramen is variable among Callichthyinae since it is antero-laterally developed and reduces the foramen size. In *Dianema* and *Hoplosternum* the prootic is anteriorly expanded on its inner margin and sutures with the orbitosphenoid (state 2, Fig. 10b). However, in *Callichthys*, *Lepthoplosternum*, and *Megalechis*, besides displaying the anterior condition, they develop an additional expansion of the prootic through the compound foramen, which is directed towards the pterosphenoid and forms a bony bridge that delimits the posterior wall of a small anterior foramen for the passage of the optic nerve (state 3, Fig. 10c). This character was analyzed in Reis, 1998 (character 5).

38. Prootic, degree of participation in the synchondral joint for hyomandibular articulation: (0) Large. (1) Small.

The hyomandibula of Loricarioidea is articulated to the ventral surface of the cranium by means of a large synchondral joint located on the sphenotic, prootic, and compound pterotic (only pterotic in Trichomycteridae). However, there is variation among loricarioids in the degree of participation of the cranial bones involved in the synchondral joint, especially the prootic in Callichthyidae. In most Loricarioidea including the Corydoradinae there is a large participation of the prootic, the synchondral joint being associated to its entire lateral margin (state 0). However, in *Trichogenes* and Callichthyinae there is a small participation of the prootic and the synchondral joint is associated to its antero-lateral margin (state 1). This character was analyzed in Reis, 1998 (character 6).

39. Prootic, development of a long laminar process: (0) Absent. (1) Present.

The lateral margin of the prootic of *Callichthys*, *Lepthoplosternum*, and *Megalechis* develops a thin and long laminar process on its anterior portion that serves as the attaching point to the synchondral joint for the hyomandibular articulation (state 1, Fig. 10c). This laminar process is absent is remaining Loricarioidea (state 0, Figs. 10a, 10b).

40. Prootic, area contacting the antero-dorsal laminar process of hyomandibula: (0) Small antero-lateral margin. (1) Small anterior margin. (2) Large anterior margin. (3) Absent, contacts parietal.

In loricarioidea, besides the participation in the synchondral joint for the articulation of the hyomandibula, the prootic also participates in the articulation with the antero-dorsal laminar process of the hyomandular. In Trichomycteridae, Callichthyinae, and Loricariidae the laminar process of the hyomandibula articulates to the prootic in a small area located on its antero-lateral margin (state 0). In most Corydoradinae the laminar process of the hyomandibula articulates to the prootic in a small area of the anterior margin (state 1). In some *Corydoras* and *Scleromystax* species the laminar process of the hyomandibula articulates to the prootic in an evidently larger area, about 70% of its anterior margin (state 2). In Scoloplacidae and Astroblepidae the area in contact with the antero-dorsal laminar process of the hyomandibula is on the parietal and not prootic (state 3).

41. Basioccipital, bony bridge for passage of the aortic canal: (0) Absent. (1) Present.

The aortic canal leaves the gills and runs ventrally to the basioccipital and then to the complex vertebra. In Trichomycteridae and Callichthyidae the complex vertebra has a bony bridge for the canal passage which is usually wider in *Copionodon* and *Trichogenes*. However, Scoloplacidae, Astroblepidae, and

Loricariidae lack such structure, and in the loricariids studied two deep lateral walls were observed instead. In addition to the bony bridge of the complex vertebra, the Callichthyidae exhibit simultaneously a second bony bridge, which is located in the basioccipital (state 1, Fig. 12b). This structure is absent in remaining Loricarioidea, which develops a smooth surface in the basioccipital (state 0).

42. Basioccipital, lateral walls for passage of the aortic canal: (0) Absent. (1) Present.

As mentioned above, most Loricarioidea including the Callichthyinae have a smooth surface in the basioccipital (state 0, Figs. 12a, 12b). However, in Corydoradinae the aortic canal pass throught the basioccipital between two lateral walls expanded anteriorly, these walls are fused to those located bellow the bony bridge of the basioccipital and to those located below the bony bridge of the complex vertebra (state 1, Figs. 12c, 12d). This character was analyzed in Reis, 1998 (character 46) and Britto, 2003 (character 50).

Mandibular arch and autopalatine, suspensorium, & opercular series

Mandibular arch and autopalatine

43. Jaws teeth, shape: (0) Spatulate. (1) Bifid. (2) Conical.

In most Callichthyidae the jaws are provided with minute conic teeth (state 2). However, remaining Loricarioids typically exhibit bifid teeth (state 1), with the exception of *Copionodon* which exhibit spatulate teeth (state 0). The jaws of Corydoradinae and *Hoplosternum magdalenae* lack teeth in adult specimens and this character was coded as inapplicable for these taxa.

44. Premaxillary teeth: (0) Present. (1) Absent.

Typical Loricariodea usually have teeth as adult specimens. The premaxilla of Trichomycteridae, *Lepthoplosternum*, *Megalechis picta*, Scoloplacidae, Astroblepidae, and Loricariidae possess distinct teeth (state 0). However, most Callichthyidae usually lack teeth in adult specimens, being only present in young specimens (state 1). This character was analyzed in Reis, 1998 (character 33).

45. Premaxilla, size compared to maxilla: (0) Larger or equal size. (1) Half size. (2) One-third size.

Typical Loricarioidea usually possess a large premaxilla, its size roughly equal to the maxilla and in some cases even larger (state 0). However, there is a reduction in size of the premaxilla in some Loricarioidea. In some *Aspidoras*, some *Corydoras*, and Scoloplacidae the premaxilla is about half size of the maxilla (state 1). In most Callichthyidae the premaxilla is strongly reduced, its size about one-third of the maxilla (state 2, Fig. 13a). This character was analyzed in Reis, 1998 (character 32).

46. Premaxilla, shape of its dorsal process that articulates with mesethmoid: (0) Wide, shallow lamina. (1) Medial pointed lamina. (2) Proximal pointed lamina. (3) Proximal curved process. (4) Distal rounded process.

The premaxilla of Loricarioidea exhibits a dorsal process that serves as the articulation point of ligaments associated to the mesethmoid and maxilla. In Trichomycteridae and Scoloplacidae the process has a wide and shallow laminar shape (state 0). In Callichthyinae the process has a pointed laminar shape located medially (state 1). In Corydoradinae the process has a distinctly pointed laminar shape located proximally (state 2). In Astroblepidae the process has a pointed laminar shape, but it is anteriorly curved and located proximally (state 3). In Loricariidae the process is rounded in shape and located distally (state 4). This character was analyzed in Britto, 2003 (character 38).

47. Maxilla, process on its posterior margin: (0) Absent. (1) Large. (2) Small.

In Trichomycteridae the posterior margin of the maxilla develops a large and wide laminar process, located distally, that serves as the articulation point for the coronomaxillar cartilage, that joints maxilla and the coronoid process of the dentary (state 1). The *adductor mandibulae* of trichomycterids is also attached to the coronoid process of the dentary and, according to Datovo & Bockmann (2010), develops three sections where one of them (A3") inserts primarily onto the distal part of the maxilla and could be considered a *retractor tentaculi* muscle. However, in Corydoradinae the posterior margin of maxilla exhibit a small laminar process, located around the middle of the bone, which serves as the attaching point for the *retractor tentaculi* (state 2, Fig. 13a). A laminar process on the posterior margin of maxilla is absent in Callichthyinae, Scoloplacidae, Astroblepidae, and Loricariidae (state 0, Figs. 13b, 13c). This character was analyzed in Reis, 1998 (character 31) and Britto, 2003 (character 39). The last author mentioned that the Corydoradinae exhibit two conditions of this character and distinguished rounded and pointed processes; however, no distinction in shape was observed in this study.

48. Maxilla, shape of its distal tip: (0) Extremely narrow. (1) Narrow. (2) Wide.

The distal tip of the premaxilla of most Loricarioidea is extremely narrow, its width smaller than 10% bone length, and with a roughly rounded or pointed shape (state 0). Conversely, in Corydoradinae the premaxilla is narrow and rounded in shape, its width about 20% bone length (state 1). In Callichthyinae the premaxilla is wide and rounded in shape, its width about 33% bone length (state 2).

49. Autopalatine, size compared to maxilla: (0) Longer. (1) Equal. (2) Shorter.

The autopalatine is usually a long bone in Trichomycteridae, some *Corydoras*, some *Aspidoras*, and *Scleromystax*; its size excluding the terminal cartilage is longer than the maxilla (state 0, Fig. 13a). In some *Corydoras*, some *Aspidoras*, most Callichthyinae, and Astroblepidae the autopalatine is roughly equal to maxilla in length (state 1, Fig. 13b). However, the autopalatine is shorter than the maxilla (about 80% of its length) in some Callichthyidae, Scoloplacidae, Loricariidae, Astroblepidae (state 2, Fig. 13c). This character was analyzed in Britto, 2003 (character 40).

50. Dentary teeth: (0) Present. (1) Absent.

Teeth are usually present in the dentary of Loricarioidea and most Callichthyinae (state 0, Fig. 14a). However, in Corydoradinae and *Hoplosternum magdalenae* teeth are absent (state 1, Figs. 14b, 14c, 14d). This character was analyzed in Reis, 1998 (character 34).

51. Dentary, process on the antero-ventral portion for insertion of the *intermandibularis*: (0) Absent. (1) Present.

The *intermandibularis* is a large muscle that connects both dentary bones. In Callichthyidae the dentary develops a distinct ventral process on its anterior portion that serves as the attaching point for this muscle (state 1, Figs. 14a-c). A distinct process in this region of the dentary is absent in remaining Loricarioidea (state 0). This character was analyzed in Reis, 1998 (character 36).

52. Dentary, dorsal process on its medial portion: (0) Highly developed. (1) Shallow with a pointed lamina displaced laterally. (2) Shallow.

The general shape of the dentary of Loricariodea is elongate and roughly triangular because of its medially located dorsal process. The dorsal process of the dentary is fused to the dorsal process of the angular complex; and the combination of these structures forms the coronoid process. The coronoid process serves for the insertion of the *adductor mandibulae*. The dentary of Loricarioidea exhibits particular variation of its dorsal process among its members, being abruptly elevated in Trichomycteridae, gradually elevated in Astroblepidae, and robust and rounded in Loricariidae. However, these families share the condition of a highly developed dorsal process (state 0). The dorsal process in Scoloplacidae is comparatively shallow in shape (state 2). The dorsal process in Callichthyidae is also shallow, but it also exhibits an acuminate lamina that gives to the dentary a peculiar shape because it is small, displaced laterally, and directed posteriorly (state 1, Figs. 14a-c). This character was analyzed in Reis, 1998 (character 35).

53. Angular complex, shape: (0) Extremely deep. (1) Deep. (2) Slender.

The posterior component of the lower jaw of Loricarioidea consists of a compound complex of three bones appearing as a massive unit, named as angulo-articular (Reis, 1998), fused angular, articular, and retroarticular (Arratia, 2003), or angular complex (Hyusentruyt & Adriaens, 2005). The general shape is elevated on its anterior portion, where it develops a dorsal process that is fused to the dentary to form the coronoid process. On its posterior portion its shape is shallow and bears a concavity that serves as the articular facet for the quadrate articulation. In Loricarioidea the degree of development of the dorsal process determines the general shape of the angular complex. In most Loricarioidea the dorsal process is largely developed giving a total heigh of the bone roughly equal to its length, this development conferes to the angular complex an extremely deep general shape (state 0). The dorsal process exhibit and intermediate development in some *Corydoras* species and Scoloplacidae, where total heigh of the bone is one-half its length or a little smaller and conferes to the angular complex a deep general shape (state 1, Fig. 14b). However, the dorsal process of most Callichthyidae exhibits a small development, the total heigh of the bone being one-third of its length or a little smaller, and giving to the angular complex a slender general shape (state 2, Figs. 14a, 14c, 14d). This character was analyzed in Britto, 2003 (character 36).

54. Angular complex, position of its dorsal process: (0) Anterior. (1) Medial. (2) Posterior.

The position of the dorsal process varies among the Loricarioidea; it is anteriorly developed in Trichomycteridae, Scoloplacidae, and Loricariidae (state 0). In some Corydoradinae species and *Astroblepus* spB the process is located around the middle of the bone (state 1, Fig. 14c). In most Callichthyidae and some Astroblepidae the process is wider, and is extended to the posterior portion of the bone (state 2, Figs. 14a, 14b, 14d).

55. Angular complex, shape of the posterior margin of its dorsal process: (0) Rounded or pointed. (1) Falciform.

The posterior margin of the dorsal process of some *Corydoras* exhibit a particular shape, being falciform and with a pointed tip oriented posteriorly (state 1, Fig. 14b). Alternatively, remaining Loricarioidea display a smooth posterior margin; sometimes rounded or nearly pointed (state 0, Figs. 14a, 14c, 14d). This character was analyzed in Britto, 2003 (character 37).

56. Angular complex, additional dorsal process towards its internal margin: (0) Absent. (1) Present.

The Callichthyinae possess a distinct shallow ridge located towards its internal margin, ranging almost entirely among its dorsal surface (state 1, Fig. 14a). Conversely, remaining Loricarioidea lack a distinct process in this region and the dorsal portion exhibits a smooth surface or a nearly rounded elevation in this area (state 0, Figs. 14b-d).

Suspensorium

57. Metapterygoid, development of its anterior projection: (0) Large. (1) Intermediate. (2) Small.

The metapterygoid is roughly quadrangular in shape in Trichomycteridae, Astroblepidae, and Loricariidae; roughly triangular in Callichthyidae; and sickle-shaped in Scoloplacidae. The anterior portion of the metapterygoid is developed anteriorly in Loricarioidea, running parallel to and below the autopalatine, and being variably developed among its members. In Trichomycteridae, some Corydoradinae, and Scoloplacidae the anterior projection is large, almost reaching or reaching to the middle of the autopalatine (state 0). In *Trichomycterus balios*, some Corydoradinae, most Callichthyinae, and *Rineloricaria microlepidogaster* the anterior projection is intermediate, reaching about one-third the posterior portion of the autopalatine (state 1). In some *Corydoras* species, *Callichthys*, *Dianema*, *Hoplosternum magdalenae*, Astroblepidae, and Loricariidae the anterior projection is small, just reaching or slightly surpassing the posterior tip of the autopalatine (state 2).

58. Metapterygoid, antero-dorsal projection: (0) Present, articulated to vomer. (1) Present, articulated to lateral ethmoid. (2) Absent.

The metapterygoid of Loricarioidea exhibits an anterior projection usually associated to the autopalatine by means of ligaments. However, they also exhibit a dorsal laminar projection on its anterior portion that is articulated to other cranial bones. The antero-dorsal projection of Trichomycteridae is articulated to the vomer by means of short ligaments (state 0). *Corydoras guapore* exhibits a small dorsal projection articulated to the vomer and was coded as the anterior condition; however, it is narrow and not wide as in trichomycterids. In Callichthyinae, Astroblepidae, and Loricariidae it is articulated to the lateral ethmoid by means of ligaments (sutural in Loricariidae) (state 1, Figs. 15a, 15b). In Corydoradinae and Scoloplacidae the antero-dorsal projection is absent (state 2, Figs. 15c, 15d). This character was analyzed in Reis, 1998 (character 30). Howes (1983) also mentioned this character.

59. Metapterygoid, tendon-bone entopterygoid: (0) Absent. (1) Present.

The metapterygoid of Corydoradinae is connected to the vomer through a ligament; the ligament bears a small bone on its middle portion located just posterior to the proximal portion of the autopalatine (state 1, Figs. 15c, 15d). This ligament was named as free lateral vomers (Hoedeman, 1960), palatal splints (Reis, 1998), or tendon-bone entopterygoid (Arratia, 1990). The presence of a tendon-bone entopterygoid was reported as an autapomorphy of Nematogenyidae by Arratia (1990), absent in remaining Loricarioidea (state 0, Figs. 15a, 15b). However, this author only examined *Callichthys* specimens, which lacks this ligament as remaining Callichthyinae (state 0).

60. Metapterygoid, size of the sutural articulation with quadrate: (0) Absent, only synchondral articulation. (1) Small area restricted on anterior portion. (2) Large area among entire surface.

The ventral portion of metapterygoid is articulated to the dorsal portion of quadrate by means of cartilage in *Copionodon*, *Trichomycterus areolatus*, and most Callichthyidae (state 0, Figs. 15a, 15c). However, *Trichogenes longipinnis*, *Trichomycterus balios*, and some Callichthyidae exhibit a small area of sutural articulation between metapterigoid and quadrate, which is rectricted on the anterior portion (state 1, Figs. 15b, 15d). The sutural articulation between metapterydoid and quadrate is largely developed in Scoloplacidae, Astroblepidae, and Loricariidae; in these taxa the sutural contact is expanded towards its entire ventral surface (state 2). This character was analyzed in Reis, 1998 (character 29) and Britto, 2003 (character 33).

61. Metapterygoid, size of the laminar expansion of its postero-dorsal portion: (0) Large. (1) Small. (2) Absent or extremely reduced.

The metapterygoid of Loricarioidea has a postero-dorsal laminar expansion commonly sutured with the anterior outgrowth of the hyomandibula. The laminar expansion can be identified as the posterior region developed above the synchondral area of contact of the hyomandibula, quadrate, and metapterygoid. The laminar expansion of most Loricarioidea including the Callichthyidae is usually large, its measure about equal size the synchondral area or even larger (state 0, Figs. 15a, 15c, 15d). On the contrary, the laminar expansion is usually small in *Hoplosternum*, most *Lepthoplosternum* species, *Megalechis*, and *Harttia kronei*; its measures about one-fourth the synchondral area of articulation of the suspensorium bones (state 1). In *Dianema* and Scoloplacidae the postero-dorsal laminar is absent or extremely reduced (state 2, Fig. 15b). Reis (1998) mentioned that only *Callichthys* posses a postero-dorsal projection, and that the postero-dorsal lamina is absent in remaining Loricarioidea. However, in contrast with Reis (1998), I identify as being part of the postero-dorsal projection the area in contact with the anterior outgrowth of hyomandibula. This interpretation is based on the observation that *Callichthys serralabium* also shows a sutural contact between the upper margin of the postero-dorsal projection and the anterior outgrowth of the hyomandibula, as is also the condition in Corydoradinae. Remaining specimens of *Callichthys* here analyzed does not show a sutural contact, and probably is because they are smaller in size than the specimen of *C. serralabium*. This character was analyzed in Reis, 1998 (character 28).

62. Hyomandibula, shape: (0) Deep. (1) Slender.

The general shape of the hyomandibula is deep in most Loricarioidea and most Callichthyinae, its height roughly equal to its length or a little smaller (state 0, Fig. 15a). However, in *Trichomycterus areolatus*, Corydoradinae, *Dianema*, most *Hoplosternum* species, and Scoloplacidae the hyomandibula is slender in shape, its height about one-half its length or a little smaller (state 1, Figs. 15a, 15b, 15c). This character was analyzed in Britto, 2003 (character 29).

63. Hyomandibula, size of its anterior outgrowth: (0) Small. (1) Absent or extremely reduced. (2) Large.

The hyomandibula develops a membranous outgrowth on its antero-dorsal portion that serves as the internal wall of the eye. This laminar membrane is variably developed in Loricarioidea. In order to evaluate the degree of development of the anterior outgrowth comparison was done with height of the anterior portion of the hyomandibula, but considering only the region connected to the cartilaginous joint with quadrate. In *Copionodon*, some *Corydoras* species, most Callichthyinae, Scoloplacidae, and *Hemipsilichthys* the anterior outgrowth is little developed, its measure about one-half the height of the anterior portion of the bone or even a little smaller (state 0, Fig. 15a). The anterior outgrowth is extremely reduced or absent in *Dianema* and *Hoplosternum* (state 1, Fig. 15b). However, the anterior outgrowth is large or well developed in most Loricarioidea and Corydoradinae, its measure about equal size the height of the anterior portion of the bone and usually even larger (state 2, Figs. 15c, 15d). This character was analyzed in Britto, 2003 (character 31).

64. Hyomandibula, projection of its anterior outgrowth: (0) Largely developed. (1) Little developed. (2) Not developed.

The anterior outgrowth of the hyomandibula is largely developed over the cartilaginous joint with quadrate and is usually expanded over this bone in Trichomycteridae, some *Corydoras* species, *Aspidoras psammatides*, Scoloplacidae, and Astroblepidae (state 0, Fig. 15d). The anterior outgrowth is little expanded over the cartilaginous joint, but not exceeding its anterior half, in some *Corydoras* species (state 1). However, the typical condition found in most Callicthyidae and Loricariidae is an anterior outgrowth not developed over the synchondral joint with quadrate (state 2, Figs. 15a, 15c). The anterior outgrowth is extremely reduced or absent in *Dianema* and *Hoplosternum* and this character was coded as inapplicable for these taxa.

65. Hyomandibula, sutural contact between its anterior outgrowth and metapterygoid: (0) Absent. (1) Present.

The anterior outgrowth of the hyomandibula is not articulated to the posterior portion of metapterygoid in Trichomycteridae, *Callichthys callichthys*, *Lepthoplosternum*, and Scoloplacidae (state 0, Fig. 15a). However, there is sutural articulation between these two bones in Corydoradinae, *Callichthys*, *Megalechis*, Astroblepidae, and Loricariidae (state 1, Figs. 15c, 15d). The anterior outgrowth is extremely reduced or absent in *Dianema* and *Hoplosternum* and this character was coded as inapplicable for these taxa. This character was analyzed in Reis, 1998 (character 24).

66. Hyomandibula, size of the sutural contact of its anterior outgrowth with metapterygoid: (0) Small dorsally. (1) Small ventrally. (2) Large.

The sutural articulation between the anterior outgrowth of the hyomandibula and the posterior portion of metapterygoid is restricted on its dorsal portion in some *Corydoras* species and some *Scleromystax* species; the sutural area cover about one-half its anterior outgrowth or a little smaller (state 0). In Loricariinae the sutural articulation between these two bones is also small, but the sutural area is restricted on its ventral portion and covers about one-half of its anterior outgrowth (state 1). However, the sutural contact in most Callichthyidae, Astroblepidae, and Loricariidae is largely developed; it covers entirely the hyomandibula and metapterygoid margins (state 2). In Trichomycteridae, *Callichthys callichthys*, *Lepthoplosternum*, and Scoloplacidae the anterior outgrowth of the hyomandibula is not articulated to the posterior portion of metapterygoid and this character was coded as inapplicable for these taxa. This character was analyzed in Britto, 2003 (character 30).

67. Hyomandibula, crest for articulation with infraorbital 1: (0) Absent. (1) Present.

The hyomandibula of Loricarioidea and most Callichthyinae is not articulated to the infraorbital 1 (state 0, Figs. 15a, 15b). However, in Corydoradinae, *Hoplosternum littorale*, *Lepthoplosternum pectorale*, and *Megalechis* the hyomandibula exhibit a small crest on its lateral margin that serves as the attaching point of the infraorbital 1 (state 1, Figs. 15c, 15d). This character was analyzed in Reis, 1998 (character 25) and Britto, 2003 (character 32).

68. Hyomandibula, position of its articular facet for opercle: (0) Medially. (1) Dorsally. (2) Ventrally.

The posterior margin of the hyomandibula exhibits a rounded articular facet for the insertion of the opercle. However, the position of this facet is variable among the Loricarioidea. In Trichomycteridae, Callichthyinae, and *Rineloricaria microlepidogaster* this facet is located in the middle of the bone (state 0, Figs. 15a, 15b). In Corydoradinae, Scoloplacidae, and Astroblepidae this facet is located dorsally, around its upper one-fourth portion (state 1, Figs. 15c, 15d). However, in *Hemipsilichthys* and *Harttia* this facet is located ventrally, around its lower three-fourth portion (state 2).

69. Hyomandibula, groove on inner margin above its articular facet for opercle: (0) Absent. (1) Present.

The inner margin of the hyomandibula of Corydoradinae exhibit a small groove above the articular facet for opercle, this groove serves as an extra attachment point where a small projection of the opercular condyle inserts and reinforces the articulation hyomandibula-opercle (state 1). In remaining Loricarioidea, no extra attachment point exists besides the articular facet of hyomandibula (state 0).

70. Hyomandibula, distinct postero-dorsal ridge: (0) Absent. (1) Present and covered by skin. (2) Present and exposed externally.

The hyomandibula of Loricarioidea articulates to the preopercle on its postero-ventral margin. In Corydoradinae and Scoloplacidae the hyomandibula exhibits near the region of the articular facet for the opercle a distinct ridge externally exposed just above the preopercle (state 2, Figs. 15c, 15d). This ridge is also present in *Trichogenes*, Callichthyinae, Astroblepidae, and Loricariidae; but is covered by a thick layer of skin (state 1, Figs. 15a, 15b). In Trichomycteridae the hyomandibula presents a smooth surface in this region, without any distinct ridge (state 0). Schaefer (1991) reported a vertical crest on the hyomandibula extending from the posterior corner of the preopercle to the dorsal articular condyle of the hyomandibula (adductor crest, character 18). According to this author, the hyomandibula ridge separates the adductor musculature of the cheek from the *dilatator* and *levator operculi*.

Astroblepidae and Loricariidae present a single suprapreopercle canal between the compound pterotic and preopercle. Nematogenyidae present two suprapreopercle canals (Schaefer, 1988). Huysentruyt & Adriaens (2005) named the hyomandibula ridge of *Corydoras aeneus* as suprapreopercle. However, these authors hesitated about the homology of this structure as being part of the preopercular branch and suggested additional research to resolve this issue. Callichthyidae and Scoloplacidae present a distinct ridge in the hyomandibula but no canals associated to it, therefore I decided to consider this structure as being part of the hyomandibula. Moreover, the presence of hyomandibula ridge and a suprapreopercular canal in Astroblepidae and Loricariidae suggests non homology.

71. Hyomandibula, length of its postero-dorsal ridge: (0) Long. (1) Small. (2) Extremely small.

The postero-dorsal ridge of the hyomandibula of most Loricarioidea including most Corydoradinae is usually long, its measure roughly equal to the distance from dorsal tip to the articular facet for opercle, or even larger (state 0). In some Callichthyidae the hyomandibula ridge is small, its measure about one-half that distance or a little larger (state 1). However, in most Callichthyinae the hyomandibula ridge is extremely reduced, its measure about one-third that distance (state 2).

Copionodon and *Trichomycterus* lack the hyomandibula ridge and this character was coded as inapplicable for these taxa.

72. Hyomandibula, width of its postero-dorsal ridge: (0) Narrow. (1) Wide.

The postero-dorsal ridge of the hyomandibula of most Loricarioidea including most Callichthyidae is usually narrow (state 0). However, in some Corydoradinae the hyomandiblar ridge is peculiarly wide, its width about one-half its length (state 1). *Copionodon* and *Trichomycterus* lack the hyomandibular ridge and this character was coded as inapplicable for these taxa.

73. Hyomandibula, external exposition of its dorsal process: (0) Absent. (1) Present.

The hyomandibula of some Corydoradinae exhibit an additional dorsal process on its external margin, this process is located between the compound pterotic and dorsal portion of the opercle and is roughly rounded in shape and exposed externally (state 1). This process is absent in remaining Loricarioidea or covered by a thick layer of skin (state 0).

74. Hyosymplectic fenestra: (0) Absent. (1) Present.

The suspensorium bones of Loricarioidea are articulated by means of a large hyosymplectic cartilage that is expanded ventrally to the dorsal margin of preopercle (state 0, Figs. 15c, 15d). However, in Callichthyinae the hyosymplectic cartilage is not largely expanded toward the preopercle and leaves a large foramen in that area (state 1, Figs. 15a, 15b). This character was analyzed in Reis, 1998 (character 27).

Infraorbital series

75. Infraorbital bones, number of elements: (0) Absent. (1) Two. (2) Six. (3) Seven.

The infraorbital series of Siluriformes consists entirely of the canal-bearing portions of the bones (Fink & Fink, 1981). These authors mentioned that primitive otophysians possess infraorbital canals associated to bony plates, and that the plated-like infraorbitals of Callichthyidae and Loricariidae are exceptions among Siluriformes displaying this compound structure as secondarily evolved. Taking these ideas in consideration, it was distinguished infraorbital canals and infraorbital bones as separate elements. The infraorbital canal will be discussed later in conjunction with the lateral line system. The infraorbital bones are absent in Siluriformes including most Loricarioidea (state 0). Callichthyidae exhibit two bones associated to the infraorbital canals (state 1, Fig. 11a-e). In Loricariinae (*Harttia* and *Rineloricaria*) six infraorbital bones are present (state 2) and in Delturinae (*Hemipsilichthys*) seven bones are present (state 1). This character was analyzed in Reis, 1998 (character 15). Apparently, the infraorbital bone 1 of the Callichthyidae resulted from the fusion of two bones. The presence of two infraorbital canals contained in a single bone in the Corydoradinae might support this idea. However, no canals are associated to the infraorbital bone 1 in the Callichthyinae (Fig. 11e) and probably lost of canal innvervations has occurred in these taxa as an apomorphic condition (see characters under infraobital lateral line system). The association of the antepenultimate infraorbital plate to the lateral ethmoid in Loricariidae also supports this idea (see character 81). Despite of being fused or not, the presence of infraorbital bones in a reduced number is apomorphic for the ingroup.

76. Infraorbital bones, external exposition: (0) Exposed. (1) Covered by skin.

The infraorbital bones of Callichthyidae and Loricariidae are externally exposed (state 0, Figs. 11a, 11b, 11c, 11e). However, the infraorbital bone 1 of *Callichthys* is covered by a thick layer of skin (state 1, Fig. 11d). In Trichomycteridae, Scoloplacidae, and Astroblepidae the infraorbital bones are absent and this character was coded as inapplicable for these taxa. This character was analyzed in Reis, 1998 (character 17).

77. Infraorbital bone 1, size of its anterior expansion: (0) Absent. (1) Small. (2) Large. (3) Very large.

The infraorbital bone 1 of the Callichthyidae is the anteriormost structure that participates as the ventral wall of the eye and exhibit coalesced canal tubules (except for the Callichthyinae). Comparison of this structure with loricariids was done with the antepenultimate infraorbital bone, which corresponds to the infraorbital bone 4 of Loricariinae (*Harttia* and *Rineloricaria*) and to the infraorbital bone 5 of Delturinae (*Hemipsilichthys*). The anterior expansion is delimited as the area in contact with the external margin of the lateral ethmoid and was compared with remaining part of the infraorbital bone 1. Taking this in consideration, the codification of character states varies with regard to that done by Britto (2003). The anterior expansion is absent in Callichthyinae, *Aspidoras psammatides*, and Loricariidae (state 0, Fig. 11e). In some *Aspidoras*, most *Scleromystax*, and most *Corydoras* species the anterior expansion is small; its measure about one-third the remaining portion of the bone (state 1, Fig. 11a). In some *Corydoras*, some *Aspidoras*, and *Scleromystax macropterus* the anterior expansion is large; its measure about one-half the remaining portion of the bone or a little larger (state 2). In *Corydoras difluviatilis*, *C. pantanalensis*, *C. rabauti*, and *Aspidoras raimundi* the anterior expansion is very large; its measure roughly equal to or a little larger than remaining portion of the bone (state 3, Fig. 11f). In Trichomycteridae, Scoloplacidae, and Astroblepidae the infraorbital bones are absent and this character was coded as inapplicable for these taxa. This character was analyzed in Reis, 1998 (character 19) and Britto, 2003 (character 15).

78. Infraorbital bone 1, ventral development of its anterior expansion: (0) Small. (1) Large.

The anterior expansion is developed ventrally among the Corydoradinae, being the typical condition a small development, its measure smaller that one-half its length (state 0). However, in some *Corydoras* species and in *Aspidoras poecilus* the ventral development is large, roughly equal to its length or a little smaller (state 1). In Trichomycteridae, Scoloplacidae, and Astroblepidae the infraorbital bones are absent and this character was coded as inapplicable for these taxa. *Aspidoras psammatides*, Callichthyinae, and Loricariidae lack an anterior expansion and this character was also coded as inapplicable.

79. Infraorbital bone 1, internal lamina: (0) Absent. (1) Present.

The infraorbital bone 1 of Callichthyidae develops an inner laminar expansion that serves as the floor of the orbital cavity (state 1, Fig. 11a, 11d, 11e). Such laminar expansion below the eye is absent in Loricariidae (state 0). In Trichomycteridae, Scoloplacidae, and Astroblepidae the infraorbital bones and this character was coded as inapplicable for these taxa.

80. Infraorbital bone 1, size of its internal lamina: (0) Small. (1) Large. (2) Very large.

To evaluate the size of the internal lamina the width of the inner expansion was compared with the length of the infraorbital bone 1 without its anterior portion. The internal laminar expansion is small in most *Corydoras*, *Aspidoras psammatides*, *A. raimundi*, and *Scleromystax*; its measure about one-third the infraorbital bone 1 length (state 0). The internal laminar expansion is large in *Corydoras difluviatilis*, *C. rabauti*, most *Aspidoras*, *Dianema*, *Hoplosternum*, *Lepthoplosternum altamazonicum*, *L. beni*, and *Megalechis thoracata*; its measure around one-half the infraorbital bone 1 length or a little larger (state 1). The internal laminar expansion is very large in *Aspidoras taurus*, *Callichthys*, most *Lepthoplosternum*, and *Megalechis picta*; its measure rougly equal to the infraorbital bone 1 length (state 2). In Trichomycteridae, Scoloplacidae, and Astroblepidae the infraorbital bones are absent and were coded as inapplicable. Loricariidae lack internal laminar expansion and this character was coded as inapplicable for these taxa. This character was analyzed in Reis, 1998 (character 20) and Britto, 2003 (character 16).

81. Infraorbital bone 1, articulation with lateral ethmoid: (0) By direct contact. (1) By indirect contact.

The infraorbital bone of most Callichthyidae and Loricariidae is attached to the lateral etmoid by means of a direct contact (state 0). In Loricariidae the articulation is on the antero-dorsal portion of the antepenultimate infraorbital bone. In most Callichthyidae the articulation is on the antero-dorsal portion and the inner margin of the infraorbital bone 1. However, in *Dianema* the inner margin of the infraorbital bone 1 is indirectly articulated to the lateral ethmoid by means of connective tissue (state 1). In Trichomycteridae, Scoloplacidae, and Astroblepidae the infraorbital bones are absent and this character was coded as inapplicable for these taxa. This character was analyzed in Reis, 1998 (character 18).

82. Infraorbital bone 2, articulation with infraorbital bone 1: (0) On its ventral tip. (1) On its anterior facet. (2) By connective tissue.

The last infraorbital bone of Corydoradinae and Loricariidae is disposed vertically and articulates directly to the penultimate infraorbital bone by its ventral tip (state 0, Fig. 11f). However, in most Callichthyinae the infraorbital bone 2 articulates directly to the infraorbital bone 1 by its anterior facet (state 1, Fig. 11e). In *Dianema* and most *Hoplosternum* species the infraorbital bones are distant from each other and the contact is indirect, by means of connective tissue and skin (state 2).

83. Infraorbital bone 2, internal lamina: (0) Absent. (1) Present.

The infraorbital bone 2 of Callichthyidae develops an inner laminar expansion that serves as the posterior wall of the orbital cavity (state 1). Such laminar expansion behind the eye is absent in Loricariidae (state 0). In Trichomycteridae, Scoloplacidae, and Astroblepidae the infraorbital bones are absent and this character was coded as inapplicable for these taxa.

84. Infraorbital bone 2, size of its internal lamina: (0) Small. (1) Large. (2) Very large.

To evaluate the size of the internal lamina the width of the inner expansion was compared with the whole length of the infraorbital bone 2. The internal laminar expansion is small in most *Corydoras*, *A. psammatides*, *A. virgulatus*, *Scleromystax barbatus*, and most *Callichthys*, measuring about one-third the infraorbital length (state 0). The internal laminar expansion is large in *Corydoras* spB, *C. difluviatilis*, *C. diphyes*, *C. nattereri*, *C. rabauti*, most *Aspidora*s, most *Scleromystax*, *Dianema*, *Hoplosternum*, *Lepthoplosternum stellatum*, and *L. tordilho*, measuring about one-half the infraorbital length or a little larger (state 1). The internal laminar expansion is very large in *Callichthys serralabium*, most *Lepthoplosternum*, and *Megalechis*, measuring roughly equals the infraorbital length (state 2). In Trichomycteridae, Scoloplacidae, and Astroblepidae the infraorbital bones are absent and this character was coded as inapplicable for these taxa. Loricariidae lack internal laminar expansion and this character was also coded as inapplicable. This character was analyzed in Reis, 1998 (character 21) and Britto, 2003 (character 17).

85. Infraorbital bone 2, dorsal keel for articulation with sphenotic: (0) Absent. (1) Present.

The last infraorbital bone of Callichthyidae and Loricariidae articulates to the sphenotic by means of its dorsal tip (state 0). However, the internal margin in most callichthyids develops a dorsal keel that reinforces the attachment to the cranium (state 1). In Trichomycteridae, Scoloplacidae, and Astroblepidae the infraorbital bones are absent and this character was coded as inapplicable for these taxa. This character was analyzed in Reis, 1998 (character 22).

86. Infraorbital 2, postero-dorsal expansion that contacts compound pterotic: (0) Absent. (1) Present.

The last infraorbital bone of most Callichthyidae and Delturinae (*Hemipsilichthys*) is usually slender in shape and do not articulates to the compound pterotic (state 0, Fig. 11b). However, in some *Corydoras* species, *Hoplosternum littorale*, and Loricariinae (*Harttia* and *Rineloricaria*) the last infraorbital bone is expanded postero-dosally and articulates to the compound pterotic (state 1, Figs. 11c, 11f). In Trichomycteridae, Scoloplacidae, and Astroblepidae the infraorbital bones are absent and this character was coded as inapplicable for these taxa. This character was analyzed in Reis, 1998 (character 23) and Britto, 2003 (character 18). The last author codified the shape of the postero-dorsal expansion that contacts compound pterotic (triangular or rectangular). However, I did not observe differences in shape, with specimens analyzed exhibiting a roughly rounded postero-dorsal expansion.

Opercular series

87. Interopercle, size of its postero-ventral margin expansion: (0) Highly expanded. (1) Moderately expanded. (2) Reduced.

The shape of the interopercle is quite variable among loricarioids. In Trichomycteridae it is large and bifid anteriorly. In Callichthyidae, Scoloplacidae, and Loricariidae it is small and roughly triangular. In Astroblepidae it is large and roughly quadrangular. However, despite their particular shapes they also exhibit a variable development of its postero-ventral portion. In Trichomycteridae and Astroblepidae the postero-ventral portion is highly expanded (state 0). In Corydoradinae it is moderately expanded (state 1, Fig. 15c). Conversely, there is a particular reduction in Callichthyinae, Scoloplacidae, and Loricariidae; where the preopercle is thin and little expanded postero-ventrally (state 2, Figs. 15a, 15b).

88. Interopercle, anterior expansion: (0) Absent. (1) Present, almost reaching the articular complex.

The interopercle is expanded anteriorly in some *Corydoras* species and Callichthyinae, its anterior tip reaching about three-fourths the distance opercle-mandible or almost reaching the angular complex (state 1, Fig. 15b). However, the typical condition found in most Loricarioidea including most Corydoradinae is an interopercle little expanded anteriorly, its anterior tip reaching about one-half that distance (state 0, Fig. 15c).

89. Interopercle, external exposition: (0) Not exposed, covered by skin. (1) Not exposed, covered by preopercle. (2) Exposed externally.

The interopercle is covered by a thick layer of skin in Loricarioidea including some Corydoradinae (state 0). In most Callichthyinae the interopercle is covered by expansions of the ventral margin of the preopercle and a thick layer of skin (state 1). However, most Corydoradinae species and *Hoplosternum magdalenae* exhibit an externally exposed interopercle (state 2). *Dianema* is polymorphic for this character and exhibit states one and two. This character was analyzed in Reis, 1998 (character 39).

90. Interopercle, odontodes: (0) Present, extremely developed. (1) Present, minute odontodes. (2) Absent.

The interopercle of Trichomycteridae exhibit extremely developed odontodes restricted on its distal margin (state 0). In some Corydoradinae species the interopercle exhibit small odontodes dispersed over its whole lateral margin (state 1). In most Loricarioidea including most Callichthyidae the interopercle lack odontodes (state 2). This character was analyzed in Britto, 2003 (character 41).

91. Preopercle, external exposition: (0) Covered by skin. (1) Exposed externally.

The preopercle of most Loricarioidea including most Callichthyinae is typically covered by a thick layer of skin (state 0). However, Corydoradinae, *Dianema urostriatum*, *Hoplosternum magdalenae*, Scoloplacidae, and *Hemipsilichthys* have the preopercle externally exposed (state 1). This character was analyzed in Reis, 1998 (character 26) and Britto, 2003 (character 34).

92. Opercle, shape: (0) Very narrow. (1) Slender.

The opercle of *Copionodon* and most Callichthyinae is very narrow in shape, its greater depth about one-fourth its length (state 0, Fig. 15a). However, the typical condition in most Loricarioidea including most Callichthyidae is a slender opercle, its greater depth about one-half its length (state 1, Fig. 15c). This character was analyzed in Britto, 2003 (character 42). This author proposed a deep opercle as a synapomorphy of *Aspidoras* and some *Corydoras* species, its depth somewhat smaller than its length. However, such extension in deep was not observed here; with the depth of specimens analyzed ranging near half size its length, sometimes a little smaller or a little larger. Conversely, a notably narrow depth was possible to detect in *Callichthys*, *Lepthoplosternum*, and *Megalechis*.

93. Opercle, shape of its posterior margin: (0) Concave. (1) Smooth. (2) Convex.

The posterior margin of the opercle is variable is shape in Loricarioidea. In Trichomycteridae is roughly concave (state 0). In most Callichthyinae and Loricariidae is smooth, nearly straight (state 1, Fig. 15b). In Corydoradinae, *Hoplosternum magdalenae*, Scoloplacidae, and Astroblepidae the opercle is convex posteriorly (state 2, Fig. 15c). This character was analyzed in Britto, 2003 (character 43). This author proposed an opercle strongly angulated forming ventral and posterior borders as a synapomorphy for some *Aspidoras* and some *Corydoras* species. However, all Corydoradinae exhibit a convex posterior margin and the distinction between the different degrees of angles was not clear to delimit additional character states. Most *Corydoras*, *Aspidoras*, and *Scleromystax* species exhibit strong curvatures on its posterior margin with angles between 115° and 135°. However, distinction was not evident and a single state was codified which contrast with the nearly smooth margin of the callichthyines.

94. Opercle, development of the postero-dorsal crest of inner margin: (0) Large. (1) Small. (2) Extremely reduced or absent.

This character was analyzed in Reis, 1998 (character 37) and Britto, 2003 (character 45); however, it was separated in two characters, see below, opposed as addressed by those authors. Members of the Callichthyidae bear on the inner margin of the opercle a strong crest for insertion of the *levator operculi* which could be extended postero-dorsally or postero-ventrally (Reis, 1998). However, I observed that a small crest postero-dorsally expanded is also present in some species with a strong crest postero-ventrally expanded. In Trichomycteridae, Callichthyinae, *Hemipsilichthys nimius*, and *Rineloricaria microlepidogaster* the postero-dorsal crest is large, its measure one-half the distance hyomandibular articulation-postero-dorsal tip or usually larger (state 0). In *Scleromystax salmacis*, Scoloplacidae, *Hemipsilichthys gobio*, and *Harttia kronei* the postero-dorsal crest is small, its measure about one-third that distance (state 1). However, the typical condition observed in Corydoradinae and Astroblepidae is a postero-dorsal crest extremely reduced or absent (state 2).

95. Opercle, postero-ventral crest of inner margin: (0) Absent. (1) Present.

The postero-ventral crest of the opercle is absent in most Loricarioidea including the Callichthyinae (state 0). However, in most Corydoradinae and Astroblepidae the postero-ventral crest is present, its measure usually one-third the distance from hyomandibular articulation to its postero-medial margin. This character was analyzed in Reis, 1998 (character 37) and Britto, 2003 (character 45).

96. Opercle, development of the antero-dorsal laminar expansion: (0) Small. (1) Large.

The antero-dorsal portion of the opercle, located above the condyle for articulation to the hyomandibula and anterior to the crest for insertion of the *levator operculi*, is largely developed as a laminar expansion towards the hyomandibula and almost reaching the compound pterotic in *Trichomycterus areolatus*, *Thichogenes*, and most Corydoradinae (state 1). However, the antero-dorsal laminar expansion is small in remaining Loricarioidea including some *Aspidoras* species, *Scleromystax salmacis*, and the Callichthyinae (state 0). In these taxa the laminar expansion usually attains one-third the distance from the hyomandibular articulation to the ventral margin of the compound pterotic, sometimes a little larger, and is also covered by thick layer of skin in that region. This character was analyzed in Reis, 1998 (character 38).

Hyoid arch & branchial arches

97. Articulation of the branchiostegal rays with opercle, contact through a patch of branchiostegal cartilage: (0) Absent. (1) Present.

The distal tip of the branchiostegal rays of Loricariodea are articulated to the inner margin of the opercle on its dorsal portion (state 0). However, the articulation to the opercle is via a small patch of cartilage in Callichthyidae (state 1, Fig. 16a). This character was analyzed in Reis, 1998 (character 42).

98. Articulation of the branchiostegal rays with ceratohyal, contact through a small rod of cartilage: (0) Absent. (1) Present.

The proximal tip of the branchiostegal rays of the Loricarioidea are articulated to the posterior margin of the anterior ceratohyal, which develops in that area a large patch of cartilage (state 0, Fig. 16b). However, the branchiostegal rays are not directly attached to the patch of cartilage of the ceratohyal in Callichthyinae (state 1); they exhibit instead three small rods between these structures (Fig. 16c). This character was analyzed in Reis, 1998 (character 41).

99. Branchiostegal rays, number of rays associated to the anterior ceratohyal: (0) Five or more. (1) Four. (2) Two.

Branchiostegal rays are numerous in basal Loricarioidea; ranging from eight to twelve in Nematogenyidae and from five to eight in some Trichomycteridae, with an intraspecific and interspecific variation in the total number of rays (Arratia & Schultze, 1990). However, there is a reduction in the number of branchiostegal rays in remaining Loricarioidea, being invariably four in Callichthyidae, Scoloplacidae, Astroblepidae, and Loricariidae. Moreover, the individual branchiostegal rays are associated to different parts of the hyoid arc. In Trichomycteridae five or more rays are connected to the anterior ceratohyal, one or two to the interceratohyal cartilage, and one or two to the posterior ceratohyal (state 0). In Callichthyidae four rays are connected to the anterior ceratohyal (state 1, Figs. 16b, 16c). In Scoloplacidae, Astroblepidae, and Loricariidae two rays are connected to the anterior ceratohyal and two to the posterior ceratohyal (state 2).

100. First branchiostegal ray, size: (0) Long. (1) Short. (2) Absent.

As mentioned above, the total number of branchiostegal rays and the place of articulation of each element to the hyoid arc are variable within Loricarioidea. Such variability requests caution in using this feature as a systematic character if based on few specimens or only on juveniles (Arratia & Schultze, 1990). However, I observed variation within the subfamilies of Callicthyidae in size and shape of the first two branchiostegal rays and made an attempt to homologize this variation with remaining Loricarioidea. I observed seven to nine branchiostegal rays in the trichomycterids examined. Five rays are associated to the anterior ceratohyal, being the first of them always free. There are no free elements in the remaining Loricarioidea; this may suggest that the last four rays associated to the anterior ceratohyal of Trichomycteridae could be homologous with the four rays of the Callichthyidae, and also with the two rays of Scoloplacidae, Astroblepidae, and Loricariidae. Taking this in consideration, the second ray of Trichomycteridae is homologous with the first of Callichthyidae, and the first and second rays are missing in advanced Loricarioidea. To evaluate the size of the first ray comparison was done with the fouth ray. In Trichomycteridae and most Callichthyinae the first branchiostegal ray is long, its measure about three-fourths the fourth ray (state 0). In Corydoradinae and *Lepthoplosternum* the first branchiostegal ray is short, its measure about one-half the fourth ray or a little larger (state 1). The first ray is absent in Scoloplacidae, Astroblepidae, and Loricariidae (state 2).

101. Second branchiostegal ray, size: (0) Long. (1) Short. (2) Absent.

In Trichomycteridae and Callichthyinae the branchiostegal second ray is about the same size of the last two outer rays (state 0). Moreover, because the ray of callichthyines is long it is connected to the branchiostegal cartilage on its distal tip. However, in Corydoradinae the first two inner rays are evidently shorter, with their distal tips reaching the ventral margin of the branchial opening, and the second ray shorter than the fourth ray (about 75% of its size or a little smaller) and not connected to the branchiostegal cartilage (state 1). The second ray is absent in Scoloplacidae, Astroblepidae, and Loricariidae (state 2).

102. Parurohyal, shape: (0) Wide. (1) Compact. (2) Elongated. (3) Extremely elongated. (4) Extremely wide.

The parurohyal is typically a wide bone in most Trichomycteridae, *Corydoras ehrhardti*, *Corydoras flaveolus*, and *Corydoras weitzmani*; its length reaching about three-fourth its greater width (state 0). The parurohyal is compact in shape in *Thichogenes*, most Callichthyidae, and Scoloplacidae; its length about the same size its greater width or a little larger sometimes (state 1, Fig. 16b). The parurohyal is elongated in some *Corydoras* species, most *Hoplosternum*, and some *Lepthoplosternum*; its length about one-and-a-half its greater width (state 2, Fig. 16c). The parurohyal is extremely elongated in *Dianema* and *Hoplosternum magdalenae*; its length about two-and-a-half its greater width (state 3, Fig. 16d). The parurohyal is extremely wide of Astroblepidae and Loricariidae; its length reaching one-half its greater width or a little smaller (state 4).

103. Dorsal hypohyal: (0) Absent. (1) Present.

The dorsal hypohyal is typically absent in most Loricarioidea including the Callichthyinae (state 0, Fig. 16d). However, in Corydoradinae the dorsal hypohyal is present, typically small and roughly quadrangular in shape (state 1, Fig. 16a). This character was analyzed in Reis, 1998 (character 40) and Britto, 2003 (character 19).

104. Hypobranchial 1, shape: (0) Slender. (1) Deep.

The general shape of the hypobranchial 1 of most Callichthyidae is generally deep (state 1). Alternatively, the hypobrachial 1 is generally slender in Loricarioidea and *Callichthys* species (state 0). This character was analyzed in Britto, 2003 (character 20).

105. Hypobranchial 1, development of the laminar expansion of its anterior margin: (0) Poorly developed. (1) Well developed. (2) Laminar expansion absent.

The hypobranchial 1 of the Callichthyidae is entirely ossified and exhibit an antero-lateral projection expanded towards the anterior ceratohyal. *Copionodon*, *Trichogenes*, and Scolopacidae exhibit a similar hypobranchial 1, but totally cartilaginous in *Scoloplax*. In Callichthyidae the antero-lateral projection is well developed and contacts the posterior margin of the anterior ceratohyal (state 2). In *Copionodon*, *Trichogenes*, and Scolopacidae the antero-lateral projection is small and do not reach the anterior ceratohyal (state 1). *Trichomycterus*, Astroblepidae, and Loricariidae exhibit a rod-like hypobranchial 1, without the antero-lateral projection (state 2).

106. Hypobranchial 2, degree of ossification: (0) Totally cartilaginous. (0) Ossification reduced. (1) Ossification expanded.

The hypobranchial 2 is entirely cartilaginous in *Copionodon* and most Loricarioidea (state 0). In *Trichomycterus*, *Corydoras difluviatilis*, *Scleromystax barbatus*, and most Callichthyinae the hypobranchial 2 exhibits a reduced ossified portion, restricted anteriorly and equal in size or a little smaller than the cartilaginous posterior portion (state 1, Fig. 16e). However, in most Corydoradinae, most *Hoplosternum*, *Lepthoplosternum beni*, and *Megalechis picta* the ossified portion of the hypobranchial 2 is expanded posteriorly, reaching 75% or a little more of the entire bone (state 2, Fig. 16a). This character was analyzed in Britto, 2003 (character 21).

107. Hypobranchial 2, development of its anterior process: (0) Small. (1) Large.

The hypobranchial 2 exhibit a pointed anterior process developed towards the hypobranchial 1. In Loricarioidea, some *Aspidoras*, and *Scleromystax barbatus* the anterior process is small and do not contact the hypobranchial 1 (state 0). However, most Callichthyidae exhibit a long anterior process, which contact the hypobranchial 1 (state 1).

108. Ceratobranchial 1, process on its anterior margin: (0) Absent. (1) Small. (2) Large.

The ceratobranchial 1 of most Trichomycteridae, some Corydoradinae, most Callichthyinae, Scoloplacidae, and most Astroblepidae displays a smooth anterior margin, without processes (state 0). In most Corydoradinae, *Callichthys callichthys*, *Lepthoplosternum altamazonicum*, *Megalechis* picta, *Trichomycteus balios*, *Astroblepus* spB, and *Rineloricaria microlepidogaster* the anterior margin of ceratobranchial 1 exhibit a small process towards its proximal tip (state 1). In most Loricariidae the ceratobranchial 1 exhibit an extremely large process inserted on its proximal tip and developed postero-laterally (state 2). This character was analyzed in Britto, 2003 (character 22).

109. Ceratobranchial 5, size of its anterior portion: (0) Long. (1) Short.

The ceratobranchial 5 is curved around the middle and compose an anterior portion towards its proximal tip and a lateral portion towards its distal tip. In most Loricarioidea including the Corydoradinae the anterior portion is roughly equal or a little smaller than the lateral portion (state 0, Fig. 16g). However, in the

Callichthyinae and Astroblepidae the size of the anterior portion is evidently smaller than the lateral portion, its measure about one-third the total length of the bone (state 1, Fig. 16f). This character was analyzed in Britto, 2003 (character 24).

110. Epibranchial 1, laminar process on its anterior margin: (0) Absent. (1) Present.

The anterior margin of epibranchial 1 of the Corydoradinae exhibit a small laminar process located towards its proximal tip (state 1). Typical members of the Loricarioidea including the Callichthyinae lack such a process on the anterior margin towards its proximal portion (state 0). The epibranchial 1 bears a conspicuous anterior accessory flange for support of the first row of modified gill rakers (Schaefer, 1987). This process is also found in *Trichomycterus*. However, the position and orientation of the accessory flange suggest non homology with this structure. This character was analyzed in Reis, 1998 (character 43) and Britto, 2003 (character 25).

111. Epibranchial 2, pointed process on its posterior laminar expansion: (0) Laminar expansion without process. (1) Laminar expansion with a small process. (2) Laminar expansion with a large process. (3) Laminar expansion dorsally developed. (4) Laminar expansion absent.

In Trichomycteridae, *Corydoras armatus*, *C. brevirostris*, *C. cochui*, *C. difluviatilis*, *C. sanchesi*, and *Aspidoras fuscoguttatus* the epibranchial 2 exhibits a laminar expansion developed posteriorly and located in the proximal portion of its posterior margin (state 0). In most Callichthyidae the laminar expansion of the epibranchial 2 exhibit a small pointed process oriented towards its distal tip (state 1, Fig. 16h). In Astroblepidae the laminar expansion exhibit a large pointed process oriented towards its distal tip (state 2). In Loricariidae the laminar expansion is developed dorsally and the pointed process is located distally (state 3). In Scoloplacidae the epibranchial 2 is rod-like shaped and the laminar expansion is absent (state 4). This character was analyzed in Britto, 2003 (character 26). This author proposed the absence of a pointed process in the laminar expansion as a synapomorphy a larger group of *Aspidoras* species and some *Corydoras* species; however, the pointed process was observed in almost all callichthyids examined except those indicated above. Nevertheless, despite callichthyids and astroblepids exhibit a pointed process, the small size of the process seems to be unique among loricarioids.

112. Epibranchial 3, shape of the laminar expansion of its posterior margin: (0) Triangular. (1) Uncinate. (2) Wide lamina. (3) Laminar expansion absent.

The posterior margin of epibranchial 3 exhibit a triangular process developed dorsally in Trichomycteridae, some *Corydoras* species, *Aspidoras*, *Scleromystax barbatus*, most Callichthyinae, and Astroblepidae (state 0, Fig. 16h). However, in most *Corydoras* species, *Scleromystax*, and some *Lepthoplosternum* species the dorsal process is curved distally and shaped like a hook (state 1). In Loricariidae the laminar expansion is wide and the uncinate process is located distally (state 2). In Scoloplacidae the epibranchial 3 is rod-like shaped and the laminar expansion is absent (state 3). This character was analyzed in Britto, 2003 (character 27).

113. Neomorphic cartilaginous nodule: (0) Present. (1) Absent.

According to Bockmann & Miquelarena (2008) a neomorphic cartilaginous nodule is located near the inner tips of epibranchials 1 and 2 and the anterior tip of pharyngobranchial 3. This structure was observed in *Copionodon* and Callichthyinae (state 0, Fig. 16h). However, such a structure is absent in remaining Loricarioidea including the Corydoradinae (state 1). This character was analyzed in Reis, 1998 (character 45), who suggested this structure as homologous with the pharyngobranchial 2.

114. Pharyngobranchial 3, development of the laminar expansion of its posterior margin: (0) Small. (1) Large. (2) Absent.

The pharingobranchial 3 of *Copionodon*, *Trichogenes*, and most *Corydoras* species exhibits on its posterior margin a small rounded laminar expansion (state 0). In some *Corydoras* species, most *Aspidoras*, *Scleromystax*, and Callichthyinae the larminar expansion is large and triangular in shape (state 1, Fig. 16h). Most Loricarioidea exhibit a rod-like pharingobranchial 3, without laminar expansions (state 2). This character was analyzed in Britto, 2003 (character 28).

Supraorbital lateral-line canal

115. Canal entering nasal, number of pores: (0) Three. (1) Two. (2) Nasal absent.

In Trichomycteridae, some *Corydoras*, most *Aspidoras*, and some *Scleromystax* the nasal bone exhibits three sensory pores, the first on its anterior tip, the second near its posterior tip, and the third on its posterior tip (state 0). However, in most *Corydoras*, *Aspidoras psammatides*, most *Scleromysta*x, Callichthyinae, and Loricariinae the nasal exhibit two pores, the first on its anterior tip and the second on its posterior tip (state 1). In some *Corydoras* species the condition is variable, having two and three pores in the nasal. In Scoloplacidae the nasal is absent (state 2). This character was analyzed in Britto, 2003 (character 47).

116. Nasal, articulation with mesethmoid: (0) Not articulated. (1) Articulated.

The anterior margin of the nasal bone of some *Corydoras* species, *Aspidoras albater*, and Loricariinae is sutured to the postero-lateral margin of the mesethmoid (state 1, Fig. 8d). However, the typical condition found in Loricarioidea including the Corydoradinae is a nasal bone not articulated to the mesethmoid (state 0, Fig. 8e). Callichthyinae exhibits the nasal totally encapsulated by the lateral ethmoid and Scoloplacidae lack a nasal bone, this character being coded as inapplicable for these taxa. This character was analyzed in Britto, 2003 (character 9).

117. Canal entering lateral ethmoid: (0) Absent. (1) Present.

The supraorbital canal of most Loricariodea including the Corydoradinae begins at the sphenotic, passes through the parietal, and ends in the nasal (state 0). However, in Callichthyinae and Astroblepidae the supraorbital canal passes through the lateral ethmoid before entering the nasal (state 1, Fig. 8a). This character was analyzed in Reis, 1998 (character 12).

118. Canal entering parietal, length of the epiphyseal branch: (0) Short. (1) Long. (2) Extremely long. (3) Supraobital canal absent.

The supraorbital canal entering the parietal exhibits a pore opening around the middle of the bone, this pore is located near the main canal and corresponds to the epiphyseal branch in most Loricarioidea including most Callichthyidae (state 0, Fig. 8d). However, in some *Corydoras* and most *Aspidoras* species the pore is far from the main canal and develops a long branch that opens near the parietal fontanel (state 1, Fig. 8e). In Astroblepidae and Loricariidae the epiphyseal branch is extremely long and the pore is opened in the center of the head (state 2). In

Scoloplax distolothrix and *S. empousa* the supraorbital canal is absent (state 3). According to Schaefer (1990), the supraorbital canal is absent in most Scoloplacidae, being only present In *S. dicra*. This character was analyzed in Britto, 2003 (character 46).

Infraorbital lateral-line canal

119. Infraorbital canal, number of tubules: (0) Three. (1) One. (2) Zero. (3) Five. (4) Six. (5) Seven.

According to Fink & Fink (1981) primitive otophysians possess infraorbital canals associated to bony plates (compound structure), but the infraorbital series of Siluriformes consists entirely of the canal-bearing portions of the bones (single structure). However, Callichthyidae and Loricariidae are exceptions among the Siluriformes and exhibit a compound structure. In this section only characters relative to the infraorbital canals will be discussed. The recommendation of Bockmann (1998) was followed in order to individualize infraorbital canals, ossicles, or tubules. According to this author, pore openings are points of reference to distinguish canals, and each infraorbital tubule is delimited by two consecutive pores. Nevertheless, the presence of two tubules between two pores should be considered a secondary fragmentation. The first element of the infraorbital canal of Trichomycteridae displays a distinct transversal orientation and constitutes the antorbital tubule. Following these ideas, the compound lachrimal-antorbital (Schaefer, 1990) associated to the autopalatine of the Scoloplacidae is not considered as being part of the infraorbital series since it lacks coalesced canal tubules and was considered instead a palatine sesamoid bone (Schaefer, 1997). Consequently, the lost of the antorbital tubule could be considered a synapomorphy of the advanced Loricarioidea and comparison in number of the infraorbital canals omits the antorbital element of Trichomycteridae (see also on discussion the comments about the character 14 of Reis, 1998).

The infraorbital lateral-line series of *Copionodon* and Corydoradinae are constituted by three canals (state 0, Fig. 11c). In Corydoradinae the infraorbital tubules are contained in plated-like bones and the anteriormost two tubules are fused in a single bone structure. In *Trichomycterus* and Callichthyinae only one canal is present, represented by the posteriormost series associated to the sphenotics (state 1, Fig. 11e). In Scoloplacidae the infraobital series is absent, zero canals (state 2). In *Trichogenes* and *Astroblepus* five canals are present (state 3). In Loricariinae (*Harttia* and *Rineloricaria*) six canals are present (state 4). In Delturinae (*Hemipsilichthys*) seven canals are present (state 5).

Preopercular lateral-line canal

120. Canal entering preopercle, position of pore 5: (0) Anteriorly. (1) Medially.

The preopercular canal opens its pore 5 on the anterior portion of the preopercle, in the region below the quadrate in *Copionodon*, *Trichogenes*, *Hemipsilichthys*, and Corydoradinae (state 0, Fig. 15c). However, the pore 5 is located around the middle of the bone, in the region below the hyosymplectic cartilage in *Trichomycterus*, Callichthyinae, Astroblepidae, *Harttia*, and *Rineloricaria* (state 1, Fig. 15a). *Scoloplax distolothrix* and *S. empousa* lack the preopercular canal and this character was coded as inapplicable. This character was analyzed in Britto, 2003 (character 48).

121. Canal entering preopercle, position of pore 3: (0) Posterior tip of preopercle. (1) Hyomandibular postero-dorsal ridge.

The preopercular canal opens its pore 3 on the posterior tip of the preopercle in most Loricarioidea and most Callichthyidae (state 0, Fig. 15d). However, in some *Corydoras* and some *Aspidoras* the pore 3 opens in the postero-dorsal ridge of the hyomandibula (state 1, Fig. 15c). *Scoloplax distolothrix* and *S. empousa* lack preopercular canal and this character was coded as inapplicable for these species.

Otic and postotic-temporal lateral-line canals

122. Canal entering sphenotic, additional pore opening: (0) Absent. (1) Present.

The sphenotic of Loricarioidea contains on its posterior portion the otic branch, on its ventral portion the preopercular branch, and on its antero-dorsal portion the supraorbital branch (state 0). In some *Corydoras* species the sphenotic exhibits a pore opening on its supraorbital branch (state 1). *Scoloplax distolothrix* and *S. empousa* lack supraorbital canal and this character was coded as inapplicable for these species.

123. Canal entering compound pterotic, position of pore opening from the preopercle-mandibular branch: (0) Distant from anterior margin. (1) Near anterior margin.

The pterotic or the compound pterotic of most Loricariodea contains the preopercle-mandibular branch on its anterior portion and is easily identified by a pore opening. In *Copionodon*, some *Corydoras* species, and most Callichthyinae the pore opening of the preopercle-mandibular branch is located distant from the anterior margin of the pterotic or compound pterotic, around the middle of its anterior half of the bone or a little before that point (state 0, Fig. 11d). However, in most Loricarioidea, most Corydoradinae, *Dianema*, and *Hoplosternum littorale* the pore is opened near the anterior margin of the bone (state 1, Fig. 11b). *Scoloplax distolothrix* and *S. empousa* lack preopercle-mandibular branch and this character was coded as inapplicable for these species.

124. Canal entering compound pterotic, size of the preopercle-mandibular branch: (0) Long. (1) Short.

The pterotic or compound pterotic of Loricarioidea including *Aspidoras albater*, *A. poecilus*, and most Callichthyinae species exhibits a long preopercle-mandibular branch, its pore opening located ventrally, far from the main otic and postotic-temporal lateral-line canal (state 0, Fig. 11d). However, most Corydoradinae, *Dianema*, and most *Hoplosternum* exhibit a short preopercle-mandibular branch, its pore opening located around midline of the bone, near the main otic and postotic-temporal lateral-line canal (state 1, Fig. 11e). *Scoloplax distolothrix* and *S. empousa* lack preopercle-mandibular branch and this character was coded as inapplicable for these species.

125. Canal entering compound pterotic, additional branch: (0) Absent. (1) Present.

In most Loricarioidea and Corydoradinae the lateral line entering the pterotic or compound pterotic exhibit two branches; the anterior is the preopercle-mandibular branch and the posterior is the pterotic branch (located between pterotic and posttemporo-supracleithrum in some trichomycterids) (state 0). However, *Trichogenes* and Callichthyinae exhibit an additional branch between those branches (state 1, Figs. 11d, 11e). Reis (1998) named this structure as antero-lateral branch. However, to name it as additional branch seems more appropriate since the postero-lateral branch was named as pterotic branch by Arratia & Gayet (1995) and the comparison is lost without naming by the same manner the last structure. Terms of homology assessment are different from that proposed by Schaefer & Aquino (2000). Argumentation contemplates that the pterotic branch of the Corydoradinae is located immediately after the pointed ventral keel of the compound pterotic. The ventral keel of the compound pterotic of the Callichthyinae is not so sharp, is roughly rounded, and the posterior branch (when long, see below) is also located immediately after this keel. The ventral keel of the compound pterotic is identical to the postero-ventral keel of the pterotic of some trichomycterids, suggesting this region as the area where the fusion between pterotic and posttemporo-supracleithrum has ocurred. The presence of the keel in addition to the position of the pore opening of the posteriormost branch in *Callichthys*, *Lepthoplosternum*, and *Megalechis* supports this homology assessment. *Scoloplax distolothrix* and *S. empousa* lack canal tubules coalescent on compound pterotic and this character was coded as inapplicable for these species. This character was analyzed in Reis, 1998 (character 11).

126. Canal entering compound pterotic, size of the additional branch: (0) Short. (1) Long.

The pore opening of the additional branch of the pterotic or compound pterotic is short in *Trichogenes*, *Dianem*a, and *Hoplosternum*; located near the main postotic-temporal lateral-line canal (state 0, Fig. 11e). However, in *Callichthys*, *Lepthoplosternum*, and *Megalechis* the pore is opened distant from the main postotic-temporal lateral-line canal towards the ventral margin of the compound pterotic (state 1, Fig. 11d). Most Loricarioidea and Corydoradinae lack the additional branch and this character was coded as inapplicable for these taxa. *Scoloplax distolothrix* and *S. empousa* lack canal tubules coalescent on compound pterotic and this character was also coded as inapplicable for these species.

127. Canal entering compound pterotic, size of the pterotic branch: (0) Long. (1) Short. (2) Absent.

The posteriormost branch of the lateral-line canal entering the compound pterotic is the pterotic branch, which is present as a long branch in most Trichomycteridae, most Callichthyidae, and Loricariidae; its pore opening located distant from the main postotic-temporal lateral-line canal and reaching the ventral margin of the bone (state 0, Fig. 11d). However, in *Trichogenes*, *Dianema*, and *Hoplosternum* the pterotic branch is short; its pore opening located near the main postotic-temporal lateral-line canal around midline of the bone (state 1, Fig. 11e). The pterotic branch is absent in Astroblepidae (state 2). *Scoloplax distolothrix* and *S. empousa* lack canal tubules coalescent on compound pterotic and this character was coded as inapplicable for these taxa.

Trunk lateral-line canal

128. Tubules, number: (0) Sixty. (1) Thirty. (2) Twenty-six. (3) Seven. (4) Six. (5) Five. (6) Four. (7) Three. (8) Two. (9) One. (10) Zero.

The trunk lateral-line canal is composed by a large number of tubules in most Loricarioidea. However, these tubules are enclosed by large lateral body plates in Callichthyidae and Loricariidae, excepting the first two tubules which are free of association with dermal plates (Reis, 1998). The evaluation of the number of lateral-line tubules contemplates all tubules along the body distinguished by the presence of consecutive pore openings. *Copionodon* exhibits sixty tubules (state 0). *Harttia* and *Rineloricaria* thirty tubules (state 1). Astroblepidae and *Hemipsilichthys* twenty-six tubules (state 2). However, there is a reduction in the number of tubules in remaining Loricarioidea, particularly in the Callichthyidae and notably in Scoloplacidae. *Trichogenes* exhibit seven tubules (state 3). Some Corydoradinae and *Hoplosternum littorale* six tubules (state 4). Some Corydoradinae five tubules (state 5). Some Corydoradinae and *Dianema* four tubules (state 6). Most Corydoradinae, *Callichthys*, most *Hoplosternum*, *Lepthoplosternum*, and *Megalechis* three tubules (state 7). Some Corydoradinae two tubules (state 8). *Trichomycterus* one tubule (state 9). Scoloplacidae has no tubules, trunk lateral-line canal absent (state 10). This character was analyzed in Reis, 1998 (character 10).

129. First tubule, shape: (0) Tubular. (1) Laminar.

As exposed before, the anteriormost two tubules of the lateral-line canal are not associated to dermal plates. The normal condition among Loricarioidea including most Callichthyidae is a slender first tubule, without laminar expansions (state 0, Fig 11d). However, *Harttia kronei*, *Dianema*, and *Hoplosternum* exhibit the first tubule laminary expanded (state 1, Fig. 11e). *Scoloplax distolothrix* and *S. empousa* lack lateral-line tubules and this character was coded as inapplicable for these species. This character was analyzed in Reis, 1998 (character 8).

130. Second ossicle, shape: (0) Tubular. (2) Laminar.

Similar to the anterior character, the second tubule is slender in *Copionodon*, *Trichogenes*, *Callichthys*, *Lepthoplosternum*, *Megalechis*, and Astroblepidae; without laminar expansions (state 0, Fig. 11d). However, most Callichthyidae and Loricariidae exhibit the second tubule laminary expanded (state 1, Fig. 11e). *Trichomycterus* possess only one tubule and this character was coded as inapplicable for this genus. *Scoloplax distolothrix* and *S. empousa* lack lateral-line tubules and this character was also coded as inapplicable for these species. This character was analyzed in Reis, 1998 (character 9) and Britto, 2003 (character 49).

131. Second ossicle, degree of its laminar development: (0) Ventral expansion smaller in size than dorsal expansion. (1) Ventral expansion equal in size to dorsal expansion or larger. (2) Ventral expansion twice the size of dorsal expansion or larger.

This character was analyzed in Reis, 1998 (character 9). This author distinguished that the laminar expansion of *Aspidoras* and *Corydoras* (including *Brochis*) are particularly developed and codified them as a distinct character state. In fact, this observation was corroborated for most Corydoradinae, but a small number of species displays laminar expansion roughly similar in shape to those of the Callichthyinae. Three conditions were identified: In *Hoplosternum littorale* and *Hemipsilichthys* the ventral expansion is smaller than the dorsal expansion, its measure one-half the dorsal expansion or a liitle smaller (state 0). In some *Corydoras* species, *Aspidoras virgulatus*, most *Scleromystax* species, *Dianema*, and most *Hoplosternum* species the ventral expansion equals the size of the dorsal expansion and usually exceed its size (state 1). In most *Corydoras* species, most

Aspidoras species, and *Scleromystax barbatus* the ventral expansion double in size the dorsal expansion and usually exceed this measure (state 2).

Weberian apparatus, axial skeleton & unpaired fins

132. Complex vertebra, shape of the transverse process: (0) Compact. (1) Slender.

This character was analyzed in Britto, 2003 (character 12). This author proposed a compact transverse process of the complex vertebra as a synapomorphy for most *Corydoras* species excepting a small group of *Corydoras* and *Scleromystax* species; its width nearly the same size as its length. However, a compact and wide transverse process was observed in all Corydoradinae species including the *Corydoras* and *Scleromystax* species cited before and to delimit characters within this continuum resulted difficult. In Trichomycteridae, most Callichthyidae, and Scoloplacidae the width of the transverse process ranges from equal size its length (distance from lateral tip to complex centrum) to one-half that distance (state 0, Fig. 12d). However, the slender condition was easier to distinguish in *Aspidoras albater*, *A. poecilus*, *A. taurus*, *Callichthys*, *Hoplosternum*, *Lepthoplosternum*, *Megalechis*, Astroblepidae, and Loricariidae; its width about one-third its length (state 1, Fig. 12b).

133. Complex vertebra, anterior margin of the transverse process: (0) Convex. (1) Convex and carinated. (2) Straight.

The anterior margin of the transverse process of the complex vertebra is usually convex in shape in most Loricarioidea including most Callichthyidae (state 0, Fig. 12c). In some *Corydoras* species the anterior margin is convex and with a distinct keel developed anteriorly (state 1, Fig. 12d). However, in *Callichthys*, *Hoplosternum littorale*, *Lepthoplosternum*, *Megalechis*, and Loricariidae the anterior margin is straight (state 2, Fig. 12b).

134. Complex vertebra, ventral process: (0) Absent. (1) Well developed. (2) Poorly developed. (3) Posteriorly developed.

The transverse process of the complex vertebra delimits the Weberian capsule by its anterior expansions or by association to other cranial bones; in most

Loricarioidea the transverse process do not develops ventral protruding parts (state 0). However, in most Callichthyidae the transverse process exhibits a large ventral projection near the complex centrum (state 1, Fig. 12b). This structure was named as ventral process of the complex ventebra by Reis (1998). In some *Aspidoras* and *Scleromystax* species the ventral process is small or little developed (state 2). The complex vertebra of Loricariidae also exhibits a thin process; however, it is directed posteriorly and fused to the complex centrum (state 3).

135. Complex vertebra, shape of the bony bridge: (0) Wide. (1) Narrow. (2) Absent.

In Trichomycteridae and Callichthyidae the complex vertebra have on its centrum a bony bridge for the passage of the aortic canal. In Trichomycteridae the bony bridge is usually wide (state 0). In Callichthyidae the bony bridge is narrow (state 1, Fig. 12c). Scoloplacidae, Astroblepidae, and Loricariidae lack such structure (state 2).

136. Vertebrae, total number of free elements: (0) Thirty-five or more. (1) Twenty-eight. (2) Twenty-seven. (3) Twenty-six. (4) Twenty-five. (5) Twenty-four. (6) Twenty-three. (7) Twenty-two. (8) Twenty-one. (9) Twenty.

In Trichomycteridae the total number of free vertebrae is large, ranging from thirty-five in *Copionodon* to forty-one in *Trichomycterus areolatus* (state 0). However, there is a reduction in number in remaining loricariods, ranging from twenty-eight free vertebrae in *Hemipsilichthys gobio* and *Harttia kronei* (state 1) to twenty in some *Corydoras* species (state 9). This character was analyzed in Britto, 2003 (character 51).

137. Vertebra, laminar expansions on neural and haemal spines: (0) Absent. (1) Restricted to the proximal portion of spine. (2) Reaching the distal tip of spine.

The neural and haemal spines of the abdominal and caudal vertebrae of Trichomycteridae and most Callichthyidae are thin, without any expansions along their margins (state 0). However, in most *Corydoras* species the neural and haemal spines exhibit a laminar expansion restricted on the proximal portion of their anterior margin (state 0). In Scoloplacidae, Astroblepidae, and Loricariidae the neural and haemal spines are wide, with a large laminar expansion reaching their distal tips (state 1). This character was analyzed in Britto, 2003 (character 53).

138. Preural vertebrae, shape of the distal tips of neural and haemal spines: (0) Pointed and expanded. (1) Expanded and digitated. (2) Extremely expanded.

The last two preural vertebrae of Trichomycteridae and Callichthyinae exhibit pointed tips on their neural spines and expanded tips on their haemal spines (state 0). In Corydoradinae the distal tips of their neural and haemal spines are expanded and digitated (state 1). In Scoloplacidae, Astroblepidae, and Loricariidae the distal tips of their neural and haemal spines are extremely expanded (state 2).

139. Ribs, total number: (0) Twelve or more. (1) Ten. (2) Nine. (3) Eight. (4) Seven. (5) Six. (6) Five. (7) One.

Copionodon, *Trichomycterus*, and Astroblepidae exhibit twelve to fourteen ribs. In *Trichogenes*, most Callichthyinae, and most Loricariidae eight to ten ribs are present. However, in *Rineloricaria microlepidogaster* and Corydoradinae five to seven ribs are present. In Scoloplacidae the ribs are extremely reduced in number, only one pair of ribs is present. This character was analyzed in Britto, 2003 (character 52).

140. First rib, length: 0) Short. (1) Long.

The first pair of ribs is typically short in most Loricarioidea, its distal tip reaching about the midline of body or slighthly surpassing this point (state 0). However, in Callichthyidae the first pair of ribs is longer, its distal tip expanded ventrally and reaching the abdomen (state 1).

141. First rib, laminar expansions: (0) Absent. (1) Wide. (2) Elongated.

In Trichomycteridae, *Scoloplax empousa*, *Rineloricaria microlepidogaster*, and Astroblepidae the first pair of ribs is slender in shape, without laminar expansions (state 0). In *Scoloplax distolothrix*, *Hemipsilichthys*, and *Harttia* the first pair of ribs develops a wide laminar expansion restricted to its distal tip that articulates with dermal lateral plates (state 1). However, in Callichthyidae the first pair of ribs exhibits an elongated laminar expansion in a large area of the medial portion that articulates with the dorso-lateral and ventro-lateral plates (state 2).

142. First rib, connection with second dorsal-fin pterygiophore: (0) Absent. (1) By means of ligament articulation. (2) By bone articulation.

In Trichomycteridae the dorsal fin is located posteriorly, distant from the first pair of ribs and without any articulation point between both structures (state 0). However, in remaining loricarioids the dorsal fin is located anteriorly and the first pair of ribs is connected to the second dorsal-fin pterigiophore. In Callichthyidae the distal portion of the first rib is connected to the transverse process of the second pterygiophore by means of a ligament (state 1). In Scoloplacidae, Astroblepidae, and Loricariidae the articulation between both structures occurs by means of a bone (state 2). This structure was named as lateral bone by Bailey & Baskin (1976).

143. Ribs, articulation with the anterior external process of basipterygia: (0) Absent. (1) Present.

The basipterygia of Loricarioidea including most Callichthyidae is located distant from the first pair of ribs and thus not connected to it (state 0). However, in some *Corydoras* species the first rib articulates to the basipterygium by means of connective tissue (state 1). This contact is located on the external arm of the anterior process of the basipterygium, which is usually associated to the second ventro-lateral scute. In most species of *Corydoras* the first rib do not articulates to the pelvic girdle because the basipterygia is located a little posteriorly on body, usually associated to the third ventro-lateral scute.

144. Ribs, articulation with isquiatic process of basipterygia: (0) Absent. (1) Fourth rib. (2) Fifth rib. (3) Seventh rib.

The ribs are also associated to the isquiatic process of the basipterygia in Callichthyinae. In some *Lepthoplosternum* species the fourth rib contacts the isquiatic process of the basipterygium (state 1). The typical condition among Callichthyinae is the fifth rib contacting the isquiatic process (state 2). However, in *Callichthys fabricioi* the seventh rib contacts the isquiatic process (state 3). In remaining Loricarioidea, including Corydoradinae, no contact exists between ribs and the isquiatic process (state 0). This character was analyzed in Reis, 1998 (character 65).

145. Supraneurals: (0) Absent. (1) Present.

Supraneurals are absent in Trichomycteridae (state 0). The supraneural is fused to the first pterygiophore in Loricariidae (Schaefer, 1997). The typical condition of most Loricariodea including the Corydoradinae is the absence of free supraneurals (Fig. 17a); however, if they are truly absent or fused to the dorsal-fin pterygiophores is not clear and were coded as the anterior condition. However, Callichthyinae exhibit one supraneural just anterior to the first dorsal-fin pterygiophore (state 1, Fig. 17b). *Lepthoplosternum stellatum* presented one exemplar with fused supraneural to the dorsal-fin pterygiophore and were coded as polymorphic, having both conditions. This character was analyzed in Reis, 1998 (character 48).

146. Dorsal-fin pterygiophores, number: (0) Nine. (1) Eight. (2) Seven. (3) Four. (4) More than twelve.

Copionodon and *Hemipsilichthys nimius* exhibit nine dorsal-fin pterygiophores (state 0). Most Callichthyidae and remaining Trichomycteridae and Loricariidae here examined exhibit eight pterygiophores (state 1). Astroblepidae exhibits seven pterygiophores (state 2). In Scoloplacidae pterygiophores are extremely reduced in number, just four elements being present (state 3). However, some *Corydoras* shows larger number of pterygiophores, usually more than twelve elements (state 4).

147. First dorsal-fin pterygiophore, degree of development of its antero-dorsal expansion (nuchal plate): (0) Absent. (1) Small. (2) Intermediate. (3) Long.

In Trichomycteridae the antero-dorsal expansion of the first pterygiophore is absent, no nuchal plate developed (state 0). In remaining loricarioids the first pterygiophore is expanded antero-dorsally and establishes the nuchal plate. In order to evaluate size of the antero-dorsal expansion comparison was done with the main body of the pterygiophore. In some *Aspidoras* species, *Callichthys*, *Lepthoplosternum tordilho*, and *Hemipsilichthys* the antero-dorsal expansion is small, its measure about one-third its length (state 1, Fig. 17b). In most Callichthyidae the antero-dorsal expansion is intermediate, its measure about one-half its length (state 2). In *Aspidoras virgulatus*, some *Corydoras* species, *Scleromystax barbatus*, *S. macropterus*, Scoloplacidae, *Harttia*, and *Rineloricaria* the antero-dorsal expansion is long, its measure about equal size its length or a little smaller (state 3, Fig. 17a). This character was modified from Reis, 1998 (character 51) and Britto, 2003 (character

11). These authors proposed a long nuchal plate in contact with the postparieto-supraoccipital as a synapomorphy for most Corydoradinae excepting most *Aspidoras* species. However, contact between both structures also depends on the degree of development of the posterior process of the cranial bone. This is evident among some Callichthyinae that displays a nuchal plate equal in size to that of some *Corydoras*, but without contact with postparieto-supraocciptal because of its short posterior process.

148. First pterygiophore, external exposition of its antero-dorsal expansion (nuchal plate): (0) Not exposed, covered by skin. (1) Exposed externally.

The antero-dorsal expansion of the first pterygiophore of most Loricarioidea including some *Aspidoras* species and the Callichthyinae is usually covered by a thick layer of skin or by dermal plates (state 0, Fig. 17b). However, in Corydoradinae, *Scoloplax distolothrix*, *Harttia*, and *Rineloricaria* the antero-dorsal expansion is exposed externally (state 1, Fig 17a). This character was analyzed in Reis, 1998 (character 50) and Britto, 2003 (character 54).

149. First pterygiophore, degree of external exposition of its antero-dorsal expansion (nuchal plate): (0) Large. (1) Small.

The antero-dorsal expansion of the first pterygiophore of most Corydoradinae, *Harttia*, and *Rineloricaria* is usually totally exposed externally (state 0). However, in some *Aspidoras* species and *Scoloplax distolothrix* the antero-dorsal expansion exposed externally is restricted to a small area on its posterior portion (state 1). The antero-dorsal expansion of the first pterygiophore of most Loricarioidea including the Callichthyinae is covered by a thick layer of skin or by dermal plates and was coded as inapplicable.

150. Second dorsal-fin pterygiophore, articulation to the vertebral column: (0) Ninth centrum or posterior. (1) Third centrum. (2) Second centrum. (3) First centrum.

The main body of the second dorsal-fin pterygiophore is articulated to the neural spine of the vertebral column. However, according to the position of the dorsal fin the articulation point to vertebral column is variable among loricarioids. In Trichomycteridae the dorsal fin is located posteriorly on body and associated to the free vertebra of the ninth centrum in *Copionodo*n, seventeenth centrum in

Trichogenes, or twentieth centrum in *Trichomycterus* (state 0). However, in remaining loricarioids the dorsal fin is located anteriorly on body. In Scoloplacidae and Loricariinae (*Harttia* and *Rineloricaria*) the second pterygiophore is articulated to the neural spine of the third free centrum (state 1). In Callichthyinae and *Hemipsilichthys* it is articulated to the neural spine of the second free centrum (state 2, Fig. 17b). In Corydoradinae and Scoloplacidae is articulated to the neural spine of the first free centrum (state 3, Fig 17a).

151. Second dorsal-fin pterygiophore, size of its lateral process: (0) Absent. (1) Short. (2) Long.

The second dorsal-fin pterygiophore do not develops laminar expansions in Trichomycteridae (state 0). However, in Scoloplacidae, Astroblepidae, and Loricariidae the second pterygiophore develops a short lateral process that serves as the articulation point of the lateral bone and dermal plates (state 1). In Callichthyidae the lateral process is evidently longer (state 2, Fig. 17a).

152. Dorsal-fin pterygiophores, lateral processes of posteriormost elements: (0) Absent. (1) Present.

The dorsal-fin pterygiophores posterior to the second element of Trichomycteridae, *Callichthys callichthys*, *Callichthys fabricioi*, and Scoloplacidae lack transverse processes (state 0, Fig. 17b). However, remaining Loricarioidea including the Callichthyidae develop transverse processes on its pterygiophores, sometimes absent in the last two elements (state 1, Fig. 17a). This character was analyzed in Reis, 1998 (character 49). This author proposed the lost of tranversal processes as a synapomorphy of *Callichthys*. However, *Callichthys serralabium* exhibit dorsal-fin pterygiophores with transversal processes. Transversal processes in *Callichthys* should be further studied in larger specimens to discard absence due early developmental stages.

153. Second dorsal-fin ray: (0) Soft. (1) Hard, pungent spine.

The second dorsal-fin ray is usually soft in most Loricarioidea including *Callichthys* and some *Lepthoplosternum* species (state 0, Fig. 17b). However, in most Callichthyidae and Scoloplacidae the second dorsal fin is hard, appearing as a pungent spine (state 1, Fig. 17a).

154. Second dorsal-fin ray, length: (0) Extremely short. (1) Short. (2) Long.

The second dorsal-fin ray is composed of an unsegmented proximal portion followed by several small lepidotrichia towards its distal portion. The proximal portion is hard and fused as a spine in some Loricarioidea (see above) and remaining lepidotrichia are usually named as spurious rays. Despite of being soft or hard, the size of the proximal portion is variable among loricarioids. In Trichomycteridae, some *Aspidoras* species, *Callichthys*, Astroblepidae, and Loricariidae the proximal portion of the dorsal ray is extremely short, its measure about one-third its entire length (state 0). In most *Aspidoras*, most *Hoplosternum*, some *Lepthoplosternum*, and *Megalechis thoracata* the proximal portion of the dorsal-fin spine is short, its measure about one-half its entire length (state 1). However, in most Callichthyidae and Scoloplacidae the dorsal spine is usually large, its measure about 60% its entire length or larger (state 2). This character was modified from Britto, 2003 (character 55). According to this author almost all members of the Callichthyidae have a dorsal-fin spine of the same size or slightly smaller than the first two or three branched dorsal-fin rays. This author proposed as a synapomorphy of some *Corydoras* species a much longer spine than adjacent dorsal-fin rays. However, most Callichthyidae exhibit a dorsal-fin spine roughly equal in size to adjacent branched rays or a little smaller. Some *Corydoras* species (*Corydoras* long snout and *Corydoras* pygmy group) exhibit a dorsal-fin spine of about 60% adjacent rays. Other *Corydoras* species (*Corydoras armatus* and *C. loretoensis*) exhibit a dorsal-fin spine a little larger than adjacent rays. To delimit character states among this diversity resulted difficult and the shorter condition was easier to detect.

155. Second dorsal ray, denticulations on posterior margin: (0) Absent. (1) Oriented distally. (2) Oriented proximally.

The second dorsal ray lacks denticulations on its posterior margin in most Loricarioidea including *Aspidoras*, *Scleromystax macropterus*, and Callichthyinae (state 0). However, in most *Corydoras* and *Scleromystax* species the dorsal fin exhibit large denticulations oriented towards its distal tip (state 1). In some *Corydoras* species the denticulations are present, but a little smaller in size and oriented towards its base (state 2).

156. Branched dorsal-fin rays, number: (0) Seven. (1) Eight. (2) More than ten. (3) Six. (4) Four.

Trichomycteridae, most Callichthyinae, and Loricariidae usually exhibit seven branched rays in the dorsal fin (state 0). In most Callichthyidae the typical condition is the presence of eight branched rays (state 1). In some *Corydoras* species there are a larger number of branched rays, usually twelve but sometimes eighteen rays (state 2). In *Callichthys fabricioi*, some *Lepthoplosternum* species, and Astroblepidae six branched rays are present (state 3). This character was analyzed in Reis, 1998 (character 52) and Britto, 2003 (character 57).

157. Branched dorsal-fin rays, elongation of anteriormost rays in sexually dimorphic male specimens: (0) Not elongated. (1) Elongated.

Sexually dimorphic male specimens of some *Corydoras* species, *Aspidoras albater*, and most *Scleromystax* species exhibit their anteriormost three dorsal-fin branched rays distinctly elongated compared to remaining rays (state 1). In *Corydoras longipinnis*, *Corydoras paleatus*, and *Scleromystax* species the elongation is extreme, usually surpassing the adipose fin and reaching the caudal-fin base. Most Loricarioidea including the Callichyidae lack distinct elongation in their sexually dimorphic male specimens (state 0). This character was analyzed in Britto, 2003 (character 56).

158. Anal-fin pterygiophores, number: (0) Twelve or more. (1) Six. (2) Five. (3) Four.

There is a large number of anal-fin pterygiophores in *Copionodon* and *Trichogenes*, ranging from twelve to thirty-four bones (state 0). However, there is a reduction in number in remaining loricarioids. Six anal-fin perygiophores is the normal condition in *Trichomycterus*, most Callichthyidae, Astroblepidae, and *Hemipsilichthy*s (state 1). In *Callichthys serralabium*, *Dianema longibarbis*, *Lepthoplosternum*, and *Harttia kronei* five pterygiophores are present (state 2). In Scoloplacidae and *Rineloricaria microlepidogaster* only four pterygiophores are present (state 3).

159. Unbranched anal-fin rays, number: (0) Five or six. (1) Two. (2) One.

Trichomycteridae usually exhibit five or six unbranched rays in the anterior portion of the anal fin (state 0). In remaining loricarioids there is a reduction in number of the anteriormost unbranched rays. Two unbranched rays is the normal condition in most Callichthyidae and *Hemipsilichthys gobio* (state 1). However, in Scoloplacidae, *Lepthoplosternum*, Astroblepidae, and Loricariidae only one unbranched ray is present (state 2). This character was analyzed in Reis, 1998 (character 53).

160. Branched anal-fin rays, number: (0) Nine or more. (1) Six. (2) Five.

The anal fin of *Copionodon* and *Trichogenes* exhibit a large number of branched anal-fin rays, nine and thirty rays respectively (state 0). However, there is a reduction in number in remaining loricariods. Six branched rays is the normal condition in most Callichthyidae and Astroblepidae (state 1). Five rays are present in *Trichomycterus*, some *Corydoras* species, *Callichthys*, *Lepthoplosternum*, Scoloplacidae, and Loricariidae (state 2).

161. Anal-fin rays, shape of the proximal segment of anteriormost elements: (0) Thin. (1) Thick.

The anal-fin rays are usually thin in shape in Loricarioidea including most Callichthyidae (state 0). However, in some *Corydoras* species, *Dianema*, and *Hoplosternum* the proximal portion of the unbranched and branched rays are distinctly broad or thick in shape (state 1). This character was analyzed in Britto, 2003 (character 58, character 59).

162. Caudal fin, shape: (0) Bilobed. (1) Rounded.

The caudal fin of most Loricarioidea is usually bilobed in shape (state 0). However, in *Trichomycterus*, *Callichthys*, *Lepthoplosternum*, *Megalechis*, and Scoloplacidae the caudal fin is rounded in shape (state 1). This character was analyzed in Reis, 1998 (character 54) and Britto, 2003 (character 60).

Pectoral girdle and fin

163. Cleithrum, fossa on its dorsal margin: (0) Absent. (1) Present.

The antero-dorsal lamina of the cleithrum in Loricarioidea is curved anteriorly to form the posterior wall of the branchial chamber. The antero-dorsal lamina of the cleithrum of *Trichomycterus balios*, most *Lepthoplosternum* species, and Astroblepidae exhibit several small fossae (state 1). The antero-dorsal lamina of cleithrum of most Loricarioidea including most Callichthyidae is uniformly solid, without holes in this surface (state 0).

164. Cleithrum, exposition of its antero-ventral portion: (0) Not exposed. (1) Small, restricted laterally. (2) Large, expanded medially.

The antero-ventral portion of cleithrum is covered by a thick layer of skin or by dermal plates in Loricarioidea (state 0). However, in most Callichthyidae the cleithrum is externally exposed in an area restricted to the lateral margin (state 1). In some *Corydoras*, most *Hoplosternum*, most *Lepthoplosternum*, and *Megalechis picta* the exposed area of cleithrum is larger; it is expanded medially and reaches 60% or 70% of the bone surface (state 2). This character was analyzed in Britto, 2003 (character 64).

165. Cleithrum, development of its posterior process: (0) Absent. (1) Small. (2) Extremely large.

The lateral margin of cleithrum is not developed in a posterior process in Trichomycteridae (state 0). In Scoloplacidae, Astroblepidae, and Loricariidae the lateral margin is little developed posteriorly, not surpassing the last pectoral radials (state 1). Alternatively, in Callichthyidae the posterior processes of the cleithrum and coracoid are extremely developed and sutured to each other posterior to the pectoral-fin base, reaching around the middle of adpressed pectoral-fin spine (state 2). This character was analyzed in Reis, 1998 (character 55).

166. Cleithrum and scapulocoracoids, arrector fossa: (0) Absent. (1) Opened. (2) Closed by expansions of cleithrum and scapulocoracoid. (3) Closed by expansions of the scapulocoracoids.

The bones of the pectoral girdle delimit a concavity on the ventral surface for the insertion of the muscles responsible for the movement of the pectoral fin. According to Diogo *et al*. (2001), in Siluriformes there are three muscles directly associated with the movement of the pectoral spine: *arrector dorsalis*, *arrector* *ventralis*, and *abductor profundus*; and two muscles directly related with the movement of the pectoral fin: *adductor superficialis section 1* and *abductor superficialis section 2*. The cleithrum is located antero-dorsally to the pectoral-fin insertion and develops an antero-ventral lamina that delimits the anterior wall and the dorsal roof of the pectoral muscles. The scapulocoracoid is located postero-dorsally to the pectoral-fin insertion and delimits the posterior wall and the dorsal roof of the pectoral muscles. The cleithrum and scapulocoracoid of Trichomycteridae are little developed postero-ventrally and antero-ventrally, respectively, to meet each other leaving no compartment for the pectoral-fin muscles; so the arrector fossa is absent, not delimited by these bones (state 0). A similar condition was observed in Astroblepidae. Conversely, in Callichthyidae, Scoloplacidae, and Loricariidae the cleithrum and scapulocoracoid are developed posteriorly and anteriorly, respectively, to meet each other leaving a compartment for the pectoral-fin muscles. These loricarioids develop a scapulocoracoid bridge that delimits the arrector fossa for the passage of the *arrector ventralis*. In most Callichthyidae, Scoloplacidae, and Loricariidae the arrector fossa is opened, without laminar expansions covering this cavity (state 1, Fig. 18a). In some *Corydoras* species and *Aspidoras* spA the arrector fossa is partially closed by expansions of both cleithrum and scapulocoracoid, but mainly by the laminar expansions of the cleithrum (state 2, Fig. 18b). In most Callichthyinae the arrector fossa is totally closed by expansions of the scapulocoracoid (state 3).

167. Scapulocoracoids, sutural contact at midline: (0) Absent. (1) Entire margin. (2) Restricted posteriorly.

The scapulocoracoid of Trichomycteridae, Astroblepidae, and *Hemipsilichthys gobio* is little developed and does not interdigitate with its counterpart in the midventral line (state 0). In Callichthyinae, Scoloplacidae, and Loricariidae the scapulocoracoid joins its counterpart in an interdigitation of several strong serrations among its entire margin (state 1). Alternatively, in most Corydoradinae the scapulocoracoids meet medially but with strong interdigitated serrations restricted on its posterior portion only (state 2, Fig. 18a).

168. Scapulocoracoid, size of its dorsal keel: (0) Absent. (1) Small. (2) Large.

The scapulocoracoid of Trichomycteridae and Astroblepidae is little developed and do not exhibit a dorsal keel (state 0). However, in most Callichthyidae, Scoloplacidae, and Loricariidae the scapulocoracoid is developed mesially and exhibit a small dorsal keel, its measure about one-half the ventral lamina width or a little smaller (state 1). In most *Corydoras* species, *Aspidoras virgulatus*, *Scleromystax barbatus*, and *S. salmacis* the dorsal keel is large, its measure roughly equal to the ventral lamina width or a little smaller (state 2). Britto & Reis (2005) named this structure as ventral keel of scapulocoracoid.

169. Scapulocoracoid, degree of development of its posterior process: (0) Not developed. (1) Small. (2) Large. (3) Extremely large.

The lateral portion of the scapulocoracoid that borders the pectoral-fin insertion is not developed posteriorly in Trichomycteridae and Astroblepidae (state 0). In most *Aspidoras* species, *Scleromystax barbatus*, most *Callichthys*, and Loricariidae the posterior process of the scapulocoracoid is small; its measure roughly equal to the pectoral-fin insertion (area of the pectoral radials) or a little smaller (state 1, Fig. 18a). However, in most *Corydoras* species, *Aspidoras* spA, *Scleromystax macropterus*, *S. salmacis*, *Callichthys fabricioi*, and Scoloplacidae the posterior process of the scapulocoracoid is large; its measure two times the area of the pectoral-fin insertion (state 2, Fig. 18b). In all these taxa the distal tip of the posterior process of the scapulocoracoid is bordered by the postero-ventral expansion of the cleithrum. However, in some *Corydoras* species and most Callichthyidae the posterior process of the scapulocoracoid is extremely developed, such that its distal tip is not bordered by the cleithrum, the posterior process development is larger than three times the pectoral-fin insertion area and might reach up to six or seven times that area in *Dianema* (state 3).

170. Scapulocoracoid, dorsal expansion of its posterior process: (0) Not expanded. (1) Expanded.

The posterior process of the scapulocoracoid is expanded dorsally just posterior to pectoral-fin insertion area and articulates with the cleithrum (state 1). Such expansion is absent in Scoloplacidae and Loricariidae (state 0). Trichomycteridae and Astroblepidae lack a posterior expansion and this character was coded as inapplicable for these taxa.

171. Scapulocoracoid, degree of development of the medial expansion of its posterior process: (0) Small or absent. (1) Large.

The posterior process of the scapulocoracoid of most Loricarioidea, including most Callichthyidae, does not develop a medial laminar expansion, or if it does, it is very small (state 0, Fig. 18a). However, in some *Corydoras* species and most Callichthyinae it is present and distinctly large, the laminar expansion being developed medially attaining about one-fourth of the belly (state 1, Fig. 18b). Moreover, the medial expansion attains one-half of the abdomen and even meets its counterpart in sexually dimorphic male specimens. Trichomycteridae and Astroblepidae lack a posterior expansion and this character was coded as inapplicable for these taxa. This character was analyzed in Reis, 1998 (character 56) and Britto, 2003 (character 63).

172. Scapulocoracoid, external exposition of the medial expansion of its posterior process: (0) Not exposed. (1) Exposed.

The medial expansion of the posterior process of the scapulocoracoid is not exposed ventrally, covered by a thick layer of skin in some Callichthyidae, Scoloplacidae, and Loricariidae (state 0). However, in some *Corydoras* species and most Callichthyinae the medial expansion is totally or almost totally exposed externally (state 1). Trichomycteridae and Astroblepidae lack a posterior expansion and this character was coded as inapplicable for these taxa. This character was analyzed in Britto, 2003 (character 62).

173. Pectoral spine, size of its ossified portion: (0) Small. (1) Intermediate. (2) Large.

Similar to the condition observed in the dorsal-fin spine, the pectoral-fin spine of most Loricarioidea is fused and hardened as a pungent spine with a distal tip usually bearing spurious rays. The pectoral-fin ray is composed of a large, solid proximal portion followed by several small lepidotrichia towards its distal portion. Either being soft or hard, the size of the proximal portion is variable among loricarioids. In Trichomycteridae, most *Aspidoras* species, Astroblepidae, *Harttia*, and *Rineloricaria* the proximal portion of the spine is short, its measure about one-half the spine length or a little smaller (state 0). In some *Corydoras* species, *Aspidoras* spA, *A. virgulatus*, *Scleromystax*, most *Lepthoplosternum* species, and Scoloplacidae the pectoral spine is intermediate, its measure about 75% its length or a little smaller (state 1). However, the typical condition observed in most Callichthyidae and *Hemipsilichthys* is a long pectoral spine, almost totally ossified and measuring roughly equal to adjacent branched rays or a little smaller (state 2). This character was analyzed in Reis, 1998 (character 58) and Britto, 2003 (character 66).

174. Pectoral spine, rounded patch of skin in sexually dimorphic males: (0) Absent. (1) Present.

The ossified portion of the pectoral-fin spine of some *Corydoras* species and *Hemipsilichthys* exhibit a distinct patch of broaden skin in the middle portion of the spine (state 1). The extraordinary skin expansion is usually rounded and manifested in the sexually dimorphic male specimens of these taxa when the hyperthrophied odontodes appears. Such an expansion of the skin surface of the pectoral fin is absent or small in remaining Loricarioidea including most Callichthyidae, if a skin expansion appears, it is never manifested as a distinct rounded patch (state 0).

175. Pectoral-fin spine, elongation in sexually dimorphic males: (0) Not elongated. (1) Elongated. (2) Extremelly elongated.

The pectoral spine and branched rays are not elongated in sexually dimorphic males of Loricarioidea including most *Corydoras* species and *Aspidoras* (state 0). However, in some *Corydoras* species, *Scleromystax*, and Callichthyinae the pectoral fin of males are generally slightly longer or stronger than females (state 1). In a smaller group of *Corydoras* species, *Scleromystax*, *Hoplosternum*, and *Megalechis* the sexual dimorphism is manifested as a drastic elongation of the pectoral fin, especially in the pectoral-fin spine (state 2). This character was analyzed in Reis, 1998 (character 57) and Britto, 2003 (character 65). According to the first author, in *Hoplosternum littorale* the pectoral spine is also curved dorsally when drastically elongated. According to Britto (2003), the drastic elongation of the pectoral spine of *Scleromystax* is manifested only in the non ossified portion of the spine (spurious rays). A similar condition was observed in *Corydoras paleatus* and *Corydoras longipinnis*.

176. Pectoral spine, posterior margin denticulations: (0) Absent. (1) Only on proximal portion. (2) Entirely serrated.

Most Callichthyidae and Scoloplacidae exhibit denticulations or serrations distributed along the whole inner margin of the pectoral spine (state 2). However, in some *Corydoras* species the denticulations are restricted to its proximal portion (state 1). In Trichomycteridae, *Callichthys fabricioi*, Astroblepidae and Loricariidae the pectoral spine lack denticulations (state 0). This character was analyzed in Britto, 2003 (character 67).

177. Pectoral spine, size of its posterior margin denticulations: (0) Small. (1) Large.

The pectoral spine denticulation are usually small in most Callichthyidae and Scoloplacidae (state 0). However, in some *Corydoras* species, *Scleromystax*, *Lepthoplosternum beni*, *L. tordilho*, and *Megalechis picta* the pectoral spine denticulations are distinctly large (state 1). In Trichomycteridae, *Callichthys fabricioi*, Astroblepidae, and Loricariidae the pectoral spine lack denticulations and this character was coded as inapplicable for these taxa.

178. Pectoral spine, orientation of its posterior margin denticulations: (0) Proximally or somewhat straight. (1) Distally.

The denticulations of the pectoral spine are usually oriented towards the proximal portion or sometimes nearly straight orientated in most Callichthyidae and Scoloplacidae (state 0). However, in most *Corydoras* species the pectoral spine denticulations are directed towards its distal tip (state 1). In Trichomycteridae, *Callichthys fabricioi*, Astroblepidae, and Loricariidae the pectoral spine lack denticulations and this character was coded as inapplicable for these taxa.

179. Pectoral branched rays, adipose and glandular tissue on its ventral surface: (0) Absent. (1) Present.

Sexually dimorphic male specimens of the Callichthyinae exhibit on the ventral surface of the pectoral-fin rays a patch of soft, whitish, adipose and glandular tissue (state 1). Such adipose and glandular body is absent in remaining

Loricarioidea including the Corydoradinae. This character was analyzed in Reis, 1998 (character 59).

Pelvic girdle and fin

180. Basipterygium, general shape: (0) Flat. (1) Small cavity on its ventral surface. (2) Large cavity on its ventral surface.

The general shape of the basipterygium consists in a flat bone in Trichomycteridae, Astroblepidae, and *Hemipsilicthys* (state 0). However, in *Trichogenes*, *Harttia*, *Rineloricaria*, and Scoloplacidae the basipterygia develops a small concavity on the medial margin of its ventral surface (state 1). In Callichthyidae the concavity is deeply manifested giving to the bone a bowl shape (state 2). This character was analyzed in Reis, 1998 (character 61).

181. Basipterygium, shape of its anterior process: (0) Sharp. (1) Expanded. (2) Extremely expanded.

According to Reis (1998), the basipterygium of Callichthyidae exhibit two anterior processes: the anterior internal process and the anterior external process. The anterior internal process is located very proximate to the mesial margin of the basipterygium, is well developed and extended anteriorly, and exhibits an anterior dorsal ridge. The anterior external process is located towards the lateral margin of the basipterygium, is strongly reduced and expanded into a lateral lamina, and is articulated to the ventro-lateral scutes. However, in order to establish homologies with the outgroup a modification of the nomenclature of these processes will be necessary. According to Shelden (1937), each basipterygium of Siluformes may bear medial, anterior (internal and external), lateral, ventral, and posterior (isquiac) processes (Fig. 19a). According to this nomenclature, the anterior internal process corresponds to the anterior process (probably a compound process) and the anterior external process corresponds to the lateral process.

Taking this in consideration, the anterior processes (internal and external) are missing in the Callichthyidae probably due to fusion of these structures into a single compound anterior process. This was originally suggested by Shelden (1937) and subsequent authors followed these ideas. According to Arratia (2003), fusion of the anterior processes into a single broad anterior process is present in amphiliids. This author also mentions the possibility that the anterior external and internal processes are fused into a single anterior process in loricariids. According to Armbruster (2004, character 168), among loricarioids is hypothesized that any apparent absence of antero-lateral processes is due to fusion rather than loss of either type of process. The presence of an anterior dorsal ridge in the anterior internal process of the basipterygium of Astroblepidae might corroborate the fusion hypothesis of these authors. *Harttia* and *Rineloricaria* also bear a dorsal ridge but in the anterior external process, which suggest a non homologue structure (see character below).

The anterior processes are usually sharp in Trichomycteridae, most Callichthyinae, and Astroblepidae (state 0, Fig. 19b). Despite the anterior process of most callichthyines resulted from fusion of individual processes they are still sharp in shape. In Corydoradinae, *Lepthoplosternum*, and *Megalechis* the anterior process is little expanded anteriorly (state 1, Fig. 19a). However, in Scoloplacidae and Loricariidae the anterior processes are extremely expanded (state 2). This character was analyzed in Britto, 2003 (character 68).

182. Basipterygium, shape of its anterior dorsal ridge: (0) Absent. (1) Present, continuous. (2) Present, with a posterior hook.

This character was modified from Reis, 1998 (character 63). According to this author, the anterior dorsal ridge is an autapomorphy of callichthyids, which was herein found to be shared with Astroblepidae. However, the shape of the dorsal ridge shows variation among these loricarioids. In most Loricarioidea no anterior dorsal ridge is present (state 0, Fig. 19a). *Harttia* and *Rineloricaria* exhibit an additional dorsal ridge non homologous with this structure (see comments above). Astroblepidae exhibit an anterior dorsal ridge shallow and continuous in shape located in the anterior internal process (state 1). However, in Callichthyidae the dorsal ridge is deep and exhibits a posterior hook (state 2). Also, this dorsal ridge is present in a compound process, which probably resulted from the fusion of the anterior external and internal processes.

183. Basipterygium, orientation of the anterior dorsal ridge: (0) Anteriorly. (1) Mesially.

The dorsal ridge of the basipterygium is oriented anteriorly in most Callichthyidae (state 0, Fig. 19a). Conversely, in most *Corydoras* species and Astroblepidae the orientation of the dorsal ridge is directed to the mesial margin of the basipterygium and meets its counterpart before reaching the anterior tip of the bone (state 1, Fig. 19c). In Trichomycteridae, Scoloplacidae, and Loricariidae no anterior dorsal ridge is present and this character was coded as innaplicable.

184. Basipterygium, shape of its lateral process: (0) Short. (2) Long and narrow. (1) Long and wide.

This character was analyzed in Reis, 1998 (character 62) and referred to as the external anterior process. However, this structure is named herein as lateral process (see comments above). The lateral process of Callichthyidae is elongated laterally as a wide lamina that articulates to the ventro-lateral scutes by means of a lateral tendon (state 2, Fig. 19a). In Astroblepidae the lateral process of the basipterygium is also elongated laterally, but very narrow in shape (state 1). Conversely, in Trichomycteridae, Scoloplacidae, and Loricariidae the basiperygium exhibit a very short lateral process that is not expanded largely beyond the area of insertion of the pelvic-fin rays, usually rounded in shape (state 0). In scolopacids and loricarines the lateral process is present but hardly noticeable because it is fused to an extremely widened anterior external process.

185. Basipterygium, posterior expansion on its lateral process: (0) Absent or extremely small. (1) Large.

This character was analyzed in Britto, 2003 (character 69) and referred to as a posterior expansion of the external arm. However, according to the nomenclature used herein the posterior expansion is located on its lateral process (see comments above). Most Loricarioidea including most Callichthyidae do not develop a posterior expansion of its lateral process, or if present, it is very small (state 0, Fig. 19a). However, in some *Corydoras* species the lateral process exhibit a large posterior expansion that occupies about one-fourth to one-third of the area of insertion of the pelvic rays (state 1, Fig. 17c).

186. Basipterygium, shape of its posterior process: (0) Highly reduced or small. (1) Long and falciform. (2) Long and wide. (3) Long and narrow.

The posterior process or isquiac process of the basipterygium is highly variable among loricarioids. In Trichomycteridae the posterior process is highly reduced or small (state 0). In Callichthyidae the posterior process is directed postero-laterally, bent dorsally, displaying a falciform shape (state 1). In Scoloplacidae and Loricariidae the posterior process is long, but largely widened, displaying a laminar shape (state 2). Finally, in Astroblepidae the posterior process is long and very narrow in shape (state 3). This character was analyzed in Reis, 1998 (character 64) and Britto, 2003 (character 70).

187. Basipterygium, posterior margin of its posterior process: (0) Smooth. (1) With a narrow arm.

The posterior process of the basipterygium of Callichthyidae is falciform shaped, typically displaying a smooth posterior margin (state 0). However, in some *Corydoras* species the posterior margin is expanded posteriorly as a narrow arm (state 1). Remaining loricarioids do not present a falciform shaped posterior process and this character was coded as inapplicable for these taxa. This character was analyzed in Britto, 2003 (character 71).

188. Basipterygium, antero-lateral development of its posterior process: (0) Small. (1) Large.

The posterior process of the basipterygium of Callichthyidae is falciform shaped, with the antero-lateral tip small (state 0). Alternatively, in some *Corydoras* species, *Callichthys*, *Lepthoplosternum*, and *Megalechis* the antero-lateral tip is large and expanded towards the lateral process, its measure about one-half the distance between the lateral and posterior processes (state 1, Fig. 19c). This character was analyzed in Britto, 2003 (character 70).

189. Basipterygium, ventral process: (0) Absent. (1) Present.

The basipterygium of Callichthyidae exhibits a ventral process with a rod-like shape (state 1). This structure is absent in remaining loricarioids (state 0). This character was analyzed in Reis, 1998 (character 64), who stated that it delimits the anterior wall of the anal papilla. According to Shelden (1937), this structure serves as the point of attachment of the *retractor ischii*.

190. Pelvic fin, skin fold on the ventral margin of the unbranched rays: (0) Absent. (1) Present in females.

Mature females of most Loricarioidea including the Callichthyidae do not develop ridges or grooves in the pelvic fin by folding of the skin surface (state 0). However, in mature female specimens of *Dianema longibarbis*, *Hoplosternum magdalenae*, *H. punctatum*, and *Megalechis thoracata* the first ray of the pelvic fin develops a narrow and shallow ridge of skin (state 1). This character was analyzed in Reis, 1998 (character 60). This author mentioned that the probable function of this skin fold is for carrying eggs with the pelvic fins during the spawning.

External morphology and coloration pattern

191. Lower lip, shape of the flap expansion: (0) Small, restricted laterally. (1) Small, wholly bordering mouth. (2) Small, wholly bordering mouth and notched medially. (3) Broad, wholly bordering mouth.

The lower lip is variable among loricarioids. In the Trichomycteridae the lower lip is small and lobed, restricted to the mouth lateral margin, just below origin of the mouth barbels (state 0). In Scoloplacidae the lower lip is very small, wholly bordering mouth (state 1). In Callichthyidae the lower lip also borders entirely the mouth; however, the flap is small and exhibits a medial notch (state 2). In Astroblepidae and Loricariidae the lower lip is broad, the flap is expanded and wholly bordering the mouth, and shaped as a rounded oral disk (state 3). Günther (1864) was the first author that mentioned a mouth with a rather narrow cleft as diagnostic for callichthyids. Eigenmann & Eigenmann (1890) also mentioned a lower lip not reverted as exclusive for the ingroup. Scoloplacids also develops a lower lip roughly similar, but much reduced in size and without a medial notch.

192. Lower lip, shape of the mesial barbel: (0) Absent. (1) One conical barbel. (2) One flat barbel. (3) Two flat barbels.

Most Loricarioidea including *Callichthys*, *Megalechis*, and *Hoplosternum* do not develops a mesial barbel in the posterior margin of the lower lip (state 0). However, in the Corydoradinae the lower lip develops one short mesial barbel, roughly rounded in shape (state 1). *Lepthoplosternum* also develops one short mesial barbel, but it is flat shaped (state 2). In *Dianema* there are two short mesial barbels in the posterior margin of the lower lip, also flat shaped (state 3). Trichomycterids lack a flap expansion in the lower lip, and this character was coded as inapplicable for this genus. This character was analyzed in Reis, 1998 (character 67) and Britto, 2003 (character 80).

193. Maxillary barbel, length: (0) Short. (1) Long. (2) Extremely long.

The typical condition among Loricarioidea including the Corydoradinae is a short maxillary barbel, rarely reaching beyond the gill openings (state 0). However, in *Trichogenes*, most Callichthyinae, some *Aspidoras* species, and Scoloplacidae the maxillary barbel is long and reaches around the pectoral-fin insertion (state 1). An extreme condition is observed in *Lepthoplosternum*, where the maxillary barbel is extremely long and reaches around the pelvic-fin insertion (state 2). This character was analyzed in Reis, 1998 (character 68).

194. Mouth lateral margin, flap of skin ventral to the maxillary and lower lip barbels: (0) Absent. (1) Present.

The lateral corner of the mouth of Loricarioidea do not exhibit flap expansions behind the maxillary and lower lip barbels, displaying a smooth surface or a very shallow ridge of skin (state 0). However, *Corydoras cervinus* exhibit a distinct flap expansion behind the mouth barbels (state 1). This structure is known as the third rictal barbel. This character was analyzed in Britto, 2003 (character 79).

195. Snout, dermal plates on the surface: (0) Absent. (1) Small platelets. (2) Intermediate plates. (3) Large plates restricted laterally. (4) Large plate restricted antero-dorsally.

Trichomycteridae, some *Corydoras*, some *Aspidoras*, most Callichthyinae, and Astroblepidae do not exhibit dermal plates on the surface of the snout (state 0). However, in most Corydoradinae and *Dianema* the snout exhibits several small platelets covering its dorsal or lateral margins; sometimes restricted to below the infraorbital bones, lateral ethmoid area, or even over mesethmoid, premaxilla, and maxilla (state 1). In Loricariidae the dermal plates are also dispersed over the dorsal and lateral margins of the snout but they are intermediate in size (state 2). In some *Corydoras* species the plates are larger and restricted to the lateral surface of the snout (state 3). A large plate is also present in Scoloplacidae, but it is restricted to the dorsal surface of the snout and located over the mesethmoid (state 4)

196. Head lateral margin, hypertrophied odontodes in sexually dimorphic males: (0) Absent. (1) Present, located in the opercular and snout region.

This character was analyzed in Britto, 2003 (character 81). This author proposed as a synapomorphy of some *Scleromystax* species and *Aspidoras virgulatus* the presence of hypertrophied odontodes on the preopercular-opercular region and sometimes reaching anteriorly to the snout in sexually dimorphic male specimens. Hyperthrophied odontodes might also develop in the infraorbital bones and interopercle. Presence of hypertrophied odontodes in the lateral margin of the head was observed in *Scleromystax barbatus, S. macropterus*, and Loricariidae (state 1). Remaining loricarioids examined do not develop odontodes in the lateral margin of the snout, or if present they are very small is size and not large as in those taxa (state 0). The last condition was observed in most *Corydoras* and *Aspidoras* species, where the odontodes restricted to the lateral margin of the snout are a little larger than those of females but never hyperthrophied.

197. Predorsal region, small dermal platelets: (0) Absent. (1) Present.

Britto & Reis (2005) mentioned the presence of minute odontode-bearing platelets between the posterior tip of postparietosupraoccipital and nuchal plate as diagnostic for *Scleromystax* species. However, such dermal plates were observed in Scleromystax and *Aspidoras* spC, *A. poecilus*, and *A. virgulatus*. Small dermal patelets around the nuchal plate area are absent in remaining Loricarioidea including most Callichthyidae (state 0). Loricariidae exhibit dermal plates in that area, but they are evidently larger in size.

198. Body dermal plates, expansion of its dorsal and ventral lateral series: (0) Small. (1) Extremely large.

According to Schaefer (2003), loricariids share the presence of three or more lateral plate series on body (character 40). This author established as homologous the following paired series of dermal plates: dorsal, middorsal, median, midventral, and ventral. The dorsal and ventral plate series are small in Scoloplacidae and Loricariidae, distant from each other in scoloplacids and separated by additional series of dermal plates in loricariids (state 0). However, the dorsal and ventral lateral plate series are extremely expanded, such that they are in contact to each other in Callichthyidae (state 1). Trichomycteridae and Scoloplacidae lack lateral plate series on body and this character was coded as inapplicable for these taxa.

199. Body dermal plates of the ventral series, articulation to its counterparts: (0) Absent. (1) Present.

The dermal plates of the ventral lateral series are usually distant from its counterpart in most Callichthyinae, Scoloplacidae, and *Hemipsilichthys*; leaving a naked area of skin in the ventral surface of the caudal peduncle (state 0). However, most Corydoradinae, *Lepthoplosternum*, and Loricariinae (*Harttia* and *Rineloricaria*) exhibit their dermal plates of the ventral series articulated to each other (state 1). Dermal plates of callichthyids appear in the flanks since early stages of ontogenetic development and during growth they expand dorsally and ventrally. According to Schaefer (2003), plate development in loricariids progresses from caudal to rostral and those from the dorsal and ventral series ossify first, followed by those of the median series.

200. Abdomen, dermal plates over skin surface: (0) Absent. (1) Small platelets. (2) Intermediate plates. (3) Large plates.

The abdomen is usually naked in most Loricarioidea including some *Corydoras* species, *Aspidoras virgulatus*, and Callichthyinae (state 0). However, there are small plateles usually bearing small odontodes restricted to the abdomen and pectoral girdle area in most Corydoradinae and Scoloplacidae (state 1). In some *Corydoras* species and *Rineloricaria microlepidogaster* the dermal plates are intermediate in size (state 2). In *Corydoras britskii* the dermal plates are evidently larger and are expanded anteriorly almost reaching the mouth (state 3).

201. Urogenital papilla, shape: (0) Narrow or rodlike. (1) Lanceolate.

The urogenital papilla of most Loricarioidea including some Corydoradinae and Callichthyidae is narrow or rodlike, with male specimens differing from females in showing a longer papilla (state 0). However, most Corydoradinae exhibit a lanceolate papilla, tapering toward the apex and the base as a leaf (state 1). This character was analyzed in Britto, 2003 (character 82).

202. Urogenital papilla, length: (0) Short. (1) Long.

Despite the shape of the urogenital papilla, the typical size is small in most Loricarioidea including the Corydoradinae (state 0). However, in *Trichogenes*, Callichthyinae, Astroblepidae, and some Loricariidae the urogenital is evidently larger (state 1).

203. Urogenital papilla, fringed ornamentations: (0) Absent. (1) Present.

The urogenital papilla of sexually dimorphic male specimens of *Megalechis* exhibit fringed ornamentations distributed over its entire surface (state 1). However, most Loricarioidea including the Callichthyidae do not develop ornamentations over papilla, exhibing a smooth surface (state 0). In *Hoplosternum littorale* and *Trichogenes* were observed few fringes bordering anus, but never on the urogenital papilla.

204. Head antero-dorsal region, longitudinal stripe: (0) Absent. (1) Present.

The antero-dorsal surface of the head is usually similar in the coloration pattern between males and females in most Loricarioidea including the Callichthyidae (state 0). Conversely, in mature males of *Scleromystax barbatus* there is a longitudinal white stripe ranging from tip of the snout to the infraorbital area (state 1). This character was analyzed in Britto, 2003 (character 72).

205. Head lateral margin, vertical bar around eye (mask): (0) Absent. (1) Present.

Some *Corydoras* species exhibit a conspicuous vertical bar over the eye that appears as a mask (state 1). Conversely, most Loricarioidea including the Callichthyidae do not exhibit such coloration pattern over the eye (state 0). Some *Corydoras* species migh display spots or horizontal bars on the head, but never a vertical bar over the eye (state 0).

206. Body dorsal region, longitudinal stripe: (0) Absent. (1) Present.

The dorsal surface of the body of some *Corydoras* species exhibits a wide dark longitudinal stripe from dorsal-fin base to caudal-fin base (state 1). Such coloration pattern is absent in remaining loricarioids (state 0). *Corydoras gracilis* and

Aspidoras virgulatus exhibit a longitudinal stripe in the dorsal surface of body; however, it starts on the anterior portion of the head and denotes non homology.

207. Body latero-dorsal region, longitudinal stripe: (0) Absent. (1) Present.

Corydoras rabauti exhibit an oblique dark brown stripe from the posterior margin of the head to the caudal-fin base (state 1). Such coloration pattern is absent in remaining loricarioids (state 0). This character was analyzed in Britto, 2003 (character 74).

208. Body midline region, longitudinal stripe: (0) Wide. (1) Narrow. (2) Absent.

Some *Corydoras* species and *A. virgulatus* exhibit a narrow stripe in midline of the body extended to the caudal fin (state 1). Remaining loricarioids do not exhibit such coloration pattern (state 0). This character was analyzed in Britto, 2003 (character 75).

209. Body latero-ventral region, longitudinal stripe: (0) Absent. (1) Present.

Some *Corydoras* species, *Aspidoras virgulatus*, and some *Scleromystax* species exhibit a dark stripe on the latero-ventral region of body ranging just above the pelvic fin to the end of the anal fin (state 1). Remaining loricarioids do not exhibit such coloration pattern (state 0). This character was analyzed in Britto, 2003 (character 77).

210. Body below dorsal-fin region, wide bar: (0) Absent. (1) Present.

Some *Corydoras* species exhibit a wide dark bar below the dorsal-fin region (state 1). Remaining loricarioids do not exhibit such coloration pattern (state 0).

211. Body caudal peduncle, conspicuous large blotch: (0) Absent. (1) Present.

The posteriormost portion of the caudal peduncle of some *Corydoras* species exhibits a conspicuous large dark blotch, almost totally covering its surface (state 1). Remaining loricarioids do not exhibit such coloration pattern or if present they are small irregular blotches (state 0). This character was analyzed in Britto, 2003 (character 78).

212. Body of young specimens, coloration pattern: (0) Roughly similar to adults. (1) With transverse bars pattern.

This character was analyzed in Reis, 1998 (character 69). According to this author, young specimens of about 15-20 mm SL of *Hoplosternum*, *Lepthoplosternum*, and *Megalechis* display a light-brown ground and dark transverse bars between the dorsal-fin origin and the caudal fin. However, transverse bar coloration pattern in young specimens were only observed in two *Aspidoras* species, some *Hoplosternum*, and *Megalechis thoracata* (state 1). Among remaining callichthyines, young specimens were available for *Callichthys callichthys* and most *Lepthoplosternum* species, which exhibit a similar coloration pattern to that of adult specimens, without the transverse bar pattern (state 0). A similar condition was observed in most Corydoradinae and most Loricarioidea. Despite young specimens of *Corydoras rabauti* exhibit a different coloration pattern to that of adult specimens; they were coded as the anterior condition because the stripped pattern is absent. However, young specimens were not available for a large number of taxa and were coded as missing.

213. Dorsal-fin, coloration pattern: (0) With small blotches or without pigmentation. (1) Small vertical bands. (2) Large vertical bands. (3) Large blotch almost entirely covering whole fin.

The dorsal fin of Loricarioidea including most Callichthyidae exhibits a coloration pattern with small spots over branched rays or without pigmentation (state 0). However, in some *Corydoras* species there is a small vertical band restricted to the dorsal spine and first branched ray (state 1). Other *Corydoras* species exhibits a wide horizontal band restricted to the anteriormost rays (state 2). An extreme condition is found in some *Corydoras* species where a large dark blotch almost entirely covers the whole fin (state 3).

Behavioral characters

Two characters were identified as related to the behavior of callicthyids.These characters were used in the previous phylogenetic analyses of Reis (1998) and Britto (2003).

214. Spawning behavior, construction of floating nest: (0) Absent. (1) Present.

This character was analyzed in Reis, 1998 (character 71), who proposed that Callichthyinae build a floating nest composed of foam and vegetal debris for spawning (state 0). Remaining loricarioids including the Corydoradinae lay their eggs on substrates like rocks, logs, or leaves (state 0). This was first mentioned by Hoedeman (1952) to occur in species of *Callichthys*, *Hoplosternum*, and *Megalechis*; where male specimens build bubble-nest between reeds and grasses, using plant particles to make it solid. Male specimens also exhibit parental care of the nest and the later fry. According to Hoedeman (1960), the nest may attain a diameter of 20 cm and a height of 10 cm, male and female swim together all the time around the nest with the vent up. Finally, the female expel their eggs into the folded ventral fins and deposit them into the nest, about 500 eggs may be desposited. This author also stated that these fishes are monogamous and that the parental care includes female activity for a short period of time. Nijssen (1970) described the reproductive behavior for the *Corydoras* species, males swim around the female butting against the sides of her body and head with their snout; they also clean the vegetation and bottom with their mouth. Later, one pair swims near the water surface where the male pinches the head of the female using his pectoral spines, the female purses her ventral fins together to catch the fertilized eggs. Finally, the pair sinks to the bottom and the female place her adhesive eggs on leaves and the bottom substrate.

215. Swimming behavior, association to the mid-water: (0) Absent. (1) Present.

This character was analyzed in Reis, 1998 (character 72) and Britto, 2003 (character 83). According to these authors, some *Corydoras* species and *Dianema* spend most of the time swimming in midwater, distant from the bottom (state 1). Remaining loricarioids including most callichthyids typically dwell in the bottom of water environments where they usually feed (state 0).

Molecular characters

Mitochondrial data

216 to **610.** ***12S rRNA*****:** The *12S rRNA* data include 128 terminals with 159 to 387 base pairs after edition including the sequences used from GenBank. The dataset is composed of 395 characters after aligment of which 188 are conserved sites, 203 are variable sites, and 140 are parsimony informative sites.

611 to **1200.** ***16S rRNA*****:** The *16S rRNA* data include 128 terminals with 466 to 571 base pairs after edition including the sequences used from GenBank. The dataset is composed of 590 characters after aligment of which 269 are conserved sites, 315 are variable sites, and 209 are parsimony informative sites.

1201 to **2043.** ***ND4*****:** The *ND4* data include 91 terminals with 442 to 838 base pairs after edition including the sequences used from GenBank. The dataset is composed of 843 characters after aligment of which 332 are conserved sites, 507 are variable sites, and 412 are parsimony informative sites.

2044 to **3133.** ***Cytb*****:** The *Cytb* data include 67 terminals with 465 to 1,089 base pairs after edition including the sequences used from GenBank. The dataset is composed of 1090 characters after aligment of which 526 are conserved sites, 563 are variable sites, and 470 are parsimony informative sites.

Nuclear data

3134 to **3984.** ***Rag1*****:** The *Rag1* data include 121 terminals with 527 to 842 base pairs after edition including the sequences used from GenBank. The dataset is composed of 851 characters after aligment of which 428 are conserved sites, 409 are variable sites, and 298 are parsimony informative sites.

Total evidence data matrix

The final matrix that was analyzed by Cladistic parsimony under a Total evidence approach include 144 terminals, 13 outgroups (including the root) and 131 composing the ingroup. The total number of characters is of 3,985. The partial matrix with characters related to phenotype is shown in Table 5. Characters 0 from 213 correspond to morphology, 214 and 215 to behavior, 216-610 to *12S rRNA*, 611-1,200 to *16S rRNA*, 1,201-2,043 to *ND4*, 2,044-3,133 to *Cytb*, and 3,134-3,984 to *Rag1*. Morphological characters are conformed in a 25% of data from Britto (2003), 30% from Reis (1998), and 45% are newly reported in this paper. Molecular characters include a total of 530 sequences and are conformed in a 62% of data newly reported in this paper, 30% of data from Alexandrou *et al*. (2011), 5% of data from Shimabukuru-Dias *et al*. (2004), and 3% of data from Cramer *et al*. (2011), Schaefer *et al*. (2011), and Roxo *et al*. (2012).

Phylogenetic analysis

Cladistic relationships

The cladistic parsimony analysis found 89 most parsimonious trees with a length of 12,474 steps, consistency index of 0.28, and retention index of 0.64. These trees are summarized in the strict consensus tree shown in Figs. 20 and 21. Numbers above the branches of the consensus tree are node identifiers and below the branches are Bremer support values. The family Callichthyidae is corroborated as monophyletic (node 167), as well as the subfamilies Callichthyinae (node 234) and Corydoradinae (node 166). Among the Callichthyinae, two major clades are found and ranked with tribe status: Callichthyini (node 233) and Hoplosternini (node 238). Among the Callichthyini, the following three genera are corroborated as monophyletic and having the following interrelationships: (*Callichthys* (*Megalechis* + *Lepthoplosternum*)). Among the Hoplosternini, the genus *Dianema* is corroborated as monophyletic. However, the genus *Hoplosternum* is not, probably due to lack of molecular data for the species *H. magdalenae* and *H. punctatus*. It was preferred to maintain temporaliry *Hoplosternum* as paraphyletic and do not make taxonomic changes until molecular data is collected and added to the phylogenetic analysis, this data will be available soon. The interrelationships of Hoplosternini are described as follows: ("*Hoplosternum*" *littorale* (*"Hoplosternum" punctatus ("Hoplosternum" magdalenae* + *Dianema*))). Among the Corydoradinae, the genus *Scleromystax* is corroborated as monophyletic. However, the genera *Corydoras* and *Aspidoras* are not. To reconcile this situation, the genera *Gastrodermus* and *Hoplisoma* are revalidated to accommodate the species recovered in nodes 205 and 163, respectively. The genus *Scleromystax* is expanded to accommodate the species *Aspidoras virgulatus* and *Corydoras lacerdai*. Applying these modifications, the interrelationships of the Corydoradinae are described as follows: (*Corydoras* (*Gastrodermus* (*Hoplisoma* (*Scleromystax* + *Aspidoras*)))).

Patristic relationships

The following character-states were optimized in the most parsimonious trees and constitute the synapomorphies that diagnose the clades ranked in the phylogenetic classification of the Callichthyidae here proposed (see below). Common synapomorphies of the 89 trees found are listed according to the nodes shown in the consensus tree of Figs. 20 and 21 (numbers of nodes above the branches). Only the clades ranked in the phylogenetic classification are discussed below. For each clade, morphological and behavioral synapomorphies are listed. See Table 7 for all character-states transformations and optimizations in all nodes and terminals.

Phylogenetic classification

For taxonomic purposes, I have examined specimens of most species of *Corydoras* (including *Gastrodermus* and *Hoplisoma* revalidated in this paper) including their type material whenever it was possible. Despite of not being explicitly tested in this phylogenetic analysis, all current valid species of Callichthyidae are classified in this section. Species not included in the phylogenetic analysis are highlighted with an asterisk (*) and are referred provisionally to each genera. Species that could no be attributed to any genera are included as Incertae sedis. Science is built based in prior knowledge, a new classification is proposed here based in the results of this paper which intended to explicate in a phylogenetic context most phenotypic and molecular evidence available for this group. Besides character content, severity of the test is maximized with a higher number of species analyzed. I am convinced that Science grows by testing hypotheses as severely as possible and that the inclusion of these species in future research cycles will increase knowledge in the systematic of this group. I hope future research to build new taxonomies based in the information content of this paper. In addition to the information available (taxa and characters) throught this paper, emphasis should stress species not explicitly tested in this analysis.

The following phylogenetic classification is proposed based in the analysis here performed. Asymmetric portions of the cladogram were classified by sequencying, according to Wiley (1979).

Family Callichthyidae Bonaparte, 1838

Callichthini Bonaparte, 1838: 131. Type genus: *Callichthys* Scopoli, 1777.

Inmediately more inclusive taxon: Loricarioidea Rafinesque, 1815.

Content: Two subfamillies: Callichthyinae Bonaparte, 1838 and Corydoradinae Hoedeman, 1952.

Branch length: 94 synapomorphies diagnose this family.

Bremer support: 66 (Figs. 20-21 and Table 7: node 167).

Synapomorphies: 25 morphological and 69 molecular (45 mitochondrial and 24 nuclear) characters are common to all trees. See node 167 in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this node are:

Char. 17: (0→1). Parietal with a ventral process on its antero-lateral margin (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 41: (0→1). Basioccipital with a bony bridge for passage of the aortic canal (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 44: (0→1). Premaxillary teeth absent (L=4, CI=25, RI=85).

Char. 45: (0→2). Premaxilla of one-third size compared to maxilla (exclusive synapomorphy, L=14, CI=14, RI=53).

Char. 51: (0→1). Dentary with a process on the antero-ventral portion for insertion of *intermandibularis* (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 52: (0→1). Dentary with a shallow dorsal process on its medial portion (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 53: (0→2). Angular complex slender in shape (L=9, CI=22, RI=68).

Char. 54: (0→2). Angular complex with a dorsal process located posteriorly (L=14, CI=14, RI=47).

Char. 75: (0→1). Infraorbital series with two bones (exclusive synapomorphy, L=3, CI=100, RI=100).

Char. 97: (0→1). Articulation of the branchiostegal rays with opercle by means of a patch of branchiostegal cartilage (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 104: (0→1). Hypobranchial 1 deep in shape (exclusive synapomorphy, L=2, CI=50, RI=93).

Char. 105: (2→1). Hypobranchial 1 with a well developed laminar expansion of its anterior margin (exclusive synapomorphy, L=3, CI=66, RI=90).

Char. 107: (0→1). Hypobranchial 2 with a large anterior process (exclusive synapomorphy, L=4, CI=25, RI=80).

Char. 114: (2→1). Infrapharyngobranchial 3 with a large laminar expansion of its posterior margin (L=15, CI=13, RI=69).

Char. 115: (0→1). Canal entering nasal with two pores (L=11, CI=18, RI=57).

Char. 134: (0→1). Complex vertebra with a well developed ventral process (exclusive synapomorphy, L=8, CI=37, RI=70).

Char. 140: (0→1). First rib long (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 141: (0→2). First rib with elongated laminar expansions (exclusive synapomorphy, L=4, CI=50, RI=81).

Char. 164: (0→1). Cleithrum antero-ventral portion little exposed, restricted laterally (L=11, CI=18, RI=65).

Char. 173: (0→2). Pectoral spine with a large ossified portion (L=10, CI=20, RI=75).

Char. 176: (0→2). Pectoral spine entirely serrated on its posterior margin (L=4, CI=25, RI=75).

Char. 180: (0→2). Basipterygium bowl shaped, with a large cavity on its ventral surface (exclusive synapomorphy, L=4, CI=50, RI=81).

Char. 182: (0→2). Basipterygium with a posterior hook on its antero-dorsal ridge (exclusive synapomorphy, L=2, CI=100, RI=100).

Char. 184: (0→2). Basipterygium with a long and wide lateral process (exclusive synapomorphy, L=2, CI=100, RI=100).

Char. 189: (0→1). Basipterygium with a ventral process (exclusive synapomorphy, L=1, CI=100, RI=100).

Distribution: Central and South America, from Panama to Argentina, excluding Chile. South American main river systems: Orinoco, Amazonas, Tocantins, São Francisco, and La Plata. Rivers draining to the Pacific Ocean in Panama. The Atrato and Magdalena rivers which drain to the Caribbean Sea in Colombia. Rivers from Trinidad and Tobago. Rivers draining to the Atlantic Ocean from the coastal basins ranging from Guiana to the tributaries to the Laguna Merín in Uruguay.

Subfamily Callichthyinae Bonaparte, 1838

Callichthini Bonaparte, 1838: 131. Type genus: *Callichthys* Scopoli, 1777.

Inmediately more inclusive taxon: Family Callichthyidae Bonaparte, 1838.

Sister group: Subfamily Corydoradinae Hoedeman, 1952.

Content: Five genera: *Aspidoras* Ihering, 1907; *Corydoras* La Cépède, 1803; *Gastrodermus* Cope, 1878; *Hoplisoma* Swainson, 1838; and *Scleromystax* Günther, 1864.

Branch length: 61 synapomorphies diagnose this subfamily.

Bremer support: 33 (Figs. 20-21 and Table 7: node 234).

Synapomorphies: 22 morphological, one behavioral, and 38 molecular (28 mitochondrial and 10 nuclear) characters are common to all trees. See node 234 in

Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this clade are:

Char. 6: (0→1). Lateral ethmoid wide in shape (L=2, CI=50, RI=93).

Char. 8: (0→1). Lateral ethmoid antero-lateral margin strongly developed, with a rounded projection (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 11: (0→3). Lateral ethmoid largely exposed externally on its postero-dorsal region (exclusive synapomorphy, L=8, CI=37, RI=76).

Char. 18: (1→2). Parietal middle portion wide, about equal size bone length (exclusive synapomorphy, L=11, CI=18, RI=72).

Char. 24: (0→1). Compound pterotic with a large keel on its postero-dorsal margin (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 26: (0→1). Compound pterotic straight or rounded on its ventral margin (L=5, CI=20, RI=80).

Char. 34: (0→1). Orbitosphenoid with a small participation in the compound foramen anterior margin (L=4, CI=50, RI=90).

Char. 38: (0→1). Prootic little articulated to the hyomandibular (L=2, CI=50, RI=93).

Char. 56: (0→1). Angular complex with an additional dorsal process near its internal margin (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 57: (0→1). Metapterygoid anterior projection intermediate in size (L=19, CI=10, RI=54).

Char. 74: (0→1). Hyosymplectic fenestra present (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 82: (0→1). Infraorbital bone 2 articulated to infraorbital bone 1 by its anterior facet (exclusive synapomorphy, L=2, CI=100, RI=100).

Char. 88: (0→1). Interopercle anterior expansion almost reaching the articular complex (L=4, CI=25, RI=88).

Char. 98: (0→1). Articulation of the branchiostegal rays with ceratohyal through a small rod of cartilage (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 109: (0→1). Ceratobranchial 5 anterior portion short (L=2, CI=50, RI=94).

Char. 113: (0→1). Neomorphic cartilaginous nodule absent (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 117: (0→1). Supraorbital canal entering lateral ethmoid (L=2, CI=50, RI=94).

Char. 125: (0→1). Postotic-temporal canal with an additional branch on compound pterotic (L=2, CI=50, RI=93).

Char. 144: (0→2). Fifth rib articulated to the posterior process of basipterygia (exclusive synapomorphy, L=3, CI=100, RI=100).

Char. 145: (0→1). Supraneurals present (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 179: (0→1). Pectoral branched rays with an adipose and glandular tissue on its ventral surface (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 193: (0→1). Maxillary barbel long (L=7, CI=28, RI=75).

Char. 214: (0→1). Construction of floating nest for spawning (exclusive synapomorphy, L=1, CI=100, RI=100).

Distribution: Central and South America, from Panama to Argentina, excluding Chile. South American main river systems: Orinoco, Amazonas, Tocantins, São Francisco, and La Plata. Rivers draining to the Pacific Ocean in Panama. The Atrato and Magdalena rivers which drain to the Caribbean Sea in Colombia. Rivers from Trinidad and Tobago. Rivers draining to the Atlantic Ocean from the coastal basins ranging from Guiana to the tributaries to the Laguna Merín in Uruguay.

Tribe Callichthyini Bonaparte, 1838

Callichthini Bonaparte, 1838: 131. Type genus: *Callichthys* Scopoli, 1777.

Inmediately more inclusive taxon: Subfamily Callichthyinae Bonaparte, 1838.

Sister group: Tribe Hoplosternini Miranda Ribeiro, 1959.

Content: Three genera: *Calichthys* Scopoli, 1777; *Lepthoplosternum* Reis, 1997; and *Megalechis* Reis, 1997.

Branch length: 22 synapomorphies diagnose this tribe.

Bremer support: 7 (Figs. 20-21 and Table 7: node 233).

Synapomorphies: Seven morphological and 15 molecular (all mitochondrial) characters are common to all trees. See node 233 in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this clade are:

Char. 30: (1→0). Parasphenoid anterior portion wide (L=4, CI=25, RI=82).

Char. 39: (0→1). Prootic with a long lateral process (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 92: (1→0). Opercle very narrow in shape (L=3, CI=33, RI=83).

Char. 126: (0→1). Postotic-temporal canal with a long additional branch on compound pterotic (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 133: (0→2). Transverse process of complex vertebra straight on its anterior margin (L=5, CI=40, RI=82).

Char. 162: (0→1). Caudal fin rounded in shape (L=3, CI=33, RI=85).

Char. 188: (0→1). Basipterygium posterior process expanded antero-laterally (L=16, CI=6, RI=57).

Distribution: South America, from Colombia to Argentina, excluding Chile. South American main river systems: Orinoco, Amazonas, Tocantins, São Francisco, and La Plata. Magdalena River which drain to the Caribbean Sea in Colombia. Rivers draining to the Atlantic Ocean from the Guiana coastal basins to the tributaries to the Laguna Merín in Uruguay.

Genus *Callichthys* Scopoli, 1777

Calichthys Scopoli, 1777: 451. Type species: *Silurus callichthys* Linnaeus, 1758.

Callichthys Meuschen, 1778: 39. Type species: *Silurus callichthys* Linnaeus, 1758.

Callichthys Linck, 1790: 32. Type species: *Silurus callichthys* Linnaeus, 1758.

Cataphractus Bloch, 1794: 80. Type species: *Silurus callichthys* Linnaeus, 1758.

Inmediately more inclusive taxon: Tribe Callichthyini Bonaparte, 1838.

Sister group: Unranked clade composed of *Lepthoplosternum* Reis, 1997 and *Megalechis*, Reis 1997.

Content: Four species: *Callichthys callichthys* (Linnaeus, 1758); *Callichthys fabricioi* Román-Valencia, Lehmann-A & Muñoz, 1999; *Callichthys oibaensis** Ardilia Rodríguez, 2005; *Callichthys serralabium* Lehmann & Reis, 2004.

Branch length: 71 synapomorphies diagnose this genus.

Bremer support: 4 (Figs. 20-21 and Table 7: node 232).

Synapomorphies: Seven morphological and 64 molecular (all mitochondrial) characters are common to some trees. See node 232 in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this clade are:

Char. 57: (1→2). Metapterygoid anterior projection small (L=19, CI=10, RI=54).

Char. 76: (0→1). Infraorbital bones not exposed externally (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 80: (1→2). Infraorbital bone 1 internal lamina very large (L=10, CI=20, RI=65).

Char. 104: (1→0). Hypobranchial 1 slender in shape (L=2, CI=50, RI=93).

Char. 136: (5→2). Vertebrae with 27 free elements (L=43, CI=20, RI=43).

Char. 147: (2→1). First pterygiophore antero-dorsal expansion (nuchal plate) small (L=29, CI=10, RI=40).

Char. 169: (3→1). Scapulocoracoid posterior process small (L=15, CI=20, RI=71).

Distribution: South America, from Colombia to Argentina, excluding Chile. South American main river systems: Orinoco, Amazonas, Tocantins, São Francisco, and La Plata. Magdalena River basin (Cauca and Suárez rivers) in Colombia. Rivers draining to the Atlantic Ocean from the coastal basins ranging from Guiana to the tributaries to the Laguna Merín in Uruguay.

Genus *Megalechis* Reis, 1997

Megalechis Reis, 1997: 310. Type species: *Callichthys thoracatus* Valenciennes, 1840.

Inmediately more inclusive taxon: Tribe Callichthyini Bonaparte, 1838.

Sister group: *Lepthoplosternum* Reis, 1997.

Content: Two species: *Megalechis picta* (Müller & Troschel, 1848); and *Megalechis thoracata* (Valenciennes, 1840).

Branch length: 22 synapomorphies diagnose this genus.

Bremer support: 4 (Figs. 20-21 and Table 7: node 245).

Synapomorphies: Three morphological and 19 molecular (all mitochondrial) characters are common to all trees. See node 245 in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this clade are:

Char. 60: (0→1). Metapterygoid and quadrate with a small sutural articulation on its anterior portion (L=19, CI=10, RI=55).

Char. 67: (0→1). Hyomandibular with a small crest for articulation with infraorbital 1 (L=4, CI=25, RI=87).

Char. 203: (0→1). Urogenital papilla of sexually dimorphic males with fringed ornamentations (exclusive synapomorphy, L=1, CI=100, RI=100).

Distribution: South America, from Colombia to Argentina, excluding Chile. South American main river systems: Orinoco, Amazonas, Tocantins, and Paraguay.

Magdalena River which drain to the Caribbean Sea in Colombia. Rivers draining to the Atlantic Ocean from the Guiana shield. Rivers draining to the Atlantic Ocean from the states of Pará and Maranhão, Brazil.

Genus *Lepthoplosternum* Reis, 1997

Lepthoplosternum Reis, 1997: 315. Type species: *Callichthys pectoralis* Boulenger, 1895.

Inmediately more inclusive taxon: Tribe Callichthyini Bonaparte, 1838.

Sister group: *Megalechis* Reis, 1997.

Content: Six species: *Lepthoplosternum altamazonicum* Reis, 1997; *Lepthoplosternum beni* Reis, 1997; *Lepthoplosternum pectorale* (Boulenger, 1895); *Lepthoplosternum stellatum* Reis & Kaefer, 2005; *Lepthoplosternum tordilho* Reis, 1997; and *Lepthoplosternum ucamara* Reis & Kaefer, 2005.

Branch length: 28 synapomorphies diagnose this genus.

Bremer support: 8 (Figs. 20-21 and Table 7: node 239).

Synapomorphies: Eight morphological and 20 molecular (all mitochondrial) characters are common to all trees. See node 239 in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this clade are:

Char. 4: (0→1). Mesethmoid posterior portion exposed (L=14, CI=7, RI=68).

Char. 65: (1→0). Hyomandibular anterior outgrowth not sutured to metapterygoid (L=4, CI=25, RI=75).

Char. 136: (5→6). Vertebrae with 23 free elements (L=43, CI=20, RI=43).

Char. 158: (1→2). Five anal-fin pterygiophores (L=7, CI=42, RI=63).

Char. 159: (0→2). One unbranched anal-fin ray (L=4, CI=50, RI=87).

Char. 192: (0→2). Lower lip with one flat mesial barbel (exclusive synapomorphy, L=3, CI=100, RI=100).

Char. 193: (1→2). Maxillary barbel extremely long (exclusive synapomorphy, L=7, CI=28, RI=75).

Char. 199: (0→1). Body dermal plates of the ventral series articulated to its counterpart (L=9, CI=11, RI=57).

Distribution: South America, from Peru to Paraguay and South of Brazil, excluding Chile. Amazonas, Paraguay, and Uruguay River basins. Rivers from the state of Rio Grande do Sul, Brazil, which drain to the Laguna dos Patos basin and Uruguay River.

Tribe Hoplosternini Miranda Ribeiro, 1959

Hoplosterninae Miranda Ribeiro, 1959: 1. Type genus: *Hoplosternum* Gill, 1858.

Inmediately more inclusive taxon: Subfamily Callichthyinae Bonaparte, 1838.

Sister group: Callichthyini Bonaparte, 1838.

Content: Two genera: "*Hoplosternum*"' Gill, 1858 and *Dianema* Cope, 1871.

Branch length: 15 synapomorphies diagnose this tribe.

Bremer support: 1 (Figs. 20-21 and Table 7: node 238).

Synapomorphies: Nine morphological and six molecular (all mitochondrial) characters are common to all trees. See node 238 in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this clade are:

Char. 60: (0→1). Metapterygoid and quadrate with a small sutural articulation on its anterior portion (L=19, CI=10, RI=55).

Char. 84: (0→1). Infraorbital bone 2 internal lamina large (L=14, CI=14, RI=53).

Char. 85: (0→1). Infraorbital bone 2 with a dorsal keel that articulates with sphenotic (L=17, CI=5, RI=61).

Char. 102: (1→2). Parurohyal elongated in shape (L=13, CI=30, RI=64).

Char. 127: (0→1). Postotic-temporal canal with a long pterotic branch on compound pterotic (L=3, CI=66, RI=85).

Char. 129: (0→1). First tubule of the trunk lateral-line laminar in shape (L=2, CI=50, RI=80).

Char. 161: (0→1). Anal-fin rays thick on its anteriormost proximal segments (L=4, CI=25, RI=66).

Char. 190: (0→1). Pelvic-fin unbranched ray with a skin fold in mature females (L=3, CI=33, RI=50).

Char. 212: (0→1). Body coloration with a transversal stripe pattern in young specimens (L=4, CI=25, RI=25).

Distribution: South America, from Panama to Argentina, excluding Chile. Pacific coastal drainages of Panama. Atrato, Sinú, and Magdalena rivers which drain to the Caribbean Sea in Colombia. South American main river systems: Orinoco, Amazonas, Tocantins, São Francisco, and La Plata. Rivers draining to the Atlantic Ocean from the Guiana shield. Laguna dos Patos basin from the state of Rio Grande do Sul, Brazil.

“Hoplosternum” littorale (Hancock, 1828)

Callichthys littoralis Hancock, 1828: 244.

Callichthys laevigatus Valenciennes, 1836: 47.

Callichthys subulatus Valenciennes, 1840: 311.

Callichthys albidus Valenciennes, 1840: 316.

Callichthys chiquitos Castelnau, 1855: 38.

Hoplosternum stevardii Gill, 1858: 401.

Callichthys melampterus Cope, 1872: 275.

Hoplosternum schreineri Miranda Ribeiro, 1911: 150.

Cascadura maculocephala Ellis, 1913: 387.

Hoplosternum shirui Fowler, 1940: 232.

Hoplosternum littorale daillyi Hoedeman, 1952: 7.

Hoplosternum thoracatum cayennae Hoedeman, 1961: 130.

Inmediately more inclusive taxon: Tribe Hoplosternini Miranda Ribeiro, 1959.

Sister group: Unranked clade composed of *Hoplosternum punctatum* Meek & Hildebrand, 1916; *Hoplosternum magdalenae* Eigenmann, 1913; and *Dianema* Cope, 1871.

Branch length: 50 autapomorphies diagnose this species.

Autapomorphies: Four morphological and 47 molecular (34 mitochondrial and 13 nuclear) characters are common to all trees. See *Hoplosternum littorale* in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this species are:

Char. 67: (0→1). Hyomandibular with a small crest for articulation with infraorbital 1 (L=4, CI=25, RI=87).

Char. 86: (0→1). Infraorbital 2 with a postero-dorsal expansion contacting compound pterotic (L=11, CI=9, RI=67).

Char. 128: (7→4). Trunk lateral-line with six tubules (L=25, CI=36, RI=52).

Char. 139: (2→1). Ten ribs (L=35, CI=20, RI=48).

Distribution: South America, from Colombia to Argentina including the Island of Trinidad, excepting Chile. South American main river systems: Orinoco, Amazonas, Tocantins, São Francisco, and La Plata. Rivers draining to the Atlantic

Ocean from the Guiana shield. Laguna dos Patos basin from the state of Rio Grande do Sul, Brazil.

“Hoplosternum” punctatum Meek & Hildebrand, 1916

Hoplosternum punctatum Meek & Hildebrand, 1916: 264.

Inmediately more inclusive taxon: Tribe Hoplosternini Miranda Ribeiro, 1959.

Sister group: Unranked clade composed of *Hoplosternum magdalenae* Eigenmann, 1913 and Dianema Cope, 1871.

Branch length: Three autapomorphies diagnose this species.

Autapomorphies: Three morphological characters are common to all trees. See *Hoplosternum punctatum* in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this species are:

Char. 19: (0→4). Large parietal fontanels, posterior opening small and anterior opening large (L=14, CI=42, RI=84).

Char. 44: (1→0). Premaxillary teeth present (L=4, CI=25, RI=85).

Char. 91: (0→1). Preopercle exposed externally (L=5, CI=20, RI=81).

Distribution: Central and South America, from Panama to Colombia. Pacific coastal drainages from Panama. Atrato River which drain to the Caribbean Sea in Colombia.

“Hoplosternum” magdalenae Eigenmann, 1913

Hoplosternum magdalenae Eigenmann in Ellis, 1913: 412.

Inmediately more inclusive taxon: Tribe Hoplosternini Miranda Ribeiro, 1959.

Sister group: *Dianema* Cope 1871.

Branch length: Seven autapomorphies diagnose this species.

Autapomorphies: Eight morphological characters are common to all trees. See *Hoplosternum magdalenae* in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this species are:

Char. 19: (0→5). Small parietal fontanels, only anterior opening present (L=14, CI=42, RI=84).

Char. 37: (2→3). Compound trigemino-facial and optic foramen divided by expansions of the prootic (L=6, CI=50, RI=88).

Char. 50: (0→1). Dentary teeth absent (L=2, CI=50, RI=96).

Char. 62: (1→0). Hyomandibular deep in shape (L=7, CI=14, RI=73).

Char. 93: (1→2). Opercle convex on its posterior margin (L=4, CI=50, RI=90).

Char. 133: (0→2). Transverse process of complex vertebra straight on its anterior margin (L=5, CI=40, RI=82).

Char. 136: (5→6). Vertebrae with 23 free elements (L=43, CI=20, RI=43).

Char. 139: (2→1). Ten ribs (L=35, CI=20, RI=48).

Distribution: South America in Colombia. Sinú and Magdalena rivers which drain to the Caribbean Sea in Colombia.

Genus *Dianema* Cope, 1871

Dianema Cope, 1871: 112. Type species: *Dianema longibarbis* Cope, 1872.

Decapogon Eigenmann & Eigenmann, 1888: 165. Type species: *Callichthys adspersus* Steindachner, 1877.

Inmediately more inclusive taxon: Tribe Hoplosternini Miranda Ribeiro, 1959.

Sister group: “*Hoplosternum*” *magdalenae*.

Content: Two species: *Dianema longibarbis* Cope, 1872 and *Dianema urostriatum* (Miranda Ribeiro, 1912).

Branch length: 10 synapomorphies diagnose this genus.

Bremer support: 10 (Figs. 20-21 and Table 7: node 235).

Synapomorphies: Nine morphological and one behavioral characters are common to all trees. See node 235 in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this species are:

Char. 14: (0→1). Lateral ethmoid postero-ventral process as a large lamina (L=2, CI=50, RI=66).

Char. 15: (2→1). Lateral ethmoid internal-surface foramen located posteriorly (L=4, CI=50, RI=92).

Char. 61: (1→2). Metapterygoid postero-dorsal portion without a laminar expansion or extremely reduced (L=6, CI=33, RI=69).

Char. 81: (0→1). Infraorbital bone 1 articulated to lateral ethmoid by indirect contact (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 128: (7→6). Trunk lateral-line canal with four tubules (L=25, CI=36, RI=52).

Char. 132: (1→0). Transverse process of complex vertebra compact in shape (L=7, CI=14, RI=73).

Char. 154: (1→2). Second dorsal ray long (L=12, CI=16, RI=67).

Char. 192: (0→3). Lower lip with two flat mesial barbels (exclusive synapomorphy, L=3, CI=100, RI=100).

Char. 195: (0→1). Snout with small platelets covering its skin surface (L=18, CI=22, RI=64).

Char. 215: (0→1). Swimming associated to the mid-water (L=2, CI=50, RI=50).

Distribution: South America, Peru and Brazil. Amazonas River basin.

Subfamily Corydoradinae Hoedeman, 1952

Corydoradinae Hoedeman, 1952. Type genus: *Corydoras* La Cépède, 1803.

Inmediately more inclusive taxon: Family Callichthyidae Bonaparte, 1838.

Sister group: Subfamily Callichthyinae Bonaparte, 1838.

Content: Five Genera: *Aspidoras* Ihering, 1907; *Corydoras* La Cépède, 1803; *Gastrodermus* Cope, 1878; *Hoplisoma* Swainson, 1838; and *Scleromystax* Günther, 1864.

Branch length: 139 synapomorphies diagnose this subfamily.

Bremer support: 49 (Figs. 20-21 and Table 7: node 166).

Synapomorphies: 42 morphological and 97 molecular (67 mitochondrial and 30 nuclear) characters are common to all trees. See node 166 in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this species are:

Char. 12: (0→1). Lateral ethmoid postero-ventral process located medially (L=4, CI=50, RI=93).

Char. 13: (0→1). Lateral ethmoid postero-ventral process acuminate (L=5, CI=20, RI=87).

Char. 19: (0→1). Large parietal fontanels, posterior opening large and anterior opening small (L=14, CI=42, RI=84).

Char. 21: (0→1). Postparieto-supraoccipital posterior process long, about 50% bone length (L=6, CI=33, RI=88).

Char. 29: (0→2). Parasphenoid anterior portion compressed, forming a very narrow midline bridge (exclusive synapomorphy, L=4, CI=50, RI=94).

Char. 31: (0→1). Orbitosphenoid wide (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 32: (0→2). Orbitosphenoid articulated with lateral ethmoid by alternating synchondral and sutural contact (exclusive synapomorphy, L=6, CI=33, RI=85).

Char. 36: (0→1). Pterosphenoid with a cavity for articulation of the antero-dorsal process of hyomandibular (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 42: (0→1). Basioccipital with laminar walls for passage of the aortic canal (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 47: (0→2). Maxilla with a small process on its posterior margin (exclusive synapomorphy, L=2, CI=100, RI=100).

Char. 50: (0→1). Dentary teeth absent (L=2, CI=50, RI=96).

Char. 58: (1→2). Metapterygoid without an antero-dorsal projection (L=4, CI=50, RI=92).

Char. 59: (0→1). Metapterygoid with a tendon-bone entopterygoid (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 67: (0→1). Hyomandibular with a crest for articulation with infraorbital 1 (L=4, CI=25, RI=87).

Char. 69: (0→1). Hyomandibular with a groove on inner margin above its articular facet for opercle (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 70: (1→2). Hyomandibular with a distinct postero-dorsal ridge externally exposed (L=6, CI=33, RI=85).

Char. 77: (0→1). Infraorbital bone 1 with a small anterior expansion (L=25, CI=12, RI=52).

Char. 87: (2→1). Interopercle postero-ventral margin expanded (exclusive synapomorphy, L=3, CI=66, RI=96).

Char. 90: (2→1). Interopercle with minute odontodes (L=20, CI=10, RI=53).

Char. 91: (0→1). Preopercle externally exposed (L=5, CI=20, RI=81).

Char. 94: (0→2). Inner margin of opercle with a small postero-dorsal crest (L=6, CI=33, RI=84).

Char. 95: (0→1). Inner margin of opercle with a postero-ventral crest (L=2, CI=50, RI=96).

Char. 96: (0→1). Antero-dorsal lamina of opercle largely expanded (L=8, CI=12, RI=75).

Char. 101: (0→1). Second branchiostegal ray short (exclusive synapomorphy, L=2, CI=100, RI=100).

Char. 103: (0→1). Dorsal hypohyal present (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 110: (0→1). Epibranchial 1 with a laminar process on its anterior margin (exclusive synapomorphy, L=1, CI=100, RI=100).

Char. 120: (1→0). Pore 5 of canal entering preopercle anteriorly located (L=3, CI=33, RI=90).

Char. 131: (0&1→2). Second ossicle laminar in shape, its ventral expansion twice size dorsal expansion or larger (L=19, CI=10, RI=39).

Char. 136: (5→6). Vertebrae with 23 free elements (L=43, CI=20, RI=43).

Char. 137: (0→1). Vertebral neural and haemal spines with laminar expansions restricted to the proximal portion (exclusive synapomorphy, L=12, CI=16, RI=79).

Char. 138: (0→1). Neural and haemal spines of preural vertebrae with their distal tips expanded and digitated (exclusive synapomorphy, L=2, CI=100, RI=100).

Char. 148: (0→1). First pterygiophore antero-dorsal expansion (nuchal plate) externally exposed (L=5, CI=20, RI=85).

Char. 154: (0→2). Second dorsal ray long (L=12, CI=16, RI=67).

Char. 155: (0→1). Second dorsal ray with posterior margin denticulations oriented distally (L=5, CI=40, RI=93).

Char. 156: (0→1). Eight branched dorsal-fin rays (L=8, CI=50, RI=81).

Char. 167: (1→2). Scapulocoracoids articulated mesially with strong interdigitations restricted on its posterior portion (exclusive synapomorphy, L=4, CI=50, RI=92).

Char. 181: (0→1). Basipterygium anterior process expanded (L=4, CI=50, RI=89).

Char. 192: (0→1). Lower lip with one conical mesial barbel (exclusive synapomorphy, L=3, CI=100, RI=100).

Char. 195: (0→1). Snout with small platelets covering its skin surface (L=18, CI=22, RI=64)

Char. 199: (0→1). Body dermal plates of the ventral series articulated to its counterpart (L=9, CI=11, RI=57).

Char. 200: (0→1). Ventral region of body with small platelets covering its skin surface (L=22, CI=13, RI=58).

Char. 202: (1→0). Urogenital papilla of sexually dimorphic males short (L=3, CI=33, RI=88).

Distribution: South America, from Colombia to Argentina, excluding Chile. South American main river systems: Orinoco, Amazonas, Tocantins, São Francisco, and La Plata. Rivers from Trinidad and Tobago. Rivers draining to the Atlantic Ocean from the coastal basins ranging from Guiana to the tributaries to the Laguna Merín in Uruguay.

Genus *Corydoras* La Cépède, 1803

Corydoras La Cépède, 1803. Type species: *Corydoras geoffroy* La Cépède, 1803.

Cordorinus Rafinesque, 1815. Type species: *Corydoras geoffroy* La Cépède, 1803.

Inmediately more inclusive taxon: Subfamily Corydoradinae Hoedeman, 1952.

Sister group: Unranked clade composed of *Aspidoras* Ihering, 1907; *Gastrodermus* Cope, 1878; *Hoplisoma* Swainson, 1838; and *Scleromystax* Günther, 1864.

Content: 29 species: *Corydoras acutus** Cope, 1872; *Corydoras amapaensis* Nijssen, 1972; *Corydoras areio* Knaack, 2000; *Corydoras aurofrenatus** Eigenmann & Kennedy, 1903; *Corydoras blochi** Nijssen, 1971; *Corydoras cervinus* Rössel, 1962; *Corydoras coriatae** Burgess, 1997; *Corydoras ellisae* Gosline, 1940; *Corydoras filamentosus** Nijssen & Isbrücker, 1983; *Corydoras fowleri** Böhlke, 1950; *Corydoras geoffroy* La Cépède, 1803; *Corydoras heteromorphus** Nijssen, 1970; *Corydoras maculifer** Nijssen & Isbrücker, 1971; *Corydoras narcissus* Nijssen & Isbrücker, 1980; *Corydoras negro** Knaack, 2004; *Corydoras ourastigma* Nijssen, 1972; *Corydoras oxyrhynchus** Nijssen & Isbrücker, 1967; *Corydoras pastazensis** Weitzman, 1963; *Corydoras saramaccensis** Nijssen, 1970; *Corydoras sarareensis** Dinkelmeyer, 1995; *Corydoras semiaquilus* Weitzman, 1964; *Corydoras septentrionalis** Gosline, 1940; *Corydoras serratus** Sands, 1995; *Corydoras simulatus* Weitzman & Nijssen, 1970; *Corydoras solox** Nijssen & Isbrücker, 1983; *Corydoras spilurus** Norman, 1926; *Corydoras stenocephalus* Eigenmann & Allen, 1942; and *Corydoras treitlii* Steindachner, 1906; *Corydoras vittatus** Nijssen, 1971.

Branch length: 41 synapomorphies diagnose this genus.

Bremer support: 15 (Figs. 20-21 and Table 7: node 192).

Synapomorphies: Nine morphological and 30 molecular (21 mitochondrial and nine nuclear) characters are common to all trees. See node 192 in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this species are:

Char. 7: (0→1). Portion of lateral ethmoid anterior to the nasal capsule long (L=4, CI=25, RI=78).

Char. 55: (0→1). Dorsal process of angular complex falciform on its posterior margin (exclusive synapomorphy, L=2, CI=50, RI=66).

Char. 118: (0→1). Supraorbital canal with a long epiphyseal branch on parietal (L=5, CI=60, RI=88).

Char. 122: (0→1). Supraorbital canal with an additional pore opening on sphenotic (L=3, CI=33, RI=71).

Char. 128: (7→6). Trunk lateral-line canal with four tubules (L=25, CI=36, RI=52).

Char. 133: (0→1). Transverse process of complex vertebra convex and carinated on its anterior margin (exclusive synapomorphy, L=5, CI=40, RI=82).

Char. 173: (2→1). Pectoral spine with an intermediate ossified portion (L=10, CI=20, RI=75).

Char. 174: (0→1). Pectoral spine with a rounded patch of skin in sexually dimorphic males (L=3, CI=33, RI=60).

Char. 201: (0→1). Urogenital papilla of sexually dimorphic males with a lanceolate shape (L=9, CI=11, RI=70).

Distribution: South America, from Colombia to Argentina; excluding Chile. South American main river systems: Orinoco, Amazonas, Tocantins, Paraná-Paraguay. Rivers draining to the Atlantic Ocean from the Guiana shield.

Genus *Gastrodermus* Cope, 1878

Gastrodermus Cope, 1878. Type species: *Corydoras elegans* Steindachner, 1877.

Microcorydoras Myers, 1953. Type species: *Corydoras hastatus* Eigenmann & Eigenmann, 1888.

Inmediately more inclusive taxon: Subfamily Corydoradinae Hoedeman, 1952.

Sister group: Unranked clade composed of *Aspidoras* Ihering, 1907; *Hoplisoma* Swainson, 1838; and *Scleromystax* Günther, 1864.

Content: 12 species: *Gastrodermus bilineatus** (Knaack, 2002), **new combination**; *Gastrodermus elegans* (Steindachner, 1877), **new combination**; *Gastrodermus gracilis* (Nijssen & Isbrücker, 1976), **new combination**; *Gastrodermus guapore* (Knaack, 1961), **new combination**; *Gastrodermus hastatus* (Eigenmann & Eigenmann, 1888), **new combination**; *Gastrodermus mamore** (Knaack, 2002), **new combination**; *Gastrodermus nanus** (Nijssen & Isbrücker, 1967), **new combination**; *Gastrodermus napoensis* (Nijssen & Isbrücker, 1986), **new combination**; *Gastrodermus nijsseni* (Sands, 1989), **new combination**; *Gastrodermus paucerna** (Knaack, 2004), **new combination**; *Gastrodermus pygmaeus* (Knaack, 1966), **new combination**; and *Gastrodermus undulatus* (Regan, 1912), **new combination**.

Branch length: 16 synapomorphies diagnose this genus.

Bremer support: 15 (Figs. 20-21 and Table 7: node 192).

Synapomorphies: Five morphological and 11 molecular (10 mitochondrial and one nuclear) characters are common to all trees. See node 234 in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this species are:

Char. 45: (2→1). Premaxilla about half size maxilla (L=14, CI=14, RI=53).

Char. 60: (0→1). Metapterygoid and quadrate with a small sutural articulation on its anterior portion (L=19, CI=10, RI=55).

Char. 64: (2→0). Hyomandibular anterior outgrowth little developed over the hyosymplectic cartilage (L=16, CI=12, RI=50).

Char. 86: (0→1). Infraorbital 2 with a postero-dorsal expansion contacting compound pterotic (L=11, CI=9, RI=67).

Char. 139: (5→4). Seven ribs (L=35, CI=20, RI=48).

Distribution: South America, from Peru to Argentina, excluding Chile. Amazonas, Paraguay-Paraná, and Uruguay River basins. Laguna dos Patos basin in the state of Rio Grande do Sul, Brazil.

Genus *Hoplisoma* Swainson, 1838

Hoplisoma Swainson, 1838. Type species: *Cataphractus punctatus* Bloch, 1794.

Brochis Cope, 1871. Type species: *Brochis coeruleus* Cope, 1872.

Chaenothorax Cope, 1878. Type species: *Chaenothorax bicarinatus* Cope, 1878.

Osteogaster Cope, 1894. Type species: *Corydoras eques* Steindachner, 1877.

Inmediately more inclusive taxon: Subfamily Corydoradinae Hoedeman, 1952.

Sister group: Unranked clade composed of *Aspidoras* Ihering, 1907 and *Scleromystax* Günther, 1864.

Content: 113 species: *Hoplisoma aeneus* (Gill, 1858), **new combination**; *Hoplisoma acrensis** (Nijssen, 1972), **new combination**; *Hoplisoma adolfoi* (Burgess, 1982), **new combination**; *Hoplisoma agassizii** (Steindachner, 1877), **new combination**; *Hoplisoma albolineatus** (Knaack, 2004), **new combination**; *Hoplisoma amandajanea** (Sands, 1995), **new combination**; *Hoplisoma ambiacus* (Cope, 1872), **new combination**; *Hoplisoma amphibelus** (Cope, 1872), **new combination**; *Hoplisoma approuaguensis* (Nijssen & Isbrücker, 1983), **new combination**; *Hoplisoma araguaiaensis* (Sands, 1990), **new combination**; *Hoplisoma arcuatus* (Elwin, 1939), **new combination**; *Hoplisoma armatus* (Günther, 1868), **new combination**; *Hoplisoma atropersonatus* (Weitzman & Nijssen, 1970), **new combination**; *Hoplisoma axelrodi** (Rössel, 1962), **new combination**; *Hoplisoma baderi** (Geisler, 1969), **new combination**; *Hoplisoma bicolor** (Nijssen & Isbrücker, 1967), **new combination**; *Hoplisoma bifasciatus** (Nijssen, 1972), **new combination**; *Hoplisoma boehlkei** (Nijssen & Isbrücker, 1982), **new combination**; *Hoplisoma boesemani* (Nijssen & Isbrücker, 1967), **new combination**; *Hoplisoma bondi** (Gosline, 1940), **new combination**; *Hoplisoma breei* (Isbrücker & Nijssen, 1992), **new combination**; *Hoplisoma brevirostris* (Fraser-Brunner, 1947), **new combination**; *Hoplisoma britskii* (Nijssen & Isbrücker, 1983), **new combination**; *Hoplisoma burgessi* (Axelrod, 1987), **new combination**; *Hoplisoma carlae** (Nijssen & Isbrücker, 1983), **new combination**; *Hoplisoma caudimaculatus* (Rössel, 1961), **new combination**; *Hoplisoma cochui* (Myers & Weitzman, 1954), **new combination**; *Hoplisoma concolor** (Weitzman, 1961), **new combination**; *Hoplisoma condiscipulus* (Nijssen & Isbrücker, 1980), **new combination**; *Hoplisoma copei** (Nijssen & Isbrücker, 1986), **new combination**; *Hoplisoma coppenamensis* (Nijssen, 1970), **new combination**; *Hoplisoma crimmeni** (Grant, 1997), **new combination**; *Hoplisoma cruziensis** (Knaack, 2002), **new combination**; *Hoplisoma crypticus** (Sands, 1995), **new combination**; *Hoplisoma davidsandsi** (Black, 1987), **new combination**; *Hoplisoma delphax** (Nijssen & Isbrücker, 1983), **new combination**; *Hoplisoma difluviatilis* (Britto & Castro, 2002), **new combination**; *Hoplisoma diphyes* (Axenrot & Kullander, 2003), **new combination**; *Hoplisoma duplicareus** (Sands, 1995), **new combination**; *Hoplisoma ehrhardti* (Steindachner, 1910), **new combination**; *Hoplisoma ephippifer* (Nijssen, 1972), **new combination**; *Hoplisoma eques** (Steindachner, 1877), **new combination**; *Hoplisoma esperanzae** (Castro, 1987), **new combination**; *Hoplisoma evelynae** (Rössel, 1963), **new combination**; *Hoplisoma flaveolus* (Ihering, 1911), **new combination**; *Hoplisoma garbei** (Ihering, 1911), **new combination**; *Hoplisoma geryi** (Nijssen & Isbrücker, 1983), **new combination**; *Hoplisoma gomezi** (Castro, 1986), **new combination**; *Hoplisoma gossei* (Nijssen, 1972), **new combination**; *Hoplisoma griseus** (Holly, 1940), **new combination**; *Hoplisoma guianensis* (Nijssen, 1970), **new combination**; *Hoplisoma habrosus* (Weitzman, 1960), **new combination**; *Hoplisoma haraldschultzi** (Knaack, 1962), **new combination**; *Hoplisoma imitator* (Nijssen & Isbrücker, 1983), **new combination**; *Hoplisoma incolicana** (Burgess 1993), **new combination**; *Hoplisoma isbrueckeri** (Knaack, 2004), **new combination**; *Hoplisoma julii* (Steindachner, 1906), **new combination**; *Hoplisoma kanei* (Grant, 1997), **new combination**; *Hoplisoma lamberti** (Nijssen & Isbrücker, 1986), **new combination**; *Hoplisoma latus** (Pearson, 1924), **new combination**; *Hoplisoma leopardus** (Myers, 1933), **new combination**; *Hoplisoma leucomelas* (Eigenmann & Allen, 1942), **new combination**; *Hoplisoma loretoensis* (Nijssen & Isbrücker, 1986), **new combination**; *Hoplisoma loxozonus** (Nijssen & Isbrücker, 1983), **new combination**; *Hoplisoma longipinnis* (Knaack 2007), **new combination**; *Hoplisoma melanistius* (Regan, 1912), **new combination**; *Hoplisoma melanotaenia** (Regan, 1912), **new combination**; *Hoplisoma melini* (Lönnberg & Rendahl, 1930), **new combination**; *Hoplisoma metae* (Eigenmann, 1914), **new combination**; *Hoplisoma micracanthus** (Regan, 1912), **new combination**; *Hoplisoma multimaculatus** (Steindachner, 1907), **new combination**; *Hoplisoma multiradiatus** (Orcés, 1960), **new combination**; *Hoplisoma nattereri* (Steindachner, 1877), **new combination**; *Hoplisoma noelkempffi** (Knaack, 2004), **new combination**; *Hoplisoma oiapoquensis** (Nijssen, 1972), **new combination**; *Hoplisoma ornatus** (Nijssen & Isbrücker, 1976), **new combination**; *Hoplisoma orphnopterus** (Weitzman & Nijssen, 1970), **new combination**; *Hoplisoma osteocarus** (Böhlke, 1951), **new combination**; *Hoplisoma paleatus* (Jenyns, 1842), **new combination**; *Hoplisoma panda* (Nijssen & Isbrücker, 1971), **new combination**; *Hoplisoma pantanalensis* (Knaack, 2001), **new combination**; *Hoplisoma paragua** (Knaack, 2004), **new combination**; *Hoplisoma parallelus** (Burgess 1993), **new combination**; *Hoplisoma pinheiroi** (Dinkelmeyer, 1995), **new combination**; *Hoplisoma polystictus* (Regan, 1912), **new combination**; *Hoplisoma potaroensis** (Myers, 1927), **new combination**; *Hoplisoma pulcher* (Isbrücker & Nijssen, 1973), **new combination**; *Hoplisoma punctatus* (Bloch, 1794), **new combination**;

Hoplisoma rabauti (La Monte, 1941), **new combination**; *Hoplisoma reticulatus* (Fraser-Brunner, 1938), **new combination**; *Hoplisoma reynoldsi** (Myers & Weitzman, 1960), **new combination**; *Hoplisoma robineae* (Burgess, 1983), **new combination**; *Hoplisoma robustus** (Nijssen & Isbrücker, 1980), **new combination**; *Hoplisoma sanchesi* (Nijssen & Isbrücker, 1967), **new combination**; *Hoplisoma schwartzi* (Rössel, 1963), **new combination**; *Hoplisoma seussi* (Dinkelmeyer, 1996), **new combination**; *Hoplisoma similis** (Hieronimus, 1991), **new combination**; *Hoplisoma sipaliwini** (Hoedeman, 1965), **new combination**; *Hoplisoma sodalis* (Nijssen & Isbrücker, 1986), **new combination**; *Hoplisoma spectabilis** (Knaack, 1999), **new combination**; *Hoplisoma splendens* (Castelnau, 1855), **new combination**; *Hoplisoma steindachneri** (Isbrücker & Nijssen, 1973), **new combination**; *Hoplisoma sterbai** (Knaack, 1962), **new combination**; *Hoplisoma surinamensis** (Nijssen, 1970), **new combination**; *Hoplisoma sychri** (Weitzman, 1960), **new combination**; *Hoplisoma trilineatus* (Cope, 1872), **new combination**; *Hoplisoma tukano* (Britto & Lima, 2003), **new combination**; *Hoplisoma urucu* (Britto, Wosiacki & Montag, 2009), **new combination**; *Hoplisoma virginiae** (Burgess, 1993), **new combination**; *Hoplisoma weitzmani* (Nijssen, 1971), **new combination**; *Hoplisoma wotroi* (Nijssen & Isbrücker, 1967), **new combination**; *Hoplisoma xinguensis* (Nijssen, 1972), **new combination**; *Hoplisoma zygatus* (Eigenmann & Allen, 1942), **new combination**.

Branch length: 32 synapomorphies diagnose this genus.

Bremer support: 6 (Figs. 20-21 and Table 7: node 163).

Synapomorphies: Four morphological and 25 molecular (16 mitochondrial and nine nuclear) characters are common to all trees. See node 163 in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this species are:

Char. 57: (0→1). Metapterygoid anterior projection intermediate (L=19, CI=10, RI=54).

Char. 178: (0→1). Pectoral spine posterior margin denticulations oriented distally (L=4, CI=25, RI=91).

Char. 183: (0→1). Basipterygium antero-dorsal ridge orientated mesially (L=9, CI=11, RI=79).

Char. 185: (0→1). Basipterygium lateral process with a large posterior expansion (exclusive synapomorphy, L=9, CI=11, RI=72).

Distribution: South America, from Colombia to Argentina, excluding Chile. South American main river systems: Orinoco, Amazonas, Tocantins, São Francisco, and La Plata. Rivers from Trinidad and Tobago. Rivers draining to the Atlantic Ocean from the coastal basins ranging from Guiana to the tributaries to the Laguna Merín in Uruguay.

Genus *Scleromystax* Günther, 1864

Scleromystax Günther, 1864: 225. Type species: *Callichthys barbatus* Quoy & Gaimard, 1824.

Sister group: *Aspidoras* Ihering, 1907.

Content: Six species: *Scleromystax barbatus* (Quoy & Gaimard, 1824); *Scleromystax lacerdai* (Hieronimus, 1995), **new combination**; *Scleromystax macropterus* (Regan, 1913); *Scleromystax prionotos* (Nijssen & Isbrücker, 1980); *Scleromystax salmacis* Britto & Reis, 2005; and *Scleromystax virgulatus* (Nijssen & Isbrücker, 1980), **new combination**.

Branch length: 34 synapomorphies diagnose this genus.

Bremer support: 13 (Figs. 20-21 and Table 7: node 226).

Synapomorphies: Four morphological and 29 molecular (25 mitochondrial and four nuclear) characters are common to all trees. See node 226 in Table 7 to individualize characters and transformations of their character-states. Phenotypic characters that diagnose this species are:

Char. 49: (2→0). Autopalatine longer than maxilla (L=20, CI=10, RI=64).

Char. 54: (2→1). Dorsal process of angular complex located medially (L=14, CI=14, RI=47).

Char. 131: (2→1). Second ossicle laminar in shape, its ventral expansion equal size dorsal expansion or larger (L=19, CI=10, RI=39).

Char. 197: (0→1). Predorsal region with small dermal platelets (L=4, CI=25, RI=50).

Distribution: South America, Brazil. Eastern, southeastern, and southern Brazilian coastal rivers from the Jucurucu River in the state of Bahia to the Mapituba River in the state of Santa Catarina.

Genus *Aspidoras* Ihering, 1907

Aspidoras Ihering, 1907: 30. Type species: *Aspidoras rochai* Ihering, 1907.

Sister group: *Scleromystax* Günther, 1864.

Content: 19 species: *Aspidoras albater* Nijssen & Isbrücker, 1976; *Aspidoras belenos** Britto, 1998; *Aspidoras brunneus** Nijssen & Isbrücker, 1976; *Aspidoras carvalhoi** Nijssen & Isbrücker, 1976; *Aspidoras depinnai** Britto, 2000; *Aspidoras eurycephalus* Nijssen & Isbrücker, 1976; *Aspidoras fuscoguttatus** Nijssen & Isbrücker, 1976; *Aspidoras lakoi** Miranda Ribeiro, 1949; *Aspidoras maculosus** Nijssen & Isbrücker, 1976; *Aspidoras menezesi** Nijssen & Isbrücker, 1976; *Aspidoras microgalaeus** Britto, 1998; *Aspidoras pauciradiatus** Weitzman & Nijssen, 1970; *Aspidoras poecilus* Nijssen & Isbrücker, 1976; *Aspidoras psammatides* Britto, Lima & Santos, 2005; *Aspidoras raimundi* (Steindachner, 1907); *Aspidoras rochai** Ihering, 1907; *Aspidoras spilotus** Nijssen & Isbrücker, 1976; *Aspidoras taurus* Lima & Britto, 2001; and *Aspidoras velites** Britto, Lima & Moreira, 2002.

Branch length: 54 synapomorphies diagnose this genus.

Bremer support: 20 (Figs. 20-21 and Table 7: node 220).

Synapomorphies: Seven morphological and 46 molecular characters (all mitochondrial) are common to all trees. See node 220 in Table 7 to individualize characters and transitions of their character-states. Phenotypic characters that diagnose this species are:

Char. 2: (0&1→2). Mesethmoid posterior margin extremely wide (L=19, CI=10, RI=58).

Char. 13: (1→0). Lateral ethmoid postero-ventral process laminar in shape (L=5, CI=20, RI=87).

Char. 21: (1→0). Postparieto-supraoccipital posterior process short, about 30% bone length (L=6, CI=33, RI=88).

Char. 29: (2→1). Parasphenoid anterior portion compressed, forming a thin midline bridge (L=4, CI=50, RI=94).

Char. 72: (0→1). Hyomandibular postero-dorsal ridge wide (L=9, CI=11, RI=42).

Char. 90: (1→2). Interopercle without odontodes (L=20, CI=10, RI=53).

Char. 154: (2→1). Second dorsal ray short (L=12, CI=16, RI=67).

Distribution: South America, Brazil. Rivers from the Brazilian shield including the Xingú, Tocantins, Parnaíba, Jaguaribe, Ipojuca, Itapicurú, Paraguaçú, Upper Paraná, and Upper Paraguay.

Incertae sedis

† *Corydoras revelatus* Cockerell, 1925

Discussion

Morphological and behavioral characters

Eleven transformation series previously reported in the literature for the Callichthyidae were not included in this analysis. One myological character related to the mouth was proposed by Schaefer (1990). Five characters related to head (one to the branchial arch, one to the lateral-line system, one to the external morphology) and one character related to behavior were also analyzed in Reis (1998). Four osteological characters and one of coloration pattern were also proposed by Britto (2003). They are discussed as follows mentioning the character statements and states as originally proposed.

Schaefer (1990, character 62) reported that the *adductor mandibulae* of Callichthyidae is subdivided in two portions, one of them with antero-dorsal fibers approaching the premaxilla but not directly inserted to it. *Adductor* fibers approaching premaxilla were difficult to observe in cleared and stained specimens and this character was not analyzed.

Reis (1998, character 7) proposed that basioccipital and exoccipital are separated bones in most Loricarioidea but fused in Callichthyidae and Scoloplacidae. This author also proposed an interrupted preopercular-mandicular canal as a synapomorphy of the Callichthyidae (character 13). However, Trichomycteridae and Scoloplacidae also exhibit a preopercular canal interrupted, not continuous with the canal entering the compound pterotic. Reis (1998, character 16) proposed that Callichthyidae and Loricariidae exhibit laminar expanded infraorbital bones. This author also proposed the presence of an anterior expansion in the epibranchial 2 as a synapomorphy of the Callichthyidae (character 44). However, all Trichomycteridae examined show a triangular expansion in the inner margin. *Copionodon* medially located; *Trichogenes* and *Trichomycterus* mesially located as in Callichthyidae. Considering that these characters are also present in the outgroup and that no variation occurs within the ingroup they are not informative, thus, not included in this analysis.

Reis (1998, character 14) proposed the absence of a lachrimal-antorbital as a synapomorphy of the Callichthyidae. However, identity of this structure among Loricarioidea is problematic because of the contradictory nomenclature employed in this group. Schaefer (1990) proposed a compound lachrimal-antorbital without canal innervations as a synapomorphy of Callichthyidae, Scoloplacidae, Astroblepidae, and Loricariidae. However, with reversions in *Corydoras* and *Aspidoras*, which exhibit lachrimal-antorbital with canals. Nevertheless, Schaefer (1987) stated that callichthyids lack lachrimal-antorbital and also a palatine splint. This author also pointed that the infraorbital canal of astroblepids do not approach the palatine splint, and that this element also lacks a canal. Consequently, the palatal splint of astroblepids and loricariids is not homologous with the lachrimal-antorbital of other catfishes. This author concluded that the lachrimal was lost in callichthyids, astroblepids, and loricariids; and that the palatine splint represents a sesamoid ossification. Following these ideas, the compound lachrimal-antorbital associated to the autopalatine of the Scoloplacidae is not considered as being part of the infraorbital series since it lack canal innervations. Consequently, the loss of the antorbital tubule could be considered a synapomorphy of the advanced Loricarioidea.

Reis (1998, character 66) suggested that the presence of dermal plates is a synapomorphy of advanced Loricarioidea, but with a subsequent reversion in Astroblepidae. This author also mentioned that the arrangement of these plates is unique for each family, and that two longitudinal series are found only in Callichthyidae. However, two lateral series is also present in Scoloplacidae which makes the pattern of two plate series as non informative. Moreover, Schaefer (2003) analyzed the pattern of lateral plate series of loricarioids and established as homologous series the dorsal and ventral plates of Callichthyidae, Scoloplacidae, and Loricariidae (character 40). According to this author, the presence of dorsal and ventral dermal plate series is a symplesiomorphy of these loricarioids, being the presence of additional three series (middorsal, median, midventral) between those plates a synapomorphy of Loricariidae.

Reis (1998, character 70) proposed buoyancy via air breathing as autapomorphic for the Callichthyidae. However, records are only known from Gee (1976) and Gee & Graham (1978) who used *Hoplosternum punctatum* (identified as *Hoplosternum thoracatum*) and *Corydoras splendens* (identified as *Brochis splendens*) in their experiments. It was preferred to omit this behavioral character from the analysis considering that only two species were corroborated by experimental studies.

Britto (2003, character 13) proposed that the infraorbital bones exhibit odontodes variably distributed on bones 1 and 2, and that a small group of *Corydoras* totally lacks odontodes. However, almost all Corydoradinae analyzed exhibit odontodes on infraorbital bones 1 and 2. Exceptions among the ingroup are *Aspidoras albater*, most *Lepthoplosternum* species, and *Megalechis thoracata* which exhibit odontodes restricted on infraorbital bone 1. *Hoplosternum littorale* and *Lepthoplosternum tordilho* totally lack odontodes. Despite these observations, it is difficult to codify them as character-states because most odontodes are lost after the clearing and staining procedure. It was preferred to omit this character from the analysis at least for this moment, a re-examination of alcohol preserved specimens will be necessary to corroborate the absence of odontodes already observed in c&s specimens.

Britto (2003, character 35) proposed the presence of odontodes on the preopercle as a synapomorphy of most Corydoradinae, except some *Corydoras* species (including *Brochis*). This author also proposed the absence of odontodes on the lateral margin of the opercle as a synapomorphy for some *Corydoras* species (character 44). However, it was observed the presence of odontodes in all specimens of Callichthyidae analyzed. The odontodes are dispersed over its whole surface in most Callichthyidae; those restricted on its lateral margin are sometimes a little larger in size. In *Aspidoras psammatides* only a few odontodes are scattered over its lateral surface. Despite it was observed some variation in the amount of odontodes dispersed over the opercle lateral surface, it is difficult to codify them as character-states because most odontodes are lost after the clearing and staining procedure. Taking this in consideration, I preferred to omit this character from the analysis.

Britto (2003, character 23) proposed a notched posterior lamina of the ceratobranchial 3 as a synapomorphy of some *Corydoras* species. This author also proposed a thick proximal segment of the caudal-fin rays as a synapomorphy of some *Corydoras* species (character 61). However, both character conditions are not clearly distinguishable from their opposed conditions and were omitted from the analysis.

Britto (2003, character 73) proposed the arc-like stripe pattern of body from head to caudal peduncle as a synapomorphy of *Corydoras gracilis* and *C. arcuatus*. However, the stripe begins in the snout tip in *C. gracilis* and around the eye in *C. arcuatus* suggesting non homology.

Molecular characters

Alexandrou *et al*. (2011) generated partial fragments of about 900 bp of the nuclear gene F-reticulon 4 (*RTN4*) for 24 species of callichthyids, mostly corydoradines. Mariguela *et al*. (2013) generated partial fragments of about 350 bp of the nuclear gene Seven in absentia 1A (*sina*) for 11 species of callichthyids, mostly callichthyines. Pereira *et al*. (2013) generated partial fragments of about 700 bp of the mitochondrial gene Cytochrome oxidase subunit 1 (*COI*) for 11 species, mostly corydoradines. However, all these sequences are available for a little group of species and were not included in the analysis. Moreover, the voucher specimens were not checked in this study.

Analysis of the concatenated mitochondrial data (*12S rRNA*, *16S rRNA*, *ND4*, and *Cytb*) recovered as monophyletic Callichthyidae, Callichthyinae, and Corydoradinae. Within Callichthyinae, all genera but *Lepthoplosternum* are recovered as monophyletic. *Dianema* is the sister group of the following remaining Callichthyinae: (*Hoplosternum* (*Callichthys* ((*Lepthoplosternum tordilho* + *L. ucamara*) (*Megalechis* (*L. altamazonicum* + *L. pectorale*))))). Within Corydoradinae, just *Aspidoras* and *Scleromystax* are recovered as monophyletic when compared with the Total Evidence analysis. The following phylogenetic arrangement is reported for this partial dataset and using the new combinations proposed in this paper. A large clade of *Corydoras* is the sister group of the following remaining Corydoradinae: (*Corydoras semiaquilus* ((*Gastrodermus* small clade + *Aspidoras*) (*Scleromystax* (*Hoplisoma flaveolus* + *Gastrodermus* large clade + *Hoplisoma* small clade + *Hoplisoma* large clade)))).

Analysis of the nuclear data (*Rag1*) recovered as monophyletic Callichthyidae, Callichthyinae, and Corydoradinae. Within Callichthyinae, all genera are recovered as monophyletic. *Dianema* is the sister group of the following remaining Callichthyinae: (*Callichthys* (*Hoplosternum* (*Megalechis* (*Lepthoplosternum ucamara* + *L. pectorale*)))). Within Corydoradinae, all genera but *Gastrodermus* are recovered as monophyletic when compared with the Total Evidence analysis. The following phylogenetic arrangement is reported for this partial dataset and using the new combinations proposed in this paper. *Corydoras* is the sister group of the following remaining Corydoradinae: (*Gastrodermus* large clade (*G. pygmaeus* + *G. hastatus* + *G. guapore* + *Hoplisoma* + (*Aspidoras* + *Scleromysta*x))).

Analysis of the concatenated mitochondrial and nuclear data recovered as monophyletic Callichthyidae, Callichthyinae, and Corydoradinae. Within Callichthyinae, all genera are recovered as monophyletic. *Dianema* is the sister group of the following remaining Callichthyinae: (*Hoplosternum* (*Callichthys* (*Megalechis* + *Lepthoplosternum*))). Within Corydoradinae, all genera but *Gastrodermus* are recovered as monophyletic when compared with the Total Evidence analysis. The following phylogenetic arrangement is reported for this partial dataset and using the new combinations proposed in this paper. *Corydoras* is the sister group of the following remaining Corydoradinae: (*Gastrodermus* large clade (*Gastrodermus* small clade + *Aspidoras* + (*Scleromysta*x + *Hoplisoma*))).

Cladistic and patristic relationships

Monophyly of Callichthyidae

The monophyly of the family Callichthyidae is corroborated in the Cladistic parsimony analysis here performed under a Total Evidence approach. This group of fishes was recognized since Bonaparte (1838), most of the subsequent papers dealt with taxonomic classifications or species descriptions within callichthyids and added characters to its distinction, some of them were used here in the phylogenetic analysis. However, these characters were only tested by explicit phylogenetic methods around 20 years ago. Schaefer (1990) performed a phlylogenetic analysis of the Scoloplacidae and some Loricariodea; this author proposed as a synapomorphic character for the Callichthyidae an *adductor mandibulae* subdivided in two portions, one of them with antero-dorsal fibers approaching the premaxilla but not directly inserted to it (character 62), see comments above.

Reis (1998) was the first author that proposed the monophyly of Callichthyidae based on 28 synapomorphies. Seven of those characters (7, 13, 14, 16, 44, 66, and 70 from Reis, 1998) were not analyzed here, see comments above. Nine of those characters are corroborated as synapomorphic for the Callichthyidae (see characters 44, 45, 51, 52, 75, 97, 180, 182, and 184 on “Character description” and on “Synapomorphies” under “Phylogenetic classification”). However, remaining 12 characters (see characters 0, 25, 76, 80, 81, 84, 85, 128, 144, 152, 165, and 186 on “Character description”) were analyzed here but not corroborated as synapomorphies for this family. A total of 25 phenotypic characters are proposed here as synapomorphic for the Callichthyidae, 16 of them are novelties from this work (see characters 17, 41, 53, 54, 104, 105, 107, 114, 115, 134, 140, 141, 164, 173, 176, and 189 on “Character description” and on “Synapomorphies” under “Phylogenetic classification”).

Shimabukuru-Dias *et al*. (2004) also corroborated the monophyly of the family based in six phylogenetic analyses using the mitochondrial markers *12S rRNA*, *16S rRNA*, and *ND4*. One analysis was performed employing the parsimony method (only analyzing their molecular data), two analyses employing the maximum likelihood method (only analyzing their molecular data and using different models on each), and three analyses employing the parsimony method [analyzing their molecular data in addition to the phylogenetic data matrix of Reis (1998) by weighting morphology equal, five, and ten times heavier than molecular]. These authors performed two phylogenetic methods using different datasets and treating them differently on each analysis, a total of six different phylogenetic hypotheses were generated. Considering this situation is difficult to address a discussion comparing their results with the one here obtained. These authors advocated for a molecular study of the callichthyids and, according to their introduction, the molecular and morphological combination was addressed in order to suggest an alternative phylogenetic hypothesis for the family. However, three different hypotheses were generated by their molecular study. For the discussion addressed here, species relationships within the Callichthyidae were done focusing on the cladogram obtained by the parsimony method based in the molecular data alone (Fig. 5a). In the Total Evidence phylogeny here performed, I included the same molecular markers used by these authors in addition to the *Cytb* and *Rag1* data and also corroborated Callichthyidae monophyletic. A total of 94 synapomorphies are proposed here as synapomorphic for the Callichthyidae, 69 of them are molecular characters and includes five synapomorphies from the *12S rRNA* (characters 224, 373, 413, 475, and 529), 12 synapomorphies from *16S rRNA* (characters 645, 889, 939, 958, 966, 980, 1000, 1016, 1042, 1094, 1101, and 1103), five synapomorphies from *ND4* (1531, 1537, 1629, 1671, and 1752), 23 synapomorphies from *Cytb* (characters 2268, 2322, 2328, 2340, 2394, 2496, 2497, 2500, 2517, 2583, 2590, 2598, 2607, 2680, 2691, 2702, 2778, 2820, 2821, 2929, 3088, 3123, and 3131), and 24 synapomorphies from *Rag1* (characters 3178, 3217, 3232, 3278, 3287, 3332, 3386, 3419, 3446, 3506, 3515, 3579, 3581, 3626, 3636, 3758, 3788, 3815, 3817, 3838, 3853, 3880, 3955, and 3972).

Monophyly of Callichthyinae

The subfamily Callichthyinae is here corroborated as monophyletic and containing two monophyletic clades (herein ranked as tribes, see below): Hoplosternini and Callichthyini. Gosline (1940) first suggested that the Callichthyidae split into three phylogenetic groups based in five morphological characters, these are: anteriormost dorso-lateral scutes development, postparieto-supraoccipital posterior process development, scapulocoracoid development, shape of the lower lip, and position of the eye. Two of these groups are corroborated here as belonging to the Callichthyinae and the morphological characters proposed by Gosline were analyzed in this research. Hoedeman (1952) was the first author that ranked Callichthyinae with a subfamily status; however, no phylogenetic interrelationships were proposed among its members. Reis (1998) proposed the monophyly of Callichthyinae based on 12 synapomorphies. Four of those characters (see characters 5, 16, 58, and 98 on “Character description”) were analyzed here and not corroborated as synapomorphies for this subfamily. Eight of those characters were corroborated as synapomorphic for the Callichthyidae (see characters 74, 113, 117, 125, 145, 179, 193, and 214 on “Character description” and on “Synapomorphies” under “Phylogenetic classification”). A total of 23 phenotypic characters are proposed here as synapomorphic for the Callichthyinae, 15 of them are novelties from this work (see characters 6, 8, 11, 18, 24, 26, 34, 38, 56, 57, 82, 86, 96,109, and 144 on “Character description” and on “Synapomorphies” under “Phylogenetic classification”). Shimabukuru-Dias *et al*. (2004) also corroborated the monophyly of the subfamily. A total of 61 synapomorphies are proposed here as synapomorphic for the Callichthyinae, 38 of them are molecular characters and includes eight synapomorphies from the *12S rRNA* (characters 305, 421, 437, 440, 532, 572, 584, and 604), ten synapomorphies from *16S rRNA* (characters 646, 773, 815, 849, 859, 904, 916, 935, 967, and 979), ten synapomorphies from *ND4* (characters 1215, 1309, 1318, 1323, 1389, 1524, 1590, 1593, 1596, and 1626), and ten synapomorphies from *Rag1* (characters 3268, 3275, 3326, 3625, 3686, 3698, 3716, 3816, 3957, and 3965).

Monophyly of Callichthyini

The clade composed of *Callichthys*, *Megalechis*, and *Lepthoplosternum* are ranked with a tribe status (node 233), and the following interrelationships are proposed: (*Callichthys* (*Lepthoplosternum* + *Megalechis*)). Reis (1998) did not found this arrangement in his phylogenetic analysis, proposing instead the following interrelationships: (*Callichthys* (*Lepthoplosternum* (*Megalechis* (*Dianema* + *Hoplosternum*))))). On the other hand, this clade was corroborated in Shimabukuru-Dias *et al*. (2004) having a similar relationship, but with *Lepthoplosternum* as paraphyletic. A total of 22 characters are proposed here as synapomorphic for the Callichthyini, seven are phenotypic (see characters 30, 39, 92, 126, 133, 162, and 188 on "Character description" and on "Synapomorphies" under "Phylogenetic classification") and 15 are molecular. Molecular synapomorphies include three from the *12S rRNA* (characters 260, 541, and 544), six from *16S rRNA* (characters 685, 753, 854, 894, 912, and 914), and six from *ND4* (characters 1239, 1281, 1344, 1548, 1668, and 1727).

Monophyly of *Callichthys*

The genus *Callichthys* (node 232) is herein corroborated as monophyletic, but without resolution of the interrelationships for the three species analyzed. Reis (1998) proposed six autapomorphies for this genus. Five of those characters (see characters 38, 84, 61, 96, and 152 on "Character description") were analyzed here and not corroborated as synapomorphies for this genus. However, one of those characters is corroborated as synapomorphic for *Callichthys* (see character 76 on "Character description" and on "Synapomorphies" under "Phylogenetic classification"). A total of 71 characters are proposed here as synapomorphic for *Callichthys*, seven are phenotypic characters (six of them are novelties from this work, see characters 57, 80, 104, 136, 147, and 169 on "Character description" and on "Synapomorphies" under "Phylogenetic classification") and 64 are molecular characters. Molecular characters include three synapomorphies from the *12S rRNA* (characters 260, 541, and 544), six synapomorphies from *16S rRNA* (characters

685, 753, 854, 894, 912, and 914), and six synapomorphies from *ND4* (characters 1239, 1281, 1344, 1548, 1668, and 1727).

Monophyly of *Megalechis*

The genus *Megalechis* (node 245) is herein corroborated as monophyletic; it contains two species. Reis (1998) considered this genus as valid and proposed one synapomorphic character (see character 175 on "Character description"); however, this character is not corroborated in this analysis. Shimabukuru-Dias *et al*. (2004) also found this genus as monophyletic. A total of 22 characters are proposed here as synapomorphic for *Megalechis*, all of them are novelties from this work, they include three phenotypic characters (see characters 60, 67, and 203 on "Character description" and on "Synapomorphies" under "Phylogenetic classification") and 64 molecular characters. Molecular characters include one synapomorphy from the *12S rRNA* (character 408), one synapomorphy from *16S rRNA* (character 886), and 17 synapomorphies from *ND4* (characters 1203, 1277, 1375, 1389, 1482, 1611, 1627, 1635, 1665, 1681, 1689, 1751, 1752, 1824, 1857, 1926, and 1983).

Monophyly of *Lepthoplosternum*

The genus *Lepthoplosternum* (node 239) is corroborated here as monophyletic and the following interrelationships are proposed: (*L. altamazonicum* (*L. beni* (*L. stellatum* (*L. pectorale* (*L. tordilho* + *L. ucamara*))))). Reis (1998) considered this genus as valid and proposed two synapomorphic characters. These characters were corroborated here as synapomorphic for this genus with the addition of six other characters as novelties from this work (see characters 4, 65, 136, 158, 159, 192, 193, and 199 on "Character description" and on "Synapomorphies" under "Phylogenetic classification"). However, Shimabukuru-Dias *et al*. (2004) recovered this genus as paraphyletic, with the following relationships for the two species analyzed (see fig. 5a): (*L. tordilho* (*L. altamazonicum* + *Megalechis*)). A total of 28 characters are proposed here as synapomorphic for *Lepthoplosternum*, 20 of them are molecular characters. Molecular characters include three synapomorphies from the *12S rRNA* (characters 314, 372, and 437), seven synapomorphies from *16S rRNA* (characters 848, 870, 888, 917, 946, 952, and 982), and ten synapomorphies from *ND4* (characters 1215, 1269, 1356, 1485, 1542, 1650, 1659, 1683, 1830 and 1978).

Monophyly of Hoplosternini

The clade composed of *“Hoplosternum”* and *Dianema* are ranked with a tribe status (node 235), the following interrelationships are proposed: (“*Hoplosternum*” *littorale* (*“Hoplosternum” punctatus (“Hoplosternum” magdalenae + Dianema*))). Reis (1998) also found *Hoplosternum* and *Dianema* as close related based on four synapormorphic features. Only one of them is corroborated here as synapomorphic and a total of nine characters were optimized as phenotypic synapomorphies for this tribe (characters 60, 84, 85, 102, 127, 129, 161, 190, and 212); remaining three characters were analyzed but not optimized as synapomorphies for this tribe (see characters 37, 130, and 162 on “Character description”). However, this clade is not corroborated in Shimabukuru-Dias *et al*. (2004), who proposed instead *Dianema* as basal and sister group of all callichthyines. A total of 15 characters are proposed here as synapomorphic for Hoplosternini, six of them are molecular characters that include three synapomorphies from the *12S rRNA* (characters 529, 543, and 547) and three synapomorphies from *16S rRNA* (characters 667, 901, and 1037).

Paraphyly of *Hoplosternum*

The genus *Hoplosternum* is not corroborated as monophyletic. According to my present hypothesis, I could transfer *H. punctatum* and *H. magdalenae* to *Dianema*, in order to keep only monophyletic genera. However, the dataset is incomplete for the species of *Hoplosternum*, as I have been unable to obtain tissue samples of *H. punctatum* and *H. magdalenae*, from Panama and Colombia respectively. As I believe that relationships are likely to change when molecular data is added, and there is a possibility that *Hoplosternum* becomes monophyletic, it was decided to hold making taxonomic changes at this moment and refer the species currently in this genus temporarily as “*Hoplosternum*”. On the other hand, Reis (1998) found this genus as monophyletic based in one synapomorphic character. This character is analyzed here but not optimized as a synapomorphy of this genus (see character 86 on “Character description”), it is optimized instead as an autapomorphy of *Hoplosternum littorale* (see character 86 on “Autapomorphies” under “Phylogenetic classification”.

Monophyly of *Dianema*

The genus *Dianema* (node 235) is herein corroborated as monophyletic; it contains two species. Reis (1998) proposed four synapomorphic characters for this genus. Three of those characters were corroborated here as synapomorphies for this genus, remaining one character is analyzed here but not optimized as synapomorphy (see character 60 on "Character description"). A total of ten characters are proposed here as synapomorphies for *Dianema*, all of them are phenotypic characters and seven of them are novelties from this work (see characters 14, 15, 61, 81, 128, 132, 154, 192, 195, and 215 on "Character description" and on "Synapomorphies" under "Phylogenetic classification"). Shimabukuru-Dias *et al*. (2004) also found this genus as monophyletic.

Monophyly of Corydoradinae

The subfamily Corydoradinae is herein corroborated as monophyletic. However, some taxonomic changes are necessary to turn the genus *Corydoras* and *Aspidoras* monophyletic. Two genera are revalidated (*Gastrodermus* and *Hoplisoma*) and the species *Corydoras lacerdai* and *Aspidoras virgulatus* are transferred to *Scleromystax*. Applying these modifications, the following interrelationships are proposed for the Corydoradinae: (*Corydoras* (*Gastrodermus* (*Hoplisoma* (*Scleromystax* + *Aspidoras*)))).

Reis (1998) corroborated the monophyly of Corydoradinae based on fourteen synapomorphies. Ten of those characters were corroborated in this analysis as synapomorphic for Corydoradinae (see characters 42, 47, 50, 67, 77, 91, 94, 103, 110, and 148 on "Character description" and on "Synapomorphies" under "Phylogenetic classification"). However, remaining four characters were analyzed here but not corroborated as synapomorphies for this subfamily (see characters 65, 130, 162, and 176 on "Character description"). This author included the following terminals and proposed the following interrelationships: (*Aspidoras* (*Brochis* + *Corydoras*)). He also mentioned that no autapomorphies diagnose *Corydoras*, so the recognition of *Brochis* makes this genus as non-monophyletic.

Britto (2003) also found this subfamily as monophyletic based in 25 synapomorphies. His characters 13 and 35 were not analyzed here, see comments above. Eleven of those characters were corroborated in this analysis as synapomorphies for Corydoradinae (see characters 42, 47, 67, 77, 91, 94, 110, 120, 148, 181, and 192 on "Character description" and on "Synapomorphies" under "Phylogenetic classification"). However, twelve of those characters were analyzed in this paper but not corroborated as synapomorphies for this subfamily (see characters 18, 46, 62, 66, 103, 104, 108, 109, 130, 139, 162, and 201 on "Character description"). In that paper, this author revalidated *Scleromystax* to accommodate some *Corydoras* species and synonymized *Brochis* to *Corydoras* to turn the later genus monophyletic. Applying these modifications, the following interrelationships are proposed: (*Corydoras* (*Scleromystax* + *Aspidoras*)). In this paper, 42 phenotypic characters are proposed as synapomorphies for Corydoradinae and 29 of them are novelties from this work (see characters 12, 13, 19, 21, 29, 31, 32, 36, 56, 59, 69, 70, 87, 90, 95, 96, 101, 131, 136, 137, 137, 138, 154, 155, 156, 167, 195, 199, 200, and 202 on "Character description" and on "Synapomorphies" under "Phylogenetic classification").

Shimabukuru-Dias *et al*. (2004) also found this subfamily as monophyletic and included as terminals some representative species of *Aspidoras*, *Brochis*, and *Corydoras*. Applying the modifications proposed by Britto (2003), they found *Scleromystax* as paraphyletic and the following interrelationships are proposed within Corydoradinae: (((*Aspidoras fuscoguttatus* (*A. poecilus* + *S. macropterus*)) (*Scleromystax* + *Corydoras*))). A total of 139 characters are proposed here as synapomorphies for Corydoradinae, 97 of them are molecular characters. Molecular characters include ten synapomorphies from *12S rRNA* (characters 304, 311, 364, 397, 470, 515, 530, 593, 605, and 607), ten synapomorphies from *16S rRNA* (characters 647, 755, 850, 854, 881, 947, 1027, 1037, 1054, and 1095), 17 synapomorphies from *ND4* (characters 1311, 1341, 1476, 1512, 1540, 1543, 1557, 1659, 1665, 1686, 1727, 1741, 1775, 1797, 1927, 1949, and 1997), 30 synapomorphies from *Cytb* (characters 2086, 2091, 2103, 2109, 2199, 2203, 2217, 2225, 2269, 2382, 2421, 2460, 2478, 2547, 2562, 2563, 2587, 2617, 2655, 2658, 2713, 2743, 2814, 2826, 2941, 2942, 2953, 2971, 2983, and 3112), and 30 synapomorphies from *Rag1* (characters 3181, 3192, 3194, 3209, 3226, 3331, 3350, 3392, 3421, 3428, 3449, 3456, 3479, 3491, 3504, 3534, 3629, 3644, 3683, 3769, 3770, 3782, 3818, 3850, 3887, 3900, 3902, 3906, 3939, and 3951).

Monophyly of *Corydoras*

The genus *Corydoras* as currently recognized is not corroborated herein as monophyletic; this group is recovered instead as paraphyletic. According to the phylogenetic results of this paper, to turn this genus monophyletic two genera are revalidated (*Gastrodermus* and *Hoplisoma*) and the species *Corydoras lacerdai* is transferred to *Scleromystax*. The genus *Corydoras* is restricted to contain the species recovered in the clade 192 (Figs. 20 and 21). Applying these modifications, the following interrelationships are proposed: (*C. semiaquilus* (*C. simulatus* (*C. geoffroy* (*C. amapaensis* (*C. narcissus* + *C. treitlii*))) ((*C. ourastigma* + *C. stenocephalus*) (*C. cervinus* (*C. areio* + *C. ellisae*))))).

The genus *Corydoras* was originally proposed by La Cépède (1803) to contain his new species *C. geoffroy*, which is the type species of the genus by monotypy. This species was synonymized to *Cataphractus punctatus* Bloch, 1794 by Bleeker (1858); he also proposed *Corydoras punctatus* as a new combination. Isbrücker (2000) reported that the holotype of *C. geoffroy* is lost from the fish collection of the Museum National d'Histoire Naturelle in Paris. This author considered this species as valid and conspecific with *Corydoras octocirrus* Nijssen, 1970; he also designated the holotype of the latter as the neotype of *C. geoffroy*. I will mention here some taxonomic papers that split *Corydoras* into smaller groups which are herein corroborated as monophyletic. Nijssen (1970) reviewed the *Corydoras* species from Suriname and made commentaries about the zoogeography of the group. In this attempt, he stated that *Corydoras* could be divided into nine species groups based on color pattern, morphometrics, and meristic characters; these groups are: *acutus*, *aeneus*, *barbatus*, *caudimaculatus*, *hastatus*, *elegans*, *eques*, *nattereri*, and *punctatus*. However, he mentioned that despite these groups are somewhat ill defined it worth to make a beginning. Comparing the groups proposed by Nijssen (1970) and the phylogenetic analysis herein performed, only his *acutus* group is corroborated as monophyletic (here recovered in the clade 192). This group was characterized as having serrated pectoral-fin spine and grayish color pattern. Some species listed by this author coincident with terminals here analyzed are: *C. ellisae*, *C. cervinus*, *C. geoffroy*, *C. semiaquilus*, C. *septentrionalis*, *C. stenocephalus*, and *C. treitlii*. Nijssen & Isbrücker (1980) reviewed the 99 species of *Corydoras* known by that date and arranged them into five groups without mentioning their diagnostic characters, these are: *acutus*, *aeneus*, *barbatus*, *elegans*, and *punctatus*. Comparing their groups and the phylogenetic analysis here performed the *acutus* group is corroborated as monophyletic, some species listed by those authors are coincident with the terminals here analyzed and recovered in the clade 192 (those selected above from the 1970 paper are not mentioned again here): *C. amapaensis*, *C. narcissus*, *C. ourastigma*, and *C. simulatus*.

Britto (2003) recovered *Corydoras* as polyphyletic and proposed some taxonomic changes to turn this genus monophyletic, see comments above. Applying those modifications, this author proposed *Corydoras* as monophyletic and having the following interrelationships (see Fig. 3 to distinguish species of the clades cited): (*C. difluviatilis* (clade 2 (*C. reticulatus* (*C. ambiacus* + *C. araguaiaensis* + *C. bondi* + *C. ehrhardti* + *C. elegans* + *C. guapore* + *C. leucomelas* + *C. maculifer* + *C. metae* + *C. nanus* + *C. napoensis* + *C. nattereri* + *C. paleatus* + *C. polystictus* + *C. punctatus* + clade 4 + clade 5 + clade 6 + clade 7 + clade 8 + clade 9)))). Britto (2003) proposed four synapomorphies as diagnostic for this genus. Three of these characters were analyzed in this paper (see characters 55, 132, and 172 on “Character description”); however, his character 23 is not analyzed (see comments above). His clade 2 includes an aditional clade within, named clade 3, and containing three species coincident with the terminals here restricted to *Corydoras* (*C. acutus*, *C. aurofrenatus*, and *C. septentrionalis* were not analyzed in the present study). The following interrelationships were proposed for the species of clade 3: (*C. ellisae* (*C. acutus* (*C. septentrionalis* + *C. stenocephalus*) (*C. aurofrenatus* + *C. vittatus*))). Britto (2003) proposed seven synapomorphies as diagnostic for his clade 3. Four of those characters were analyzed here but not corroborated as synapomorphies of this genus (see characters 47, 49, 86, and 194 on “Character description”); however, his character 23 were not analyzed (see comments above). On the other hand, two of those characters were corroborated and a total of nine phenotypic characters are proposed here as synapomorphies of *Corydoras*, seven of them are novelties from this paper (see characters 7, 55, 118, 122, 128, 133, 173, 174, and 201 on “Character description” and on “Phylogenetic classification”).

Shimabukuru-Dias *et al*. (2004) did not include any terminal coincident with the *Corydoras* clade as here recognized making comparisons with this study not possible. Alexandrou *et al*. (2011) also found *Corydoras* as paraphyletic, with the long snouted species grouped as basal to remaining corydoradines (this assemblage included the short and intermediate snouted species derived within this clade, see Fig. 7 clade 3). These authors performed a phylogenetic analysis employing the maximum likelihood method based in the mitochondrial data. However, these authors also performed two additional analyses in their supplemental material adding nuclear data (*Rag1* and *RTN4*). Comparison with their results is addressed here naming some of their clades with numbers (see Figs. 6 and 7). The clade 1 is coincident with the *Corydoras* species as here recognized, they proposed the following interrelationships: ((*C. semiaquilus* (*C. coriatae* + *C. fowleri*)) (((*C. maculifer* + *C. simulatus*) ((*C. orcesi* + *C. pastazensis*) ((*C. septentrionalis* + *C. stenocephalus*) ((*C. acutus* + *C. cervinus*) (*C. negro* (*C. aurofrenatus* + *C. ellisae*)))) (*C. geoffroy* ((*C. amapaensis* (*C. oxyrhynchus* + *C. solox*)) (*C. vittatus* (*C. blochi* (*C. serratus* (*C. narcissus* + *C. treitlii*))))))))). In the Total Evidence phylogeny here performed, I included the same molecular markers used by these authors in addition to the *Rag1* data and also corroborated *Corydoras* paraphyletic. A total of 39 synapomorphies are proposed in this paper for the restricted *Corydoras*, 30 of them are molecular characters and include four synapomorphies from *12S rRNA* (characters 435, 469, 517, and 539), two synapomorphies from *16S rRNA* (characters 894, and 1009), 15 synapomorphies from *Cytb* (characters 2052, 2073, 2153, 2394, 2472, 2685, 2710, 2731, 2811, 2853, 2980, 2996, 3014, 3118, and 3119), and nine synapomorphies from *Rag1* (characters 3235, 3347, 3437, 3593, 3647, 3692, 3734, 3743, and 3826).

Revalidation of *Gastrodermus*

To reconcile a monophyletic classification for the Corydoradinae, the genus *Gastrodermus* is revalidated to accommodate the species recovered in the clade 205 (Figs. 20 and 21). This genus was originally proposed by Cope (1878) but without designation of a type species. It was subsequently designated by Gosline (1940), who proposed *Corydoras elegans* Steindachner, 1877 as the type species. Applying these modifications, the following interrelationships are proposed in accordance to the new combinatinations: ((*G. pygmaeus* (*G. hastatus* + *G. guapore*)) (*G. gracilis* (*G. undulatus* (*G. elegans* (*G. napoensis* + *G. nijsseni*))))).

Nijssen (1970) divided the *Corydoras* species into nine groups, see comments above. Despite of not being corroborated as monophyletic, I will mention the characterization of two of these groups because in the subsequent paper this author employs them without mentioning any characters. The *hastatus* group was characterized by exhibiting dwarf adult individuals, and the *elegans* group was characterized by having the body with several brown horizontal stripes along the lateral body scutes. Nijssen & Isbrücker (1980) divided *Corydoras* into five groups; one of them, the *elegans* group, is recovered here as monophyletic and coincident with the species here recognized as *Gastrodermus*. These authors included the *hastatus* group of Nijssen (1970) into this assemblage; most of the species listed are coincident with the terminals here analyzed: *C. elegans*, *C. gracilis*, *C. guapore*, *C. hastatus*, *C. pygmaeus*, and *C. undulatus*.

Britto (2003) did not recovered the *Gastrodermus* clade as monophyletic; however, species of this group were scattered in a large basal polytomy inside one of his *Corydoras* clade, some species into his clade 4 and others on clade 8. Shimabukuru-Dias *et al*. (2004) did not include any terminal coincident with the *Gastrodermus* clade making comparisons with this study not possible. On the other hand, Alexandrou *et al*. (2011) found the *Gastrodermus* clade as monophyletic, see Fig. 6 clade 2. They proposed the following interrelationships: ((*C. pygmaeus* (*C. hastatus* + *C. guapore*)) (*C. gracilis* ((*C. bilineatus* + *C. undulatus*) (*C. nanus* (*C. elegans* (*C. napoensis* + *C. nijsseni*)))))). A total of 16 synapomorphies are proposed in this paper for *Gastrodermus*, five of them are phenotypic characters and 11 are molecular characters, all of them are novelties from this paper. Molecular synapomorphies include one from *16S rRNA* (character 995), four from *ND4* (characters 1246, 1392, 1740, and 1884), five from *Cytb* (characters 2136, 2229, 2274, 2613, and 3115), and one from *Rag1* (character 3329).

Revalidation of *Hoplisoma*

To reconcile a monophyletic classification for the Corydoradinae, the genus *Hoplisoma* is revalidated to accommodate the species recovered in the clade 163. This genus was originally proposed by Swainson (1838) who designated *Cataphractus punctatus* Bloch, 1794 as its type species. Applying these modifications, the following interrelationships are proposed in accordance to the new combinations (see clade 163 in Figs. 20 and 21): (*Hoplisoma* clade 172 (*Hoplisoma* clade 176 (*Hoplisoma* clade 169 + *Hoplisoma* clade 160))). Because this is the largest group among the Corydoradinae I will mention below the interrelationships of each clade referring to some particular species or group.

<u>The *H. paleatus* clade:</u>

The clade 172 includes species resembling *Hoplisoma paleatus*: (*H. flaveolus* (*Hoplisoma* spA + (*Hoplisoma* spB (*H. cochui* + *H. tukano*)) + (*H. diphyes* (*H. paleatus* (*H. nattereri nattereri* (*H. nattereri juquiae* (*H. longipinnis* (*H. ehrhardti* + *H. ehrhardti* LBP + *H. nattereri triseriatus*)))))))).

<u>The *H. melanistius* clade:</u>

The clade 176 includes *Hoplisoma difluviatilis*, *Hoplisoma pantanalensis*, species formerly recognized as *Brochis*, and species commonly referred to as intermediate snouted *Corydoras*: (*Hoplisoma difluviatilis* ((*H. pantanalensis* (*H. britskii* + *H. splendens*)) ((*H. reticulatus* + *H. sodalis*) (*H. ambiacus* + *H. approuaguensis* + *H. ephippifer* + *H. melanistius* + *H. pulcher* + *H. robinae* + *H. seussi* + (*H. condiscipulus* + *H. imitator*))))).

<u>The *H. aeneus* clade:</u>

The clade 169 includes species resembling *Hoplisoma aeneus*: (*Hoplisoma* spC + *H. aeneus* + (*H. armatus* + *H. rabauti* + *H. zygatus*)).

<u>The *H. punctatus* clade:</u>

The clade 160 includes species commonly referred to as short snouted *Corydoras*: (*Hoplisoma habrosus* (*H. araguaiaensis* + *H. atropersonatus* + *H. brevirostris* + *H. burgessi* + *H. julii* + *H. loretoensis* + *H. gossei* + *H. guianensis* + *H. xinguensis* + (*H. boesemani* (*H. breei* + *H. coppenamensis*))+ (*H. metae* (*H. adolfoi* + *H. melini*)) + (*H. panda* (*H. weitzmani* (*H. caudimaculatus* + *H. polystictus*))) + (*H. sanchesi* + *H. wotroi* + (*H. leucomelas* + *H. punctatus* + *H trilineatus*) + ((*H. schwartzi* + *H. urucu*) (*H. arcuatus* + *H. kanei*))))).

Nijssen (1970) divided the *Corydoras* species into nine groups, see comments above. Despite not being corroborated as monophyletic, I will mention the characterization of some of these groups because in subsequent papers this author employs them without mentioning any characters. Species of the *barbatus* group were characterized by having a blotched color pattern on the dorso-lateral body scutes alternated with others on the ventro-lateral scutes. Species of the *eques* group were characterized by having a black band on the upper part of the body; it was additionally divided into smaller groups by their scapulocoracoids variably developed as a mesial lamina. Species of the *punctatus* group were characterized by having spots on body and head; it was additionally divided into smaller groups by having a dark blotch on the upper part of the dorsal fin, a mask across the eyes accompanied by a dark blotch beneath the dorsal fin, a long snout, a relatively elongate or deep body, a relatively long dorsal spine. Nijssen & Isbrücker (1980) arranged the *Corydoras* species into five groups without mentioning their diagnostic characters, some of these groups coincident with the *Hoplisoma* clade are: *aeneus*, *barbatus*, and *punctatus*. The *aeneus* group is herein recovered as monophyletic (clade 161), some species coincident with terminals here analyzed were additionally grouped into smaller clades: *C. aeneus*, *C. rabauti*, and *C. zygatus* (here recovered in the clade 169), and *C. arcuatus*, *C. boesemani*, *C. coppenamensis*, *C. guianensis*, *C. habrosus*, *C. melini*, *C. metae*, *C. panda*, *C. sanchesi*, and *C. weitzmani* (here recovered in the clade 160). The *barbatus* group is found polyphyletic according to the phylogenetic analysis, two monophyletic clades can be detected from their group as originally listed: *C. barbatus*, *C. macropterus*, *C. prionotos* (genus *Scleromystax*, see clade 228), and *C. cochui*, *C. ehrhardti*, *C. flaveolus*, *C. nattereri*, and *C. paleatus* (clade 172). The *punctatus* group is found polyphyletic according to the phylogenetic analysis, two monophyletic clades can be detected from their group as originally listed: *C. atropersonatus*, *C. brevirostris*, *C. caudimaculatus*, *C. julii*, *C. polystictus*, *C. punctatus*, *C. trilineatus*, *C. schwartzi*, and *C. xinguensis* (clade 159), and *C. ambiacus*, *C. ephippifer*, *C. melanistius*, *C. reticulatus* (clade 174).

Reis (1998) corroborated the monophyly of *Brochis* based on four synapomorphies. All these characters were analyzed in this paper (see characters 0, 106, 139, and 157 on “Character description”); however, none of them were optimized as synapomorphies for the clade containing *C. bristkii* and *C. splendens*. This assemblage is recovered here as monophyletic (clade 183), supported by 16 synapomorphies (five phenotypic and 11 molecular, see Table 7), and sister group of *H. pantanalensis*. Britto (2003) did not found *Hoplisoma* as monophyletic. However, species recognized to this clade were splitted over his *Corydoras* clade. Most species were scattered in a large basal polytomy inside one *Corydoras* clade and other assemblages within it named as clade 5, clade 6, clade 7, clade 8, and clade 9. In fact, according to this study, the inclusion of several *Gastrodermu*s species scattered over his large *Corydoras* clade makes that assemblage polyphyletic.

On the other hand, Shimabukuru-Dias *et al*. (2004) found the assemblage named in this paper as *Hoplisoma* monophyletic. Making the changes proposed by Britto (2003), these authors proposed the following interrelationships for this assemblage: ((*C. aeneus* (*C. araguaiaensis* + *C. metae*)) ((*C. flaveolus* (*C. paleatus* (*C. nattereri* (*C. ehrhardti* + *C. nattereri*)))) ((*C. difluviatilis* + *C. sodalis*) (*C. britskii* + *C. splendens*)))). Moreover, these authors found these species grouped into three major clades which are coincident with those recovered in this paper into the clades 161, 172, 176 (see Figs. 20 and 21). Alexandrou *et al*. (2013) also recovered the assemblage named in this paper as *Hoplisoma* monophyletic, see Fig. 7 clade 3. Species recovered here into the *H. paleatus* clade are inside his clade 3a, the *aeneus* clade into his clade 3b, the *splendens* and *melanistius* clade into his clade 3c, and the *punctatus* clade into his clade 3d. A total of 29 synapomorphies are proposed in this paper for *Hoplisoma*, four phenoptypic and 25 molecular (see node 166 in Table 7).

Monophyly of *Aspidoras*

The genus *Aspidoras* as currently accepted is not corroborated as monophyletic. The species *A. virgulatus* is transferred to *Scleromystax* to turn *Aspidoras* monophyletic. Applying these modifications, the following interrelationships are proposed (see clade 220 in Figs. 20 and 21): (*A. psammatides* ((*Aspidoras* spA + *Aspidoras taurus*) ((*Aspidoras* spB (*Aspidoras* spC + *A. raimundi*)) (*A. albater* + *A. eurycephalus* + *A. poecilus*)))). This genus was originally proposed by Ihering (1907) to contain his new species *Aspidoras rochai*, which is its type species by original designation. Reis (1998) considered *Aspidoras* monophyletic and proposed three diagnostic synapomorphies. However, all those characters were analyzed in this paper but not corroborated as synapomorphies for this genus (see characters 19, 20, and 173). Britto (2003) proposed *Aspidoras* monophyletic with the species *Scleromystax virgulatus* derived within this clade. This author proposed the following interrelationships: (*A. microgalaeus* (*A. belenos* (*A. fuscoguttatus* + *A.*

poecilus + *A*. aff. *poecilus*) (*A. albater* + *A. rochai* + *A. virgulatus*)))). This author proposed five synapomorphies as diagnostic for this genus. However, only one of them was corroborated in this paper as synapomorphic for *Aspidoras* (see character 2 on "Character description" and on synapomorphies under "Phylogenetic classification") and remaining four characters were analyzed but not corroborated (see characters 19, 20, 92, and 173). A total of seven phenotypic characters are proposed in this paper as synapomorphies for this genus, six of them are novelties from this work.

Shimabukuru-Dias *et al*. (2004) recovered *Aspidoras* as paraphyletic. Applying the modifications proposed by Britto (2003), the following interrelationships were proposed: (((*Aspidoras fuscoguttatus* (*A. poecilus* + *S. macropterus*)) (*Scleromystax* + *Corydoras*))). Alexandrou *et al*. (2011) recovered *Aspidoras* as monophyletic. These authors proposed the following interrelationships: (*A. eurycephalus* (*A. albater* (*A. poecilus* (*A. raimundi* (*A. depinnai* + *A. spilotus*) (*A. microgalaeus* + *A. taurus*)))))). A total of 53 synapomorphies are proposed in this paper for *Aspidoras*, seven phenotypic and 46 molecular. Molecular characters include 12 synapomorphies from *16S rRNA* (characters 745, 881, 902, 903, 912, 948, 959, 963, 968, 972, 976, and 999), and 34 synapomorphies from *ND4* (characters 1233, 1237, 1251, 1272, 1287, 1326, 1374, 1392, 1452, 1467, 1500, 1560, 1603, 1611, 1647, 1670, 1674, 1683, 1692, 1710, 1719, 1723, 1749, 1752, 1792, 1812, 1821, 1824, 1857, 1933, 1934, 1983, 1984, and 1996).

Monophyly of *Scleromystax*

The genus *Scleromystax* is herein corroboborated as monophyletic. However, it is necessary to expand this group to accommodate the species *Aspidoras virgulatus* and *Corydoras lacerdai* in order to turn the genera *Aspidoras* and *Corydoras* monophyletic. Applying these modifications, the following interrelationships are proposed in accordance to the new combinations (see clade 226 in Figs. 20 and 21): ((*S. lacerdai* + *S. virgulatus*) (*S. barbatus* (*S. prionotos* (*S. macropterus* + *S. salmacis*)))).

Scleromystax was originally proposed by Günther (1864) as a sub-genus of *Callichthys*, the type species is *Callichthys barbatus* Quoy & Gaimard, 1824 by monotypy. Nijssen (1970) recognized the *barbatus* group within the genus

Corydoras. That group, however, is herein recovered as polyphyletic, containing species from *Scleromystax*, *Hoplisoma*, and *Gastrodermus*. Nijssen (1970) listed two species inside his *barbatus* group, *Corydoras barbatus* and *Corydoras macropterus*, which are recovered here within *Scleromystax*. Nijssen & Isbrücker (1980) also recognized the *barbatus* group within *Corydoras*. Again, this grouping is recovered polyphyletic according to our phylogenetic analysis. The following species were listed by these authors as belonging to the *barbatus* group and recovered here within *Scleromystax*: *C. barbatus*, *C. macropterus*, and *C. prionotos*.

Britto (2003) revalidated the genus *Scleromystax* to accommodate some *Corydoras* species and turn the later monophyletic. The following interrelationships were proposed by this author: (*S. prionotos* (*S. barbatus* + *S. macropterus*)). This author proposed four synapomorphies for this genus. Only one of those characters were corroborated in this paper as synapomorphic for *Scleromystax* (see character 49 on "Character description" and on "Synapomorphies" under "Phylogenetic classification") and remaining three characters were analyzed but not corroborated as synapomorphies (see characters 6, 147, and 196 on "Character description").

On the other hand, Shimabukuru-Dias *et al*. (2004) recovered *Scleromystax* as paraphyletic, with the species *S. barbatus* and *S. prionotos* more related to *Corydoras* and the *S. macropterus* more related to *Aspidoras*. Alexandrou *et al*. (2011) recovered *Scleromystax* as monophyletic. These authors considered the species *Corydoras lacerdai* as belonging to *Scleromystax*. The following relationships were proposed: (*S. lacerdai* (*S. macropterus* (*S. barbatus* + *S. prionotos*))). A total of 33 synapomorphies are proposed in this paper as synapomorphies for *Scleromystax*, four of them are phenotypic characters (see characters 49, 54, 131, and 197 on "Character description" and on "Synapomorphies" under ""Phylogenetic classification"; three of them are novelties from this work) and 29 are molecular characters. Molecular characters include three synapomorphies from *12S rRNA* (characters 376, 421, and 543), three synapomorphies from *16S rRNA* (characters 793, 816, and 1095), ten synapomorphies from *ND4* (characters 1234, 1375, 1398, 1404, 1512, 1539, 1641, 1885, 1927, and 1992), nine synapomorphies from *Cytb* (characters 2214, 2268, 2347, 2433, 2451, 2658, 2790, 2895, and 2974), and four synapomorphies from *Rag1* (characters 3268, 3443, 3503, and 3752).

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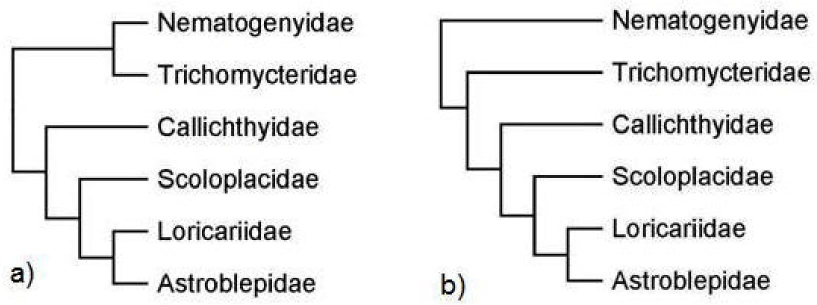

Figure 1. Loricarioidea interrelationships based on the analysis of: a) Anatomical data from Diogo (2004). b) Molecular data from Sullivan *et al*. (2006).

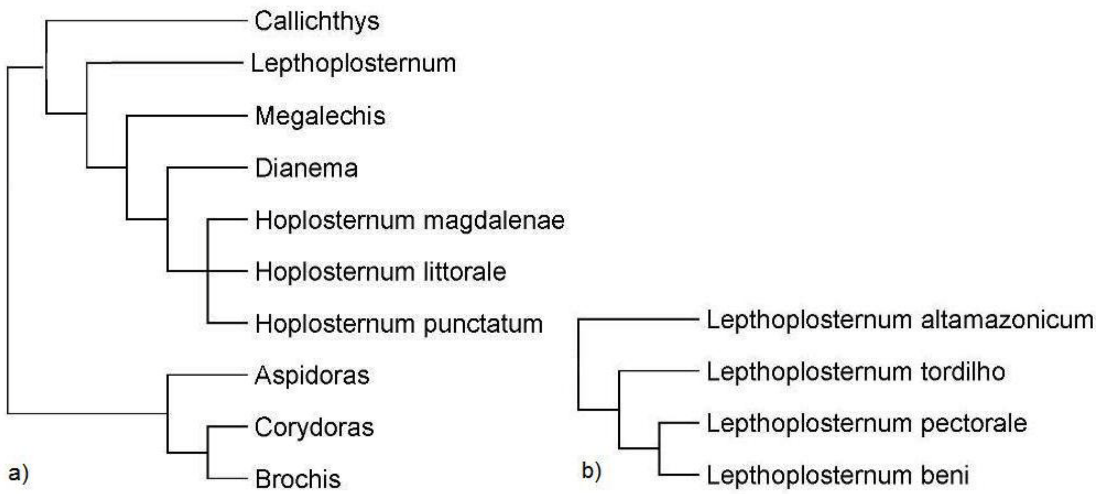

Figure 2. Cladogram showing the phylogenetic relationships of: a) Callichthyidae from Reis (1998a). b) *Lepthoplosternum* from Reis (1998b).

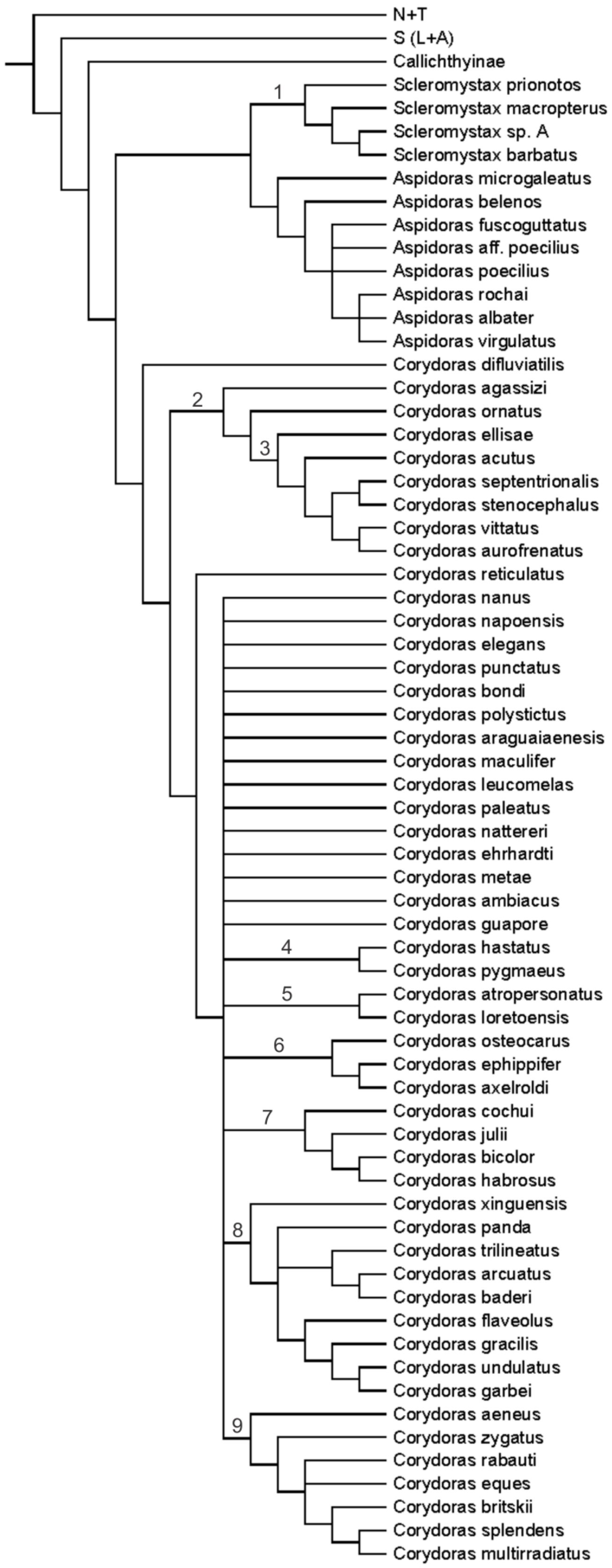

Figure 3. Cladogram showing the phylogenetic relationships of Corydoradinae from Britto (2003). Number above branches are clade identifiers as originally discussed in that paper.

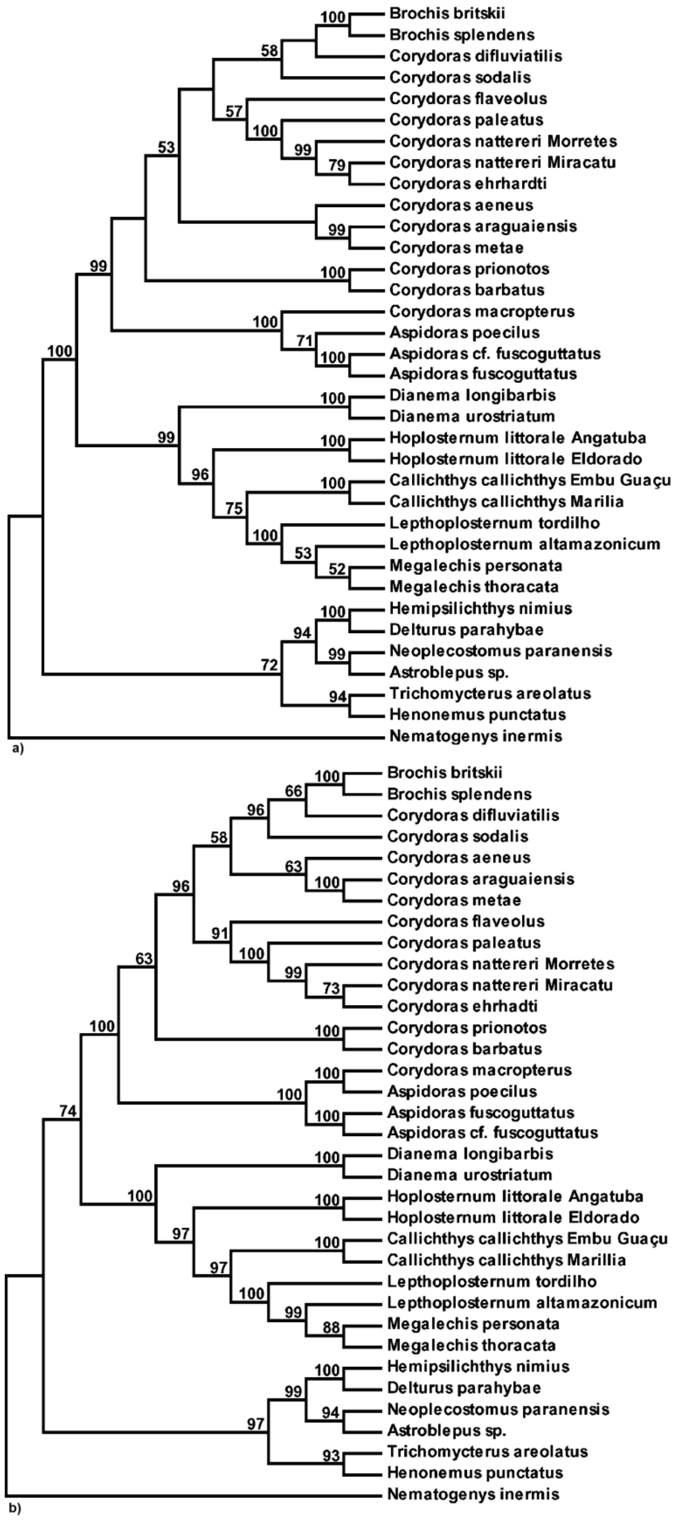

Figure 4. Cladograms obtained from Shimabukuru-Dias *et al*. (2004): a) Maximum likelihood using GTR model of molecular data alone. b) Maximum likelihood using HKY85 model of molecular data alone. Numbers above branches are bootstrap values based on 1000 replicates. Values below 50% are not shown.

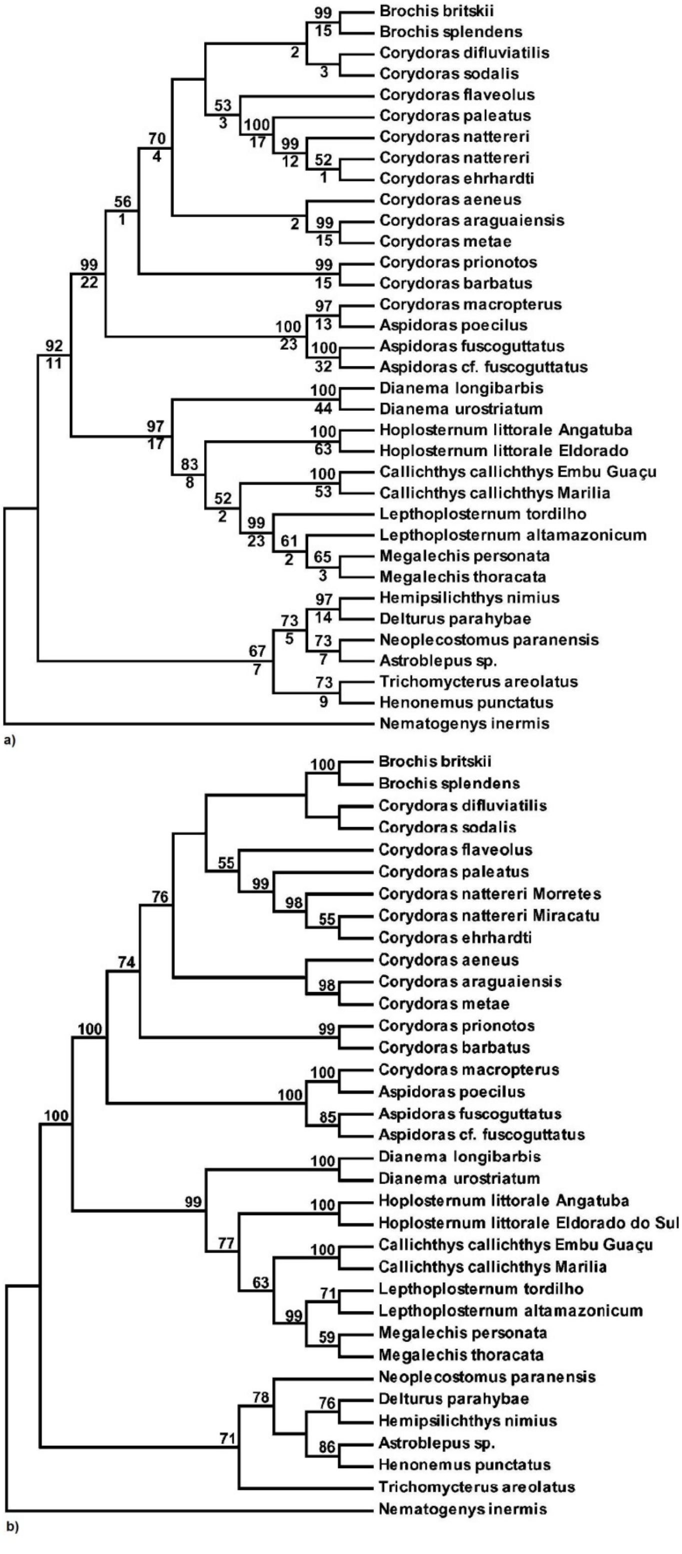

Figure 5. Cladograms obtained from Shimabukuru-Dias *et al*. (2004): a) Parsimony of molecular data alone. b) Parsimony of molecular and morphological data combined with equal weight. Numbers above branches are bootstrap values based on 1000 replicates. Values below 50% are not shown. Numbers below branches represent Bremer support index values.

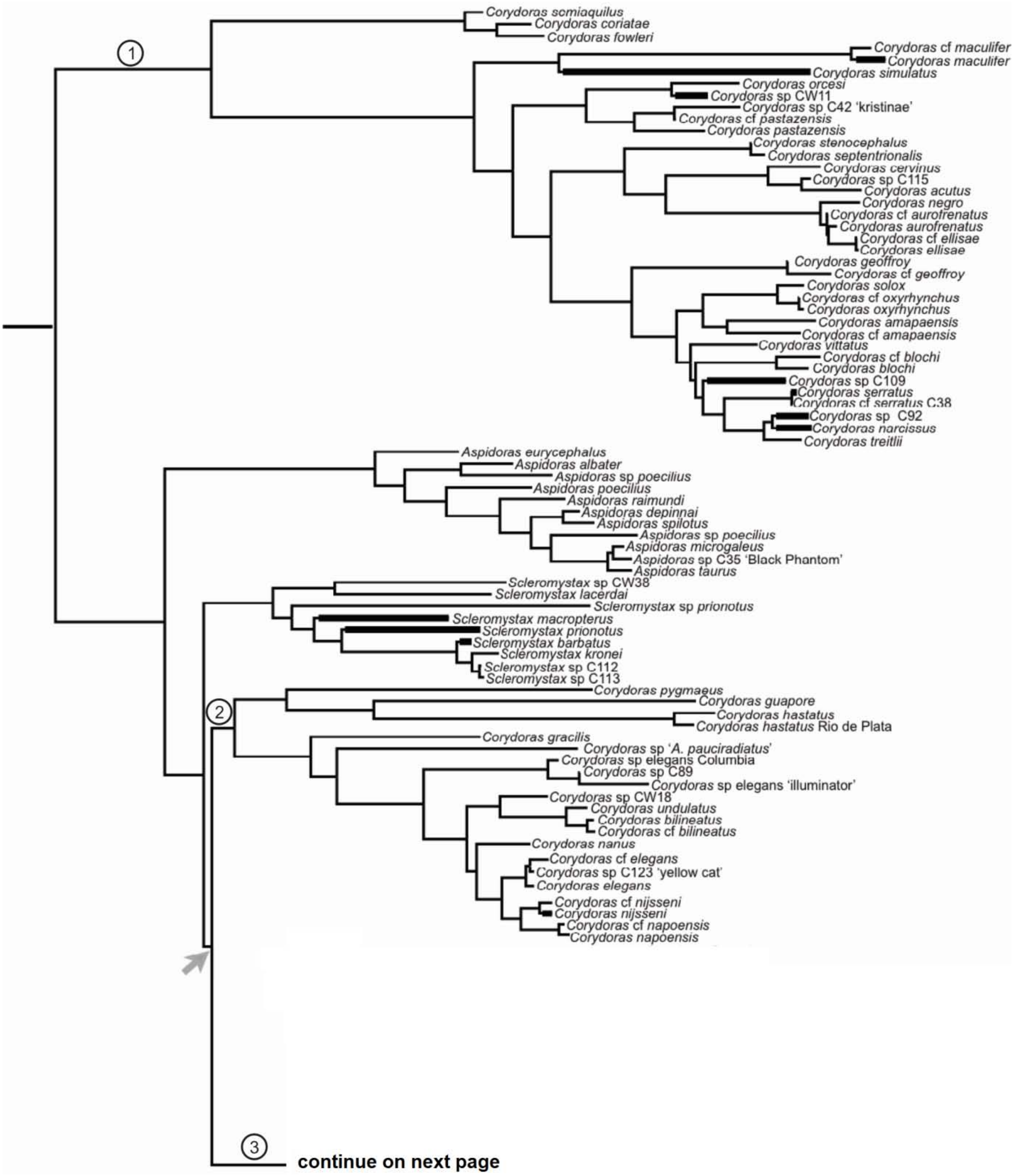

Figure 6. Maximum likelihood topology obtained by Alexandrou *et al*. (2011) based in the analysis of mitochondrial data. Branches with mimetic species are highlighted on the tree in black. Areas of support lower than 70% (ML) and 0.8 (BI) are denoted with arrows pointing to the nodes. Numbers above branches are discussed on text (Continues on next page).

Figure 7 (Continuation) Maximum likelihood topology obtained by Alexandrou *et al*. (2011).

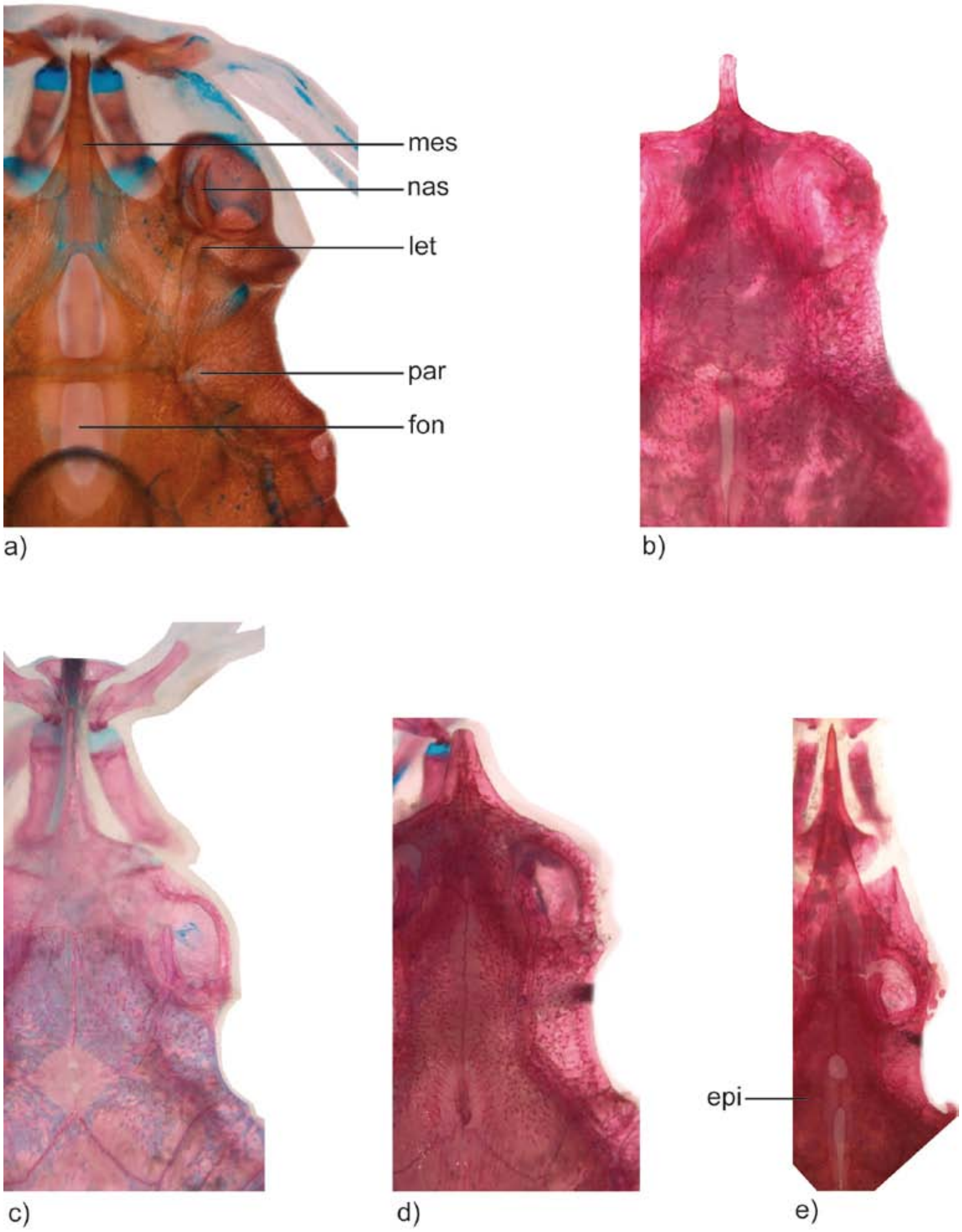

Figure 8. Anterior portion of head in dorsal view. a) *Hoplosternum littorale* (MCP 14601, 52.4 mm SL), b) *Corydoras elegans* (MCP 23226, 37.0 mm SL), c) *Aspidoras albater* (UFRGS 11248, 30.6 mm SL), d) *Corydoras nattereri* (MCP 14980, 46.8 mm SL), e) *Corydoras stenocephalus* (MCP 28805, 59.2 mm SL). Abbreviations: mes = mesethmoid, nas = nasal, let = lateral ethmoid, fon = parietal fontanel, epi = epiphysial branch.

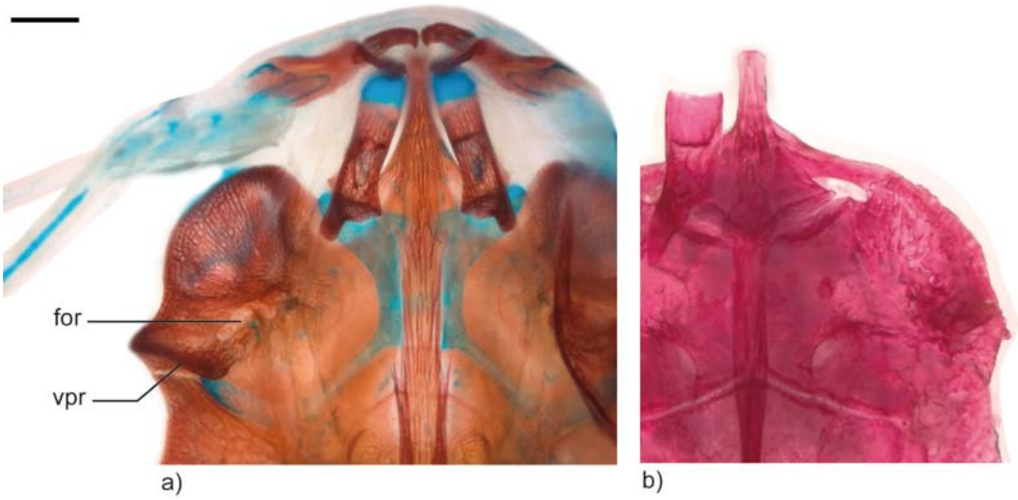

Figure 9. Lateral ethmoid in ventral view. a) *Hoplosternum littorale* (MCP 14601, 52.4 mm SL), b) *Corydoras elegans* (MCP 23226, 37.0 mm SL). Abbreviations: for = foramen, vpr = ventral process.

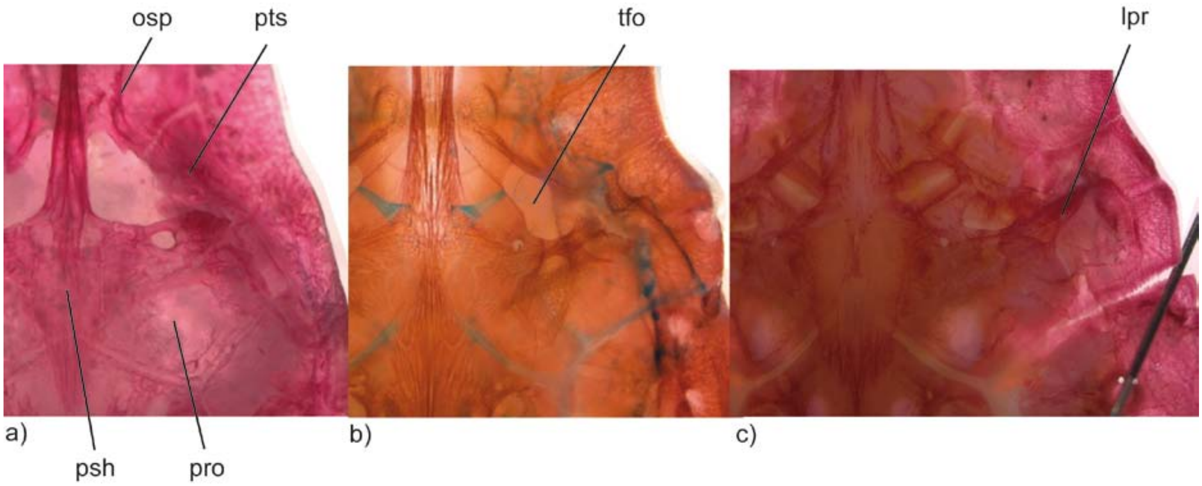

Figure 10. Cranium in ventral view showing the prootic. a) *Corydoras elegans* (MCP 23226, 37.0 mm SL), b) *Hoplosternum littorale* (MCP 14601, 52.4 mm SL), c) *Megalechis thoracatha* (MCP 28435, 101.0 mm SL). Abbreviations: osp = orbitosphenoid, pts = pterosphenoid, tfo = compound trigeminofacial and optic foramen, lpr = lateral process of prootic, psh = parasphenoid, pro = prootic.

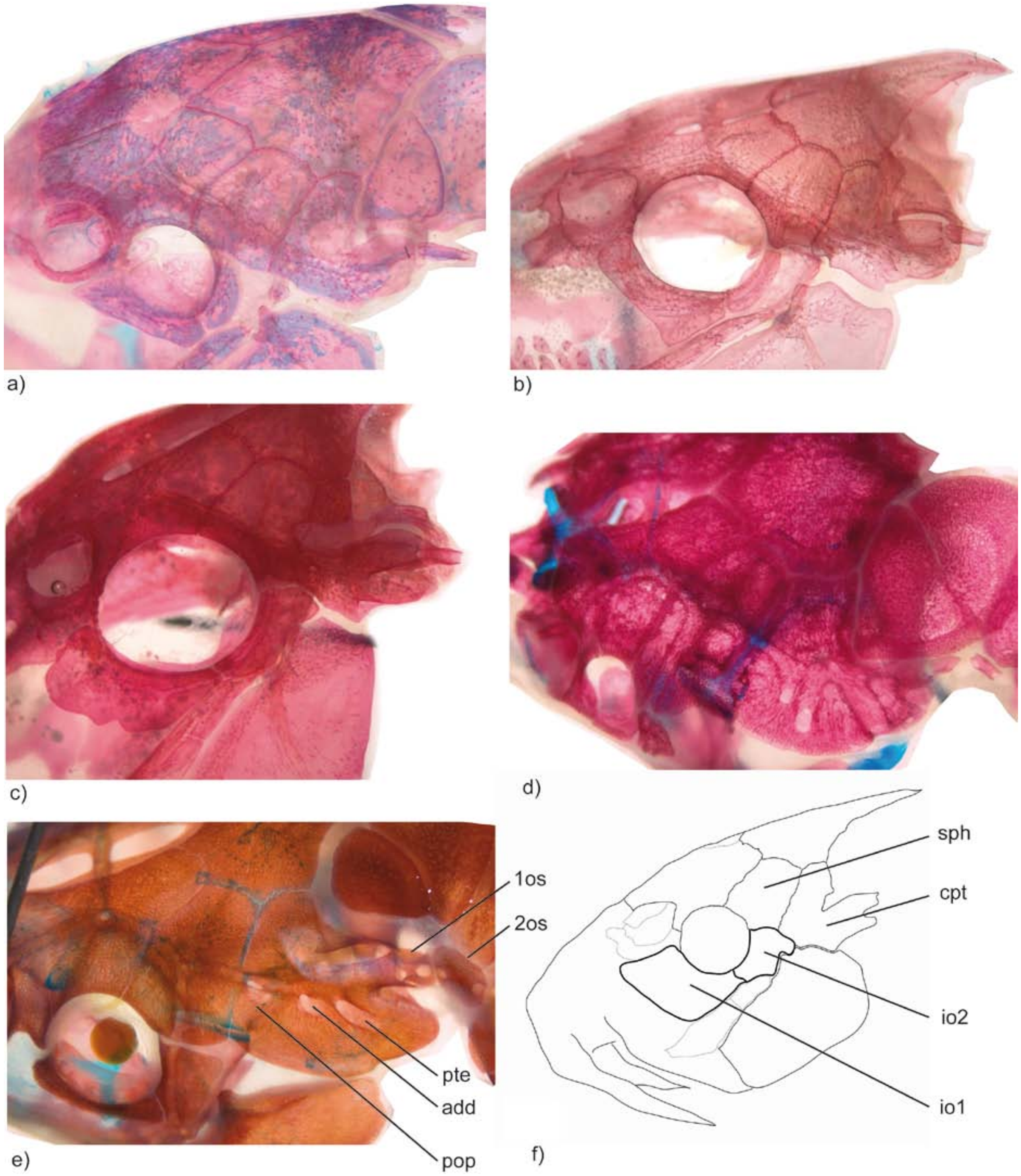

Figure 11. Lateral view of the head. a) *Aspidoras albater* (UFRGS 11248, 30.6 mm SL), b) *Scleromystax barbatus* (MCP 12180, 43.9 mm SL), c) *Corydoras stenocephalus* (MCP 28805, 59.2 mm SL), d) *Callichthys callichthys* (MCP 7026, 54.1 mm SL), e) *Hoplosternum littorale* (MCP 14601, 52.4 mm SL), f) *Corydoras difluviatilis*. Abbreviations: 1os = 1st ossicle of trunk lateral-line canal, 2os = 2nd ossicle, pte = pterotic branch, add = additional branch, pop = preopercular branch.

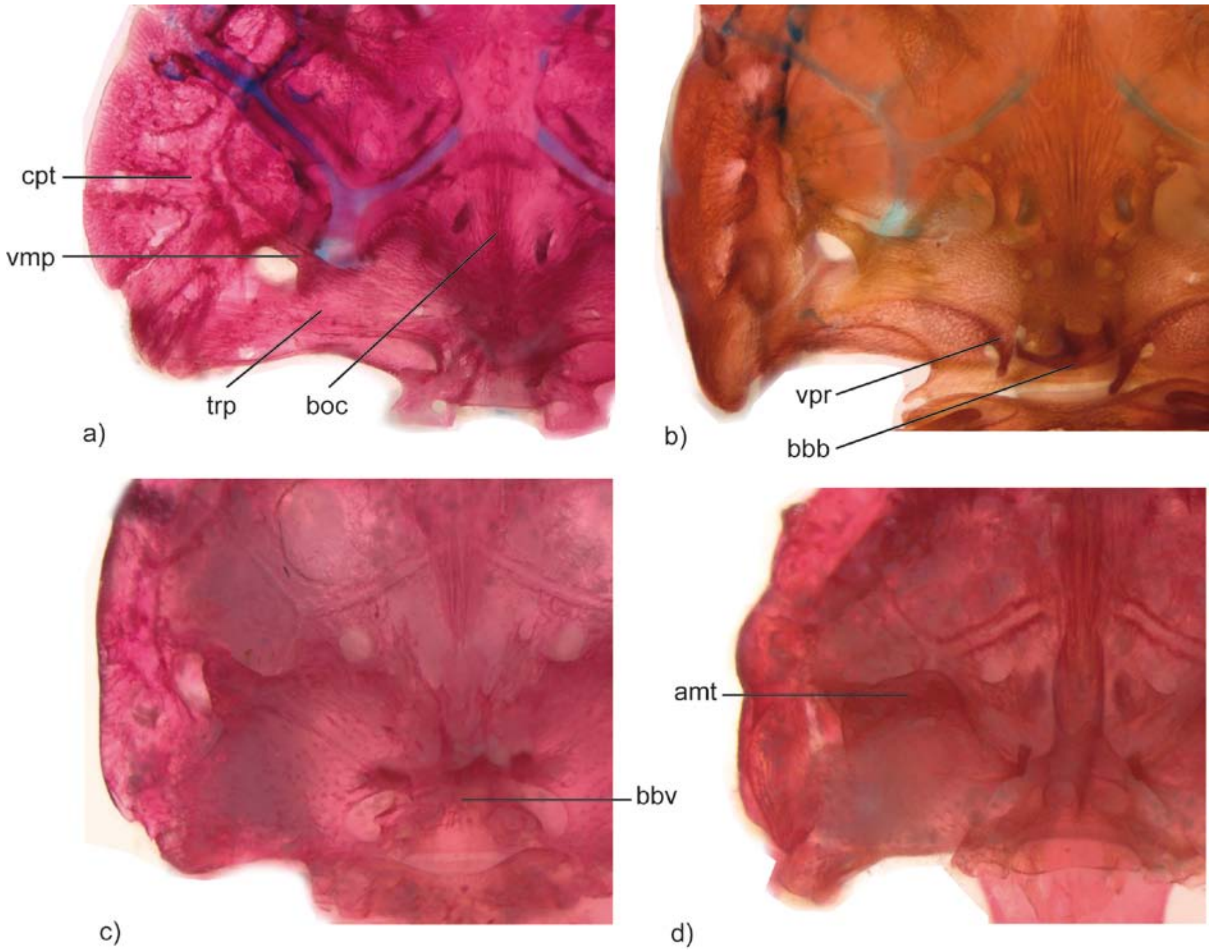

Figure 12. Posterior portion of the cranium in ventral view. a) *Callichthys callichthys* (MCP 7026, 54.1 mm SL), b) *Hoplosternum littorale* (MCP 14601, 52.4 mm SL), c) *Corydoras elegans* (MCP 23226, 37.0 mm SL), d) *Corydoras stenocephalus* (MCP 28805, 59.2 mm SL). Abbreviations: cpt = compound pterotic, vmp = ventro-medial process of the compound pterotic, trp = transverse process of the complex vertebra, boc = basioccipital, vpr = ventral process of the complex vertebra, bbb = bony bridge of basioccipital, bbv = bony bridge of complex vertebra, amt = anterior margin of transverse process.

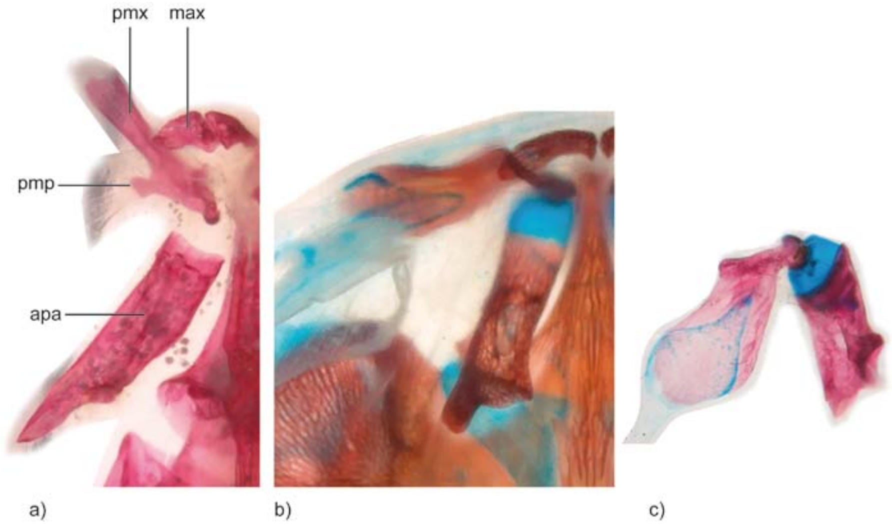

Figure 13. Autopalatine, premaxilla, and maxilla. a) *Corydoras stenocephalus* (MCP 28805, 59.2 mm SL), b) *Hoplosternum littorale* (MCP 14601, 52.4 mm SL). c) *Callichthys callichthys* (MCP 7026, 54.1 mm SL). Abbreviations: pmx = premaxilla, max = maxilla, pmp = posterior margin process of premaxilla, apa = autopalatine. Figures a and b in ventral view, figure c in dorsal view.

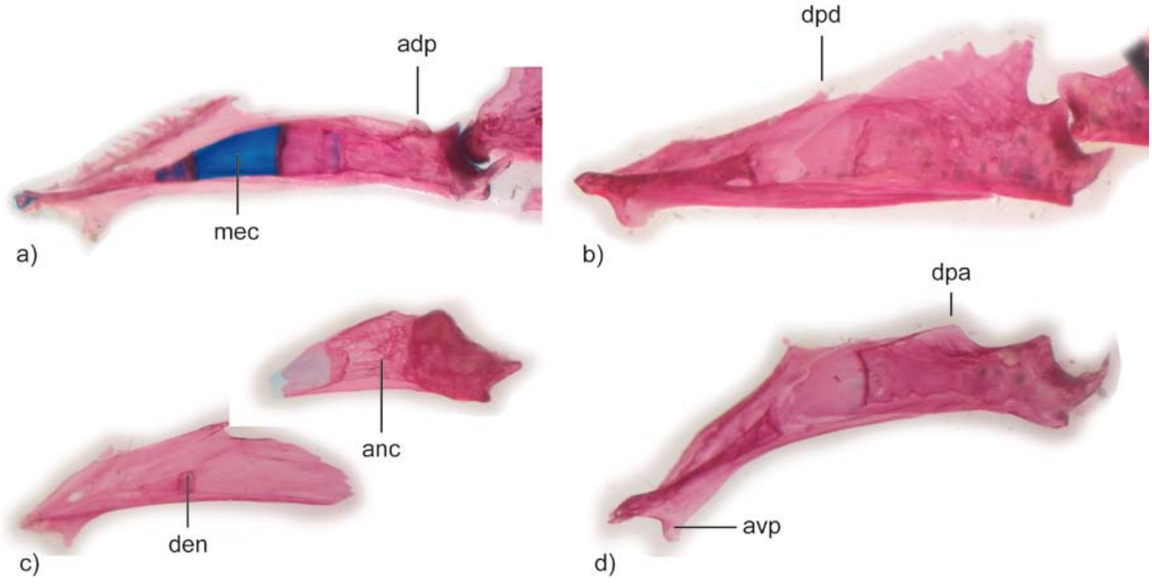

Figure 14. Lower jaw in mesial view. a) *Callichthys callichthys* (MCP 7026, 54.1 mm SL), b) *Corydoras stenocephalus* (MCP 28805, 59.2 mm SL), c) *Scleromystax barbatus* (MCP 31549, 60.7 mm SL), d) *Corydoras nattereri* (MCP 20658, 52.6 mm SL). Abbreviations: mec = Meckelian cartilage, adp = additional process of angular complex, dpd = dorsal process of dentary, den = dentary, anc = angular complex, avp = antero-ventral process for intermandibularis insertion, dpa = dorsal process of angular complex.

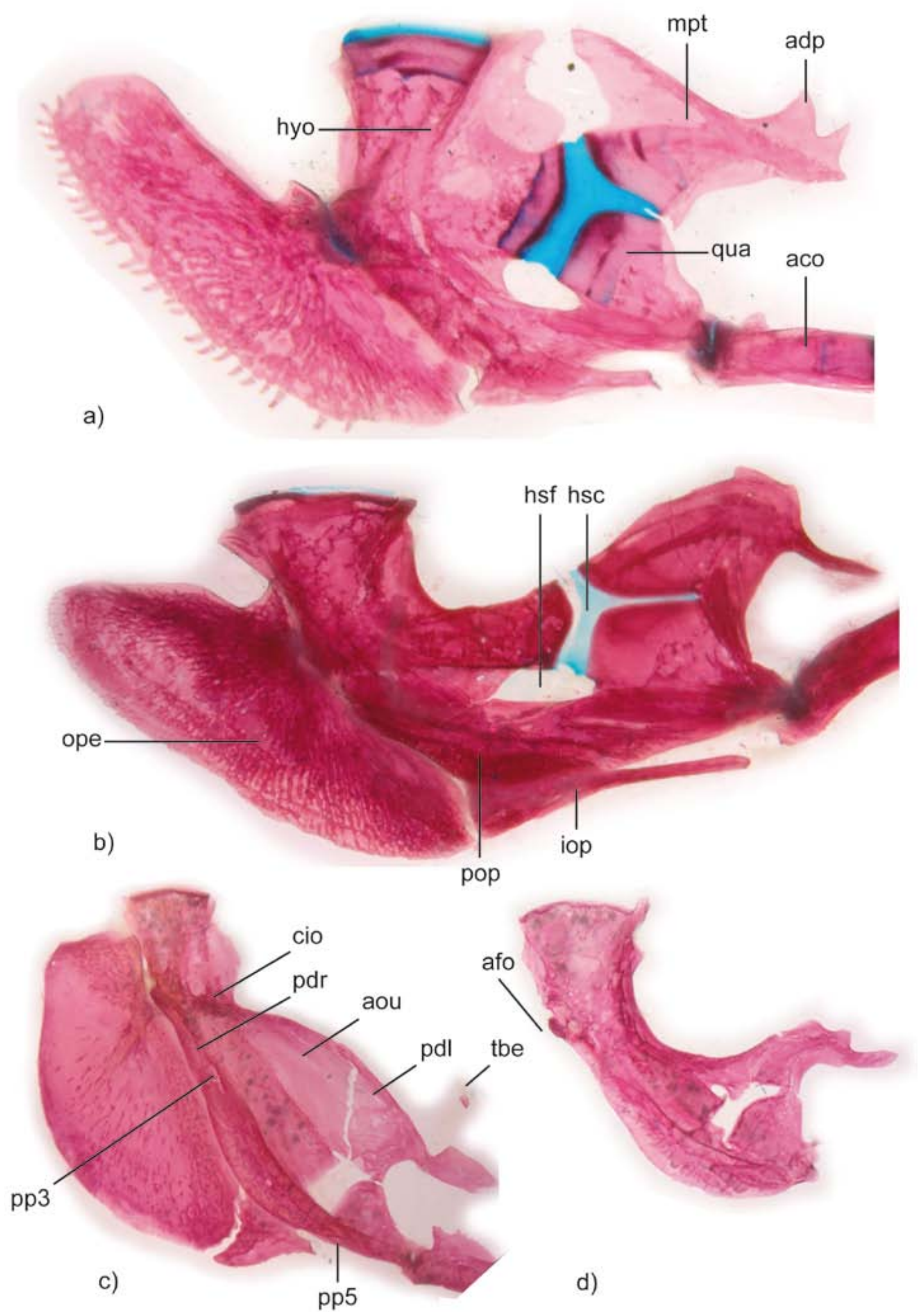

Figure 15. Suspensorium and opercular series. a) *Callichthys callichthys* (MCP 7026, 54.1 mm SL), b) *Dianema longibarbis* (MCP 40980, 50.3 mm SL), c) *Corydoras stenocephalus* (MCP 28805, 59.2 mm SL), d) *Corydoras elegans* (MCP 23226, 37.0 mm SL). Abbreviations: hyo = hyomandibula, mpt = metapterigoid, adp = antero-dorsal process, qua = quadrate, aco = angular complex, hsf = hyosimplectic fenestra, hsc = hyosimplectic cartilage, ope = opercle, pop = preopercle, iop = interopercle, cio = crest for infraorbital1 articulation, pdr = postero-dorsal ridge, aou = anterior outgrow, pdl = postero-dorsal lamina, tbe = tendon bone ectopterygoid, afo = articular facet for opercle, pp3 & pp5 = preopercular pore 3 and 5.

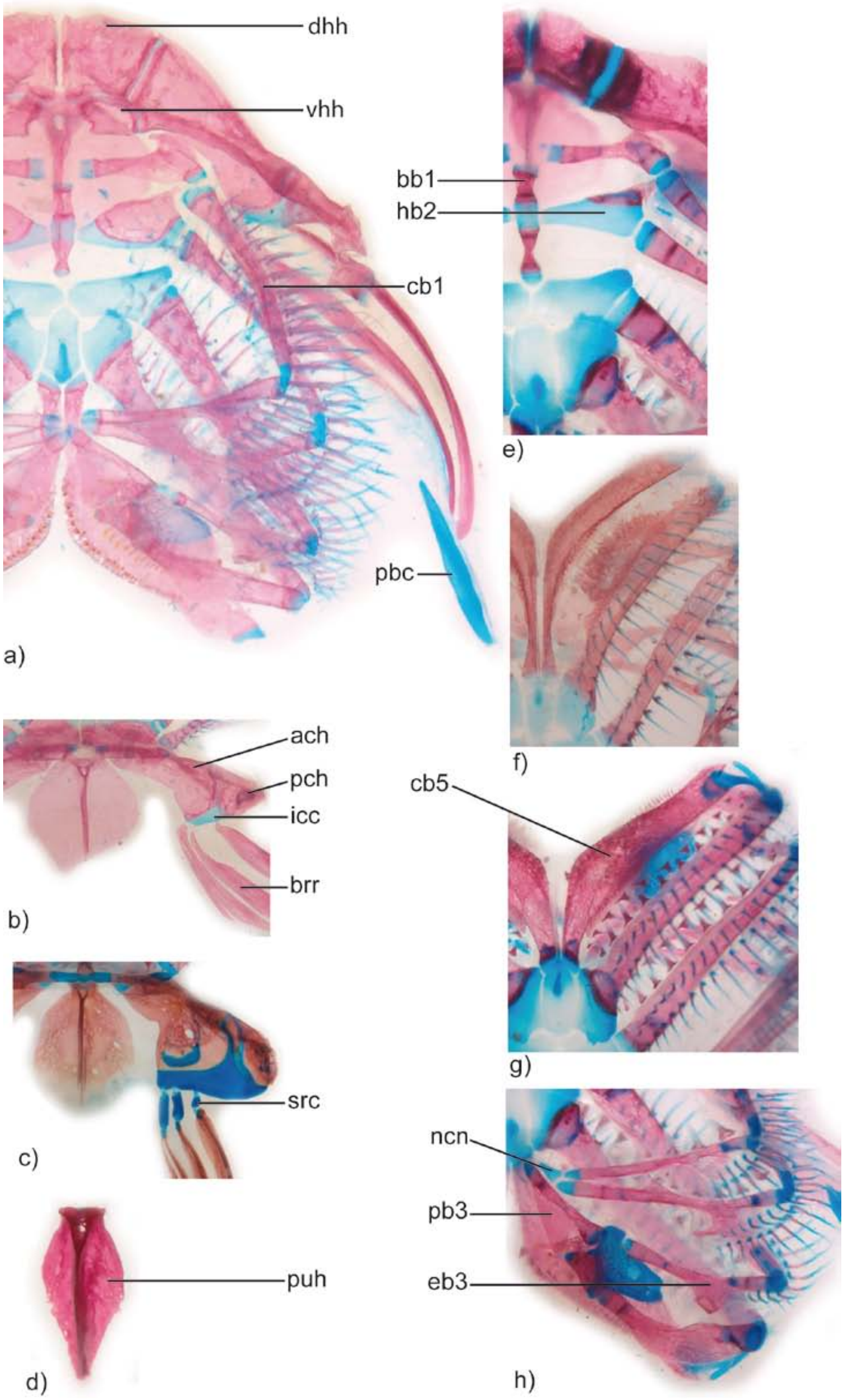

Figure 16. Hyoid and branchial arc. a) and b) *Aspidoras albater* (UFRGS 11248, 30.6 mm SL), dorsal view; c) *Hoplosternum littorale* (MCP 14601, 52.4 mm SL), dorsal view; d) *Dianema longibarbis* (MCP 40980, 50.3 mm SL), dorsal view; e) and h) *Callichthys callichthys* (MCP 7026, 54.1 mm SL), dorsal view and g) ventral view; f) *Scleromystax barbatus* (MCP 12180, 43.9 mm SL), ventral view.

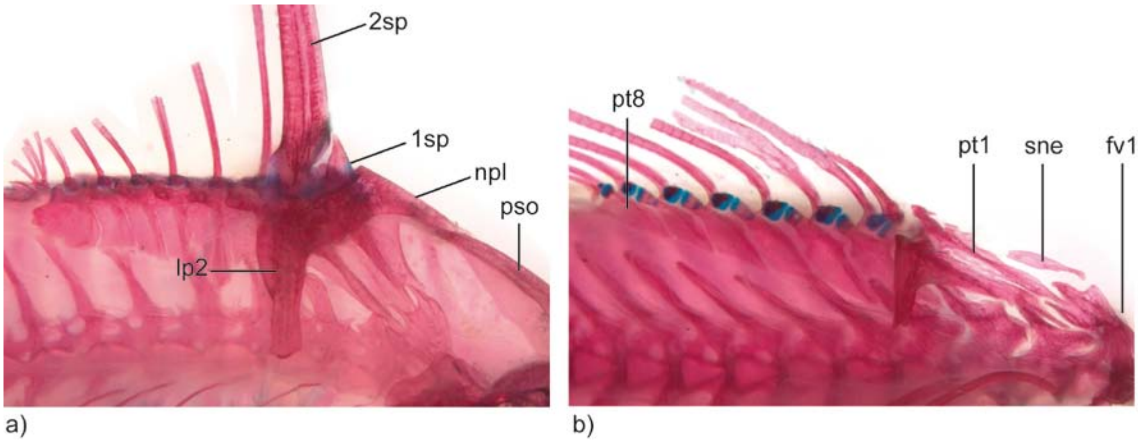

Figure 17. Dorsal fin in lateral view. a) *Corydoras nattereri* (MCP 14980, 46.8 mm SL), b) *Callichthys callichthys* (MCP 7026, 54.1 mm SL). Abbreviations: 1sp = 1st spine, 2sp = 2nd spine, lp2 = lateral process of 2nd pterigiophore, npl = nuchal plate, pso = postparieto-supraoccipital, pt1-8, pterigiophores 1 to 8, sne = supraneural, fv1 = free vertebra 1.

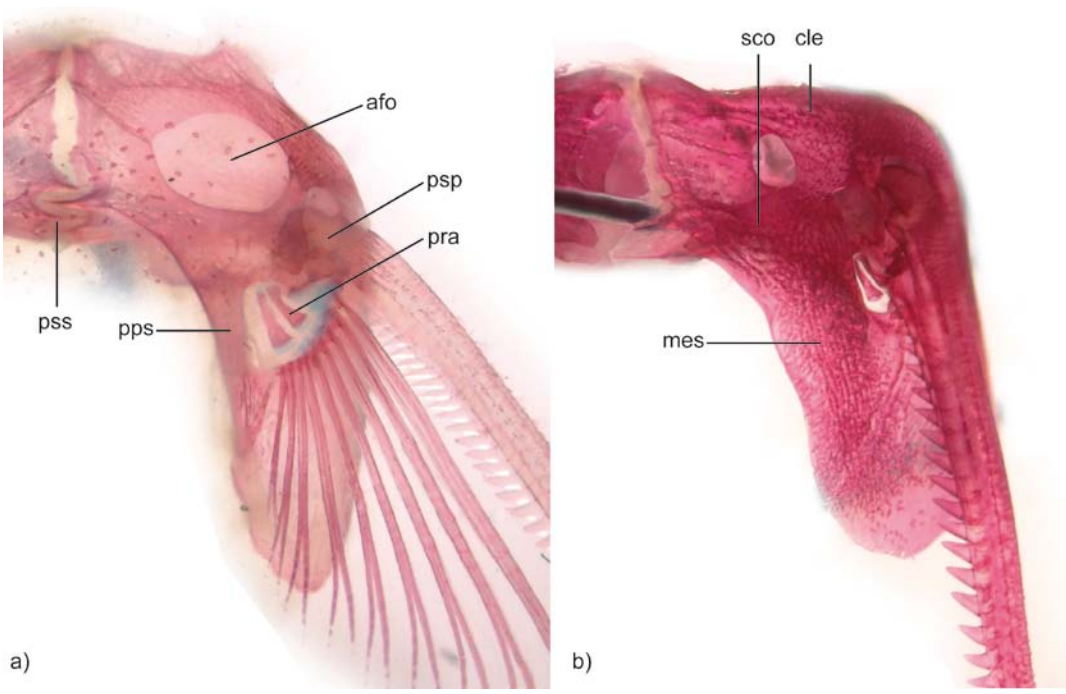

Figure 18. Pectoral girdle in ventral view. a) *Scleromystax barbatus* (MCP 12180, 43.9 mm SL), b) *Corydoras elegans* (MCP 23226, 37.0 mm SL). Abbreviations: cle – cleithrum, sco = scapulocoracoids, mes = medial expansion of scapulocoracoids, pra = pectoral radials, psp = pectoral spine, afo = arrector fossa, pps = posterior process of scapulocoracoids, pss = posterior serrations of scapulocoracoids.

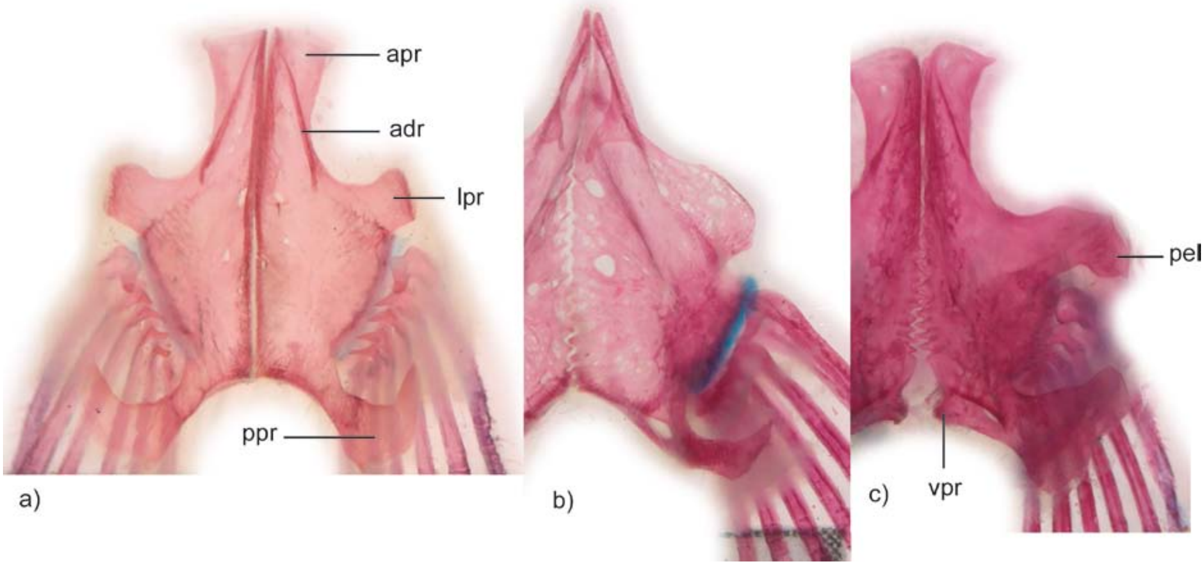

Figure 19. Pelvic girdle in dorsal view. a) *Scleromystax barbatus* (MCP 12180, 43.9 mm SL), c) *Callichthys callichthys* (MCP 7026, 54.1 mm SL), c) *Corydoras nattereri* (MCP 14980, 46.8 mm SL). Abbreviations: apr = anterior process, adr = anterior dorsal ridge, lpr = lateral process, ppr = posterior process, pel = posterior expansion of lateral process, vpr = ventral process.

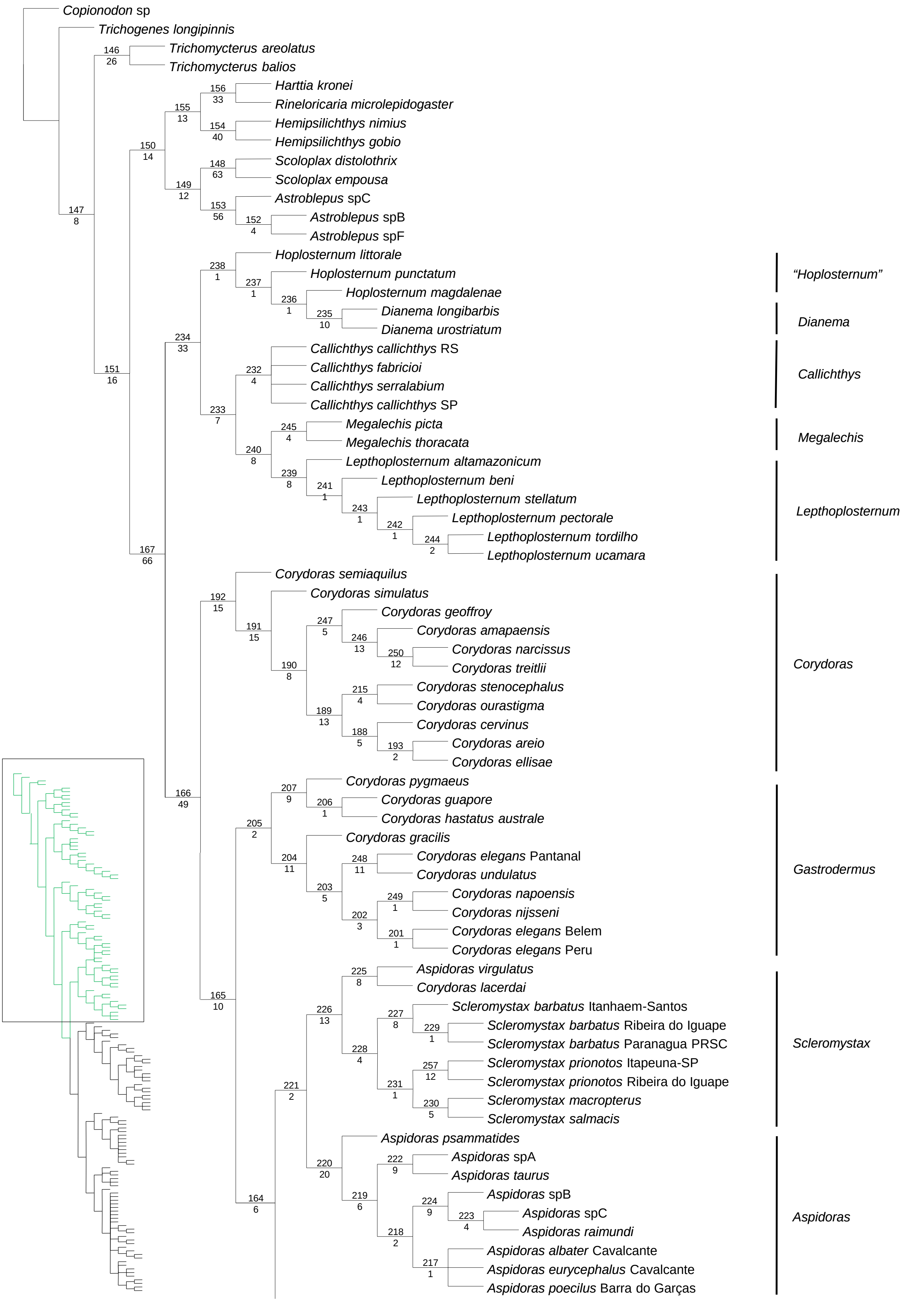

Figure 20. Strict consensus cladogram from the Cladistic parsimony analysis under a Total evidence approach. Numbers above branches are node identification numbers, see Results and Discussion for commentaries. Numbers below branches are Bremer values (continues con next page).

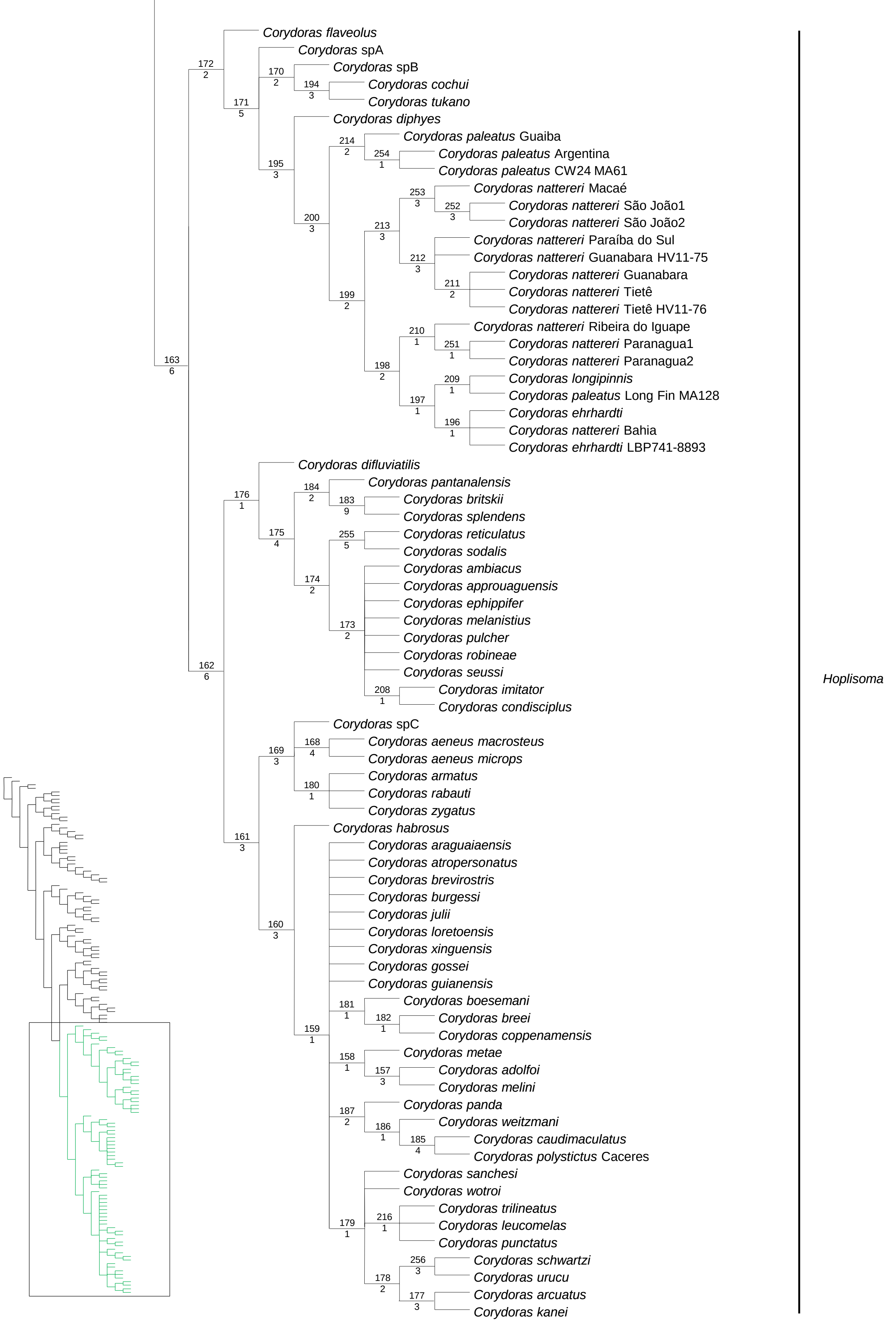

Figure 21. (Continuation) Strict consensus cladogram from the Cladistic parsimony analysis under a Total evidence approach. Numbers above branches are node identification numbers, see Results and Discussion for commentaries. Numbers below branches are Bremer values.

Table 1. Current valid genera composing the Callichthyidae including synonymy names and type species.

Callichthyinae Bonaparte, 1838	
Callichthys Scopoli, 1777 (type species: *Silurus callichthys* Linnaeus, 1758)	
	Callichthys Meuschen, 1778 (type species: *Silurus callichthys* Linnaeus, 1758)
	Callichthys Linck, 1790 (type species: *Silurus callichthys* Linnaeus, 1758)
	Cataphractus Bloch, 1794 (type species: *Silurus callichthys* Linnaeus, 1758)
Dianema Cope, 1871 (type species: *Dianema longibarbis* Cope, 1872)	
	Decapogon Eigenmann & Eigenmann, 1888 (type species: *Callichthys adspersus* Steindachner, 1877)
Hoplosternum Gill, 1858 (type species: *Callichthys laevigatus* Valenciennes, 1836)	
	Cascadura Ellis, 1913 (type species: *Cascadura maculocephala* Ellis, 1913)
	Cataphractops Fowler, 1915 (type species: *Callichthys melampterus* Cope, 1872)
	Ellisichthys Miranda Ribeiro, 1920 (type species: *Cascadura maculocephala* Ellis, 1913)
	Diasternum Franz, 2001 (type species: *Hoplosternum punctatum* Meek & Hildebrand, 1916)
Lepthoplosternum Reis, 1997 (type species: *Callichthys pectoralis* Boulenger, 1895)	
Megalechis Reis, 1997 (type species: *Callichthys thoracatus* Valenciennes, 1840)	
Corydoradinae Hoedeman, 1952	
Aspidoras Ihering, 1907 (type species: *Aspidoras rochai* Ihering, 1907)	
Corydoras La Cépède, 1803 (type species: *Corydoras geoffroy* La Cepède, 1803)	
	Cordorinus Rafinesque, 1815 (type species: *Corydoras geoffroy* La Cepède, 1803)
	Hoplisoma Swainson, 1838 (type species: *Cataphractus punctatus* Bloch, 1794)
	Brochis Cope, 1871 (type species: *Brochis coeruleus* Cope, 1872)
	Chaenothorax Cope, 1878 (type species: *Chaenothorax bicarinatus* Cope, 1878)
	Gastrodermus Cope, 1878 (type species: *Corydoras elegans* Steindachner, 1877)
	Osteogaster Cope, 1894 (type species: *Corydoras eques* Steindachner, 1877)
	Microcorydoras Myers, 1953 (type species: *Corydoras hastatus* Eigenmann & Eigenmann, 1888)
Scleromystax Günther, 1864 (type species: *Callichthys barbatus* Quoy & Gaimard, 1824)	

Table 2. Examined material with the species are grouped in major taxonomic groups and listed alphabetically within each group. Voucher specimen details as follows: Collection acronym and catalog number; Number of specimens analyzed (alc = alcohol, c&s = cleared and stained, tis = tissue); Country; Departamento, Estado, or Provincia; City; Collecting locality.

OUTGROUP TAXA:

Trichomycteridae: *Copionodon* sp: LBP 7185, alc 24, tis 5, Brazil, Bahia, Lençois, rio Paraguaçu. MCP 18310, alc 9, c&s 1, Brazil, Bahia, Lençois, rio Lençois. *Trichogenes longipinnis*: LBP 3862, alc 9, tis 8, Brazil, Sao Paulo, Ubatuba, cachoeira do Amor. MCP 40982 c&s 2, Brazil, São Paulo, Ubatuba, cachoeira dos Amores. *Trichomycterus areolatus*: LBP 994, alc 7, tis 5, Chile, Malleco, Traiguén, Río Rehue. UFRGS 10785, alc 6, c&s 1, Chile, Bio Bio, Los Angeles, afluente Río Duqueco. *Trichomycterus balios*: MCP 41292, alc 26, c&s 2, tis 1, Brazil, Rio Grande do Sul, Tainhas, rio Contendas.

Scoloplacidae: *Scoloplax empousa*: MCP 15686, alc 2, c&s 2, Brazil, Mato Grosso, Cáceres. UFRGS 12789, tis 1, Brazil, Mato Grosso, Poconé. *Scoloplax distolothrix*: MCP 40282, alc 43, tis 4, Brazil, Mato Grosso, Posto da Mata, rio Traíras.

Astroblepidae: *Astroblepus* spB: ANSP 180587, alc 2, c&s 1, tis 1, Peru, Cuzco, Marcapata, Río Araza. *Astroblepus* spC: ANSP 180586, alc 1, c&s 1, tis 1, Peru, Cuzco, Marcapata, Río Araza. *Astroblepus* spF: ANSP 180594, alc 1, c&s 1, tis 1, Peru, Cuzco, Quellouno, Río Yanalili.

Loricariidae: *Hemipsilichthys nimius*: MCP 30671, alc 9, c&s 1, tis 1, Brazil, São Paulo, Salesopolis, Cachoeira do Tobogâ. MCP 38777, alc 7, c&s 1, Brazil, Rio de Janeiro, Parati, rio Carrasquinho. *Hemipsilichthys gobio*: LBP 2368-15363, tis 1, Brazil, Sao Paulo, Ubatuba, rio Macaquinho. MCP 19780, alc 7, c&s 2, Brazil, Sao Paulo, silveiras, rio Piraitinga. MCP 42452, alc 1, tis 1, Brazil, Minas Gerais, Lima Duarte, rio Pirapetinga. *Harttia kronei*: MCP 20148, alc 21, c&s 1 of 3, Brazil, Paraná, Rio Branco do Sul, rio Piedade. MCP 31596, alc 9, tis 1, Brazil, São Paulo, Iporanga, rio Betari. *Rineloricaria microlepidogaster*: MCP 25051, alc 44, c&s 1, tis 1, Brazil, Rio Grande do Sul, Pinheiro Machado, arroio dos Pires.

INGROUP TAXA:

Aspidoras: *A. albater* Cavalcante: UFRGS 11199, alc 7, Brazil, Goiás, Cavalcante, afluente do rio Paraná. UFRGS 11357, alc 4, tis 1, Brazil, Goiás, Nova Roma, córrego Kavanca. UFRGS 112488, alc 33, Brazil, Goiás, Nova Roma, córrego Kavanca. *A. eurycephalus* Cavalcante: UFRGS 9906, alc 17, Brazil, Goiás, Cavalcante, córrego Grotão. UFRGS 11196, alc 24, Brazil, Goiás, Cavalcante, afluente do rio Paraná. UFRGS 14858, tis 1, Brazil, Goiás, Cavalcante, córrego Grotão. *A. poecilus* Barra do Garcas: LBP 1272-11098, alc 9, tis 5, Brazil, Mato Grosso, Barra do Garças, córrego Águas Quentes. *A. psammatides*: LBP 7188, alc 5, tis 24, Brazil, Bahia, Lençois, rio Lapão. *A. raimundi*: MCP 23210, alc 6, tis 1, Brazil, Piauí, Teresina, Riacho dos Macacos. MZUSP 74915, alc 8 of 13, Brazil, Piauí, Campo Maior, rio Sorumbi. MNRJ 35326, alc 5, Brazil, Piauí, Palmeiras, rio Parnaíba. *Aspidoras* spA: LBP 1437-12304, alc 41, tis 10, Brazil, Mato Grosso, Alto Araguaia, Corrego do Sapo. *Aspidoras* spB: MNRJ 33856, alc 21, tis 1, Brazil, Mato Grosso, Novo Mundo. MCP 30154, alc 2, Brazil, Mato Grosso, Itaúba. MCP 30151, alc 3, Brazil, Mato Grosso, Itaúba.MCP 30148, alc 2, Brazil, Mato Grosso, Itaúba. *Aspidoras* spC: LBP 7282-35874, alc 30, tis 6, Brazil, Goiais, Bela Vista de Goiais, afluente do rio Arapuca. *Aspidoras taurus*: MCP 25269, alc 5, Brazil, Mato Grosso, Alto Garças, rio Itiquira. MZUSP 41455, alc 228, c&s 5, Brazil, Mato Grosso, Alto Garça, rio Itiquira. LBP 1427-12306, alc 33, tis 10, Brazil, Mato Grosso, Alto Garça, rio Itiquira. *A. virgulatus:* MCP 27750, alc 3, Brazil, Bahia, Trancoso, rio Trancoso. UFRGS 11019, alc 2, Brazil, Bahia, Caravelas. UFRGS 11122 (TEC1114D), alc 4, tis 3, Brazil, Bahia, Prado. UFRGS 11026, alc 2, Brazil, Bahia, Prado.

Callichthys: *C. callichthys* RS: MCP 29384, alc 2, tis 2, Rio Grande do Sul, Eldorado do Sul, Jacui. MCP 7026, alc 1, c&s 1, Brazil, Rio Grande do Sul, Eldorado do Sul. MCP 10193, alc 1, c&s 1, Brazil, Rio Grande do Sul, Canoas, afluente do rio dos Sinos. MCP 29384, alc 2, tis 2, Brazil, Rio Grande do Sul, Eldorado do Sul. MCP 10282, alc 14, c&s 1, Uruguay, Cerro Largo, Arreria. *C. callichthys* SP: MCP 23513, alc 3, Brazil, Minas Gerais, Juatuba, rio Paraopeba. MCP 26013, alc 5, Brazil, Bahia, Candeias. MCP 33119, alc 3, Brazil, Amazonas, Alvarães, lago Curuçá. MCP 19919, alc 3, Venezuela, Barínas, Río Michay. LBP 485-6040-6041, alc 2, Brazil, São Paulo, Marilia, Córrego do Pombo. *C. fabricioi:* MCP 21174, alc 2, Colombia, Cauca, Santander de Quilichao, afluente do Río Cauca. MCP 21175, alc 3, Colombia, Cauca, Buenos Aires, afluente do Río Cauca. MCP 30690, c&s 1, Colombia, Cauca, Timba, Río Timba. *C. serralabium:* MCP 30693, alc 4, c&s 1, Venezuela, Amazonas, Esmeralda, laguna Tonina. MCP 37389, alc 2, Peru, Loreto, Jenaro Herrera.

Corydoras: *C. adolfoi*: MCP 46063, alc 3, c&s 1, tis 1, Brazil, Amazonas, Manaus, Aquarium. MCP 46055, alc 3, tis 1, Brazil, Amazonas, Manaus, Aquarium. INPA 22959, alc 4, Brazil, Amazonas, São Gabriel da Cachoiera, rio Negro Miuá. *C. aeneus macrosteus*: MCP 20662, alc 22, c&s 2, Brazil, São Paulo, Mogi das Cruzes. MNRJ 29811, alc 3, tis 1, Brazil, São Paulo, Urupês, córrego Inácia. *C. aeneus microps*: MCP 36303, alc 8, c&s 2, tis 1, Brazil, Mato Grosso, Poconé. CZCEN 330, tis 1, Paraguay, unkow locality. *C. amapaensis*: MHNG 2682.025, alc 2, tis 1, French Guiana, Camopi, Crique forestière. *C. ambiacus*: MCP 14259, alc 4,c&s 2, Aquarium, Unknow locality. MCP 46068, alc 5, tis 1, Brazil, Amazonas, Manaus, Aquarium. MCP 34489, alc 14, c&s 4, Peru, Loreto, Río Pacaya. MHNG 2711.004, alc 2, tis 1, Peru, Ucayali. ANSP 190492, alc 23, tis 2, Peru, Loreto, Maynas, Caño Shirui. *C. approuaguensis*: MCP 46057, alc 3, c&s 1, tis 1, Brazil, Pará, Santarém, rio Arapiuns. MPEG 14373, alc 1, Brazil, Pará, Juruti. *C. araguaiaensis*: MCP 34140, alc 6, c&s 1, Brazil, Mato Grosso, Ribeirão Cascalheira. MCP 34141, alc 10, c&s 2, Brazil, Mato Grosso, Ribeirão Cascalheira, rio São João. MCP 40243, alc 5, c&s 1, tis 1, Brazil, Mato Grosso, Vila Rica, afluente Ribeirão Gameleira. UFRGS 11592, alc 7, Brazil, Mato Grosso, Barra di Garças, rio Araguaia. *C. areio*: MZUSP 59364, alc 7 of 11, c&s 1, Brazil, Mato Grosso do Sul, Aquidauana, rio Taboco. NUP 10228, alc 13, Brazil, Mato Grosso, Córrego Cancela. LBP 10098- 46623, alc 3, tis 3, Brazil, Mato Grosso do Sul, Coxim, Ribeirão dos Veados. *C. arcuatus*: MCP 46064, alc 4, c&s 1, tis 1, Brazil, Amazonas, Manaus, Aquarium. *C. armatus*: MZUSP 49567, alc 1, Brazil, Amazonas, Boca do Acre, rio Acre. NRM 13715, alc 5 of 5, Peru, Loreto, Río Yavari. NRM 28593, alc 2, Brazil, Amazonas, rio Yavari. UF 82099, alc 27, Bolivia, Beni, Marban, Río Ibare. *C. atropersonatus*: MCP 37159, alc 1, Peru, Loreto, Nauta, Diamante Azul. MNRJ 19962 alc 2+c&s 2, Peru, Loreto, Río Nanay. NRM 28561, alc 24, Peru, Loreto, Río Nanay. ANSP 182532, alc 1 of 3, tis 1, Peru, Loreto, Maynas, Río Nanay. ANSP 181129, alc 5, Peru, Loreto, Maynas, Río Nanay. *C. boesemani*: MHNG 2673.074, alc 5 of 55, c&s 1, Surinam, Sipaliwini, Gran Rio à Assigon. *C. breei* : MHNG 2671.094 alc 6 of 81+tis 1, Surinam, Sipaliwini, afluente Río Corantijne. ANSP 180694 alc 19/21+tis 2. AMNH 91139, alc 15 of 46, Venezuela, Bolivar, Río Paragua. AMNH 54905, alc 15 of 80, Surinam, Nickerie, Corintijn River. INPA 8129, alc 18, c&s 2, Brazil, Roraima, Bonfim. *C. brevirostris*: LBP 3080-19704, alc 29, tis 5, Venezuela, Bolivar, Caicara del Orinoco, Río Orinoco. *C. britskii*: MCP 16452, alc 2, Unknow locality, Aquarium. AMNH 98088, alc 2 of 46, c&s 1, Unknow locality. LBP 688-8112, alc 16, tis 8, Brazil, Mato Grosso, Poconé, afluentes del rio Pirai. *C. burgessi*: MZUSP 93417, alc 6 of 6, c&s 1, Brazil, Amazonas, São Gabriel da Cachoeira, rio Negro. LBP 6867-32741, alc 2, tis 10, Brazil, Amazonas, São Gabriel da Cachoeira, rio Negro. *C. caudimaculatus*: MCP 36287, alc 1, Brazil, Mato Grosso, Vila Bela da Santíssima Trindade, afluente do rio Guaporé. INPA 34998, alc 3, c&s 1, Brazil, Mato Grosso, Vila Bela da Santíssima Trindade, córrego Ribeirão Seixas. LBP 562-7253, alc 5, tis 5, Brazil, Mato Grosso, Cuibá. *C. cervinus*: MCP 15516, alc 4, c&s 1, Brazil, Mato Grosso, Pontes e Lacerda, rio Guaporé. MCP 36325, alc 2, Brazil, Mato Grosso, Pontes e Lacerda, Arroio afluente do rio Galera. MCP 36326, alc 5, Brazil, Mato Grosso, Comodoro, afluente do rio Guaporé. LBP 10097 alc 2+tis 2. *C. cochui* Araguaia: MCP 41432, alc 1, Brazil, Goiás, Piranhas, rio Piranhas. MCP 41450, alc 4, Brazil, Goiás, Piranhas, rio Piranhas. MZUSP 89055, alc 6 of 6, Brazil, Goiás, Faina Araguaia, rio do Peixe. LBP 1853-13270, alc 9, tis 5, Brazil, Mato Grosso, Barra do Garças, rio Insula. *C. condiscipulus*: MHNG 2682.024, alc 2 of4, tis 1, French Guiana, Camopi, Crique forestière. *C. coppenamensis*: AMNH 72978, alc 5, Guayana, Mazaruni-Potaro, Littlel Takutu Riverl. MHNG 2690.017, alc 2 of 3, tis 1, Surinam, Sipaliwini. USNM 225537, alc 4 of 5, Ecuador, Pastaza, Río Dalbana. *C. difluviatilis*: MCP 28500, alc 29, c&s 2, Brazil, Goiás, Davinópolis, Córrego Grande. MCP 16994, alc 23, c&s 2, Brazil, Minas Gerais, Bocaiúva. MNRJ 26951, alc 10 of 10, Brazil, Minas Gerais, Paracatu, córrego Bonsucesso. LBP 382-4624, alc 3, tis 17, Brazil, São Paulo, Araras, Córrego Água Boa. *C. diphyes*: NRM 51995, alc 2, c&s 1, Paraguay. LBP 2813-18904, alc 1, tis 3, Aquarium, Unknow locality. *C. ehrhardti*: MCP 14354, alc 5, c&s 2, Brazil, Santa Catarina, São Bento do Sul. MCP 22591, alc 14, c&s 2, tis 1, Brazil, Paraná, Paulo Frontin, Arroio Barra Grande. LBP 741-7990, alc 41, tis 13, Brazil, Santa Catarina, Jaraguá do Sul, córrego Ribeirão Cavalo. *C. ehrardti*: LBP 741-8893. *C. elegans* Belem: MHNG 2602.19-BR98-161, alc 3 of 6, tis 3, Brazil, Pará, rio Guama. MCP 23226, alc 8, c&s 2, Brazil, Pará, Ourém, rio Guamá. MCP 46035, alc 4, tis 1, Brazil, Pará, Belém, Aquarium. *C. elegans* Pantanal: MCP 36275, alc 3, Brazil, Mato Grosso, Poconé, Ribeirão Figueira. LBP 1959-13647, alc 5, tis 4, Brazil, Mato Grosso do Sul, Coxim, Ribeirão dos Veados. *C. elegans* Peru : MCP 46629, alc 5, tis 1, Peru , Loreto, Iquitos, Aquarium. MCP 35615, alc 1, Peru, Loreto, Jenaro Herrera. MCP 15533, alc 1, Brazil, Mato Grosso, Cáceres. AMNH 78049, alc 14, Peru, Loreto, Río Yarapa, tributário Río Ucayali. *C. ellisae*: MCP 15517, alc 2, c&s 2, Brazil, Mato Grosso, Cáceres, afluente do rio Paraguai. MCP 36265, alc 3, Brazil, Mato Grosso, Cáceres, afluente do rio Paraguai. UMMZ 206876, alc 9, Paraguay, Caaguazu, Arroyo Tobatiry. ANSP 182420, alc 6 of 8, tis 3, Argentina, Corrientes. *C. ephippifer*: MHNG 2602.12, alc 1 of 2, tis 1, Brazil, Pará, Igarapé Puraquequara. MCP 46041, alc 5, tis 1, Brazil, Pará, Belém, Aquarium. *C. flaveolus*: MZUSP 47925, alc 15 of 22, Brazil, São Paulo, Salto, rio Buru. UMMZ 206401, alc 20 of 38, Paraguay, Canindeyu, Río Piratiy. MCP 28271, alc 14, c&s 2, Minas Gerais, Guarda-Mor, Sao Francisco, Córrego Macaúba. MNRJ 22370, alc 1, tis 1, Brazil, Bahia, Barra, rio São Franciasco. LBP 3670-21758, alc 4, tis 4, Brazil, São Paulo, Botucatu, rio Alambari. MA109**.** *C. geoffroy*: MHNG 2683.016, alc 2 of 3, tis 1, French Guiana, Saint-Laurent du Maroni, Crique Voltaire. *C. gossei*: LBP 544-7168, alc 5, tis 5, Brazil, Rondonia, Porto Velho. C. gracilis: MCP 46056, alc 4, c&s 2, tis1, Brazil, Pará, Santarem, rio Arapiuns. INPA 7759, alc 10 of 19, c&s 2, Brazil, Roraima, Porto Velho, Igarapé Jaman. *C. guapore*: MCP 15648, alc 1, Brazil, Mato Grosso, Pontes e Lacerda, rio Guaporé. AMNH 229297, alc 1 of 4, Bolivia, Santa Cruz, Río Itenez. AMNH 39741, alc 3 of 7, Bolivia, Beni, Río Itenez. LBP 10089-46595, alc 72, tis 5, Brazil, Mato Grosso, Vila Bela da Santíssima Trindade, rio Guaporé. *C. guianensis*: MHNG 2718.036-SU08-583, alc 5 of 53, tis 1, Surinam, Sipaliwini, affluent du Tapanahony. *C. habrosus*: UF 77905, alc 42, Venezuela, Apure, Caño Santa Barbara. LBP 2808-18893, alc 1, tis 1, Aquarium, Unknow locality. *C. hastatus australe*: CZCEN 331, tis 1, Paraguay, unknow locality. *C. imitator*: MCP 46061, alc 4, c&s 1, tis 1, Brazil, Amazonas, Manaus, Aquarium. AMNH 225218, alc 1, Venezuela, Amazonas, Río Negro, Río Mawarinuma. LBP 6862-32502, tis 23, Brazil, Amazonas, São Grabriel da Cachoeira, Igarapé Puranga. *C. julii*: MCP 23205, alc 30, c&s 4, Brazil, Pará, São Miguel do Guamá, rio Guamá. MCP 23217, alc 1, Brazil, Maranhão, Timon, Igarapé do Pinto. MCP 46050, alc 19, tis 2, Brazil, Pará, Ourém, rio Guamá. MCP 23206, alc 123, c&s 4, Brazil, Maranhão, Peritoró, rio Peritoró. LBP 1359-11429, alc 2, tis 2, Brazil, Pará, Ouren, Igarapé Caitezinho. *C. kanei*: ANSP 180696, alc 4, tis 1, Guyana, Rupununi, Moco-Moco River. *C. lacerdai*: LBP 1966-13676, alc 14, tis 11, Brazil, Bahia, Canavieiras, rio Ribeira da Terra Firme. *C. leucomelas*: MCP 45748, alc 4, tis 1, Peru , Ucayali, Pucallpa, laguna Yarinacocha. *C. longipinnis*: CI-FML 5113, alc 3, c&S 1, Argentina, Tucuman, Leales, afluente Río Sali-Dulce. CI-FML 5194, alc 2, Argentina, unknow locality. MCP 45225, alc 3, tis 1, Argentina, Salta, Tres Palmeiras, Río Arias. *C. loretoensis*: ANSP 181122-1475, alc 8, tis 1, Peru, Loreto, Maynas, Río Nanay. ANSP 167671, alc 7 of 38, c&s 2 of 5, Peru, Loreto, Río Nanay . MZUSP 30838, alc 14, Brazil, Amazonas, Tefé, rio Tefé. *C. melanistius*: ANSP 180693, alc 16, tis 1, Guyana, Rupununi. ANSP 177163, alc 14, Guyana, Essequibo, Siparuni River. ANSP 177162, alc 24 of 94, Guyana, Essequibo, Siparuni River. *C. melini*: MCP 46062, alc 5, tis 1, Brazil, Amazonas, Manaus, Aquarium. *C. metae*: LBP 2793-18854, alc 1, tis 3, Aquarium, Unknow locality. *C. napoensis*: MCP 46630, alc 7, tis 1, Peru, Loreto, Iquitos, Aquarium. LBP 1962-13660, alc 3, tis 3, Aquarium, Unknow locality. *C. narcissus*: LBP 10094-46610, alc 1, tis 1, Brazil, Amazonas, Lábrea, afluente rio Purus. *C. nattereri* Bahia: MCP 18041, alc 43, c&s 2, Brazil, Bahia, Itamaraju, rio Jucuruçu. *C. nattereri* Guanabara: MNRJ 37043, Brazil, Rio de Janeiro, Cachoeira de Macacu, rio Soarinho. *C. nattereri* Guanabara HV11-75: LBP 3480-16042, alc 1, tis 1, Brazil, Rio de Janeiro, Itaboraí, rio Macacu. MCP 20658, alc 29, c&s 4, Brazil, Rio de Janeiro, Cachoeiras de Macacu, rio Macacú. *C. nattereri* Macaé: LBP 2574-17106, alc 1, tis 1, Brazil, Rio de Janeiro, Macaé, afluente rio Aduelas. *C. nattereri* Paraíba do Sul: LBP 5777-28181, alc 11, tis 5, Brazil, Rio de Janeiro, Comendador Levy Gasparian. MCP 34457, alc 1, Brazil, Minas Gerais, Muriaé, Córrego Boa Vista. *C. nattereri* Paranaguá1 : LBP 778-8301, alc 1, tis 1, Brazil, Paraná, Morretes, rio Marumbi. C. nattereri Paranaguá2: LBP 903-9697, alc 3, tis 2, Brazil, Paraná, Morretes, rio Marumbi. *C. nattereri* Ribeira do Iguape: MCP 12833, alc 39, c&s 2, Brazil, São Paulo, Sete Barras. MCP 14980, alc 3, c&s 1, Brazil, São Paulo, Iporanga, rio Iporanga. LBP 1266-11110, alc 10, tis 5, Brazil, São Paulo, Miracatu, rio Fau. *C. nattereri* São João1: MNRJ 37470-DNA 3506, Brazil, Rio de Janeiro, Casimiro Abreu, Córrego Aldeia Velha. *C. nattereri* São João2: MNRJ 37470-DNA 3507, Brazil, Rio de Janeiro, Casimiro Abreu, Córrego Aldeia Velha. *C. nattereri* Tietê: MHNG 2587.012, alc 1 of 9, tis 1, Brazil, São Paulo, Riacho Paraitinguinha. MCP 20656, alc 22, Brazil, São Paulo, Salesópolis, Riacho Paraitinguinha. *C. nattereri* Tietê HV11-76: LBP 3480-16042, alc 1, tis 1, Brazil, Rio de Janeiro, Itaboraí, rio Macacu. *C. nijsseni*: LBP 6861-32532, alc

2, tis 8, Brazil, Amazonas, São Gabriel da Cachoeira, Igarapé Puranga. *C. ourastigma*: MCP 28799, alc 4, tis 1, Brazil, Acre, Rio Branco, rio Iquirí. MCP 36262, alc 1, Brazil,Rondônia, Ariquemes, Igarapé São José. MCP 36289, alc 1, Brazil, Rondônia, rio Crespo, rio Preto do Crespo. *C. paleatus* Argentina: MHNG 2678.017, alc 2 of 3, tis 1, Argentina, Buenos Aires, Soladillo. *C. paleatus* CW24 MA61: MA61 *C. paleatus* Guaíba: MCP 14835, alc 5, c&s 2, Brazil, Rio Grande do Sul, Morungava, rio Morungava. LBP 567-7416, alc 33, tis 24, Brazil, Rio Grande do Sul, Santo Antonio da Patrulha. *C. paleatus* Long Fin MA128: MA128 *C. panda*: MCP 45746, alc 5, tis 1, Peru , Ucayali, Pucallpa, laguna Yarinacocha. *C. pantanalensis*: MCP 15697, alc 1, c&s 1, Brazil, Mato Grosso, Cáceres, afluente do rio Paraguai. NUP 10192, alc 6, Brazil, Mato Grosso, Barão de Melgaço, afluente rio Cuiabá. CAS 217157, alc 2, Bolivia, Santa Cruz. LBP 691-8126, Brazil, alc 20, tis 7, Mato Grosso, Poconé, afluente rio Pirai. *C. polystictus* Caceres: LBP 8477-42469, alc 10, tis 5, Brazil, Mato Grosso, Cáceres, rio Paraguai *C. pulcher*: LBP 909-8957, alc 3, tis 2, Aquarium, Unknow locality. *C. punctatus*: MHNG 2724.029-SU08-1115 alc 1/16+tis 1 *C. pygmaeus*: MCP 34498, alc 72, c&s 4, Peru, Loreto, Río Pacaya. LBP 2791-18848, alc 1, tis 3, Aquarium, Unknow locality. *C. rabauti*: MCP 14258, alc 7, c&s 1, Aquarium. MCP 36261, alc 1, Brazil, Acre, Braziléia. MZUSP 30858, alc 10 of 15, Brazil, Acre, Tarauacá, rio Tarauacá. LBP 2827-18940, alc 1, tis 3, Aquarium, Unknow locality. *C. reticulates*: MHNG 2711.003, alc 2 of 3, tis 1, Peru, Ucayali. MZUSP 15298, alc 1, Peru, Loreto, Iquitos, Río Nanay. *C. robineae*: MCP 46065, alc 5, tis 1, Brazil, Amazonas, Manaus, Aquarium. *C. sanchesi*: USNM 203810, alc 3, Colombia, MCP 46128, alc 2, tis 1, Brazil, Roraima, Caroebe, rio Jauperi. MCP 46156, alc 1, tis 1, Brazil, Roraima, Igarapé Cocó. MCP 46181, alc 4, tis 1, Brazil, Roraima, Caroebe, rio Jauaperi. *C. schwartzi*: LBP 1783-7120, alc 4, tis 4, Brazil, Alto rio Negro. *C. semiaquilus*: ANSP 178613-1459, alc 3, tis 1, Peru, Loreto, Maynas, Caño Sabalito. MCP 46625, alc 6, tis 2, Peru , Loreto, Iquitos, Aquarium. MCP 35614, alc 7, Peru, Loreto, Jenaro Herrera. MCP 37396, alc 1, Peru, Loreto, Jenaro Herrera, Quebrada Chica. *C. seussi*: LBP 545-7123, alc 5, tis 5, Brazil. *C. simulatus*: LBP 2820-18924, alc 1, tis 3, Aquarium, Unknow locality. *C. sodalis*: MCP 45719, alc 3, tis 1, Aquarium, unknow locality. *Corydoras* spA: ANSP 168192, alc 7, Venezuela, Bolivar, Caño Curumito. INPA 1126, alc 8, Brazil, Rondonia, Ariquemes, Igarapé Madeira. MZUSP 67817, alc 3 of 5, Brazil, Amapá, afluente do rio Amapari. LBP 10101-46632, alc 3, tis 3, Brazil, Rondonia, Porto Velho, rio Mutumparaná. *Corydoras* spB: MZUSP 96764, alc 20 of 64, Brazil, Mato Grosso, Peixoto do Azevedo, afluente rio Teles Pires. MZUSP 97005, alc 10 of 40, Brazil, Mato Grosso, Campinápolis. INPA 6973, 34 of 34, Brazil, Pará, Itaituba, Tapajos Pimental. LBP uncat- 2011100101. *Corydoras* spC: MCP 45747, alc 5, tis 1, Peru, Ucayali, Pucallpa, laguna Yarinacocha. MCP 35517, alc 1, Brazil, Acre, Rio Branco, Igarapé Água Fria. *C. splendens*: MCP 14261, alc 1, c&s 1, Aquarium, unknow locality. MCP 45750, alc 3, c&s 1, tis 1, Peru, Ucayali, Pucallpa, laguna Yarinacocha. MCP 34491, alc 8, Peru, Loreto, Río Pacaya. NUP 2207, alc 4, Brazil, Mato Grosso, rio Cuiabá. MCP 15678, alc 2, Brazil, Mato Grosso, Cáceres, afluente do rio Paraguai. *C. stenocephalus*: MUSM 33865 tis 1. MCP 28805, alc 4, c&s 1, Brazil, Acre, Sena Madureira, afluente do rio Antimari. MCP 36284, alc 2, c&s 1, Brazil, Acre, Xapuri, afluente do rio Acre. *C. treitlii*: MCP 23200, alc 1, Brazil, Pará, Santa Luzia do Pará, rio Gurupi. MCP 46038, alc 1, tis 1, Brazil, Pará, Belém, Aquarium. *C. trilineatus*: MCP 45745, alc 3, c&s 1, tis 1, Peru, Ucayali, Pucallpa, laguna Yarinacocha. MCP 36301, alc 33, c&s 3,tis 1, Brazil, Acre, Braziléia, drenagem do Xapuri. MCP 36302, alc 12, Brazil, Rondônia, Cacoal, córrego afluente do Igarapé Grande. *C. tukano*: LBP 6872-32672, alc 21, tis 10, Brazil, Amazonas, São Gabriel da Cachoeira, rio Tiquié. *C. undulatus* Guaíba: MCP 41943, alc 2, Brazil, Rio Grande do Sul, Cacequi, afluente do rio Cacequi. LBP 566-7386, alc 1, tis 4, Brazil, Rio Grande do Sul, Eldorado do Sul, afluente rio Guaíba. *C. urucu*: LBP 4142, alc 2, tis 2, Brazil, Acre, Mancio Lima, rio Moa. *C. weitzmani*: MCP 46633, alc 10, tis 2, Peru, Loreto, Iquitos, Aquarium. MA35 *C. wotroi*: MCP 46049, alc 6, tis 1, Brazil, Pará, Marabá, rio Tocantins. *C. xinguensis*: MCP 30146, alc 5, c&s 2, tis 1, Brazil, Mato Grosso, Tapurah, rio Arinos e Tapurah. *C. zygatus*: NRM 28596, alc 5, Peru, Loreto, Río Samiria. LBP 2830-18945, alc 1, tis 2, Aquarium, Unknow locality.

Dianema: *D. longibarbis*: MCP 19403, c&s 3, Brazil, Amazonas, Humaitá, Igarapé Joari. MCP 40980, c&s 2, Brazil, Amazonas, Benjamim Constant, rio Solimões. LBP 557-7230, alc 5, tis 4, Brazil, Amazonas, rio Purus. LBP 5274-26494 alc 12, tis 7, Brazil, Pará, Almeirim, Igarapé Carucaru. *D. urostriatum*: MCP 19404, c&s 2, Brazil, Amazonas, Humaitá, Igarapé Banheiro. MCP 40979, c&s 2, Brazil, Amazonas, Humaitá, Igarapé Banheiro. LBP 558-13631, alc 5, tis 5, Brazil, Amazonas, rio Purus.

Hoplosternum: *H. littorale*: MCP 7027, c&s 1, Brazil, Rio Grande do Sul, Eldorado do Sul. MCP 9393, alc 4,c&s 1, Brazil, Rio Grande do Sul, Canoas, rio dos Sinos. MCP 11507, c&s 2, Brazil, Rio Grande do Sul, Triunfo. MCP 14601, alc 25, c&s 1, Brazil, Rio Grande do Sul, Triunfo. LBP 210-4134, alc 1, tis 2, Brazil, Acre, Rio Branco, Igarapé São Francisco. *H. magdalenae*: MCP 17298, alc 1, Colombia, Córdoba, Murrucucú. MCP 19917, alc 3, Venezuela, Zulia, Perija, tributario del Río Guaco. UF 25438, alc 5, Venezuela, Zulia, Goajira. *H. punctatum*: MCP 17302, alc 4, c&s 4, Panamá, Río Sucubti. MCP 21439, alc 2, Auarium, unknow locality. CAS 76513, alc 4, Colombia, Choco, Río Truando. UMMZ 217258, alc 1, Panamá, Darien, Río Chucunaque.

Lepthoplosternum: *L. altamazonicum*: MCP 17313, alc 1, c&s 2, Peru, Ucayali, Pucallpa, Río Ucayali. MCP 26197, alc 1, Peru, Loreto, Maynas, Río Pacaya. MCP 34559, alc 29, tis 2, Peru, Loreto, Río Pacaya. MUSM 33721 alc 1+tis 1 MUSM 33723 alc 1+tis 1. *L. Beni*: MCP 17300, alc 4, c&s 2, Bolívia, Beni, Río Maniqui. CAS 59480, alc 3, Peru, Madre de Dios. *L. pectorale*: MCP 17310, alc 2, Paraguay, Presidente Hayes. MCP 17312, alc 1, c&s 1, Paraguay, Presidente Hayes. LBP 1554-12341, alc 7, tis 7, Brazil, Mato Grosso, Itiquira, Lagoa Temporária. *L. stellatum*: MCP 30651, alc 6, c&s 1, Brazil, Amazonas, Tefé, Iguarapé Repartimento. *L. tordilho*: MCP 20221, alc 1, Brazil, Rio Grande do Sul, Eldorado do Sul, Arroio Passos dos Carros. MCP 21164, alc 3, Brazil, Rio Grande do Sul, Eldorado do Sul. MCP 29383, alc 2, tis 1, Brazil , Rio Grande do Sul, Eldorado do Sul. *L. ucamara*: MCP 29316, alc 2, c&s 1, Brazil, Amazonas, Alvarães, lago Mamirauá. MCP 29318, alc 2, c&s 1, Brazil, Amazonas, Alvarães, lago Mamirauá. MUSM 33717 alc 3+tis 1.

Megalechis: *M. picta*: MCP 17305, alc 2, c&s 2, Peru, Madre de Dios, Puerto Maldonado. MCP 46040, alc 1, tis 1, Brazil, Pará, Belém, Aquarium. MCP 17297, alc 2, c&s 1, Peru, Loreto, Santa Elena, afluente do Río Samiria. LBP 526, alc 1, tis 5, Brazil, Alto rio Negro. MCP 17303, alc 2, c&s 2, Venezuela, Apuré. ANSP 190489, alc 2 of 8, tis 2, Venezuela, Amazonas, Atabapo, Caño Tigre. *M. thoracata:* MCP 28432, alc 2, Brazil, Acre, Rio Branco, Igarapé do Almoço. MCP 28435, alc 5, 1c&s, Brazil, Acre, Rio Branco, Igarapé do Almoço. LBP 239-8845, alc 1, tis 3, Brazil, Acre, Rio Branco, Igarapé do Almoço.

Scleromystax: *S. barbatus* Itanhaem-Santos: LBP 1237-11125, alc 13, tis 4, Brazil, São Paulo, Itanhaém, afluente rio Preto. MA 323 *S. barbatus* Ribeira do Iguape: MCP 12180, alc 35, c&s 2, Brazil, São Paulo, Juquiá, afluente do rio Juquiá. NUP 6722, alc 1, Brazil, São Paulo, Sete Barras, afluente do rio Ribeira do Iguape. LBP 2658-17416, alc 9, tis 5, Brazil, São Paulo, Iporanga, rio Betari. *S. barbatus* Paranaguá/PR & SC: MCP 10604, alc 21, c&s 6, Brazil, Santa Caraeina, Joinville, afluente rio Cubatão. MCP 13812, alc 2, Brazil, Paraná, Pedra Branca, rio São João. MNRJ 32811, alc 8, tis 1, Brazil, Paraná, Antonina, rio Gervasio. LBP 2077-14417, alc 1, tis 1, Brazil, Paraná, Morretes, Nundiaquara. *S. macropterus*: MZUSP 100696, alc 20 of 37, Brazil, São Paulo, Itanhaém, afluente do rio Castro. UFRGS 8863, alc 1, Brazil, Santa Catarina, São Francisco do Sul. UFRGS 13905 (TEC117B) tis 1, Unknow locality. LBP 461 Unknow locality. LBP 1238-11126, alc 4, tis 1, Brazil, São Paulo, Itanhaém, afluente rio Preto. *S. prionotos* Itapeuna-SP: LBP 7392-35383, alc 5, tis 5, Brazil, São Paulo, Itapeúna, rio Jaguary. *S. prionotos* Ribeira do Iguape: LBP 1267-11105, alc 10, tis 6, Brazil, São Paulo, Miracatu, rio Fau. *S. salmacis*: MCP 28729, alc 20, c&s 3, tis 1, Brazil, Santa Catarina, Florianópolis, afluente do rio Ratones. MCP 29299, alc 3, c&s 1, tis 1, Brazil, Santa Catarina, Praia Grande, Arroio Molha Coco. MCP 37652, alc 1, Brazil, Santa Catarina, Florianópolis, afluente do rio Palha. MNRJ 28883, alc 4, Brazil, Santa Catarina, Florianópolis, afluente rio Ratones.

Table 3. Numbers and references for the molecular data with the species grouped in major taxonomic groups and listed alphabetically. For each molecular marker is informed the GenBank accession numbers or the following codes: + data available, - data not available. Voucher specimens are detailed under Examined material (Table 2).

OUTGROUP TAXA				
Terminal	**Molecular Data**	**GenBank Accesion Number**	**Voucher specimens**	**Reference**
Trichomycteridae				
Copionodon sp	*12S rRNA*	-	-	-
	16S rRNA	+	LBP 7185-34695	This study
	ND4	+	LBP 7185-34695	This study
	Cytb	+	LBP 7185-34695	This study
	RAG1	+	LBP 7185-34695	This study
Trichogenes longipinnis	*12S rRNA*	+	LBP 3862-22409	This study
	16S rRNA	+	LBP 3862-22409	This study
	ND4	+	LBP 3862-22409	This study
	Cytb	-	-	-
	RAG1	+	LBP 3862-22409	This study
Trichomycterus areolatus	*12S rRNA*	AY307252	LBP 994	Shimabukuru-Dias *et al*., 2004
	16S rRNA	AY307287	LBP 994	Shimabukuru-Dias *et al*., 2004
	ND4	AY307217	LBP 994	Shimabukuru-Dias *et al*., 2004
	Cytb	-	-	-
	RAG1	-	-	-
Trichomycterus balios	*12S rRNA*	+	MCP 41292	This study
	16S rRNA	+	MCP 41292	This study
	ND4	+	MCP 41292	This study
	Cytb	-	-	-
	RAG1	-	-	-

Scoloplacidae				
Scoloplax empousa	*12S rRNA*	-	-	-
	16S rRNA	+	UFRGS 12789-1499	This study
	ND4	+	UFRGS 12789-1499	This study
	Cytb	-	-	-
	RAG1	-	-	-
Scoloplax distolothrix	*12S rRNA*	+	MCP 40282	This study
	16S rRNA	+	MCP 40282	This study
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GQ214686	MCP 40282	Cramer *et al*., 2011

Astroblepidae				
Astroblepus spB	*12S rRNA*	+	ANSP 180587-4779	This study
	16S rRNA	HM049008	ANSP 180587-4779	Schaefer *et al*., 2011
	ND4	+	ANSP 180587-4779	This study
	Cytb	HM049097	ANSP 180587-4779	Schaefer *et al*., 2011
	RAG1	-	-	-
Astroblepus spC	*12S rRNA*	+	ANSP 180586- 4794	This study
	16S rRNA	HM049016	ANSP 180586- 4794	Schaefer *et al*., 2011
	ND4	+	ANSP 180586- 4794	This study
	Cytb	HM049104	ANSP 180586- 4794	Schaefer *et al*., 2011
	RAG1	-	-	-
Astroblepus spF	*12S rRNA*	+	ANSP 180594-4839	This study
	16S rRNA	HM049027	ANSP 180594-4839	Schaefer *et al*., 2011
	ND4	-	-	-
	Cytb	HM049115	ANSP 180594-4839	Schaefer *et al*., 2011
	RAG1	-	-	-

Loricariidae				
Hemipsilichthys nimius	*12S rRNA*	AY307256	MCP 30671	Shimabukuru-Dias *et al*., 2004
	16S rRNA	AY307291	MCP 30671	Shimabukuru-Dias *et al*., 2004
	ND4	AY307221	MCP 30671	Shimabukuru-Dias *et al*., 2004
	Cytb	-	-	-
	RAG1	GQ214587	MCP 31990	Cramer *et al*., 2011
Hemipsilichthys gobio	*12S rRNA*	FJ965460	LBP 2368-15363	Roxo *et al*., 2012
	16S rRNA	FJ434499	LBP 2368-15363	Roxo *et al*., 2012
	ND4	+	MCP 42452	This study
	Cytb	FJ965535	LBP 2368-15363	Roxo *et al*., 2012
	RAG1	GQ214586	MCP 42452	Cramer *et al*., 2011
Harttia kronei	*12S rRNA*	+	MCP 31596	This study
	16S rRNA	+	MCP 31596	This study
	ND4	+	MCP 31596	This study
	Cytb	-	-	-
	RAG1	GQ214582	MCP 31596	Cramer *et al*., 2011
Rineloricaria microlepidogaster	*12S rRNA*	+	MCP 25051	This study
	16S rRNA	+	MCP 25051	This study
	ND4	+	MCP 25051	This study
	Cytb	-	-	-
	RAG1	+	MCP 25051	This study
INGROUP TAXA				
Aspidoras albater Cavalcante	*12S rRNA*	+	UFRGS 11357-1195A	This study
	16S rRNA	+	UFRGS 11357-1195A	This study
	ND4	+	UFRGS 11357-1195A	This study
	Cytb	+	UFRGS 11357-1195A	This study
	RAG1	+	UFRGS 11357-1195A	This study
Aspidoras eurycephalus Cavalcante	*12S rRNA*	+	UFRGS 14858-988	This study
	16S rRNA	+	UFRGS 14858-988	This study
	ND4	+	UFRGS 14858-988	This study
	Cytb	+	UFRGS 14858-988	This study
	RAG1	+	UFRGS 14858-988	This study

Aspidoras poecilus Barra do Garcas	*12S rRNA*	GU210542	LBP 1272-11098	Alexandrou *et al*., 2011
	16S rRNA	GU210967	LBP 1272-11098	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU208874	LBP 1272-11098	Alexandrou *et al*., 2011
Aspidoras psammatides	*12S rRNA*	+	LBP 7188	This study
	16S rRNA	+	LBP 7188	This study
	ND4	+	LBP 7188	This study
	Cytb	-	-	-
	RAG1	-	-	-
Aspidoras raimundi	*12S rRNA*	+	MCP 23210	This study
	16S rRNA	+	MCP 23210	This study
	ND4	+	MCP 23210	This study
	Cytb	-	-	-
	RAG1	+	MCP 23210	This study
Aspidoras spA	*12S rRNA*	GU210544	LBP 1437-12304	Alexandrou *et al*., 2011
	16S rRNA	GU210969	LBP 1437-12304	Alexandrou *et al*., 2011
	ND4	GU210119	LBP 1437-12304	Alexandrou *et al*., 2011
	Cytb	GU209294	LBP 1437-12304	Alexandrou *et al*., 2011
	RAG1	GU208880	LBP 1437-12304	Alexandrou *et al*., 2011
Aspidoras spB	*12S rRNA*	+	MNRJ 33856	This study
	16S rRNA	+	MNRJ 33856	This study
	ND4	+	MNRJ 33856	This study
	Cytb	-	-	-
	RAG1	+	MNRJ 33856	This study
Aspidoras spC	*12S rRNA*	+	LBP 7282-35874	This study
	16S rRNA	+	LBP 7282-35874	This study
	ND4	+	LBP 7282-35874	This study
	Cytb	-	-	-
	RAG1	+	LBP 7282-35874	This study

Aspidoras taurus	*12S rRNA*	+	LBP 1427-12306	This study
	16S rRNA	+	LBP 1427-12306	This study
	ND4	+	LBP 1427-12306	This study
	Cytb	+	LBP 1427-12306	This study
	RAG1	+	LBP 1427-12306	This study
Aspidoras virgulatus	*12S rRNA*	-	-	-
	16S rRNA	-	-	-
	ND4	+	UFRGS 11122-1114D	This study
	Cytb	+	UFRGS 11122-1114D	This study
	RAG1	+	UFRGS 11122-1114D	This study
Callichthys callichthys RS	*12S rRNA*	-	-	-
	16S rRNA	+	MCP 29384	This study
	ND4	+	MCP 29384	This study
	Cytb	-	-	-
	RAG1	GQ214572	MCP 29384	Cramer *et al*., 2011
Callichthys callichthys SP	*12S rRNA*	AY307276	LBP 485	Shimabukuru-Dias *et al*., 2004
	16S rRNA	AY307311	LBP 485	Shimabukuru-Dias *et al*., 2004
	ND4	AY307241	LBP 485	Shimabukuru-Dias *et al*., 2004
	Cytb	-	-	-
	RAG1	-	-	-
Callichthys fabricioi	*12S rRNA*	-	-	-
	16S rRNA	-	-	-
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	-	-	-
Callichthys serralabium	*12S rRNA*	-	-	-
	16S rRNA	-	-	-
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	-	-	-

Corydoras adolfoi	*12S rRNA*	+	MCP 46063	This study
	16S rRNA	+	MCP 46063	This study
	ND4	+	MCP 46063	This study
	Cytb	+	MCP 46063	This study
	RAG1	-	-	-
Corydoras aeneus macrosteus	*12S rRNA*	GU210436	LBP 2863-18564	Alexandrou *et al*., 2011
	16S rRNA	GU210861	LBP 2863-18564	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209060	LBP 2863-18564	Alexandrou *et al*., 2011
Corydoras aeneus microps	*12S rRNA*	+	MCP 36303	This study
	16S rRNA	+	MCP 36303	This study
	ND4	+	MCP 36303	This study
	Cytb	+	MCP 36303	This study
	RAG1	+	MCP 36303	This study
Corydoras amapaensis	*12S rRNA*	GU210254	MHNG 2682.025-GF06-201	Alexandrou *et al*., 2011
	16S rRNA	GU210679	MHNG 2682.025-GF06-201	Alexandrou *et al*., 2011
	ND4	GU209834	MHNG 2682.025-GF06-201	Alexandrou *et al*., 2011
	Cytb	GU209316	MHNG 2682.025-GF06-201	Alexandrou *et al*., 2011
	RAG1	GU208902	MHNG 2682.025-GF06-201	Alexandrou *et al*., 2011
Corydoras ambiacus	*12S rRNA*	+	MHNG 2711.004-PE08-928	This study
	16S rRNA	+	MHNG 2711.004-PE08-928	This study
	ND4	+	MHNG 2711.004-PE08-928	This study
	Cytb	+	MHNG 2711.004-PE08-928	This study
	RAG1	+	MHNG 2711.004-PE08-928	This study
Corydoras approuaguensis	*12S rRNA*	+	MCP 46057	This study
	16S rRNA	+	MCP 46057	This study
	ND4	+	MCP 46057	This study
	Cytb	-	-	-
	RAG1	+	MCP 46057	This study

Corydoras araguaiaensis	*12S rRNA*	GU210209	LBP 7212-32879	Alexandrou *et al.*, 2011
	16S rRNA	GU210634	LBP 7212-32879	Alexandrou *et al.*, 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU208909	LBP 7212-32879	Alexandrou *et al.*, 2011
Corydoras areio	*12S rRNA*	+	LBP 10098-46623	This study
	16S rRNA	+	LBP 10098-46623	This study
	ND4	+	LBP 10098-46623	This study
	Cytb	-	-	
	RAG1	+	LBP 10098-46623	This study
Corydoras arcuatus	*12S rRNA*	+	MCP 46064	This study
	16S rRNA	+	MCP 46064	This study
	ND4	+	MCP 46064	This study
	Cytb	+	MCP 46064	This study
	RAG1	+	MCP 46064	This study
Corydoras armatus	*12S rRNA*	-	-	-
	16S rRNA	-	-	-
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	-	-	-
Corydoras atropersonatus	*12S rRNA*	GU210326	ANSP 182532-1472	Alexandrou *et al.*, 2011
	16S rRNA	GU210751	ANSP 182532-1472	Alexandrou *et al.*, 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU208917	ANSP 182532-1472	Alexandrou *et al.*, 2011
Corydoras boesemani	*12S rRNA*	GU210222	MHNG 2673.074-SU05-127	Alexandrou *et al.*, 2011
	16S rRNA	GU210647	MHNG 2673.074-SU05-127	Alexandrou *et al.*, 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU208929	MHNG 2673.074-SU05-127	Alexandrou *et al.*, 2011

Corydoras breei	*12S rRNA*	GU210224	MHNG 2671.094-SU05-427	Alexandrou *et al*., 2011
	16S rRNA	GU210649	MHNG 2671.094-SU05-427	Alexandrou *et al*., 2011
	ND4	GU209804	MHNG 2671.094-SU05-427	Alexandrou *et al*., 2011
	Cytb	GU209398	MHNG 2671.094-SU05-427	Alexandrou *et al*., 2011
	RAG1	GU208981	MHNG 2671.094-SU05-427	Alexandrou *et al*., 2011
Corydoras brevirostris	*12S rRNA*	+	LBP 3080-19704	This study
	16S rRNA	+	LBP 3080-19704	This study
	ND4	-	-	-
	Cytb	+	LBP 3080-19704	This study
	RAG1	+	LBP 3080-19704	This study
Corydoras britskii	*12S rRNA*	GU210546	LBP 688-8112	Alexandrou *et al*., 2011
	16S rRNA	GU210971	LBP 688-8112	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU208884	LBP 688-8112	Alexandrou *et al*., 2011
Corydoras burgessi	*12S rRNA*	GU210205	LBP 6867-32741	Alexandrou *et al*., 2011
	16S rRNA	GU210630	LBP 6867-32741	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU208939	LBP 6867-32741	Alexandrou *et al*., 2011
Corydoras caudimaculatus	*12S rRNA*	GU210549	LBP 562-7253	Alexandrou *et al*., 2011
	16S rRNA	GU210974	LBP 562-7253	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU208941	LBP 562-7253	Alexandrou *et al*., 2011
Corydoras cervinus	*12S rRNA*	+	LBP 10097-46621	This study
	16S rRNA	+	LBP 10097-46621	This study
	ND4	+	LBP 10097-46621	This study
	Cytb	-	-	-
	RAG1	+	LBP 10097-46621	This study

Corydoras cochui Araguaia	*12S rRNA*	-	-	-
	16S rRNA	+	LBP 1853-13270	This study
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	+	LBP 1853-13270	This study
Corydoras condiscipulus	*12S rRNA*	GU210258	MHNG 2682.024-GF06-208	Alexandrou *et al*., 2011
	16S rRNA	GU210683	MHNG 2682.024-GF06-208	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU208987	MHNG 2682.024-GF06-208	Alexandrou *et al*., 2011
Corydoras coppenamensis	*12S rRNA*	GU210234	MHNG 2690.017-SU1-463	Alexandrou *et al*., 2011
	16S rRNA	GU210659	MHNG 2690.017-SU1-463	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU208989	MHNG 2690.017-SU1-463	Alexandrou *et al*., 2011
Corydoras difluviatilis	*12S rRNA*	GU210397	LBP 382-4624	Alexandrou *et al*., 2011
	16S rRNA	GU210822	LBP 382-4624	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209002	LBP 382-4624	Alexandrou *et al*., 2011
Corydoras diphyes	*12S rRNA*	+	LBP 2813-18904	This study
	16S rRNA	+	LBP 2813-18904	This study
	ND4	+	LBP 2813-18904	This study
	Cytb	+	LBP 2813-18904	This study
	RAG1	+	LBP 2813-18904	This study
Corydoras ehrhardti	*12S rRNA*	GU210399	LBP 741-7990	Alexandrou *et al*., 2011
	16S rRNA	GU210824	LBP 741-7990	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209006	LBP 741-7990	Alexandrou *et al*., 2011

Corydoras ehrhardti LBP 741-8893	*12S rRNA*	GU210400	LBP 741-8893	Alexandrou *et al*., 2011
	16S rRNA	GU210825	LBP 741-8893	Alexandrou *et al*., 2011
	ND4	GU209786	LBP 741-8893	Alexandrou *et al*., 2011
	Cytb	GU209426	LBP 741-8893	Alexandrou *et al*., 2011
	RAG1	GU209007	LBP 741-8893	Alexandrou *et al*., 2011
Corydoras elegans Belem	*12S rRNA*	GU210231	MHNG 2602.19-BR98-161	Alexandrou *et al*., 2011
	16S rRNA	GU210656	MHNG 2602.19-BR98-161	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	+	MCP 46035	This study
	RAG1	+	MCP 46035	This study
Corydoras elegans Pantanal	*12S rRNA*	GU210386	LBP 1959-13647	Alexandrou *et al*., 2011
	16S rRNA	GU210811	LBP 1959-13647	Alexandrou *et al*., 2011
	ND4	GU209964	LBP 1959-13647	Alexandrou *et al*., 2011
	Cytb	GU209367	LBP 1959-13647	Alexandrou *et al*., 2011
	RAG1	GU208953	LBP 1959-13647	Alexandrou *et al*., 2011
Corydoras elegans Peru	*12S rRNA*	+	MCP 46629	This study
	16S rRNA	+	MCP 46629	This study
	ND4	+	MCP 46629	This study
	Cytb	+	MCP 46629	This study
	RAG1	+	MCP 46629	This study
Corydoras ellisae	*12S rRNA*	GU210327	ANSP 182420-1470	Alexandrou *et al*., 2011
	16S rRNA	GU210752	ANSP 182420-1470	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU208918	ANSP 182420-1470	Alexandrou *et al*., 2011
Corydoras ephippifer	*12S rRNA*	GU210228	MHNG 2602.12-BR98-143	Alexandrou *et al*., 2011
	16S rRNA	GU210653	MHNG 2602.12-BR98-143	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU208905	MHNG 2602.12-BR98-143	Alexandrou *et al*., 2011

Corydoras flaveolus	*12S rRNA*	+	LBP 3670-21758	This study
	16S rRNA	+	LBP 3670-21758	This study
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	+	LBP 3670-21758	This study
Corydoras geoffroy	*12S rRNA*	GU210249	MHNG 2683.016	Alexandrou *et al*., 2011
	16S rRNA	GU210674	MHNG 2683.016	Alexandrou *et al*., 2011
	ND4	GU209829	MHNG 2683.016	Alexandrou *et al*., 2011
	Cytb	GU209379	MHNG 2683.016	Alexandrou *et al*., 2011
	RAG1	GU208964	MHNG 2683.016	Alexandrou *et al*., 2011
Corydoras gossei	*12S rRNA*	GU210403	LBP 544-7168	Alexandrou *et al*., 2011
	16S rRNA	GU210828	LBP 544-7168	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209031	LBP 544-7168	Alexandrou *et al*., 2011
Corydoras gracilis	*12S rRNA*	+	MCP 46056	This study
	16S rRNA	+	MCP 46056	This study
	ND4	+	MCP 46056	This study
	Cytb	-	-	-
	RAG1	+	MCP 46056	This study
Corydoras guapore	*12S rRNA*	+	LBP 10089-46595	This study
	16S rRNA	+	LBP 10089-46595	This study
	ND4	+	LBP 10089-46595	This study
	Cytb	+	LBP 10089-46595	This study
	RAG1	+	LBP 10089-46595	This study
Corydoras guianensis	*12S rRNA*	GU210278	MHNG 2718.036-SU08-583	Alexandrou et al. 2011
	16S rRNA	GU210703		Alexandrou et al. 2011
	ND4	GU209858		Alexandrou et al. 2011
	Cytb	GU209603		Alexandrou et al. 2011
	RAG1	GU209181		Alexandrou et al. 2011

Corydoras habrosus	*12S rRNA*	+	LBP 2808-18893	This study
	16S rRNA	+	LBP 2808-18893	This study
	ND4	+	LBP 2808-18893	This study
	Cytb	+	LBP 2808-18893	This study
	RAG1	+	LBP 2808-18893	This study
Corydoras hastatus australe	*12S rRNA*	+	CZCEN 331	This study
	16S rRNA	+	CZCEN 331	This study
	ND4	+	CZCEN 331	This study
	Cytb	+	CZCEN 331	This study
	RAG1	+	CZCEN 331	This study
Corydoras imitator	*12S rRNA*	GU210188	LBP 6862-32502	Alexandrou *et al*., 2011
	16S rRNA	GU210613	LBP 6862-32502	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209046	LBP 6862-32502	Alexandrou *et al*., 2011
Corydoras julii	*12S rRNA*	GU210407	LBP 1359-11429	Alexandrou *et al*., 2011
	16S rRNA	GU210832	LBP 1359-11429	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209048	LBP 1359-11429	Alexandrou *et al*., 2011
Corydoras kanei	*12S rRNA*	+	ANSP 180696-2427	This study
	16S rRNA	+	ANSP 180696-2427	This study
	ND4	+	ANSP 180696-2427	This study
	Cytb	+	ANSP 180696-2427	This study
	RAG1	+	ANSP 180696-2427	This study
Corydoras lacerdai	*12S rRNA*	GU210449	LBP 1966-13676	Alexandrou *et al*., 2011
	16S rRNA	GU210874	LBP 1966-13676	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209268	LBP 1966-13676	Alexandrou *et al*., 2011

Corydoras leucomelas	*12S rRNA*	+	MCP 45748	This study
	16S rRNA	+	MCP 45748	This study
	ND4	+	MCP 45748	This study
	Cytb	+	MCP 45748	This study
	RAG1	-	-	-
Corydoras longipinnis	*12S rRNA*	+	MCP 45225	This study
	16S rRNA	+	MCP 45225	This study
	ND4	+	MCP 45225	This study
	Cytb	-	-	-
	RAG1	+	MCP 45225	This study
Corydoras loretoensis	*12S rRNA*	GU210325	ANSP 181122-1475	Alexandrou *et al*., 2011
	16S rRNA	GU210750	ANSP 181122-1475	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209057	ANSP 181122-1475	Alexandrou *et al*., 2011
Corydoras melanistius	*12S rRNA*	GU210330	ANSP 180693-1460	Alexandrou *et al*., 2011
	16S rRNA	GU210755	ANSP 180693-1460	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209066	ANSP 180693-1460	Alexandrou *et al*., 2011
Corydoras melini	*12S rRNA*	+	MCP 46062	This study
	16S rRNA	+	MCP 46062	This study
	ND4	+	MCP 46062	This study
	Cytb	+	MCP 46062	This study
	RAG1	+	MCP 46062	This study
Corydoras metae	*12S rRNA*	+	LBP 2793-18854	This study
	16S rRNA	+	LBP 2793-18854	This study
	ND4	-	-	-
	Cytb	+	LBP 2793-18854	This study
	RAG1	+	LBP 2793-18854	This study

Corydoras napoensis	*12S rRNA*	GU210390	LBP 1962-13660	Alexandrou *et al*., 2011
	16S rRNA	+	MCP 46630	This study
	ND4	GU209968	LBP 1962-13660	Alexandrou *et al*., 2011
	Cytb	GU209388	LBP 1962-13660	Alexandrou *et al*., 2011
	RAG1	GU208972	LBP 1962-13660	Alexandrou *et al*., 2011
Corydoras narcissus	*12S rRNA*	+	LBP 10094-46610	This study
	16S rRNA	+	LBP 10094-46610	This study
	ND4	+	LBP 10094-46610	This study
	Cytb	+	LBP 10094-46610	This study
	RAG1	+	LBP 10094-46610	This study
Corydoras nattereri Bahia	*12S rRNA*	-	-	-
	16S rRNA	-	-	-
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	-	-	-
Corydoras nattereri Guanabara	*12S rRNA*	+	MNRJ 37043-3281	This study
	16S rRNA	+	MNRJ 37043-3281	This study
	ND4	+	MNRJ 37043-3281	This study
	Cytb	+	MNRJ 37043-3281	This study
	RAG1	+	MNRJ 37043-3281	This study
Corydoras nattereri Guanabara HV11-75	*12S rRNA*	+	LBP 3480-16042	This study
	16S rRNA	+	LBP 3480-16042	This study
	ND4	+	LBP 3480-16042	This study
	Cytb	+	LBP 3480-16042	This study
	RAG1	+	LBP 3480-16042	This study
Corydoras nattereri Macaé	*12S rRNA*	+	LBP 2574-17106	This study
	16S rRNA	+	LBP 2574-17106	This study
	ND4	+	LBP 2574-17106	This study
	Cytb	+	LBP 2574-17106	This study
	RAG1	+	LBP 2574-17106	This study

Corydoras nattereri Paraíba do Sul	*12S rRNA*	+	LBP 5777-28181	This study
	16S rRNA	+	LBP 5777-28181	This study
	ND4	+	LBP 5777-28181	This study
	Cytb	+	LBP 5777-28181	This study
	RAG1	+	LBP 5777-28181	This study
Corydoras nattereri Paranaguá1	*12S rRNA*	AY307272	LBP 778-8301	Shimabukuru-Dias *et al*., 2004
	16S rRNA	AY307307	LBP 778-8301	Shimabukuru-Dias *et al*., 2004
	ND4	AY307237	LBP 778-8301	Shimabukuru-Dias *et al*., 2004
	Cytb	-	-	-
	RAG1	+	LBP 778-8301	This study
Corydoras nattereri Paranaguá2	*12S rRNA*	GU210411	LBP 903-9697	Alexandrou *et al*., 2011
	16S rRNA	GU210836	LBP 903-9697	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209083	LBP 903-9697	Alexandrou *et al*., 2011
Corydoras nattereri Ribeira do Iguape	*12S rRNA*	AY307271	LBP 1266-11110	Shimabukuru-Dias *et al*., 2004
	16S rRNA	AY307306	LBP 1266-11110	Shimabukuru-Dias *et al*., 2004
	ND4	AY307236	LBP 1266-11110	Shimabukuru-Dias *et al*., 2004
	Cytb	-	-	-
	RAG1	+	LBP 1266-11110	This study
Corydoras nattereri São João1	*12S rRNA*	+	MNRJ 37470-3506	This study
	16S rRNA	+	MNRJ 37470-3506	This study
	ND4	+	MNRJ 37470-3506	This study
	Cytb	+	MNRJ 37470-3506	This study
	RAG1	+	MNRJ 37470-3506	This study
Corydoras nattereri São João2	*12S rRNA*	+	MNRJ 37470-3507	This study
	16S rRNA	+	MNRJ 37470-3507	This study
	ND4	+	MNRJ 37470-3507	This study
	Cytb	+	MNRJ 37470-3507	This study
	RAG1	+	MNRJ 37470-3507	This study

Corydoras nattereri Tietê	*12S rRNA*	+	MHNG 2587.012-151.10	This study
	16S rRNA	+	MHNG 2587.012-151.10	This study
	ND4	+	MHNG 2587.012-151.10	This study
	Cytb	+	MHNG 2587.012-151.10	This study
	RAG1	+	MHNG 2587.012-151.10	This study
Corydoras nattereri Tietê HV11-76	*12S rRNA*	+	LBP 3480-16042	This study
	16S rRNA	+	LBP 3480-16042	This study
	ND4	+	LBP 3480-16042	This study
	Cytb	+	LBP 3480-16042	This study
	RAG1	+	LBP 3480-16042	This study
Corydoras nijsseni	*12S rRNA*	GU210190	LBP 6861-32532	Alexandrou *et al*., 2011
	16S rRNA	GU210615	LBP 6861-32532	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209089	LBP 6861-32532	Alexandrou *et al*., 2011
Corydoras ourastigma	*12S rRNA*	+	MCP 28799	This study
	16S rRNA	+	MCP 28799	This study
	ND4	+	MCP 28799	This study
	Cytb	-	-	
	RAG1	GU208884	MCP 28799	Cramer *et al*., 2011
Corydoras paleatus Argentina	*12S rRNA*	+	MHNG 2678.017-PR015	This study
	16S rRNA	+	MHNG 2678.017-PR015	This study
	ND4	+	MHNG 2678.017-PR015	This study
	Cytb	+	MHNG 2678.017-PR015	This study
	RAG1	+	MHNG 2678.017-PR015	This study
Corydoras paleatus CW24 MA61	*12S rRNA*	GU210354	MA61	Alexandrou *et al*., 2011
	16S rRNA	GU210779	MA61	Alexandrou *et al*., 2011
	ND4	GU209933	MA61	Alexandrou *et al*., 2011
	Cytb	GU209394	MA61	Alexandrou *et al*., 2011
	RAG1	GU208978	MA61	Alexandrou *et al*., 2011

Corydoras paleatus Guaíba	*12S rRNA*	GU210413	LBP 567-7416	Alexandrou *et al*., 2011
	16S rRNA	GU210838	LBP 567-7416	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209099	LBP 567-7416	Alexandrou *et al*., 2011
Corydoras paleatus Long Fin MA128	*12S rRNA*	GU210148	MA128	Alexandrou *et al*., 2011
	16S rRNA	GU210573	MA128	Alexandrou *et al*., 2011
	ND4	GU209729	MA128	Alexandrou *et al*., 2011
	Cytb	GU209657	MA128	Alexandrou *et al*., 2011
	RAG1	GU209234	MA128	Alexandrou *et al*., 2011
Corydoras panda	*12S rRNA*	+	MCP 45746	This study
	16S rRNA	-	-	-
	ND4	+	MCP 45746	This study
	Cytb	+	MCP 45746	This study
	RAG1	+	MCP 45746	This study
Corydoras pantanalensis	*12S rRNA*	GU210416	LBP 691-8126	Alexandrou *et al*., 2011
	16S rRNA	GU210841	LBP 691-8126	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209105	LBP 691-8126	Alexandrou *et al*., 2011
Corydoras polystictus Caceres	*12S rRNA*	+	LBP 8477-42469	This study
	16S rRNA	+	LBP 8477-42469	This study
	ND4	-	-	-
	Cytb	+	LBP 8477-42469	This study
	RAG1	+	LBP 8477-42469	This study
Corydoras pulcher	*12S rRNA*	GU210419	LBP 909-8957	Alexandrou *et al*., 2011
	16S rRNA	GU210844	LBP 909-8957	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209113	LBP 909-8957	Alexandrou *et al*., 2011

Corydoras punctatus	*12S rRNA*	GU210269	MHNG 2724.029-SU08-1115	Alexandrou *et al*., 2011
	16S rRNA	GU210694	MHNG 2724.029-SU08-1115	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209115	MHNG 2724.029-SU08-1115	Alexandrou *et al*., 2011
Corydoras pygmaeus	*12S rRNA*	+	LBP 2791-18848	This study
	16S rRNA	+	LBP 2791-18848	This study
	ND4	+	LBP 2791-18848	This study
	Cytb	+	LBP 2791-18848	This study
	RAG1	+	LBP 2791-18848	This study
Corydoras rabauti	*12S rRNA*	+	LBP 2827-18940	This study
	16S rRNA	+	LBP 2827-18940	This study
	ND4	+	LBP 2827-18940	This study
	Cytb	+	LBP 2827-18940	This study
	RAG1	+	LBP 2827-18940	This study
Corydoras reticulatus	*12S rRNA*	+	MHNG 2711.003-PE08-925	This study
	16S rRNA	+	MHNG 2711.003-PE08-925	This study
	ND4	+	MHNG 2711.003-PE08-925	This study
	Cytb	-	-	-
	RAG1	+	MHNG 2711.003-PE08-925	This study
Corydoras robineae	*12S rRNA*	+	MCP 46065	This study
	16S rRNA	-	-	-
	ND4	+	MCP 46065	This study
	Cytb	-	-	-
	RAG1	+	MCP 46065	This study
Corydoras sanchesi	*12S rRNA*	+	MCP 46181	This study
	16S rRNA	+	MCP 46181	This study
	ND4	+	MCP 46181	This study
	Cytb	+	MCP 46181	This study
	RAG1	+	MCP 46181	This study

Corydoras schwartzi	*12S rRNA*	GU210421	LBP 1783-7120	Alexandrou *et al*., 2011
	16S rRNA	+	LBP 1783-7120	This study
	ND4	+	LBP 1783-7120	This study
	Cytb	+	LBP 1783-7120	This study
	RAG1	GU209130	LBP 1783-7120	Alexandrou *et al*., 2011
Corydoras semiaquilus	*12S rRNA*	GU210321	ANSP 178613-1459	Alexandrou *et al*., 2011
	16S rRNA	+	MCP 46625	This study
	ND4	-	-	-
	Cytb	+	MCP 46625	This study
	RAG1	GU209132	ANSP 178613-1459	Alexandrou *et al*., 2011
Corydoras seussi	*12S rRNA*	GU210423	LBP 545-7123	Alexandrou *et al*., 2011
	16S rRNA	GU210848	LBP 545-7123	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209139	LBP 545-7123	Alexandrou *et al*., 2011
Corydoras simulatus	*12S rRNA*	+	LBP 2820-18924	This study
	16S rRNA	+	LBP 2820-18924	This study
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	+	LBP 2820-18924	This study
Corydoras sodalis	*12S rRNA*	+	MCP 45719	This study
	16S rRNA	-	-	-
	ND4	+	MCP 45719	This study
	Cytb	+	MCP 45719	This study
	RAG1	+	MCP 45719	This study
Corydoras spA	*12S rRNA*	+	LBP 10101-46632	This study
	16S rRNA	+	LBP 10101-46632	This study
	ND4	+	LBP 10101-46632	This study
	Cytb	+	LBP 10101-46632	This study
	RAG1	+	LBP 10101-46632	This study

Corydoras spB	*12S rRNA*	+	LBP uncat- 2011100101	This study
	16S rRNA	+	LBP uncat- 2011100101	This study
	ND4	+	LBP uncat- 2011100101	This study
	Cytb	+	LBP uncat- 2011100101	This study
	RAG1	+	LBP uncat- 2011100101	This study
Corydoras spC	*12S rRNA*	+	MCP 45747	This study
	16S rRNA	+	MCP 45747	This study
	ND4	+	MCP 45747	This study
	Cytb	+	MCP 45747	This study
	RAG1	+	MCP 45747	This study
Corydoras splendens	*12S rRNA*	+	MCP 45750	This study
	16S rRNA	+	MCP 45750	This study
	ND4	+	MCP 45750	This study
	Cytb	+	MCP 45750	This study
	RAG1	+	MCP 45750	This study
Corydoras stenocephalus	*12S rRNA*	+	MUSM 33865	This study
	16S rRNA	-	-	-
	ND4	+	MUSM 33865	This study
	Cytb	-	-	-
	RAG1	+	MUSM 33865	This study
Corydoras treitlii	*12S rRNA*	-	-	-
	16S rRNA	+	MCP 46038	This study
	ND4	+	MCP 46038	This study
	Cytb	-	-	-
	RAG1	+	MCP 46038	This study
Corydoras trilineatus	*12S rRNA*	+	MCP 45745	This study
	16S rRNA	-	-	-
	ND4	+	MCP 45745	This study
	Cytb	+	MCP 45745	This study
	RAG1	+	MCP 45745	This study

Corydoras tukano	*12S rRNA*	GU210200	LBP 6872-32672	Alexandrou *et al*., 2011
	16S rRNA	GU210625	LBP 6872-32672	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209248	LBP 6872-32672	Alexandrou *et al*., 2011
Corydoras undulatus Guaíba	*12S rRNA*	GU210441	LBP 566-7386	Alexandrou *et al*., 2011
	16S rRNA	GU210866	LBP 566-7386	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209249	LBP 566-7386	Alexandrou *et al*., 2011
Corydoras urucu	*12S rRNA*	+	LBP 10095-46546	This study
	16S rRNA	+	LBP 10095-46546	This study
	ND4	+	LBP 10095-46546	This study
	Cytb	+	LBP 10095-46546	This study
	RAG1	-	-	-
Corydoras weitzmani	*12S rRNA*	+	MCP 46633	This study
	16S rRNA	-	-	-
	ND4	+	MCP 46633	This study
	Cytb	+	MCP 46633	This study
	RAG1	+	MCP 46633	This study
Corydoras wotroi	*12S rRNA*	+	MCP 46049	This study
	16S rRNA	+	MCP 46049	This study
	ND4	+	MCP 46049	This study
	Cytb	+	MCP 46049	This study
	RAG1	+	MCP 46049	This study
Corydoras xinguensis	*12S rRNA*	+	MCP 30146	This study
	16S rRNA	-	-	-
	ND4	-	-	-
	Cytb	+	MCP 30146	This study
	RAG1	-	-	-

Corydoras zygatus	*12S rRNA*	-	-	-
	16S rRNA	+	LBP 2830-18945	This study
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	+	LBP 2830-18945	This study
Dianema longibarbis	*12S rRNA*	GU210442	LBP 557-7230	Alexandrou *et al*., 2011
	16S rRNA	GU210867	LBP 557-7230	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	+	LBP 5274-26494	This study
Dianema urostriatum	*12S rRNA*	AY307278	LBP 558-13631	Shimabukuru-Dias *et al*., 2004
	16S rRNA	AY307313	LBP 558-13631	Shimabukuru-Dias *et al*., 2004
	ND4	AY307243	LBP 558-13631	Shimabukuru-Dias *et al*., 2004
	Cytb	+	LBP 1954	This study
	RAG1	+	LBP 1954	This study
Hoplosternum littorale	*12S rRNA*	GU210443	LBP 210-4134	Alexandrou *et al*., 2011
	16S rRNA	GU210868	LBP 210-4134	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209261	LBP 210-4134	Alexandrou *et al*., 2011
Hoplosternum magdalenae	*12S rRNA*	-	-	-
	16S rRNA	-	-	-
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	-	-	-
Hoplosternum punctatum	*12S rRNA*	-	-	-
	16S rRNA	-	-	-
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	-	-	-

Lepthoplosternum altamazonicum	*12S rRNA*	AY307282	MCP 34559	Shimabukuru-Dias *et al*., 2004
	16S rRNA	+	MCP 34559	This study
	ND4	AY307247	MCP 34559	Shimabukuru-Dias *et al*., 2004
	Cytb	-	-	-
	RAG1	-	-	-
Lepthoplosternum beni	*12S rRNA*	-	-	-
	16S rRNA	-	-	-
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	-	-	-
Lepthoplosternum pectorale	*12S rRNA*	-	-	-
	16S rRNA	+	LBP 1554-12341	This study
	ND4	+	LBP 1554-12341	This study
	Cytb	-	-	-
	RAG1	+	LBP 1554-12341	This study
Lepthoplosternum stellatum	*12S rRNA*	-	-	-
	16S rRNA	-	-	-
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	-	-	-
Lepthoplosternum tordilho	*12S rRNA*	+	MCP 21164	This study
	16S rRNA	+	MCP 21164	This study
	ND4	AY307249	MCP 21164	Shimabukuru-Dias *et al*., 2004
	Cytb	-	-	-
	RAG1	-	-	-
Lepthoplosternum ucamara	*12S rRNA*	+	MUSM 33717	This study
	16S rRNA	+	MUSM 33717	This study
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	+	MUSM 33717	This study

Megalechis picta	*12S rRNA*	AY307283	LBP 526	Shimabukuru-Dias *et al*., 2004
	16S rRNA	AY307318	LBP 526	Shimabukuru-Dias *et al*., 2004
	ND4	AY307248	LBP 526	Shimabukuru-Dias *et al*., 2004
	Cytb	-	-	-
	RAG1	+	ANSP 190489-1530	This study
Megalechis thoracata	*12S rRNA*	AY307281	LBP 239-8845	Shimabukuru-Dias *et al*., 2004
	16S rRNA	AY307316	LBP 239-8845	Shimabukuru-Dias *et al*., 2004
	ND4	AY307246	LBP 239-8845	Shimabukuru-Dias *et al*., 2004
	Cytb	-	-	-
	RAG1	-	-	-
Scleromystax barbatus Itanhaem-Santos	*12S rRNA*	GU210459	LBP 1237-11125	Alexandrou *et al*., 2011
	16S rRNA	GU210884	LBP 1237-11125	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209279	LBP 1237-11125	Alexandrou *et al*., 2011
Scleromystax barbatus Ribeira do Iguape	*12S rRNA*	GU210447	LBP 2658-17416	Alexandrou *et al*., 2011
	16S rRNA	GU210872	LBP 2658-17416	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209265	LBP 2658-17416	Alexandrou *et al*., 2011
Scleromystax barbatus Paranaguá/PR & SC	*12S rRNA*	GU210444	LBP 2077-14417	Alexandrou *et al*., 2011
	16S rRNA	GU210869	LBP 2077-14417	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209262	LBP 2077-14417	Alexandrou *et al*., 2011
Scleromystax macropterus	*12S rRNA*	+	UFRGS 13905-117B	This study
	16S rRNA	+	UFRGS 13905-117B	This study
	ND4	+	UFRGS 13905-117B	This study
	Cytb	+	UFRGS 13905-117B	This study
	RAG1	+	UFRGS 13905-117B	This study

Scleromystax prionotos Itapeuna-SP	*12S rRNA*	+	LBP 7392-35383	This study
	16S rRNA	+	LBP 7392-35383	This study
	ND4	+	LBP 7392-35383	This study
	Cytb	+	LBP 7392-35383	This study
	RAG1	+	LBP 7392-35383	This study
Scleromystax prionotos Ribeira do Iguape	*12S rRNA*	GU210456	LBP 1267-11105	Alexandrou *et al*., 2011
	16S rRNA	GU210881	LBP 1267-11105	Alexandrou *et al*., 2011
	ND4	-	-	-
	Cytb	-	-	-
	RAG1	GU209274	LBP 1267-11105	Alexandrou *et al*., 2011
Scleromystax salmacis	*12S rRNA*	+	MCP 29299	This study
	16S rRNA	+	MCP 29299	This study
	ND4	+	MCP 29299	This study
	Cytb	+	MCP 29299	This study
	RAG1	+	MCP 29299	This study

Table 4. Primers used in this study including annealing temperature

DNA region	Primer Name	Primer Sequences	Annealing temperature
12S rRNA	12sA-5F	5′-AAACTGGGATTAGATACCCCACTAT-3′	58°C
	12sB-3R	5′-GAGGGTGACGGGCGGTGTGT-3′	
16S rRNA	16sA5F	5′-CGCCTGTTTATCAAAAACAT-3′	53°C
	16sBR3R	5′-CCGGTCTGAACTCAGATCACGT-3′	
ND4	L11935	5′-CCAAAAGCACACGTAGAAGC-3′	53°C
	H12857	5′-ACCAAGAGTTTTGGTTCCTA-3′	
Cytb	GLU-CoryF	5′-CGACTTGAAAACCCATTGTTG-3′	53°C
	tRNATHr	5′-CCGGCGCTTTATGAGTTAAG-3′	
Rag1	Rag1MAF	5′-AAGGAGAGGGGTATAGATGATA-3′	54°C
	Rag1MAR	5′-GCAAAACGCTGAGAGTTGAA-3′	

Table 5. Partial data matrix analyzed by Cladistic parsimony, characters 0 from 213 corresponds to morphology and 214 and 215 to behavior.

	0	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Copionodon sp	0	0	0	0	0	0	0	?	0	0	0	0	0	0	0	0	0	0	0	0
Trichogenes longipinnis	0	0	1	0	0	0	1	?	0	0	1	0	0	0	0	0	0	0	0	0
Trichomycterus areolatus	0	0	0	0	0	0	0	?	0	0	1	0	2	?	?	0	0	0	1	0
Trichomycterus balios	0	0	0	0	0	0	0	?	0	0	1	0	2	?	?	0	0	0	1	0
Scoloplax distolothrix	2	1	0	2	0	3	0	?	0	?	?	2	1	1	?	2	0	0	0	6
Scoloplax empousa	2	1	0	2	0	3	0	?	0	?	?	2	1	1	?	2	0	0	0	6
Astroblepus spB	1	0	0	0	0	0	0	?	0	?	?	0	0	0	0	0	0	0	1	6
Astroblepus spC	1	0	0	0	0	0	0	?	0	?	?	0	0	0	0	0	0	0	1	6
Astroblepus spF	1	0	0	0	0	0	0	?	0	?	?	0	0	0	0	0	0	0	1	6
Hemipsilichthys gobio	1	0	0	0	0	1	0	?	0	0	0	0	0	0	1	0	2	0	1	6
Hemipsilichthys nimius	1	0	0	0	0	1	0	?	0	0	0	0	0	0	1	0	2	0	1	6
Harttia kronei	1	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2	0	1	6
Rineloricaria microlepidogaster	2	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	2	0	0	6
Aspidoras albater Cavalcante	2	0	2	2	0	1	0	0	0	1	1	0	0	0	0	1	1	1	0	3
Aspidoras eurycephalus Cavalcante	2	0	2	2	0	1	0	0	0	1	1	0	0	0	0	1	0	1	0	3
Aspidoras poecilus Barra do Garcas	2	0	2	2	0	1	0	0	0	1	1	0	0	0	0	1	1	1	0	3
Aspidoras psammatides	2	0	2	2	0	1	0	0	0	1	1	0	1	0	0	1	0	1	1	2
Aspidoras raimundi	2	0	1	2	0	1	0	0	0	1	1	0	0	1	?	1	0	1	0	3
Aspidoras spA	2	0	1	2	0	1	0	0	0	1	1	0	0	0	0	1	0	1	0	3
Aspidoras spB	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aspidoras spC	2	0	2	2	0	1	0	0	0	1	1	0	0	0	0	1	1	1	0	3
Aspidoras taurus	2	0	2	1	1	1	0	0	0	1	1	0	0	0	0	1	1	1	0	3
Aspidoras virgulatus	2	0	1	2	0	1	0	0	0	1	1	0	1	1	?	1	0	1	0	3
Callichthys callichthys RS	2	0	0	0	0	2	1	?	1	0	1	3	0	0	0	2	0	1	2	5
Callichthys callichthys SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Callichthys fabricioi	2	0	0	0	1	2	1	?	1	0	1	3	0	0	0	2	0	1	2	5
Callichthys serralabium	2	0	0	0	0	2	1	?	1	0	1	3	0	0	0	2	0	1	2	5
Corydoras adolfoi	2	0	1	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2

	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Corydoras aeneus macrosteus	2	0	1	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras aeneus microps	2	1	1	1	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras amapaensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ambiacus	2	0	0	0	0	1	0	1	0	2	1	0	1	1	?	1	0	1	0	1
Corydoras approuaguensis	2	0	0	0	0	1	0	1	0	2	1	0	1	1	?	1	0	1	0	1
Corydoras araguaiaensis	2	0	0	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras arcuatus	1	0	0	2	1	1	0	0	0	2	1	1	1	1	?	1	0	1	0	2
Corydoras armatus	2	0	0	1	1	1	0	0	0	2	1	2	1	1	?	1	0	1	0	2
Corydoras atropersonatus	2	0	0	2	0	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras boesemani	2	0	1	1	0	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras breei	2	0	1	1	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras brevirostris	2	0	1	1	0	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras britskii	1	1	1	1	1	1	0	1	0	1	1	2	1	1	?	1	0	1	0	2
Corydoras burgessi	2	0	0	2	0	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras caudimaculatus	2	0	1	2	1	1	0	0	0	1	1	1	1	1	?	1	0	1	0	2
Corydoras cervinus	2	0	0	0	0	1	0	1	0	2	1	0	1	1	?	1	0	1	1	1
Corydoras condisciplus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras areio	2	0	0	0	0	1	0	1	0	2	1	0	1	1	?	1	0	1	1	1
Corydoras cochui	2	0	1	1	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras coppenamensis	2	0	1	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras difluviatilis	2	0	2	1	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras diphyes	1	0	1	1	1	1	0	0	0	1	1	1	1	1	?	1	0	1	0	2
Corydoras ehrhardti	2	0	1	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras ehrhardti LBP741-8893	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras elegans Belem	2	1	1	2	0	1	0	0	0	1	1	0	1	1	?	1	0	1	0	1
Corydoras elegans Peru	2	1	1	2	0	1	0	0	0	1	1	0	1	1	?	1	0	1	0	1
Corydoras elegans Pantanal	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ellisae	2	0	1	0	0	1	0	1	0	2	1	0	1	1	?	1	0	1	1	1
Corydoras ephippifer	2	0	0	0	0	1	0	1	0	2	1	0	1	1	?	1	0	1	0	1
Corydoras flaveolus	2	0	0	2	0	1	0	0	0	1	1	0	1	1	?	1	0	1	1	2
Corydoras geoffroy	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gossei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
Corydoras gracilis	2	0	1	2	0	1	0	0	0	1	1	0	1	1	?	1	0	1	0	1
Corydoras guapore	1	0	2	1	1	1	0	0	0	1	1	1	1	0	0	1	0	1	0	1
Corydoras guianensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras habrosus	2	0	1	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras hastatus australe	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras imitator	2	0	0	0	0	1	0	1	0	2	1	0	1	1	?	1	0	1	0	1
Corydoras julii	2	0	1	1	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras kanei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras lacerdai	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras leucomelas	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras longipinnis	2	0	1	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras loretoensis	2	0	1	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	1	2
Corydoras melanistius	2	0	0	0	0	1	0	1	0	2	1	0	1	1	?	1	0	1	0	1
Corydoras melini	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras metae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras napoensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras narcissus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Ribeira do Iguape	2	0	1	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras nattereri Paranagua1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paranagua2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Guanabara	2	0	1	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras nattereri Guanabara HV11-75	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Macae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paraiba do Sul	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Tiete	2	0	1	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras nattereri Tiete HV11-76	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Bahia	2	0	1	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras nijsseni	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ourastigma	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Argentina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
Corydoras paleatus CW24 MA61	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Guaiba	2	0	1	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras paleatus Long Fin MA128	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras panda	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pantanalensis	2	0	0	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	1
Corydoras polystictus Caceres	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pulcher	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras punctatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pygmaeus	2	0	1	2	0	1	0	0	0	1	1	0	1	1	?	1	0	1	0	1
Corydoras rabauti	2	0	0	1	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras reticulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras robineae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sanchesi	2	0	0	2	0	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras schwartzi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras semiaquilus	2	0	0	0	0	1	0	1	0	2	1	0	1	1	?	1	0	1	1	1
Corydoras seussi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras simulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sodalis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras spA	2	0	1	2	0	1	0	0	0	1	1	0	1	1	?	1	0	1	1	2
Corydoras spB	2	0	1	1	0	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras spC	2	0	1	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras splendens	2	0	0	0	1	1	0	1	0	1	1	0	1	1	?	1	0	1	0	1
Corydoras stenocephalus	2	0	0	0	0	1	0	1	0	2	1	0	1	1	?	1	0	1	0	1
Corydoras treitlii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras trilineatus	2	0	0	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras tukano	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras undulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras urucu	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras weitzmani	2	0	1	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2
Corydoras wotroi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras zygatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras xinguensis	2	0	0	2	1	1	0	0	0	1	1	0	1	1	?	1	0	1	0	2

	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19
Dianema longibarbis	2	0	0	0	1	2	1	?	1	0	0	3	0	0	1	1	0	1	2	0
Dianema urostriatum	2	0	0	0	1	2	1	?	1	0	0	3	0	0	1	1	0	1	2	0
Hoplosternum littorale	2	0	0	0	0	2	1	?	1	0	1	3	0	0	0	2	0	1	2	0
Hoplosternum magdalenae	2	0	0	0	1	2	1	?	1	0	0	3	0	0	0	2	0	1	2	5
Hoplosternum punctatum	2	0	0	0	0	2	1	?	1	0	0	3	0	0	0	2	0	1	2	4
Lepthoplosternum altamazonicum	2	0	0	0	1	2	1	?	1	0	1	3	0	0	0	2	0	1	2	4
Lepthoplosternum beni	2	0	0	0	1	2	1	?	1	0	1	3	0	0	0	2	0	1	2	4
Lepthoplosternum pectorale	2	0	0	0	1	2	1	?	1	0	1	3	0	0	0	2	0	1	2	4
Lepthoplosternum stellatum	2	0	0	0	1	2	1	?	1	0	1	3	0	0	0	2	0	1	2	4
Lepthoplosternum tordilho	2	0	0	0	1	2	1	?	1	0	1	3	0	0	0	2	0	1	2	4
Lepthoplosternum ucamara	2	0	0	0	1	2	1	?	1	0	1	3	0	0	0	2	0	1	2	5
Megalechis picta	2	0	0	0	0	2	1	?	1	0	1	3	0	0	0	2	0	1	2	4
Megalechis thoracata	2	0	0	0	0	2	1	?	1	0	1	3	0	0	0	2	0	1	2	5
Scleromystax barbatus Itanhaem-Santos	2	0	0	0	0	1	0	1	0	2	1	0	1	1	?	1	0	1	1	1
Scleromystax barbatus Ribeira do Iguape	2	0	0	0	0	1	0	1	0	2	1	0	1	1	?	1	0	1	1	1
Scleromystax barbatus Paranagua PRSC	2	0	0	0	0	1	0	1	0	2	1	0	1	1	?	1	0	1	1	1
Scleromystax macropterus	2	0	1	2	0	1	0	0	0	1	1	0	1	1	?	1	0	1	0	1
Scleromystax prionotos Itapeuna-SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax prionotos Ribeira do Iguape	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax salmacis	2	0	0	1	0	1	0	0	0	1	1	0	1	1	?	1	0	1	0	1

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Copionodon sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichogenes longipinnis	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0
Trichomycterus areolatus	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0
Trichomycterus balios	0	0	0	0	0	0	0	0	1	0	0	0	0	0	2	?	0	0	0	0
Scoloplax distolothrix	0	1	1	0	0	1	0	2	0	0	0	0	1	1	2	?	0	0	0	0
Scoloplax empousa	0	1	1	0	0	1	0	2	1	0	0	0	1	1	2	?	0	0	0	0
Astroblepus spB	0	0	2	0	0	3	0	4	1	1	1	0	1	0	2	?	?	0	0	0
Astroblepus spC	0	0	2	0	0	3	0	4	1	1	1	0	1	0	2	?	?	0	0	0
Astroblepus spF	0	1	2	0	0	3	0	4	1	1	1	0	1	0	2	?	?	0	0	0
Hemipsilichthys gobio	0	0	1	0	0	3	0	0	1	1	1	0	1	2	1	0	0	3	0	0
Hemipsilichthys nimius	0	0	1	0	0	3	0	0	1	1	1	0	1	2	1	0	0	3	0	0
Harttia kronei	0	1	1	0	0	3	0	0	1	1	1	0	1	2	0	0	0	1	0	0
Rineloricaria microlepidogaster	0	0	1	0	0	3	0	0	1	1	0	0	1	2	0	0	0	0	0	0
Aspidoras albater Cavalcante	1	0	1	0	0	2	0	2	1	1	1	1	2	0	0	1	1	1	0	0
Aspidoras eurycephalus Cavalcante	1	0	1	0	0	2	1	2	1	1	1	1	2	1	0	1	1	1	0	0
Aspidoras poecilus Barra do Garcas	1	0	1	0	0	2	0	2	1	1	1	1	2	0	0	1	1	1	0	0
Aspidoras psammatides	1	0	1	0	0	2	1	2	1	1	1	1	2	0	0	0	1	1	0	0
Aspidoras raimundi	1	0	1	0	0	2	0	2	1	1	1	1	2	0	0	0	1	1	0	0
Aspidoras spA	1	0	1	0	0	2	1	2	1	1	1	1	2	1	0	1	1	1	0	0
Aspidoras spB	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aspidoras spC	1	0	1	0	0	2	0	2	1	1	1	1	2	1	0	1	1	1	0	0
Aspidoras taurus	0&1	0	1	0	0	2	1	2	0	1	1	1	2	1	0	1	1	1	0	0
Aspidoras virgulatus	1	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Callichthys callichthys RS	0	0	0	1	1	2	1	3	1	0	0	0	1	0	1	0	0	3	1	1
Callichthys callichthys SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Callichthys fabricioi	0	0	0	1	1	2	1	3	1	0	0	0	1	0	1	0	0	3	1	1
Callichthys serralabium	0	0	0	1	1	2	1	3	1	0	0	0	0	0	1	0	0	3	1	1
Corydoras adolfoi	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras aeneus macrosteus	0	1	1	0	0	2	0	2	1	2	1	1	2	1	0	0	1	1	0	0
Corydoras aeneus microps	0	1	1	0	0	2	0	2	1	2	1	1	2	1	0	0	1	1	0	0
Corydoras amapaensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ambiacus	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Corydoras approuaguensis	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras araguaiaensis	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras arcuatus	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras armatus	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras atropersonatus	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras boesemani	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras breei	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras brevirostris	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras britskii	0	1	1	0	0	2	0	2	1	2	1	1	2	1	0	0	1	1	0	0
Corydoras burgessi	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras caudimaculatus	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras cervinus	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras condisciplus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras areio	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras cochui	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras coppenamensis	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras difluviatilis	0	1	1	0	0	2	0	2	0	2	1	1	2	0	0	0	1	1	0	0
Corydoras diphyes	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras ehrhardti	0	1	1	0	0	2	0	2	0	2	1	1	2	1	0	0	1	1	0	0
Corydoras ehrhardti LBP741-8893	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras elegans Belem	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras elegans Peru	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras elegans Pantanal	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ellisae	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras ephippifer	0	1	1	0	0	2	0	2	1	2	1	1	2	1	0	0	1	1	0	0
Corydoras flaveolus	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras geoffroy	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gossei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gracilis	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras guapore	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras guianensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras habrosus	0	1	1	0	0	2	0	2	1	2	1	1	2	1	0	0	1	1	0	0

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Corydoras hastatus australe	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras imitator	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras julii	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras kanei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras lacerdai	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras leucomelas	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras longipinnis	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras loretoensis	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras melanistius	0	1	1	0	0	2	0	2	1	2	1	1	2	1	0	0	1	1	0	0
Corydoras melini	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras metae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras napoensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras narcissus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Ribeira do Iguape	0	1	1	0	0	2	0	2	0	2	1	1	2	0	0	0	1	1	0	0
Corydoras nattereri Paranagua1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paranagua2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Guanabara	0	1	1	0	0	2	0	2	0	2	1	1	2	0	0	0	1	1	0	0
Corydoras nattereri Guanabara HV11-75	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Macae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paraiba do Sul	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Tiete	0	1	1	0	0	2	0	2	0	2	1	1	2	0	0	0	1	1	0	0
Corydoras nattereri Tiete HV11-76	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Bahia	0	1	1	0	0	2	0	2	0	2	1	1	2	0	0	0	1	1	0	0
Corydoras nijsseni	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ourastigma	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Argentina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus CW24 MA61	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Guaiba	0	1	1	0	0	2	0	2	0	2	1	1	2	0	0	0	1	1	0	0
Corydoras paleatus Long Fin MA128	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras panda	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Corydoras pantanalensis	0	1	1	0	0	2	0	2	1	2	1	1	2	1	0	0	1	1	0	0
Corydoras polystictus Caceres	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pulcher	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras punctatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pygmaeus	0	1	1	0	0	2	0	2	1	2	1	1	2	1	0	0	1	1	0	0
Corydoras rabauti	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras reticulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras robineae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sanchesi	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras schwartzi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras semiaquilus	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras seussi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras simulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sodalis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras spA	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras spB	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras spC	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras splendens	0	1	1	0	0	2	0	2	1	2	1	1	2	1	0	0	1	1	0	0
Corydoras stenocephalus	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras treitlii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras trilineatus	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras tukano	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras undulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras urucu	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras weitzmani	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Corydoras wotroi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras zygatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras xinguensis	0	1	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Dianema longibarbis	0	0	0	1	1	2	1	1	1	0	1	0	0	0	1	0	0	2	1	0
Dianema urostriatum	0	0	0	1	1	2	1	1	1	0	1	0	0	0	1	0	0	2	1	0
Hoplosternum littorale	0	0	0	0	1	2	1	1	1	0	1	0	0	0	1	0	0	2	1	0
Hoplosternum magdalenae	0	0	0	1	1	2	1	1	1	0	1	0	0	0	1	0	0	3	1	0

	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Hoplosternum punctatum	0	0	0	1	1	2	1	1	1	0	1	0	0	0	1	0	0	2	1	0
Lepthoplosternum altamazonicum	0	0	0	1	1	2	1	3	1	0	0	0	0	0	1	0	0	3	1	1
Lepthoplosternum beni	0	0	0	1	1	2	1	3	1	0	0	0	1	0	1	0	0	3	1	1
Lepthoplosternum pectorale	0	0	0	1	1	2	1	3	1	0	0	0	0	0	1	0	0	3	1	1
Lepthoplosternum stellatum	0	0	0	1	1	2	1	3	1	0	0	0	1	0	1	0	0	3	1	1
Lepthoplosternum tordilho	0	0	0	1	1	2	1	3	1	0	0	0	0	0	1	0	0	3	1	1
Lepthoplosternum ucamara	0	0	0	1	1	2	1	3	1	0	0	0	0	0	1	0	0	3	1	1
Megalechis picta	0	0	0	1	1	2	1	3	1	0	0	0	0&1	0	1	0	0	3	1	1
Megalechis thoracata	0	0	0	1	1	2	1	3	1	0	0	0	0	0	1	0	0	3	1	1
Scleromystax barbatus Itanhaem-Santos	0	2	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Scleromystax barbatus Ribeira do Iguape	0	2	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Scleromystax barbatus Paranagua PRSC	0	2	1	0	0	2	0	2	1	2	1	1	2	0	0	0	1	1	0	0
Scleromystax macropterus	0	1	1	0	0	2	1	2	1	2	1	1	2	0	0	0	1	1	0	0
Scleromystax prionotos Itapeuna-SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax prionotos Ribeira do Iguape	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax salmacis	0	1	1	0	0	2	1	2	1	2	1	1	2	0	0	0	1	1	0	0

	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Copionodon sp	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Trichogenes longipinnis	0	0	0	1&2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Trichomycterus areolatus	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Trichomycterus balios	0	0	0	2	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0
Scoloplax distolothrix	3	0	0	1	0	1	0	0	0	2	0	0	0	1	0	0	0	0	2	0
Scoloplax empousa	3	0	0	1	0	1	0	0	0	2	0	0	0	1	0	0	0	0	2	0
Astroblepus spB	3	0	0	1&2	0	0	3	0	0	1	0	0	0	0	1	0	0	2	1	0
Astroblepus spC	3	0	0	1&2	0	0	3	0	0	1	0	0	0	0	2	0	0	2	1	0
Astroblepus spF	3	0	0	1&2	0	0	3	0	0	1	0	0	0	0	2	0	0	2	1	0
Hemipsilichthys gobio	0	0	0	1	0	0	4	0	0	2	0	0	0	0	0	0	0	2	1	0
Hemipsilichthys nimius	0	0	0	1	0	0	4	0	0	2	0	0	0	0	0	0	0	2	1	0
Harttia kronei	0	0	0	1	0	0	4	0	0	2	0	0	0	0	0	0	0	2	1	0
Rineloricaria microlepidogaster	0	0	0	1	0	0	4	0	0	2	0	0	0	0	0	0	0	1	1	0
Aspidoras albater Cavalcante	1	1	1	?	1	2	2	2	1	1	1	1	1	2	2	0	0	0	2	1
Aspidoras eurycephalus Cavalcante	1	1	1	?	1	2	2	2	1	1	1	1	1	2	2	0	0	1	2	1
Aspidoras poecilus Barra do Garcas	1	1	1	?	1	2	2	2	1	1	1	1	1	2	2	0	0	1	2	1
Aspidoras psammatides	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	0	2	1
Aspidoras raimundi	1	1	1	?	1	1	2	2	1	1	1	1	1	2	2	0	0	0	2	1
Aspidoras spA	1	1	1	?	1	2	2	2	1	1	1	1	1	2	2	0	0	1	2	1
Aspidoras spB	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aspidoras spC	1	1	1	?	1	2	2	2	1	1	1	1	1	2	2	0	0	1	2	1
Aspidoras taurus	1	1	1	?	1	1	2	2	1	1	1	1	1	2	2	0	0	1	2	1
Aspidoras virgulatus	1	1	1	?	1	2	2	2	1	0	1	1	1	2	1	0	0	0	2	1
Callichthys callichthys RS	0	1	0	2	1	2	1	0	2	2	0	1	1	2	2	0	1	2	1	0
Callichthys callichthys SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Callichthys fabricioi	0	1	0	2	1	2	1	0	2	2	0	1	1	2	2	0	1	2	1	0
Callichthys serralabium	0	?	?	2	1	2	1	0	2	1	0	1	1	2	2	0	1	2	1	0
Corydoras adolfoi	1	1	1	?	1	1	2	2	1	1	1	1	1	1	2	0	0	1	2	1
Corydoras aeneus macrosteus	1	1	1	?	1	1	2	2	1	2	1	1	1	2	2	0	0	1	2	?
Corydoras aeneus microps	1	1	1	?	?	1	?	?	?	?	1	1	1	1	2	0	0	1	2	1
Corydoras amapaensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ambiacus	1	1	1	?	1	1	2	2	1	2	1	1	1	2	1	0	0	1	2	?

	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Corydoras approuaguensis	1	1	1	?	1	1	2	2	1	1	1	1	1	1	1	0	0	1	2	?
Corydoras araguaiaensis	1	1	1	?	1	1	2	2	1	2	1	1	1	2	2	0	0	0	2	1
Corydoras arcuatus	1	1	1	?	1	1	2	2	1	1	1	1	1	2	2	0	0	0	2	?
Corydoras armatus	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras atropersonatus	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	?
Corydoras boesemani	1	1	1	?	1	2	2	2	1	2	1	1	1	2	1	0	0	1	2	1
Corydoras breei	1	1	1	?	1	2	2	2	1	2	1	1	1	2	1	0	0	1	2	1
Corydoras brevirostris	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras britskii	1	1	1	?	1	2	2	2	1	1	1	1	1	1	2	0	0	1	2	1
Corydoras burgessi	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras caudimaculatus	1	1	1	?	1	1	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras cervinus	2	1	1	?	1	2	2	2	1	0	1	1	1	1	2	1	0	0	2	1
Corydoras condisciplus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras areio	2	1	1	?	1	1	2	2	1	1	1	1	1	1	2	1	0	0	2	1
Corydoras cochui	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras coppenamensis	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras difluviatilis	1	1	1	?	1	2	2	2	1	1	1	1	1	2	2	0	0	1	2	1
Corydoras diphyes	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras ehrhardti	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras ehrhardti LBP741-8893	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras elegans Belem	1	1	1	?	?	?	?	?	?	?	1	1	1	2	2	0	0	?	2	?
Corydoras elegans Peru	1	1	1	?	?	?	?	2	1	1	1	1	1	2	2	0	0	?	2	?
Corydoras elegans Pantanal	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ellisae	2	1	1	?	1	2	2	2	1	0	1	1	1	1	2	0	0	0	2	1
Corydoras ephippifer	1	1	1	?	1	2	2	2	1	1	1	1	1	1	2	0	0	1	2	1
Corydoras flaveolus	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras geoffroy	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gossei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gracilis	1	1	1	?	1	1	2	2	1	1	1	1	1	2	2	0	0	0	2	1
Corydoras guapore	1	1	1	?	1	1	2	2	1	2	1	1	1	2	2	0	0	2	0	1
Corydoras guianensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras habrosus	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	2	2	1

	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Corydoras hastatus australe	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras imitator	1	1	1	?	1	2	2	2	1	0	1	1	1	2	1	0	0	0	2	1
Corydoras julii	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras kanei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras lacerdai	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras leucomelas	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras longipinnis	1	1	1	?	1	2	2	2	1	2	1	1	1	2	1	0	0	1	2	1
Corydoras loretoensis	1	1	1	?	1	2	2	2	1	2	1	1	1	2	1	0	0	1	2	1
Corydoras melanistius	1	1	1	?	1	2	2	2	1	1	1	1	1	1	2	0	0	1	2	1
Corydoras melini	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras metae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras napoensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras narcissus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Ribeira do Iguape	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras nattereri Paranagua1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paranagua2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Guanabara	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	0	2	1
Corydoras nattereri Guanabara HV11-75	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Macae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paraiba do Sul	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Tiete	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras nattereri Tiete HV11-76	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Bahia	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras nijsseni	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ourastigma	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Argentina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus CW24 MA61	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Guaiba	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras paleatus Long Fin MA128	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras panda	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Corydoras pantanalensis	1	1	1	?	1	2	2	2	1	1	1	1	1	1	1	0	0	0	2	1
Corydoras polystictus Caceres	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pulcher	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras punctatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pygmaeus	1	1	1	?	1	1	2	2	1	2	1	1	1	2	2	0	0	2	2	1
Corydoras rabauti	1	1	1	?	1	2	2	2	1	1	1	1	1	2	2	0	0	1	2	1
Corydoras reticulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras robineae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sanchesi	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras schwartzi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras semiaquilus	2	1	1	?	1	2	2	2	1	0	1	1	1	2	2	1	0	0	2	1
Corydoras seussi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras simulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sodalis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras spA	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras spB	1	1	1	?	1	2	2	2	1	2	1	1	1	2	2	0	0	1	2	1
Corydoras spC	1	1	1	?	1	1	2	2	1	1	1	1	1	2	2	0	0	1	2	1
Corydoras splendens	2	1	1	?	1	2	2	2	1	1	1	1	1	2	2	0	0	1	2	1
Corydoras stenocephalus	2	1	1	?	1	2	2	2	1	0	1	1	1	1	2	1	0	0	2	1
Corydoras treitlii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras trilineatus	1	1	1	?	1	2	2	2	1	1	1	1	1	2	2	0	0	1	2	1
Corydoras tukano	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras undulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras urucu	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras weitzmani	1	1	1	?	1	2	2	2	1	1	1	1	1	2	2	0	0	1	2	1
Corydoras wotroi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras zygatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras xinguensis	1	1	1	?	1	2	2	2	1	1	1	1	1	2	1	0	0	1	2	1
Dianema longibarbis	0	1	0	2	1	2	1	0	2	1	0	1	1	2	2	0	1	2	1	0
Dianema urostriatum	0	1	0	2	1	2	1	0	2	1	0	1	1	2	2	0	1	2	1	0
Hoplosternum littorale	0	1	0	2	1	2	1	0	2	1	0	1	1	2	2	0	1	1	1	0
Hoplosternum magdalenae	0	1	0	?	1	2	1	0	2	1	1	1	1	2	2	0	1	2	1	0

	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
Hoplosternum punctatum	0	1	0	2	0	2	1	0	2	1	0	1	1	2	2	0	1	1	1	0
Lepthoplosternum altamazonicum	0	1	0	2	0	2	1	0	2	1	0	1	1	2	2	0	1	1	1	0
Lepthoplosternum beni	0	1	0	2	0	2	1	0	2	1	0	1	1	2	2	0	1	1	1	0
Lepthoplosternum pectorale	0	1	0	2	0	2	1	0	2	1	0	1	1	2	2	0	1	1	1	0
Lepthoplosternum stellatum	0	1	0	2	0	2	1	0	2	1	0	1	1	2	2	0	1	1	1	0
Lepthoplosternum tordilho	0	1	0	2	0	2	1	0	2	1	0	1	1	2	2	0	1	1	1	0
Lepthoplosternum ucamara	0	1	0	2	0	2	1	0	2	1	0	1	1	2	2	0	1	1	1	0
Megalechis picta	0	1	0	2	0	2	1	0	2	1	0	1	1	2	2	0	1	1	1	0
Megalechis thoracata	0	1	0	2	1	2	1	0	2	1	0	1	1	2	2	0	1	1	1	0
Scleromystax barbatus Itanhaem-Santos	2	1	1	?	1	2	2	2	1	0	1	1	1	2	1	0	0	0	2	1
Scleromystax barbatus Ribeira do Iguape	2	1	1	?	1	2	2	2	1	0	1	1	1	2	1	0	0	0	2	1
Scleromystax barbatus Paranagua PRSC	2	1	1	?	1	2	2	2	1	0	1	1	1	2	1	0	0	0	2	1
Scleromystax macropterus	2	1	1	?	1	2	2	2	1	0	1	1	1	2	2	0	0	1	2	1
Scleromystax prionotos Itapeuna-SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax prionotos Ribeira do Iguape	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax salmacis	1	1	1	?	1	2	2	2	1	0	1	1	1	2	1	0	0	0	2	1

	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
Copionodon sp	0	0	0	0	0	0	?	0	0	0	0	?	?	0	0	0	?	?	?	?
Trichogenes longipinnis	1	0	0	2	0	0	?	0	0	0	1	0	0	0	0	0	?	?	?	?
Trichomycterus areolatus	0	0	1	2	0	0	?	0	0	0	0	?	?	0	0	0	?	?	?	?
Trichomycterus balios	1	0	0	2	0	0	?	0	0	0	0	?	?	0	0	0	?	?	?	?
Scoloplax distolothrix	2	2	1	0	0	0	?	0	1	0	2	0	0	0	0	0	?	?	?	?
Scoloplax empousa	2	2	1	0	0	0	?	0	1	0	2	0	0	0	0	0	?	?	?	?
Astroblepus spB	2	0	0	2	0	1	2	0	1	0	1	0	0	0	0	0	?	?	?	?
Astroblepus spC	2	0	0	2	0	1	2	0	1	0	1	0	0	0	0	0	?	?	?	?
Astroblepus spF	2	0	0	2	0	1	2	0	1	0	1	0	0	0	0	0	?	?	?	?
Hemipsilichthys gobio	2	0	0	0	2	1	2	0	2	0	1	0	0	0	0	3	0	0	?	0
Hemipsilichthys nimius	2	0	0	0	2	1	2	0	2	0	1	0	0	0	0	3	0	0	?	0
Harttia kronei	2	1	0	2	2	1	1	0	2	0	1	0	0	0	0	2	0	0	?	0
Rineloricaria microlepidogaster	2	0	0	2	2	1	1	0	0	0	1	0	0	0	0	2	0	0	?	0
Aspidoras albater Cavalcante	0	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Aspidoras eurycephalus Cavalcante	0	0	1	2	2	1	2	1	1	1	2	1	1	1	0	1	0	2	0	1
Aspidoras poecilus Barra do Garcas	0	0	1	2	2	1	2	1	1	1	2	1	1	1	0	1	0	2	1	1
Aspidoras psammatides	0	0	1	2	0	1	2	1	1	1	2	1	1	0	0	1	0	0	?	1
Aspidoras raimundi	0	0	1	2	2	1	2	1	1	1	2	0	1	1	0	1	0	3	0	1
Aspidoras spA	1	0	1	2	2	1	2	1	1	1	2	1	1	0	0	1	0	1	0	1
Aspidoras spB	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aspidoras spC	0	0	0	2	2	1	2	1	1	1	2	0	1	0	0	1	0	2	0	1
Aspidoras taurus	0	0	0	2	2	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Aspidoras virgulatus	0	0	1	2	2	1	2	1	1	1	1	0	0	0	0	1	0	1	0	1
Callichthys callichthys RS	0	0	0	0	2	0	?	0	0	0	1	1	0	0	1	1	1	0	?	1
Callichthys callichthys SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Callichthys fabricioi	0	0	0	0	2	1	2	0	0	0	1	1	0	0	1	1	1	0	?	1
Callichthys serralabium	1	0	0	0	2	1	2	0	0	0	1	2	0	0	1	1	1	0	?	1
Corydoras adolfoi	1	0	1	2	1	1	2	1	1	1	2	0	0	0	0	1	0	2	0	1
Corydoras aeneus macrosteus	1	0	1	2	1	1	2	1	1	1	2	0	0	0	0	1	0	2	1	1
Corydoras aeneus microps	0	0	1	2	2	1	2	1	1	1	2	1	0	0	0	1	0	2	1	1
Corydoras amapaensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ambiacus	1	0	1	2	1	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1

	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
Corydoras approuaguensis	1	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras araguaiaensis	0	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras arcuatus	0	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras armatus	1	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras atropersonatus	0	0	1	2	2	1	0	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras boesemani	0	0	1	2	1	1	0	1	1	1	2	0	0	0	0	1	0	2	0	1
Corydoras breei	0	0	1	0	1	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras brevirostris	0	0	1	2	2	1	0	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras britskii	1	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	2	1	1
Corydoras burgessi	0	0	1	2	2	1	0	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras caudimaculatus	0	0	1	2	2	1	0	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras cervinus	1	0	1	2	2	1	2	1	1	1	2	1	0	0	0	1	0	1	0	1
Corydoras condisciplus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras areio	0	0	1	2	2	1	0	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras cochui	0	0	1	2	2	1	0	1	1	1	2	0	0	0	0	1	0	2	0	1
Corydoras coppenamensis	0	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	2	1	1
Corydoras difluviatilis	0	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	3	1	1
Corydoras diphyes	0	0	1	2	2	1	0	1	1	1	2	0	1	1	0	1	0	2	0	1
Corydoras ehrhardti	0	0	1	2	2	1	2	1	1	1	2	0	1	1	0	1	0	2	0	1
Corydoras ehrhardti LBP741-8893	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras elegans Belem	1	0	1	2	0	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras elegans Peru	1	0	1	2	0	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras elegans Pantanal	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ellisae	0	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras ephippifer	0	0	1	2	2	1	2	1	1	1	2	0	1	0	0	1	0	2	0	1
Corydoras flaveolus	0	0	1	2	2	1	2	1	1	1	2	0	1	0	0	1	0	1	0	1
Corydoras geoffroy	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gossei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gracilis	1	0	1	2	0	1	2	1	1	1	2	0	0	0	0	1	0	2	0	1
Corydoras guapore	1	0	1	2	0	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras guianensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras habrosus	0	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	2	0	1

	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
Corydoras hastatus australe	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras imitator	0	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	2	0	1
Corydoras julii	0	0	1	2	1	1	0	1	1	1	2	0	0	0	0	1	0	2	0	1
Corydoras kanei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras lacerdai	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras leucomelas	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras longipinnis	0	0	1	2	1	1	2	1	1	1	2	0	1	0	0	1	0	2	0	1
Corydoras loretoensis	0	0	1	2	1	1	0	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras melanistius	0	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras melini	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras metae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras napoensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras narcissus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Ribeira do Iguape	0	0	1	2	1	1	2	1	1	1	2	1	0	0	0	1	0	1	0	1
Corydoras nattereri Paranagua1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paranagua2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Guanabara	0	0	1	2	1	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras nattereri Guanabara HV11-75	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Macae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paraiba do Sul	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Tiete	0	0	1	2	1	1	2	1	1	1	2	0	0	0	0	1	0	2	0	1
Corydoras nattereri Tiete HV11-76	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Bahia	0	0	1	2	1	1	2	1	1	1	2	0	1	0	0	1	0	1	0	1
Corydoras nijsseni	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ourastigma	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Argentina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus CW24 MA61	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Guaiba	0	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	2	0	1
Corydoras paleatus Long Fin MA128	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras panda	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
Corydoras pantanalensis	1	0	1	2	1	1	2	1	1	1	2	1	0	0	0	1	0	3	0	1
Corydoras polystictus Caceres	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pulcher	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras punctatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pygmaeus	1	0	1	0	0	1	2	1	1	1	2	1	0	1	0	1	0	1	0	1
Corydoras rabauti	1	0	1	2	1	1	2	1	1	1	2	1	1	0	0	1	0	3	1	1
Corydoras reticulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras robineae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sanchesi	0	0	1	2	1	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras schwartzi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras semiaquilus	0	0	1	2	2	1	0	1	1	1	2	1	0	0	0	1	0	1	0	1
Corydoras seussi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras simulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sodalis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras spA	0	0	1	2	2	1	0	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras spB	1	0	1	2	2	1	0	1	1	1	2	0	0	1	0	1	0	2	0	1
Corydoras spC	1	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	1	1	1
Corydoras splendens	0	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	2	1	1
Corydoras stenocephalus	0	0	1	2	2	1	0	1	1	1	2	1	0	0	0	1	0	1	0	1
Corydoras treitlii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras trilineatus	0	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Corydoras tukano	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras undulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras urucu	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras weitzmani	0	0	1	2	2	1	0	1	1	1	2	1	0	1	0	1	0	1	0	1
Corydoras wotroi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras zygatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras xinguensis	0	0	1	2	2	1	2	1	1	1	2	0	0	1	0	1	0	2	0	1
Dianema longibarbis	1	2	1	1	?	?	?	0	0	0	1	2	0	0	1	1	0	0	?	1
Dianema urostriatum	1	2	1	1	?	?	?	0	0	0	1	2	0	0	1	1	0	0	?	1
Hoplosternum littorale	1	1	1	1	?	?	?	1	0	0	1	1	0	0	1	1	0	0	?	1
Hoplosternum magdalenae	1	1	0	1	?	?	?	0	0	0	1	2	0	0	1	1	0	0	?	1

	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
Hoplosternum punctatum	1	1	1	1	?	?	?	0	0	0	1	1	0	0	1	1	0	0	?	1
Lepthoplosternum altamazonicum	0	1	0	0	2	0	?	0	0	0	1	2	0	0	1	1	0	0	?	1
Lepthoplosternum beni	0	1	0	0	2	0	?	0	0	0	1	2	0	0	1	1	0	0	?	1
Lepthoplosternum pectorale	0	1	0	0	2	0	?	1	0	0	1	2	0	0	1	1	0	0	?	1
Lepthoplosternum stellatum	0	1	0	0	2	0	?	0	0	0	1	2	0	0	1	1	0	0	?	1
Lepthoplosternum tordilho	0	0	0	0	2	0	?	0	0	0	1	2	0	0	1	1	0	0	?	1
Lepthoplosternum ucamara	0	1	0	0	2	0	?	0	0	0	1	2	0	0	1	1	0	0	?	1
Megalechis picta	1	1	0	0	2	1	2	1	0	0	1	2	0	0	1	1	0	0	?	1
Megalechis thoracata	1	1	0	0	2	1	2	1	0	0	1	2	0	0	1	1	0	0	?	1
Scleromystax barbatus Itanhaem-Santos	1	0	1	2	2	1	2	1	1	1	2	1	0	0	0	1	0	1	0	1
Scleromystax barbatus Ribeira do Iguape	1	0	1	2	2	1	0	1	1	1	2	0	0	0	0	1	0	1	0	1
Scleromystax barbatus Paranagua PRSC	1	0	1	2	2	1	2	1	1	1	2	0	0	0	0	1	0	1	0	1
Scleromystax macropterus	1	0	1	2	2	1	2	1	1	1	2	0	1	0	0	1	0	2	0	1
Scleromystax prionotos Itapeuna-SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax prionotos Ribeira do Iguape	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax salmacis	0	0	1	2	2	1	0	1	1	1	1	0	1	0	0	1	0	1	0	1

	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
Copionodon sp	?	?	?	?	?	?	?	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichogenes longipinnis	?	?	?	?	?	?	?	0	0	0	0	0	1	0	0	0	1	0	0	0
Trichomycterus areolatus	?	?	?	?	?	?	?	0	0	0	0	0	1	0	0	0	1	0	0	0
Trichomycterus balios	?	?	?	?	?	?	?	0	0	0	0	0	1	0	0	0	0	0	0	0
Scoloplax distolothrix	?	?	?	?	?	?	?	2	0	0	2	1	1	2	1	0	0	0	0	2
Scoloplax empousa	?	?	?	?	?	?	?	2	0	0	2	1	1	2	1	0	0	0	0	2
Astroblepus spB	?	?	?	?	?	?	?	0	0	0	2	0	1	2	2	1	0	0	0	2
Astroblepus spC	?	?	?	?	?	?	?	0	0	0	2	0	1	2	2	1	0	0	0	2
Astroblepus spF	?	?	?	?	?	?	?	0	0	0	2	0	1	2	2	1	0	0	0	2
Hemipsilichthys gobio	?	0	0	0	?	0	0	2	0	0	2	1	1	1	1	0	0	0	0	2
Hemipsilichthys nimius	?	0	0	0	?	0	0	2	0	0	2	1	1	1	0	0	0	0	0	2
Harttia kronei	?	0	0	0	?	0	1	2	0	0	2	0	1	1	1	0	0	0	0	2
Rineloricaria microlepidogaster	?	0	0	0	?	0	1	2	0	0	2	0	1	1	0	0	1	0	0	2
Aspidoras albater Cavalcante	1	0	0	1	1	1	0	1	0	2	2	1	1	2	2	1	1	1	0	1
Aspidoras eurycephalus Cavalcante	1	0	0	1	1	1	0	1	0	0	2	1	1	2	2	1	1	1	0	1
Aspidoras poecilus Barra do Garcas	1	0	0	1	1	1	0	1	0	0	2	1	1	2	2	1	1	1	?	?
Aspidoras psammatides	0	0	0	1	0	0	0	1	0	0	2	1	1	2	2	1	0	1	0	1
Aspidoras raimundi	0	0	0	1	1	1	0	1	0	2	1	1	1	2	2	1	1	1	0	1
Aspidoras spA	1	0	0	1	1	0	0	1	0	2	2	1	1	2	2	1	1	1	0	1
Aspidoras spB	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aspidoras spC	1	0	0	1	1	1	0	1	0	2	2	1	1	2	2	1	1	1	0	1
Aspidoras taurus	2	0	0	1	1	1	0	1	0	2	2	1	1	2	2	1	0	1	0	1
Aspidoras virgulatus	1	0	0	1	0	1	0	1	0	2	1	1	1	2	2	1	0	1	0	1
Callichthys callichthys RS	2	0	1	1	0	0	0	2	1	1	2	0	0	1	0	0	0	1	1	1
Callichthys callichthys SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Callichthys fabricioi	2	0	1	1	0	0	0	2	1	1	2	0	0	1	0	0	0	1	1	1
Callichthys serralabium	2	0	1	1	2	0	0	2	1	1	2	0	0	1	0	0	0	1	1	1
Corydoras adolfoi	0	0	0	1	0	0	0	1	0	0	1	1	1	2	2	1	1	1	0	1
Corydoras aeneus macrosteus	0	0	0	1	0	1	1	1	0	0	1	1	1	2	2	1	1	1	0	?
Corydoras aeneus microps	0	0	0	1	0	1	1	1	0	2	2	1	1	2	2	1	1	1	0	?
Corydoras amapaensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ambiacus	0	0	0	1	0	0	1	1	1	2	1	1	1	2	2	1	1	1	0	1

	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
Corydoras approuaguensis	0	0	0	1	0	1	1	1	1	2	1	1	1	2	2	1	1	1	0	?
Corydoras araguaiaensis	0	0	0	1	0	0	0	1	0	0	2	1	1	2	2	1	1	1	0	1
Corydoras arcuatus	0	0	0	1	0	0	1	1	1	2	1	1	1	2	2	1	1	1	?	?
Corydoras armatus	0	0	0	1	0	1	1	1	1	2	1	1	1	2	2	1	1	1	0	1
Corydoras atropersonatus	0	0	0	1	0	0	0	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras boesemani	0	0	0	1	0	0	0	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras breei	0	0	0	1	0	0	0	1	0	0	2	1	1	2	2	1	1	1	?	1
Corydoras brevirostris	0	0	0	1	0	0	0	1	0	0	2	1	1	2	2	1	1	1	0	1
Corydoras britskii	0	0	0	1	0	0	1	1	1	2	1	1	1	2	2	1	1	1	0	1
Corydoras burgessi	0	0	0	1	0	0	0	1	0	0	2	1	1	2	2	1	1	1	0	1
Corydoras caudimaculatus	0	0	0	1	0	0	1	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras cervinus	0	0	0	1	0	0	1	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras condisciplus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras areio	0	0	0	1	0	0	1	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras cochui	0	0	0	1	0	0	0	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras coppenamensis	0	0	0	1	0	1	1	1	0	0	2	1	1	2	2	1	1	1	0	1
Corydoras difluviatilis	1	0	0	1	1	1	1	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras diphyes	0	0	0	1	1	0	0	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras ehrhardti	0	0	0	1	0	0	0	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras ehrhardti LBP741-8893	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras elegans Belem	0	0	0	1	0	1	1	1	0	2	1	1	0	2	2	1	1	?	?	?
Corydoras elegans Peru	0	0	0	1	0	1	1	1	0	2	1	1	1	2	2	1	1	?	?	?
Corydoras elegans Pantanal	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ellisae	0	0	0	1	0	0	1	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras ephippifer	0	0	0	1	0	0	1	1	1	2	1	1	1	2	2	1	1	1	0	1
Corydoras flaveolus	0	0	0	1	0	0	0	1	0	0	2	1	1	2	2	1	1	1	0	1
Corydoras geoffroy	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gossei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gracilis	0	0	0	1	0	1	1	1	0	2	2	1	1	2	2	1	1	1	0	1
Corydoras guapore	0	0	0	1	0	1	1	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras guianensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras habrosus	0	0	0	1	0	0	1	1	0	2	2	1	1	2	2	1	1	1	0	1

	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
Corydoras hastatus australe	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras imitator	0	0	0	1	0	1	1	1	1	2	1	1	1	2	2	1	1	1	0	?
Corydoras julii	0	0	0	1	0	0	0	1	0	0	2	1	1	2	2	1	1	1	0	1
Corydoras kanei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras lacerdai	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras leucomelas	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras longipinnis	0	0	0	1	0	0	0	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras loretoensis	0	0	0	1	0	0	0	1	0	0	2	1	1	2	2	1	1	1	0	1
Corydoras melanistius	0	0	0	1	0	1	1	1	1	2	1	1	1	2	2	1	1	1	0	1
Corydoras melini	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras metae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras napoensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras narcissus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Ribeira do Iguape	0	0	0	1	0	1	0	1	0	2	2	1	1	2	2	1	1	1	0	1
Corydoras nattereri Paranagua1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paranagua2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Guanabara	0	0	0	1	1	1	0	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras nattereri Guanabara HV11-75	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Macae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paraiba do Sul	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Tiete	0	0	0	1	0	1	0	1	0	2	2	1	1	2	2	1	1	1	0	1
Corydoras nattereri Tiete HV11-76	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Bahia	0	0	0	1	0	1	0	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras nijsseni	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ourastigma	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Argentina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus CW24 MA61	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Guaiba	0	0	0	1	0	1	0	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras paleatus Long Fin MA128	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras panda	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
Corydoras pantanalensis	0	0	0	1	0	1	1	1	1	2	2	1	1	2	2	1	1	1	0	1
Corydoras polystictus Caceres	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pulcher	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras punctatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pygmaeus	0	0	0	1	0	1	1	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras rabauti	1	0	0	1	1	1	1	1	1	2	1	1	1	2	2	1	1	1	0	1
Corydoras reticulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras robineae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sanchesi	0	0	0	1	0	0	0	1	0	0	2	1	1	2	2	1	1	1	0	1
Corydoras schwartzi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras semiaquilus	0	0	0	1	0	0	0	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras seussi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras simulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sodalis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras spA	0	0	0	1	0	1	0	1	0	0	2	1	1	2	2	1	1	1	0	1
Corydoras spB	0	0	0	1	1	1	0	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras spC	0	0	0	1	0	1	1	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras splendens	0	0	0	1	0	1	1	1	1	2	2	1	1	2	2	1	1	1	0	1
Corydoras stenocephalus	0	0	0	1	0	0	1	1	0	2	1	1	1	2	2	1	1	1	0	1
Corydoras treitlii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras trilineatus	0	0	0	1	0	0	1	1	0	0	2	1	1	2	2	1	1	1	0	1
Corydoras tukano	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras undulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras urucu	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras weitzmani	0	0	0	1	0	0	0	1	0	0	2	1	1	2	2	1	1	1	0	1
Corydoras wotroi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras zygatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras xinguensis	0	0	0	1	0	0	1	1	0	2	2	1	1	2	2	1	1	1	0	1
Dianema longibarbis	1	1	2	1	1	1	0	2	1	1&2	1&2	0	1	1	0	0	0	1	1	1
Dianema urostriatum	1	1	2	1	0	1	0	2	1	1&2	2	1	1	1	0	0	0	1	1	1
Hoplosternum littorale	1	0	1	1	1	1	1	2	1	1	2	0	1	1	0	0	0	1	1	1
Hoplosternum magdalenae	1	0	2	1	1	1	0	2	1	2	2	0	1	2	0	0	0	?	?	?

	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99
Hoplosternum punctatum	1	0	2	1	1	1	0	2	1	1	2	1	1	1	0	0	0	1	1	1
Lepthoplosternum altamazonicum	1	0	1	1	2	0	0	2	1	1	2	0	0	1	0	0	0	1	1	1
Lepthoplosternum beni	1	0	1	1	2	0	0	2	1	1	2	0	0	1	0	0	0	?	?	?
Lepthoplosternum pectorale	2	0	1	1	2	1	0	2	1	1	2	0	0	1	0	0	0	1	1	1
Lepthoplosternum stellatum	2	0	1	1	1	0	0	2	1	1	2	0	0	1	0	0	0	1	1	1
Lepthoplosternum tordilho	2	0	1	1	1	1	0	2	1	1	2	0	0	1	0	0	0	1	?	?
Lepthoplosternum ucamara	2	0	1	1	2	1	0	2	1	1	2	0	0	1	0	0	0	1	1	1
Megalechis picta	2	0	1	1	2	0	0	2	1	1	2	0	0	1	0	0	0	?	?	1
Megalechis thoracata	1	0	1	1	2	1	0	2	1	1	2	0	0	1	0	0	0	1	1	1
Scleromystax barbatus Itanhaem-Santos	0	0	0	1	1	1	0	1	0	0	1	1	1	2	2	1	1	1	0	1
Scleromystax barbatus Ribeira do Iguape	0	0	0	1	0	0	0	1	0	0	2	1	1	2	2	1	1	1	0	1
Scleromystax barbatus Paranagua PRSC	0	0	0	1	0	0	0	1	0	0	2	1	1	2	2	1	1	1	0	1
Scleromystax macropterus	0	0	0	1	1	1	0	1	0	2	2	1	1	2	2	1	1	1	0	1
Scleromystax prionotos Itapeuna-SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax prionotos Ribeira do Iguape	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax salmacis	0	0	0	1	1	1	0	1	0	2	1	1	1	2	1	1	0	1	0	1

	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119
Copionodon sp	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichogenes longipinnis	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Trichomycterus areolatus	0	0	0	0	0	2	1	0	0	0	0	0	0	0	2	?	?	0	0	1
Trichomycterus balios	0	0	0	0	0	2	1	0	1	0	0	0	0	0	2	0	0	0	0	1
Scoloplax distolothrix	2	2	1	0	0	0	0	0	0	0	0	4	2	0	2	2	?	0	3	2
Scoloplax empousa	2	2	1	0	0	0	0	0	0	0	0	4	2	0	2	2	?	0	3	2
Astroblepus spB	?	?	4	0	0	2	0	0	1	1	0	2	0	0	2	0	0	1	2	3
Astroblepus spC	2	2	4	0	0	2	0	0	0	1	0	2	0	0	2	0	0	1	2	3
Astroblepus spF	2	2	4	0	0	2	0	0	0	1	0	2	0	0	2	0	0	1	2	3
Hemipsilichthys gobio	2	2	4	0	0	2	0	0	2	0	0	3	0	0	2	0	0	0	2	5
Hemipsilichthys nimius	2	2	4	0	0	2	0	0	2	0	0	3	0	0	2	0	0	0	2	5
Harttia kronei	2	2	4	0	0	2	0	0	2	0	0	3	0	0	2	1	1	0	2	4
Rineloricaria microlepidogaster	2	2	4	0	0	2	0	0	1	0	0	3	0	0	2	1	1	0	2	4
Aspidoras albater Cavalcante	1	1	1	1	1	1	2	1	0	0	1	1	0	0	1	0&1	0	0	1	0
Aspidoras eurycephalus Cavalcante	1	1	1	1	1	1	2	1	0	0	1	1	0	0	1	0	0	0	1	0
Aspidoras poecilus Barra do Garcas	1	1	?	1	1	1	2	1	1	0	1	1	0	0	1	0	0	0	1	0
Aspidoras psammatides	1	1	1	1	1	1	2	1	0	0	1	1	0	0	1	1	0	0	0	0
Aspidoras raimundi	1	1	1	1	1	1	2	1	1	0	1	1	0	0	1	0	0	0	1	0
Aspidoras spA	1	1	1	1	1	1	2	1	1	0	1	1	0	0	1	0	1	0	1	0
Aspidoras spB	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aspidoras spC	1	1	1	1	1	1	2	1	1	0	1	0	0	0	1	0	0	0	1	0
Aspidoras taurus	1	1	1	1	1	1	2	0	1	0	1	1	0	0	1	0	0	0	1	0
Aspidoras virgulatus	1	1	1	1	1	1	2	0	0	0	1	1	0	0	1	0	0	0	0	0
Callichthys callichthys RS	0	0	1	0	0	1	1	1	1	1	0	1	0	1	1	1	?	1	0	1
Callichthys callichthys SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Callichthys fabricioi	0	0	1	0	0	1	1	1	0	1	0	1	0	1	1	1	?	1	0	1
Callichthys serralabium	0	0	1	0	0	1	1	1	0	1	0	1	0	1	1	1	?	1	0	1
Corydoras adolfoi	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0
Corydoras aeneus macrosteus	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0
Corydoras aeneus microps	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	0&1	0&1	0	0	0
Corydoras amapaensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ambiacus	1	1	2	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0

	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119
Corydoras approuaguensis	1	1	2	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0
Corydoras araguaiaensis	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0
Corydoras arcuatus	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	1	0&1	0	0	0
Corydoras armatus	1	1	1	1	1	1	2	1	1	0	1	0	1	0	0	1	0	0	0	0
Corydoras atropersonatus	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	0&1	0	0	0	0
Corydoras boesemani	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0
Corydoras breei	1	1	1	1	1	1	2	1	0	0	1	1	1	0	0	1	0	0	0	0
Corydoras brevirostris	1	1	1	1	1	1	2	1	1	0	1	0	1	0	0	1	0	0	0	0
Corydoras britskii	1	1	2	1	1	1	2	1	1	0	1	1	1	0	0	1	1	0	0	0
Corydoras burgessi	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0
Corydoras caudimaculatus	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	0	0	0	0	0
Corydoras cervinus	1	1	1	1	1	1	2	1	0	0	1	1	0	0	1	1	0	0	1	0
Corydoras condisciplus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras areio	1	1	1	1	1	1	2	1	0	0	1	1	1	0	1	1	0	0	1	0
Corydoras cochui	1	1	1	1	1	1	2	1	1	0	1	0	1	0	0	1	1	0	0	0
Corydoras coppenamensis	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0
Corydoras difluviatilis	1	1	1	1	1	1	1	1	0	0	1	0	0	0	1	0&1	0	0	0	0
Corydoras diphyes	1	1	1	1	1	1	2	1	0	0	1	1	0	0	1	1	0	0	0	0
Corydoras ehrhardti	1	1	0	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0
Corydoras ehrhardti LBP741-8893	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras elegans Belem	?	?	1	1	1	1	2	1	0	0	1	1	0	0	1	0&1	0	0	0	0
Corydoras elegans Peru	?	1	?	1	?	?	?	?	?	0	?	?	?	?	?	1	0	0	0	0
Corydoras elegans Pantanal	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ellisae	1	1	1	1	1	1	2	1	0	0	1	1	0	0	0	1	0	0	0	0
Corydoras ephippifer	1	1	2	1	1	1	2	1	0	0	1	1	1	0	1	1	0	0	0	0
Corydoras flaveolus	1	1	0	0&1	1	1	2	1	1	0	1	1	0	0	1	1	0	0	0	0
Corydoras geoffroy	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gossei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gracilis	1	1	1	1	1	1	2	1	1	0	1	1	1	0	1	0&1	0	0	0	0
Corydoras guapore	1	1	2	1	1	1	2	1	1	0	1	1	0	0	1	1	1	0	0	0
Corydoras guianensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras habrosus	1	1	1	1	1	1	2	1	1	0	1	1	1	0	1	0&1	1	0	0	0

	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119
Corydoras hastatus australe	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras imitator	1	1	2	1	1	1	2	1	1	0	1	1	1	0	1	1	0	0	0	0
Corydoras julii	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0
Corydoras kanei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras lacerdai	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras leucomelas	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras longipinnis	1	1	1	1	1	1	2	1	0	0	1	1	1	0	1	1	1	0	0	0
Corydoras loretoensis	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0
Corydoras melanistius	1	1	2	1	1	1	2	1	0	0	1	1	0	0	1	1	0	0	0	0
Corydoras melini	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras metae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras napoensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras narcissus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Ribeira do Iguape	1	1	1	1	1	1	2	1	1	0	1	1	1	0	1	1	0	0	0	0
Corydoras nattereri Paranagua1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paranagua2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Guanabara	1	1	1	1	1	1	2	1	1	0	1	1	1	0	1	0&1	0	0	0	0
Corydoras nattereri Guanabara HV11-75	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Macae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paraiba do Sul	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Tiete	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0
Corydoras nattereri Tiete HV11-76	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Bahia	1	1	1	1	1	1	2	1	1	0	1	1	0	0	0	0&1	1	0	0	0
Corydoras nijsseni	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ourastigma	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Argentina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus CW24 MA61	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Guaiba	1	1	1	1	1	1	2	1	0	0	1	1	1	0	1	0	1	0	0	0
Corydoras paleatus Long Fin MA128	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras panda	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119
Corydoras pantanalensis	1	1	2	1	1	1	2	1	1	0	1	1	1	0	0	1	1	0	0	0
Corydoras polystictus Caceres	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pulcher	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras punctatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pygmaeus	1	1	1	1	1	1	2	1	1	0	1	1	0	0	1	0	1	0	0	0
Corydoras rabauti	1	1	1	1	1	1	2	1	0	0	1	1	1	0	1	1	1	0	0	0
Corydoras reticulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras robineae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sanchesi	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0
Corydoras schwartzi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras semiaquilus	1	1	1	1	1	1	2	1	0	0	1	1	1	0	0	1	0	0	1	0
Corydoras seussi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras simulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sodalis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras spA	1	1	1	1	1	1	2	1	0	?	1	1	0	0	0	1	0	0	0	0
Corydoras spB	1	1	1	1	1	1	2	1	1	0	1	1	0	0	0	0	1	0	0	0
Corydoras spC	1	1	1	1	1	1	2	1	0	0	1	1	1	0	0	1	0	0	0	0
Corydoras splendens	1	1	2	1	1	1	2	1	1	0	1	1	1	0	1	1	1	0	0	0
Corydoras stenocephalus	1	1	1	1	1	1	2	1	0	0	1	1	0	0	1	1	0	0	1	0
Corydoras treitlii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras trilineatus	1	1	1	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0
Corydoras tukano	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras undulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras urucu	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras weitzmani	1	1	0	1	1	1	2	1	1	0	1	1	1	0	0	1	0	0	0	0
Corydoras wotroi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras zygatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras xinguensis	1	1	1	1	1	1	2	1	0	0	1	1	0	0	0	1	0	0	0	0
Dianema longibarbis	0	0	3	0	1	1	1	1	0	1	0	1	0	1	1	1	?	1	0	1
Dianema urostriatum	0	0	3	0	1	1	1	1	0	1	0	1	0	1	1	1	?	1	0	1
Hoplosternum littorale	1	0	2	0	1	1	1	1	0	1	0	1	0	1	1	1	?	1	0	1
Hoplosternum magdalenae	?	?	3	0	1	1	2	1	0	1	0	1	0	1	1	1	?	1	0	1

	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119
Hoplosternum punctatum	1	0	2	0	1	1	2	1	0	1	0	1	0	1	1	1	?	1	0	1
Lepthoplosternum altamazonicum	1	0	2	0	1	1	1	1	1	1	0	1	0	1	1	1	?	1	0	1
Lepthoplosternum beni	1	0	1	0	1	1	2	1	0	1	0	1	0	?	1	1	?	1	0	1
Lepthoplosternum pectorale	1	0	1	0	1	1	1	1	0	1	0	1	1	1	1	1	?	1	0	1
Lepthoplosternum stellatum	1	0	1	0	1	1	1	1	0	1	0	1	0	1	1	1	?	1	0	1
Lepthoplosternum tordilho	1	0	1	0	1	1	1	1	0	1	0	1	0	1	1	1	?	1	0	1
Lepthoplosternum ucamara	0	0	2	0	1	1	1	1	0	1	0	1	1	1	1	1	?	1	0	1
Megalechis picta	0	0	1	0	1	1	2	1	1	1	0	1	0	1	1	1	?	1	0	1
Megalechis thoracata	0	0	1	0	1	1	1	1	0	1	0	1	0	1	1	1	?	1	0	1
Scleromystax barbatus Itanhaem-Santos	1	1	1	1	1	1	2	1	1	0	1	1	1	0	1	0	0	0	0	0
Scleromystax barbatus Ribeira do Iguape	1	1	1	1	1	1	1	0	1	0	1	1	0	0	1	1	0	0	0	0
Scleromystax barbatus Paranagua PRSC	1	1	1	1	1	1	1	1	1	0	1	1	1	0	1	0	0	0	0	0
Scleromystax macropterus	1	1	1	1	1	1	2	1	0	0	1	1	1	0	1	1	0	0	0	0
Scleromystax prionotos Itapeuna-SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax prionotos Ribeira do Iguape	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax salmacis	1	1	1	1	1	1	2	1	0	0	1	1	1	0	1	1	0	0	0	0

	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139
Copionodon sp	0	0	0	0	0	0	?	0	0	0	0	?	0	0	0	0	0	0	0	0
Trichogenes longipinnis	0	0	0	1	0	1	0	1	3	0	0	?	0	0	0	0	0	0	0	1
Trichomycterus areolatus	1	0	0	1	1	0	?	0	9	0	?	?	0	0	0	0	0	0	0	0
Trichomycterus balios	1	0	0	1	1	0	?	0	9	0	?	?	0	0	0	0	0	0	0	0
Scoloplax distolothrix	?	?	?	?	?	?	?	?	0&1	?	?	?	0	0	0	2	8	2	2	7
Scoloplax empousa	?	?	?	?	?	?	?	?	0&1	?	?	?	0	0	0	2	8	2	2	7
Astroblepus spB	1	0	0	1	0	0	?	2	2	0	0	?	1	0	0	2	3	2	2	0
Astroblepus spC	1	0	0	1	0	0	?	2	2	0	0	?	1	0	0	2	5	2	2	0
Astroblepus spF	1	0	0	1	0	0	?	2	2	0	0	?	1	0	0	2	5	2	2	0
Hemipsilichthys gobio	0	0	0	1	0	0	?	0	2	0	1	0	1	2	3	2	1	2	2	3
Hemipsilichthys nimius	0	0	0	1	0	0	?	0	2	0	1	0	1	2	3	2	5	2	2	3
Harttia kronei	1	0	0	1	0	0	?	0	1	1	1	1	1	2	3	2	1	2	2	2
Rineloricaria microlepidogaster	1	0	0	1	0	0	?	0	1	0	1	1	1	2	3	2	2	2	2	5&6
Aspidoras albater Cavalcante	0	1	0	1	1	0	?	0	8	0	1	2	1	0	1	1	5	0	1	5
Aspidoras eurycephalus Cavalcante	0	0&1	0	1	1	0	?	0	8	0	1	2	0	0	2	1	4	0	1	5
Aspidoras poecilus Barra do Garcas	0	1	0	1	0	0	?	0	7	0	1	2	1	0	1	1	4	0	1	5
Aspidoras psammatides	0	0	0	1	1	0	?	0	7	0	1	2	0	0	1	1	3	0	1	5
Aspidoras raimundi	0	1	0	1	1	0	?	0	7	0	1	2	0	0	1	1	6	0	1	5
Aspidoras spA	0	0	0	0	1	0	?	0	8	0	1	2	0	0	1	1	6	0	1	5
Aspidoras spB	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aspidoras spC	0	0	0	1	1	0	?	0	7	0	1	2	0	0	2	1	5	0	1	4
Aspidoras taurus	0	0	0	0	1	0	?	0	8	0	1	2	1	0	2	1	3	0	1	3
Aspidoras virgulatus	0	0	0	1	1	0	?	0	8	0	1	1	0	0	2	1	5	0	1	5
Callichthys callichthys RS	1	0	0	0	0	1	1	0	7	0	0	?	1	2	1	1	2	0	0	1
Callichthys callichthys SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Callichthys fabricioi	1	0	0	0	0	1	1	0	7	0	0	?	1	2	1	1	2	0	0	1
Callichthys serralabium	1	0	0	0	0	1	1	0	7	0	0	?	1	2	1	1	4	0	0	2
Corydoras adolfoi	0	0	0	1	1	0	?	0	7	0	1	1	0	0	1	1	8	1	1	5
Corydoras aeneus macrosteus	0	0	0	0	1	0	?	0	7	0	1	2	0	0	1	1	8	1	1	5
Corydoras aeneus microps	0	0	0	0	1	0	?	0	7	0	1	2	0	0	1	1	7	1	1	5
Corydoras amapaensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ambiacus	0	0&1	0	1	1	0	?	0	7	0	1	2	0	0	1	1	7	1	1	3

	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139
Corydoras approuaguensis	0	0	0	1	1	0	?	0	7	0	1	2	0	0	1	1	7	1	1	3
Corydoras araguaiaensis	0	0	0	0	1	0	?	0	7	0	1	1	0	0	1	1	8	1	1	5
Corydoras arcuatus	0	0	0	1	1	0	?	0	7	0	1	2	0	0	1	1	7	1	1	?
Corydoras armatus	0	0	0	0	1	0	?	0	5&6	0	1	2	0	0	1	1	8	1	1	6
Corydoras atropersonatus	0	0	0	1	1	0	?	0	6	0	1	2	0	0	1	1	8	1	1	4
Corydoras boesemani	0	0	0	1	1	0	?	0	7	0	1	2	0	0	1	1	7	1	1	5
Corydoras breei	0	0	0	1	1	0	?	0	7	0	1	2	0	0	1	1	8	1	1	5
Corydoras brevirostris	0	0	0	1	1	0	?	0	7	0	1	1	0	0	1	1	8	1	1	4
Corydoras britskii	0	0	1	1	1	0	?	0	4	0	1	2	0	0	1	1	6	1	1	3
Corydoras burgessi	0	0	0&1	0	1	0	?	0	7	0	1	2	0	0	1	1	8	1	1	4
Corydoras caudimaculatus	0	0	0	0	1	0	?	0	7	0	1	2	0	0	1	1	9	1	1	5
Corydoras cervinus	0	0	1	1	1	0	?	0	4&6	0	1	2	0	1	1	1	7	1	1	6
Corydoras condisciplus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras areio	0	0	1	1	1	0	?	0	5&6	0	1	2	0	0	1	1	7	1	1	6
Corydoras cochui	0	0	0	1	1	0	?	0	7	0	1	2	0	0	1	1	8	0	1	6
Corydoras coppenamensis	0	0	0	1	1	0	?	0	7	0	1	1	0	0	1	1	8	0	1	5
Corydoras difluviatilis	0	0	0	0	1	0	?	0	7	0	1	2	0	0	1	1	6	0	1	3
Corydoras diphyes	0	0	1	0	1	0	?	0	8	0	1	1	0	0	1	1	9	1	1	5
Corydoras ehrhardti	0	0	0	0	1	0	?	0	8	0	1	2	0	0	1	1	7	0	1	5
Corydoras ehrhardti LBP741-8893	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras elegans Belem	0	0	0	0	1	0	?	0	7	0	1	1	0	0	1	1	?	1	1	?
Corydoras elegans Peru	0	0	0	0	1	0	?	0	7	0	1	1	0	0	1	1	7	1	1	4
Corydoras elegans Pantanal	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ellisae	0	0&1	1	1	1	0	?	0	5&6	0	1	1	0	0	1	1	7	1	1	6
Corydoras ephippifer	0	0	0	0	1	0	?	0	7	0	1	1	0	0	1	1	7	0	1	5
Corydoras flaveolus	0	0	0	1	1	0	?	0	7	0	1	2	0	0	1	1	6	0	1	6
Corydoras geoffroy	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gossei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gracilis	0	0	0	1	1	0	?	0	6&7	0	1	1	0	0	1	1	6	1	1	4
Corydoras guapore	0	0	0	1	1	0	?	0	8	0	1	2	0	0	1	1	7	1	1	4
Corydoras guianensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras habrosus	0	0	0	1	1	0	?	0	8	0	1	2	0	0	1	1	8	0	1	5

	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139
Corydoras hastatus australe	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras imitator	0	0	0	1	1	0	?	0	7	0	1	1	0	0	1	1	7	1	1	4
Corydoras julii	0	0	0	1	1	0	?	0	7	0	1	1	0	0	1	1	8	1	1	4
Corydoras kanei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras lacerdai	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras leucomelas	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras longipinnis	0	0	0	0	1	0	?	0	7	0	1	2	0	0	1	1	8	0	1	5
Corydoras loretoensis	0	0	0	0	1	0	?	0	7	0	1	2	0	0	1	1	9	0	1	6
Corydoras melanistius	0	0	0	1	1	0	?	0	7	0	1	2	0	0	1	1	8	1	1	3
Corydoras melini	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras metae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras napoensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras narcissus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Ribeira do Iguape	0	0	0	0	1	0	?	0	7&8	0	1	2	0	0	1	1	7	0	1	5
Corydoras nattereri Paranagua1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paranagua2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Guanabara	0	0	0	0	1	0	?	0	8	0	1	2	0	0	1	1	8	1	1	5
Corydoras nattereri Guanabara HV11-75	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Macae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paraiba do Sul	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Tiete	0	0	0	0	1	0	?	0	8	0	1	2	0	0	1	1	8	1	1	5
Corydoras nattereri Tiete HV11-76	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Bahia	0	0	0	0	1	0	?	0	7&8	0	1	2	0	0	1	1	8	0	1	5
Corydoras nijsseni	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ourastigma	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Argentina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus CW24 MA61	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Guaiba	0	0	0	0	1	0	?	0	8	0	1	2	0	0	1	1	7	0	1	4
Corydoras paleatus Long Fin MA128	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras panda	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	120	121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139
Corydoras pantanalensis	0	0	0	1	1	0	?	0	6	0	1	2	0	0	1	1	7	1	1	4
Corydoras polystictus Caceres	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pulcher	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras punctatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pygmaeus	0	0	0	0	1	0	?	0	8	0	1	2	0	0	1	1	9	1	1	4
Corydoras rabauti	0	0	0	0	1	0	?	0	7	0	1	1	0	0	1	1	8	1	1	4
Corydoras reticulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras robineae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sanchesi	0	0	0	1	1	0	?	0	7	0	1	2	0	0	1	1	7	1	1	4
Corydoras schwartzi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras semiaquilus	0	1	1	1	1	0	?	0	6	0	1	2	0	1	1	1	6	1	1	?
Corydoras seussi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras simulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sodalis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras spA	0	0	0	1	1	0	?	0	7	0	1	2	0	0	1	1	8	1	1	6
Corydoras spB	0	0	0	1	1	0	?	0	7&8	0	1	1	0	0	1	1	8	1	1	6
Corydoras spC	0	0	0&1	0	1	0	?	0	6&7	0	1	2	0	0	1	1	7	1	1	5
Corydoras splendens	0	0	1	0	1	0	?	0	6	0	1	2	0	0	1	1	8	1	1	4
Corydoras stenocephalus	0	1	1	1	1	0	?	0	4	0	1	1	0	1	1	1	6	1	1	5
Corydoras treitlii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras trilineatus	0	0	0	0	1	0	?	0	7	0	1	2	0	0	1	1	8	1	1	5
Corydoras tukano	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras undulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras urucu	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras weitzmani	0	0	0	0	1	0	?	0	7	0	1	1	0	0	1	1	7	1	1	5
Corydoras wotroi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras zygatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras xinguensis	0	0	0	0	1	0	?	0	7	0	1	2	0	0	1	1	8	1	1	5
Dianema longibarbis	1	0	0	1	1	1	0	1	6	1	1	1	0	0	1	1	5	0	0	2
Dianema urostriatum	1	0	0	1	1	1	0	1	6	1	1	1	0	0	1	1	5	0	0	2
Hoplosternum littorale	1	0	0	1	1	1	0	1	4	1	1	0	1	0	1	1	5&6	0	0	1
Hoplosternum magdalenae	1	0	0	0	1	1	0	1	7	1	1	1	1	2	1	1	6	0	0	1

	120	**121**	**122**	**123**	**124**	**125**	**126**	**127**	**128**	**129**	**130**	**131**	**132**	**133**	**134**	**135**	**136**	**137**	**138**	**139**
Hoplosternum punctatum	1	0	0	0	0	1	0	1	7	1	1	1	1	0	1	1	5	0	0	2
Lepthoplosternum altamazonicum	1	0	0	0	0	1	1	0	7	0	0	?	1	2	1	1	6	0	0	2&3
Lepthoplosternum beni	1	0	0	0	0	1	1	0	7	0	0	?	1	2	1	1	7	0	0	2&4
Lepthoplosternum pectorale	1	0	0	0	0	1	1	0	7	0	0	?	1	2	1	1	6	0	0	3
Lepthoplosternum stellatum	1	0	0	0	0	1	1	0	7	0	0	?	1	2	1	1	6	0	0	3
Lepthoplosternum tordilho	1	0	0	0	0	1	1	0	7	0	0	?	1	2	1	1	7	0	0	2
Lepthoplosternum ucamara	1	0	0	0	0	1	1	0	7	0	0	?	1	2	1	1	6	0	0	3
Megalechis picta	1	0	0	0	0	1	1	0	7	0	0	?	1	2	1	1	5	0	0	2&3
Megalechis thoracata	1	0	0	0	0	1	1	0	7	0	0	?	1	2	1	1	?	0	0	?
Scleromystax barbatus Itanhaem-Santos	0	0	0	1	1	0	?	0	5	0	1	2	0	0	1	1	4	0	1	6
Scleromystax barbatus Ribeira do Iguape	0	0	0	1	1	0	?	0	6	0	1	1	0	0	2	1	6	0	1	6
Scleromystax barbatus Paranagua PRSC	0	1	0	1	1	0	?	0	4&5	0	1	1	0	0	2	1	6	0	1	6
Scleromystax macropterus	0	0	0	0	1	0	?	0	8	0	1	1	0	0	1	1	6	0	1	4
Scleromystax prionotos Itapeuna-SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax prionotos Ribeira do Iguape	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax salmacis	0	0	0	1	1	0	?	0	7	0	1	1	0	0	2	1	5	0	1	5

	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
Copionodon sp	0	0	0	0	0	0	0	0	0	?	0	0	0	0	0	0	0	?	0	0
Trichogenes longipinnis	0	0	0	0	0	0	1	0	0	?	0	0	0	0	0	0	0	?	0	0
Trichomycterus areolatus	0	0	0	0	0	?	?	?	0	?	0	0	0	0	0	0	0	?	1	0
Trichomycterus balios	0	0	0	0	0	0	1	0	0	?	0	0	0	0	0	0	0	?	1	0
Scoloplax distolothrix	0	0	2	0	0	0	3	3	0	?	1	1	0	1	2	0	4	0	3	2
Scoloplax empousa	0	1	2	0	0	0	3	3	1	1	1	1	0	1	2	0	4	0	3	2
Astroblepus spB	0	0	2	0	0	0	2	0	0	?	3	1	0	0	0	0	3	0	1	2
Astroblepus spC	0	0	2	0	0	0	2	0	0	?	3	1	0	0	0	0	3	?	1	2
Astroblepus spF	0	0	2	0	0	0	2	0	0	?	3	1	0	0	0	0	3	0	1	2
Hemipsilichthys gobio	0	1	2	0	0	0	1	1	0	?	2	1	1	0	0	0	0	0	1	1
Hemipsilichthys nimius	0	1	2	0	0	0	0	1	0	?	2	1	1	0	0	0	0	0	1	2
Harttia kronei	0	1	2	0	0	0	1	3	1	0	1	1	1	0	0	0	0	0	2	2
Rineloricaria microlepidogaster	0	0	2	0	0	0	1	3	1	0	1	1	1	0	0	0	0	0	3	2
Aspidoras albater Cavalcante	1	2	1	0	0	0	1	2	0	?	3	2	1	1	0	0	1	1	1	1
Aspidoras eurycephalus Cavalcante	1	2	1	0	0	0	1	1	0	?	3	2	1	1	0	0	1	0	1	1
Aspidoras poecilus Barra do Garcas	1	2	1	0	0	0	1	2	1	1	3	2	1	1	1	0	1	0	1	1
Aspidoras psammatides	1	2	1	0	0	0	1	2	?	?	3	2	1	1	1	0	1	0	1	1
Aspidoras raimundi	1	2	1	0	0	0	1	2	1	1	3	2	1	1	1	0	1	0	1	1
Aspidoras spA	1	2	1	0	0	0	1	2	1	0	3	2	1	1	1	0	1	0	1	1
Aspidoras spB	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aspidoras spC	1	2	1	0	0	0	1	1	1	1	3	2	1	1	1	0	1	0	1	1
Aspidoras taurus	1	2	1	0	0	0	1	1	1	1	3	2	1	1	0	0	1	0	1	1
Aspidoras virgulatus	1	2	1	0	0	0	1	3	1	1	3	2	1	1	0	0	1	0	1	1
Callichthys callichthys RS	1	2	1	0	2	1	1	1	0	?	2	2	0	0	0	0	0	0	1	1
Callichthys callichthys SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Callichthys fabricioi	1	2	1	0	3	1	1	1	0	?	2	2	0	0	0	0	3	0	1	1
Callichthys serralabium	1	2	1	0	2	1	1	1	0	?	2	2	1	0	0	0	0	?	2	1
Corydoras adolfoi	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras aeneus macrosteus	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras aeneus microps	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras amapaensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ambiacus	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	2	1	0	1	1

	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
Corydoras approuaguensis	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	2	1	?	1	1
Corydoras araguaiaensis	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	?	1	1
Corydoras arcuatus	1	2	1	0	?	0	1	2	1	0	3	2	1	1	2	1	1	?	1	1
Corydoras armatus	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras atropersonatus	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras boesemani	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	?	1	1
Corydoras breei	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras brevirostris	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras britskii	1	2	1	0	0	0	4	2	1	0	3	2	1	1	2	2	2	?	1	1
Corydoras burgessi	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	?	1	1
Corydoras caudimaculatus	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	?	1	1
Corydoras cervinus	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras condisciplus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras areio	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras cochui	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1&2	1
Corydoras coppenamensis	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras difluviatilis	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras diphyes	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras ehrhardti	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	1	1	1
Corydoras ehrhardti LBP741-8893	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras elegans Belem	1	2	1	0	?	0	1	2	1	0	3	2	1	1	2	1	1	?	1	1
Corydoras elegans Peru	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	0&1	1	1	1
Corydoras elegans Pantanal	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ellisae	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras ephippifer	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	2	1	0	1	1
Corydoras flaveolus	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras geoffroy	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gossei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gracilis	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras guapore	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	?	1	1
Corydoras guianensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras habrosus	1	2	1	1	0	0	1	3	1	0	3	2	1	1	2	1	1	?	1	1

	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
Corydoras hastatus australe	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras imitator	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	2	1	?	1	1
Corydoras julii	1	2	1	1	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras kanei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras lacerdai	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras leucomelas	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras longipinnis	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	1	1	1
Corydoras loretoensis	1	2	1	1	0	0	1	3	1	0	3	2	1	1	2	1	1	?	1	1
Corydoras melanistius	1	2	1	1	0	0	1	3	1	0	3	2	1	1	2	2	1	?	1	1
Corydoras melini	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras metae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras napoensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras narcissus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Ribeira do Iguape	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	1	1	1
Corydoras nattereri Paranagua1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paranagua2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Guanabara	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	1	1	1
Corydoras nattereri Guanabara HV11-75	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Macae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paraiba do Sul	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Tiete	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	1	1	1
Corydoras nattereri Tiete HV11-76	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Bahia	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	1	1	1
Corydoras nijsseni	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ourastigma	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Argentina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus CW24 MA61	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Guaiba	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	1	1	1
Corydoras paleatus Long Fin MA128	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras panda	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
Corydoras pantanalensis	1	2	1	1	0	0	1	3	1	0	3	2	1	1	2	2	1	1	1	1
Corydoras polystictus Caceres	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pulcher	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras punctatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pygmaeus	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras rabauti	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras reticulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras robineae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sanchesi	1	2	1	1	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras schwartzi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras semiaquilus	1	2	1	0	?	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras seussi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras simulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sodalis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras spA	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	?	1	1
Corydoras spB	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras spC	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras splendens	1	2	1	1	0	0	4	3	1	0	3	2	1	1	2	2	2	?	1	1
Corydoras stenocephalus	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras treitlii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras trilineatus	1	2	1	1	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras tukano	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras undulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras urucu	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras weitzmani	1	2	1	1	0	0	1	3	1	0	3	2	1	1	2	1	1	0	1	1
Corydoras wotroi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras zygatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras xinguensis	1	2	1	1	0	0	1	3	1	0	3	2	1	1	2	1	1	0	1	1
Dianema longibarbis	1	2	1	0	2	1	1	1	0	?	2	2	1	1	2	0	1	0	2	1
Dianema urostriatum	1	2	1	0	2	1	1	2	0	?	2	2	1	1	2	0	1	?	1	1
Hoplosternum littorale	1	2	1	0	2	1	1	2	0	?	2	2	1	1	0	0	0	0	1	1
Hoplosternum magdalenae	1	2	1	0	?	1	1	2	0	?	?	2	1	1	1	0	1	0	1	1

	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159
Hoplosternum punctatum	1	2	1	0	2	1	1	2	0	?	2	2	1	1	1	0	0	0	1	1
Lepthoplosternum altamazonicum	1	2	1	0	1&2	1	1	2	0	?	2	2	1	0	2	0	0	0	2	2
Lepthoplosternum beni	1	2	1	0	2	1	1	2	0	?	2	2	1	0	1	0	0	0	2	2
Lepthoplosternum pectorale	1	2	1	0	1	1	1	2	0	?	2	2	1	1	1	0	0	0	2	2
Lepthoplosternum stellatum	1	2	1	0	2	0&1	1	2	0	?	2	2	1	0	1	0	0	0	2	2
Lepthoplosternum tordilho	1	2	1	0	2	1	1	1	0	?	2	2	1	1	1	0	1&3	0	2	2
Lepthoplosternum ucamara	1	2	1	0	2	1	1	2	0	?	2	2	1	1	1	0	3	0	2	2
Megalechis picta	1	2	1	0	2	1	1	2	0	?	2	2	1	1	1	0	1	0	1	1&2
Megalechis thoracata	1	2	1	0	?	1	1	2	0	?	2	2	1	1	0	0	0	0	1	1
Scleromystax barbatus Itanhaem-Santos	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	1	1	1
Scleromystax barbatus Ribeira do Iguape	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	1	1	1
Scleromystax barbatus Paranagua PRSC	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	1	1	1	1	1
Scleromystax macropterus	1	2	1	0	0	0	1	3	1	0	3	2	1	1	2	0	1	1	1	1
Scleromystax prionotos Itapeuna-SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax prionotos Ribeira do Iguape	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax salmacis	1	2	1	0	0	0	1	2	1	0	3	2	1	1	2	1	1	0	1	1

	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179
Copionodon sp	0	0	0	0	0	0	0	0	0	0	?	?	?	0	?	?	0	?	?	?
Trichogenes longipinnis	0	0	0	0	0	0	0	0	0	0	?	?	?	0	0	0	0	?	?	0
Trichomycterus areolatus	2	0	1	0	0	0	0	0	0	0	?	?	?	0	?	?	0	?	?	?
Trichomycterus balios	2	0	1	1	0	0	0	0	0	0	?	?	?	0	?	?	0	?	?	?
Scoloplax distolothrix	2	0	1	0	0	1	1	1	1	2	0	0	0	1	0	0	2	0	0	0
Scoloplax empousa	2	0	1	0	0	1	1	1	1	2	0	0	0	1	0	0	2	0	0	0
Astroblepus spB	1	0	0	1	0	1	0	0	0	0	?	?	?	0	0	0	0	?	?	0
Astroblepus spC	1	0	0	1	0	1	0	0	0	0	?	?	?	0	?	?	0	?	?	?
Astroblepus spF	1	0	0	1	0	1	0	0	0	0	?	?	?	0	0	0	0	?	?	0
Hemipsilichthys gobio	2	0	0	0	0	1	1	0	?	1	0	0	0	2	1	0	0	?	?	0
Hemipsilichthys nimius	2	0	0	0	0	1	1	1	1	1	0	0	0	2	1	0	0	?	?	0
Harttia kronei	2	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	?	?	0
Rineloricaria microlepidogaster	2	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	?	?	0
Aspidoras albater Cavalcante	1	0	0	0	1	2	1	2	1	1	1	0	0	0	0	0	2	0	0	0
Aspidoras eurycephalus Cavalcante	1	0	0	0	1	2	1	2	1	1	1	0	0	0	0	0	2	0	0	0
Aspidoras poecilus Barra do Garcas	1	0	0	0	1	2	1	2	1	1	1	0	0	0	0	0	2	0	0	0
Aspidoras psammatides	1	0	0	0	1	2	1	2	1	1	1	0	0	0	0	0	2	0	0	0
Aspidoras raimundi	1	0	0	0	1	2	1	2	1	1	1	0	0	0	0	0	2	0	0	0
Aspidoras spA	1	0	0	0	1	2	2	2	1	2	1	0	0	1	0	0	2	0	0	0
Aspidoras spB	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aspidoras spC	1	0	0	0	1	2	1	2	1	1	1	0	0	0	0	0	2	0	0	0
Aspidoras taurus	1	0	0	0	1	2	1	2	1	1	1	0	0	0	0	0	2	0	0	0
Aspidoras virgulatus	1	0	0	0	1	2	1	2	2	1	1	0	0	1	0	0	2	0	0	0
Callichthys callichthys RS	2	0	1	0	1	2	1	1	1	1	1	0	0	2	0	1	2	0	0	1
Callichthys callichthys SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Callichthys fabricioi	2	0	1	0	1	2	1	1	1	2	1	0	0	2	0	1	0	?	?	1
Callichthys serralabium	2	0	1	0	1	2	1	1	1	1	1	0	0	2	0	1	2	0	0	1
Corydoras adolfoi	2	0	0	0	1	2	2	2	2	2	1	0	0	2	0	0	2	0	1	0
Corydoras aeneus macrosteus	1	0	0	0	1	2	2	2	2	2	1	0	1	2	0	0	2	0	1	0
Corydoras aeneus microps	1	0	0	0	1	2	2	2	2	2	1	1	1	2	0	0	2	0	1	0
Corydoras amapaensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ambiacus	1	0	0	0	1	2	2	2	2	2	1	0	1	2	0	0	2	0	0	0

	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179
Corydoras approuaguensis	1	0	0	0	1	2	2	2	2	2	1	0	0	2	?	?	2	0	0	?
Corydoras araguaiaensis	1	0	0	0	1	2	2	2	2	2	1	0	0	2	?	?	2	0	1	?
Corydoras arcuatus	1	0	0	0	1	2	2	2	2	2	1	1	0	2	?	?	2	0	1	?
Corydoras armatus	1	0	0	0	1	2	2	2	1	2	1	1	1	2	0	0	2	0	0	0
Corydoras atropersonatus	1	0	0	0	1	2	1	2	1	2	1	0	0	2	0	0	2	0	1	0
Corydoras boesemani	1	0	0	0	1	2	1	2	2	2	1	0	0	2	?	?	2	0	1	?
Corydoras breei	1	0	0	0	1	2	1	2	2	2	1	0	0	2	0	0	2	0	1	0
Corydoras brevirostris	1	0	0	0	1	2	1	2	2	2	1	0	0	2	0	0	2	0	1	0
Corydoras britskii	1	1	0	0	2	2	2	2	2	3	1	1	1	2	?	?	2	0	0	?
Corydoras burgessi	1	0	0	0	1	2	1	2	2	2	1	0	0	2	?	?	2	0	1	?
Corydoras caudimaculatus	1	0	0	0	2	2	2	2	2	2	1	1	1	2	?	?	2	0	1	?
Corydoras cervinus	1	0	0	0	1	2	1	2	1	2	1	0	0	1	1	0	2	1	0	0
Corydoras condisciplus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras areio	1	0	0	0	1	2	1	2	1	2	1	0	0	2	0	0	2	1	0	0
Corydoras cochui	1	0	0	0	1	2	2	2	1	1	1	0	0	2	0	0	2	0	1	0
Corydoras coppenamensis	1	0	0	0	1	2	1	2	2	2	1	0	0	2	?	0	2	0	1	0
Corydoras difluviatilis	1	0	0	0	1	2	1	2	2	2	1	0	0	1	0	0	0&1	0	1	0
Corydoras diphyes	1	0	0	0	1	2	1	2	2	2	1	0	0	2	0	0	2	0	1	0
Corydoras ehrhardti	2	0	0	0	1	2	1	2	2	2	1	0	0	2	0	0	2	0	1	0
Corydoras ehrhardti LBP741-8893	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras elegans Belem	1	0	0	0	2	2	2	2	1	2	1	1	1	2	?	?	2	1	0	?
Corydoras elegans Peru	1	0	0	0	1	2	2	2	1	2	1	1	1	2	0	1	2	1	0	0
Corydoras elegans Pantanal	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ellisae	1	0	0	0	1	2	1	2	1	2	1	0	0	1	1	0	2	1	0	0
Corydoras ephippifer	1	0	0	0	1	2	2	2	1	2	1	1	0	2	0	0	2	0	0	0
Corydoras flaveolus	2	0	0	0	1	2	1	2	1	2	1	0	0	2	0	0	2	0	1	0
Corydoras geoffroy	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gossei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gracilis	1	0	0	0	1	2	2	2	1	2	1	0	0	2	0	0	2	1	0	0
Corydoras guapore	1	0	0	0	2	2	2	2	1	3	1	1	1	2	?	?	2	1	0	0
Corydoras guianensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras habrosus	1	0	0	0	1	2	2	2	1	2	1	1	0	2	?	?	2	0	1	0

	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179
Corydoras hastatus australe	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras imitator	1	0	0	0	1	2	2	2	1	2	1	0	0	2	?	?	2	0	0	0
Corydoras julii	1	0	0	0	1	2	1	2	2	2	1	0	0	2	0	0	2	0	1	0
Corydoras kanei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras lacerdai	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras leucomelas	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras longipinnis	2	0	0	0	1	2	1	2	2	2	1	0	0	2	0	2	2	0	1	0
Corydoras loretoensis	1	0	0	0	1	2	1	2	2	2	1	0	0	2	?	?	2	0	1	?
Corydoras melanistius	1	1	0	0	1	2	2	2	2	2	1	0	0	2	?	?	2	0	0	0
Corydoras melini	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras metae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras napoensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras narcissus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Ribeira do Iguape	2	0	0	0	1	2	2	2	2	2	1	0	0	2	0	1	2	0	1	0
Corydoras nattereri Paranagua1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paranagua2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Guanabara	2	0	0	0	1	2	2	2	2	2	1	0	0	2	0	1	2	0	1	0
Corydoras nattereri Guanabara HV11-75	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Macae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paraiba do Sul	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Tiete	2	0	0	0	1	2	2	2	2	2	1	0	0	2	0	1	2	0	1	0
Corydoras nattereri Tiete HV11-76	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Bahia	2	0	0	0	1	2	1	2	2	2	1	0	0	?	0	1	2	0	1	0
Corydoras nijsseni	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ourastigma	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Argentina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus CW24 MA61	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Guaiba	2	0	0	0	1	2	2	2	2	3	1	0	0	2	0	2	2	0	1	0
Corydoras paleatus Long Fin MA128	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras panda	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179
Corydoras pantanalensis	1	1	0	0	2	2	2	2	2	2	1	1	1	2	0	0	2	0	0	0
Corydoras polystictus Caceres	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pulcher	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras punctatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pygmaeus	2	0	0	0	1	2	2	2	1	2	1	1	1	2	0	0	2	0	1	0
Corydoras rabauti	1	1	0	0	2	2	2	2	1	3	1	1	1	2	0	0	2	0	1	0
Corydoras reticulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras robineae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sanchesi	1	0	0	0	1	2	1	2	1	2	1	0	0	2	0	0	2	0	1	0
Corydoras schwartzi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras semiaquilus	1	0	0	0	1	2	1	2	1	2	1	0	0	1	1	1	2	1	0	0
Corydoras seussi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras simulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sodalis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras spA	2	0	0	0	1	2	2	2	1	2	1	0	0	2	?	?	2	0	1	?
Corydoras spB	1&2	0	0	0	1	2	2	2	1	1	1	0	0	2	0	0	2	0	1	0
Corydoras spC	1	0	0	0	1	2	1	2	2	2	1	0	0	2	0	0	2	0	1	0
Corydoras splendens	1	1	0	0	2	2	2	2	2	3	1	1	1	2	?	?	2	0	0	?
Corydoras stenocephalus	1	0	0	0	1	2	2	2	2	3	1	1	0	1	1	1	2	1	0	0
Corydoras treitlii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras trilineatus	1	0	0	0	1	2	2	2	2	2	1	0	0	2	0	0	2	0	1	0
Corydoras tukano	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras undulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras urucu	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras weitzmani	1	0	0	0	1	2	2	2	2	2	1	0	0	2	0	0	2	0	1	0
Corydoras wotroi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras zygatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras xinguensis	1	0	0	0	1	2	2	2	2	2	1	0	1	2	?	?	2	0	1	0
Dianema longibarbis	1	1	0	0	1	2	3	1	1	3	1	1	1	2	0	1	2	0	0	1
Dianema urostriatum	1	1	0	0	1	2	3	1	1	3	1	1	1	2	?	?	2	0	0	?
Hoplosternum littorale	1	1	0	0	1	2	3	1	1	3	1	1	1	2	0	2	2	0	0	1
Hoplosternum magdalenae	1	1	0	0	2	2	3	1	1	3	1	1	1	2	0	2	2	0	0	1

	160	161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179
Hoplosternum punctatum	1	1	0	0	2	2	3	1	1	3	1	1	1	2	0	2	2	0	0	1
Lepthoplosternum altamazonicum	2	0	1	0	2	2	3	1	1	3	1	1	1	2	0	1	2	0	0	1
Lepthoplosternum beni	2	0	1	1	2	2	3	1	1	3	1	1	1	2	?	?	2	1	0	?
Lepthoplosternum pectorale	2	0	1	1	2	2	3	1	1	3	1	1	1	1	0	0	2	0	0	1
Lepthoplosternum stellatum	2	0	1	1	2	2	3	1	1	3	1	1	1	1	0	1	2	0	0	1
Lepthoplosternum tordilho	2	0	1	0	2	2	3	1	1	3	1	1	1	1	0	1	2	1	0	1
Lepthoplosternum ucamara	2	0	1	1	1	2	3	1	1	3	1	1	1	1	0	1	2	0	0	1
Megalechis picta	1&2	0	1	0	2	2	3	1	1	3	1	1	1	2	0	2	2	1	0	1
Megalechis thoracata	1	0	1	0	1	2	3	1	1	3	1	1	1	2	0	2	2	0	0	1
Scleromystax barbatus Itanhaem-Santos	1	0	0	0	1	2	1	2	2	1	1	0	0	1	0	2	2	1	0	0
Scleromystax barbatus Ribeira do Iguape	1	0	0	0	1	2	1	2	1	1	1	0	0	1	0	2	2	1	0	0
Scleromystax barbatus Paranagua PRSC	1	0	0	0	1	2	1	2	1	1	1	0	0	1	0	2	2	1	0	0
Scleromystax macropterus	1	0	0	0	1	2	1	2	1	2	1	0	0	1	0	2	2	1	0	0
Scleromystax prionotos Itapeuna-SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax prionotos Ribeira do Iguape	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax salmacis	1	0	0	0	1	2	1	2	2	2	1	0	0	1	0	0	2	1	0	0

	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199
Copionodon sp	0	0	0	?	0	0	0	?	?	0	?	0	?	0	0	0	?	0	?	?
Trichogenes longipinnis	1	0	0	?	0	0	0	?	?	0	0	0	?	1	0	0	0	0	?	?
Trichomycterus areolatus	0	0	0	?	0	0	0	?	?	0	?	0	?	0	0	0	?	0	?	?
Trichomycterus balios	0	0	0	?	0	0	0	?	?	0	0	0	?	0	0	0	0	0	?	?
Scoloplax distolothrix	1	2	0	?	0	0	2	?	?	0	?	1	0	1	0	4	0	0	0	0
Scoloplax empousa	1	2	0	?	0	0	2	?	?	0	0	1	0	1	0	4	0	0	0	0
Astroblepus spB	0	0	1	1	1	0	3	?	?	0	?	3	0	0	0	0	0	0	?	?
Astroblepus spC	0	0	1	1	1	0	3	?	?	0	?	3	0	0	0	0	0	0	?	?
Astroblepus spF	0	0	1	1	1	0	3	?	?	0	0	3	0	0	0	0	0	0	?	?
Hemipsilichthys gobio	0	2	0	?	0	0	2	?	?	0	0	3	0	0	0	2	1	0	0	0
Hemipsilichthys nimius	0	2	0	?	0	0	2	?	?	0	0	3	0	0	0	2	1	0	0	0
Harttia kronei	1	2	0	?	0	0	2	?	?	0	0	3	0	0	0	2	1	0	0	1
Rineloricaria microlepidogaster	1	2	0	?	0	0	2	?	?	0	0	3	0	0	0	2	1	0	0	1
Aspidoras albater Cavalcante	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Aspidoras eurycephalus Cavalcante	2	1	2	0	2	0	1	0	0	1	0	2	1	1	0	0	0	0	1	0
Aspidoras poecilus Barra do Garcas	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	0	0	1	1	0
Aspidoras psammatides	2	1	2	0	2	0	1	0	1	1	0	2	1	0	0	1	0	0	1	0
Aspidoras raimundi	2	1	2	0	2	0	1	0	1	1	0	2	1	0	0	1	0	0	1	1
Aspidoras spA	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	0	0	0	1	1
Aspidoras spB	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aspidoras spC	2	1	2	0	2	0	1	0	0	1	0	2	1	1	0	1	0	1	1	1
Aspidoras taurus	2	1	2	0	2	0	1	0	0	1	0	2	1	1	0	1	0	0	1	0
Aspidoras virgulatus	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	0	1	1	1
Callichthys callichthys RS	2	0	2	0	2	0	1	0	0	1	0	2	0	1	0	0	0	0	1	0
Callichthys callichthys SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Callichthys fabricioi	2	0	2	0	2	0	1	0	1	1	?	2	0	1	0	0	0	0	1	0
Callichthys serralabium	2	0	2	0	2	0	1	0	1	1	0	2	0	1	0	0	0	0	1	0
Corydoras adolfoi	2	1	2	1	2	0	1	0	0	1	0	2	1	0	0	0	0	0	1	1
Corydoras aeneus macrosteus	2	1	2	0	2	0	1	1	0	1	0	2	1	0	0	?	0	0	1	0
Corydoras aeneus microps	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras amapaensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ambiacus	2	1	2	1	2	1	1	0	0	1	0	2	1	0	0	1	0	0	1	1

	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199
Corydoras approuaguensis	2	1	2	1	2	0	1	0	1	1	0	2	1	0	0	0	?	0	1	1
Corydoras araguaiaensis	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	1	?	0	1	1
Corydoras arcuatus	2	1	2	1	2	0	1	0	1	1	0	2	1	0	0	1	?	0	1	1
Corydoras armatus	2	1	2	1	2	0	1	0	1	1	0	2	1	0	0	1	0	0	1	1
Corydoras atropersonatus	2	1	2	0	2	1	1	0	1	1	0	2	1	0	0	0	0	0	1	1
Corydoras boesemani	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	1	?	0	1	1
Corydoras breei	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	1	0	0	1	1
Corydoras brevirostris	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	1	0	0	1	1
Corydoras britskii	2	1	2	1	2	0	1	1	0	1	0	2	1	0	0	3	?	0	1	1
Corydoras burgessi	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	0	?	0	1	1
Corydoras caudimaculatus	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	0	?	0	1	1
Corydoras cervinus	2	1	2	0	2	0	1	0	1	1	0	2	1	0	1	1	0	0	1	1
Corydoras condisciplus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras areio	2	1	2	0	2	0	1	0	1	1	0	2	1	0	0	1	0	0	1	1
Corydoras cochui	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	1	0	0	1	1
Corydoras coppenamensis	2	1	2	0	2	1	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras difluviatilis	2	1	2	1	2	1	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras diphyes	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	0	0	0	1	1
Corydoras ehrhardti	2	1	2	1	2	0	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras ehrhardti LBP741-8893	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras elegans Belem	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	?	0	1	1
Corydoras elegans Peru	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras elegans Pantanal	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ellisae	2	1	2	0	2	0	1	0	1	1	0	2	1	0	0	1	0	0	1	1
Corydoras ephippifer	2	1	2	1	2	0	1	0	0	1	0	2	1	0	0	0	0	0	1	1
Corydoras flaveolus	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	1	0	0	1	1
Corydoras geoffroy	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gossei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gracilis	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras guapore	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	?	0	1	1
Corydoras guianensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras habrosus	2	1	2	1	2	1	1	0	0	1	0	2	1	0	0	1	?	0	1	1

	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199
Corydoras hastatus australe	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras imitator	2	1	2	0	2	1	1	0	0	1	0	2	1	0	0	1	?	0	1	1
Corydoras julii	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	1	0	0	1	1
Corydoras kanei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras lacerdai	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras leucomelas	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras longipinnis	2	1	2	1	2	1	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras loretoensis	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	1	?	0	1	1
Corydoras melanistius	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	1	?	0	1	1
Corydoras melini	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras metae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras napoensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras narcissus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Ribeira do Iguape	2	1	2	1	2	1	1	0	0	1	0	2	1	0	0	0	0	0	1	1
Corydoras nattereri Paranagua1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paranagua2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Guanabara	2	1	2	1	2	1	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras nattereri Guanabara HV11-75	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Macae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paraiba do Sul	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Tiete	2	1	2	1	2	1	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras nattereri Tiete HV11-76	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Bahia	2	1	2	1	2	0	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras nijsseni	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ourastigma	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Argentina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus CW24 MA61	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Guaiba	2	1	2	1	2	0	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras paleatus Long Fin MA128	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras panda	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	180	181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199
Corydoras pantanalensis	2	1	2	1	2	1	1	1	0	1	0	2	1	0	0	0	0	0	1	1
Corydoras polystictus Caceres	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pulcher	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras punctatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pygmaeus	2	1	2	1	2	0	1	0	0	1	0	2	1	0	0	1	0	0	1	0
Corydoras rabauti	2	1	2	1	2	0	1	0	0	1	0	2	1	0	0	1	0	?	1	1
Corydoras reticulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras robineae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sanchesi	2	1	2	0	2	1	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras schwartzi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras semiaquilus	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras seussi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras simulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sodalis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras spA	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	1	?	0	1	1
Corydoras spB	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	1	0	0	1	1
Corydoras spC	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras splendens	2	1	2	1	2	1	1	1	1	1	?	2	1	0	0	3	?	0	1	1
Corydoras stenocephalus	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	0	0	1	1
Corydoras treitlii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras trilineatus	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	1	0	0	1	1
Corydoras tukano	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras undulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras urucu	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras weitzmani	2	1	2	1	2	1	1	0	0	1	0	2	1	0	0	0	0	0	1	1
Corydoras wotroi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras zygatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras xinguensis	2	1	2	1	2	1	1	0	1	1	0	2	1	0	0	0	?	0	1	1
Dianema longibarbis	2	0	2	0	2	0	1	0	0	1	1	2	3	1	0	1	0	0	1	0
Dianema urostriatum	2	0	2	0	2	0	1	0	0	1	0	2	3	1	0	1	?	0	1	0
Hoplosternum littorale	2	0	2	0	2	0	1	0	0	1	1	2	0	1	0	0	0	0	1	0
Hoplosternum magdalenae	2	0	2	0	2	0	1	0	0	1	1	2	0	1	0	0	0	0	1	0

	180	**181**	**182**	**183**	**184**	**185**	**186**	**187**	**188**	**189**	**190**	**191**	**192**	**193**	**194**	**195**	**196**	**197**	**198**	**199**
Hoplosternum punctatum	2	0	2	0	2	0	1	0	0	1	1	2	0	1	0	0	0	0	1	0
Lepthoplosternum altamazonicum	2	1	2	0	2	0	1	0	1	1	0	2	2	2	0	0	0	0	1	1
Lepthoplosternum beni	2	1	2	0	2	0	1	0	1	1	0	2	2	2	0	0	?	0	1	1
Lepthoplosternum pectorale	2	1	2	0	2	0	1	0	1	1	0	2	2	2	0	0	0	0	1	1
Lepthoplosternum stellatum	2	1	2	0	2	0	1	0	1	1	0	2	2	2	0	0	0	0	1	1
Lepthoplosternum tordilho	2	1	2	0	2	0	1	0	1	1	0	2	2	2	0	0	0	0	1	1
Lepthoplosternum ucamara	2	1	2	0	2	0	1	0	1	1	0	2	2	2	0	0	0	0	1	0&1
Megalechis picta	2	1	2	0	2	0	1	0	1	1	0	2	0	1	0	0	0	0	1	0
Megalechis thoracata	2	1	2	0	2	0	1	0	1	1	1	2	0	1	0	0	0	0	1	0
Scleromystax barbatus Itanhaem-Santos	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	1	0	1	1
Scleromystax barbatus Ribeira do Iguape	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	1	1	1	1
Scleromystax barbatus Paranagua PRSC	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	1	1	1	1
Scleromystax macropterus	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	1	1	1	1
Scleromystax prionotos Itapeuna-SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax prionotos Ribeira do Iguape	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax salmacis	2	1	2	0	2	0	1	0	0	1	0	2	1	0	0	1	0	1	1	1

	200	**201**	**202**	**203**	**204**	**205**	**206**	**207**	**208**	**209**	**210**	**211**	**212**	**213**	**214**	**215**
Copionodon sp	0	?	?	?	?	0	0	0	0	0	0	0	0	0	0	0
Trichogenes longipinnis	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Trichomycterus areolatus	0	?	?	?	?	0	0	0	0	0	0	0	0	0	0	0
Trichomycterus balios	0	?	?	?	?	0	0	0	0	0	0	0	0	0	0	0
Scoloplax distolothrix	1	0	0	0	0	0	0	0	0	0	0	0	?	0	0	0
Scoloplax empousa	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Astroblepus spB	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Astroblepus spC	0	?	?	?	?	0	0	0	0	0	0	0	?	0	0	0
Astroblepus spF	0	0	1	0	0	0	0	0	0	0	0	0	?	0	0	0
Hemipsilichthys gobio	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Hemipsilichthys nimius	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Harttia kronei	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rineloricaria microlepidogaster	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aspidoras albater Cavalcante	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aspidoras eurycephalus Cavalcante	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Aspidoras poecilus Barra do Garcas	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aspidoras psammatides	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aspidoras raimundi	1	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0
Aspidoras spA	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Aspidoras spB	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Aspidoras spC	1	1	0	0	0	0	0	0	0	0	0	0	?	0	0	0
Aspidoras taurus	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aspidoras virgulatus	0	1	0	0	0	0	0	0	1	1	0	0	0	0	0	0
Callichthys callichthys RS	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Callichthys callichthys SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Callichthys fabricioi	0	0	1	0	0	0	0	0	0	0	0	0	?	0	1	0
Callichthys serralabium	0	0	1	0	0	0	0	0	0	0	0	0	?	0	1	0
Corydoras adolfoi	1	1	0	0	0	1	1	0	0	0	0	0	0	3	0	0
Corydoras aeneus macrosteus	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corydoras aeneus microps	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corydoras amapaensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ambiacus	1	1	0	0	0	0	0	0	0	0	1	0	?	2	0	0

	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215
Corydoras approuaguensis	1	?	?	?	?	1	0	0	0	0	0	0	?	0	0	0
Corydoras araguaiaensis	0	?	?	?	?	0	0	0	0	0	0	0	0	0	0	0
Corydoras arcuatus	0	?	?	?	?	0	0	0	0	0	0	0	?	1	0	0
Corydoras armatus	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corydoras atropersonatus	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Corydoras boesemani	1	?	?	?	?	1	0	0	1	0	0	0	?	1	0	0
Corydoras breei	0	0	0	0	0	0	0	0	0&1	0	0	0	0	1	0	0
Corydoras brevirostris	0	0	0	0	0	1	0	0	0	0	1	0	0	2	0	0
Corydoras britskii	3	?	?	?	?	0	?	0	0	0	0	0	?	0	0	0
Corydoras burgessi	0	?	?	?	?	1	0&1	0	0	0	1	0	0	3	0	0
Corydoras caudimaculatus	0	?	?	?	?	0	?	0	0	0	0	1	0	0	0	0
Corydoras cervinus	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Corydoras condisciplus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras areio	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corydoras cochui	0	0	0	0	0	0	0	0	0	0	0	0	?	0	0	0
Corydoras coppenamensis	0	0	0	0	0	0	0	0	1	0	0	0	?	1	0	0
Corydoras difluviatilis	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corydoras diphyes	0	0&1	0	0	0	0	0	0	0	0	0	0	?	0	0	0
Corydoras ehrhardti	1	0&1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corydoras ehrhardti LBP741-8893	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras elegans Belem	1	?	?	?	?	0	0	0	1	0	0	0	0	0	0	0
Corydoras elegans Peru	1	0	0	0	0	0	0	0	1	0	0	0	?	0	0	0
Corydoras elegans Pantanal	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ellisae	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corydoras ephippifer	0	?	?	?	?	1	0	0	0	0	1	0	0	2	0	0
Corydoras flaveolus	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corydoras geoffroy	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gossei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras gracilis	0	0	0	0	0	0	0	0	0	0	0	0	?	0	0	0
Corydoras guapore	0	?	?	?	?	0	0	0	0	0	0	1	?	0	0	0
Corydoras guianensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras habrosus	1	?	?	?	?	0	0	0	0	0	0	1	0	0	0	0

	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215
Corydoras hastatus australe	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras imitator	1	?	?	?	?	1	1	0	0	0	0	0	?	2	0	0
Corydoras julii	2	1	0	0	?	0	0	0	0&1	0	0	0	0	0	0	0
Corydoras kanei	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras lacerdai	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras leucomelas	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras longipinnis	1	0	0	0	0	0	0	0	0	0	0	0	?	0	0	0
Corydoras loretoensis	1	?	?	?	?	0	0	0	0	0	0	0	0	1	0	0
Corydoras melanistius	1	?	?	?	?	1	0	0	0	0	1	0	?	2	0	0
Corydoras melini	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras metae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras napoensis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras narcissus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Ribeira do Iguape	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
Corydoras nattereri Paranagua1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paranagua2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Guanabara	1	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0
Corydoras nattereri Guanabara HV11-75	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Macae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Paraiba do Sul	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao1	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Sao Joao2	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Tiete	1	0	0	0	0	0	0	0	0	0	1	0	0	2	0	0
Corydoras nattereri Tiete HV11-76	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras nattereri Bahia	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
Corydoras nijsseni	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras ourastigma	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Argentina	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus CW24 MA61	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras paleatus Guaiba	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corydoras paleatus Long Fin MA128	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras panda	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?

	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215
Corydoras pantanalensis	0	0	0	0	0	0	0	0	0	0	0	0	?	0	0	0
Corydoras polystictus Caceres	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pulcher	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras punctatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras pygmaeus	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1
Corydoras rabauti	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Corydoras reticulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras robineae	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sanchesi	0	0	0	0	0	0	0	0	0	0	0	0	?	1	0	0
Corydoras schwartzi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras semiaquilus	2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corydoras seussi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras simulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras sodalis	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras spA	0	?	?	?	?	1	0	0	0	0	0	0	?	0	0	0
Corydoras spB	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Corydoras spC	0	1	0	0	0	0	0	0	0	0	0	0	?	0	0	0
Corydoras splendens	1	?	?	?	?	0	0	0	0	0	0	0	?	0	0	0
Corydoras stenocephalus	1	1	0	0	0	0	0	0	0	0	0	0	?	0	0	0
Corydoras treitlii	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras trilineatus	2	0	0	0	0	0	0	0	1	0	0	0	0	3	0	0
Corydoras tukano	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras undulatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras urucu	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras weitzmani	0	0	0	0	0	0	0	0	0	0	0	1	?	2	0	0
Corydoras wotroi	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras zygatus	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Corydoras xinguensis	1	?	?	?	?	0	0	0	0	0	0	0	0	2	0	0
Dianema longibarbis	0	0	1	0	0	0	0	0	0	0	0	0	?	0	1	1
Dianema urostriatum	0	?	?	?	?	0	0	0	0	0	0	0	?	0	1	1
Hoplosternum littorale	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0
Hoplosternum magdalenae	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0

	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215
Hoplosternum punctatum	0	0	1	0	0	0	0	0	0	0	0	0	?	0	1	0
Lepthoplosternum altamazonicum	0	0	1	0	0	0	0	0	0	0	0	0	?	0	1	0
Lepthoplosternum beni	0	?	?	?	?	0	0	0	0	0	0	0	0	0	1	0
Lepthoplosternum pectorale	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Lepthoplosternum stellatum	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Lepthoplosternum tordilho	0	0	1	0	0	0	0	0	0	0	0	0	?	0	1	0
Lepthoplosternum ucamara	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0
Megalechis picta	0	0	1	1	0	0	0	0	0	0	0	0	?	0	1	0
Megalechis thoracata	0	0	1	1	0	0	0	0	0	0	0	0	1	0	1	0
Scleromystax barbatus Itanhaem-Santos	1	1	0	0	1	0	0	0	0	1	0	0	?	0	0	0
Scleromystax barbatus Ribeira do Iguape	1	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0
Scleromystax barbatus Paranagua PRSC	1	1	0	0	1	0	0	0	0	1	0	0	?	0	0	0
Scleromystax macropterus	1	1	0	0	0	0	0	0	0	0	0	0	?	0	0	0
Scleromystax prionotos Itapeuna-SP	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax prionotos Ribeira do Iguape	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?	?
Scleromystax salmacis	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 6. Phylogenetic classification of the Callichthyidae

Family Callichthyidae Bonaparte, 1838
  Subfamily Callichthyinae Bonaparte, 1838
    Tribe Callichthyini Bonaparte, 1838
      Callichthys Scopoli, 1777
      Megalechis Reis, 1997
      Lepthoplosternum Reis, 1997
    Tribe Hoplosternini Miranda Ribeiro, 1959
      "*Hoplosternum*" Gill, 1858
      Dianema Cope, 1871
  Subfamily Corydoradinae Hoedeman, 1952
      Corydoras La Cépède, 1803
      Gastrodermus Cope, 1878
      Hoplisoma Swainson, 1838
      Aspidoras Ihering, 1907
      Scleromystax Günther, 1864

Table 7. Synapomorphies common to the 89 trees found. Character-state transformations are listed according to the nodes shown in the consensus tree of Fig. 7 (numbers above branches). Characters 0 from 213 corresponds to morphology, 214 and 215 to behavior, 216 to 610 to *12S rRNA*, 611 to 1200 to *16S rRNA*, 1201 to 2043 to *ND4*, 2044 to 3133 to *Cytb*, 3134 to 3984 to *Rag1*. Codification character-states from molecular characters are as follows: 0=A, 1=C, 2=G, 3=T.

Copionodon sp:

All trees:

No autapomorphies:

Trichogenes longipinnis:

All trees:

Char. 2: 0 → 1	Char. 638: 2 → 0	Char. 889: 3 → 1	Char. 1261: 2 → 0	Char. 1557: 1 → 3
Char. 6: 0 → 1	Char. 647: 0 → 2	Char. 909: 0 → 2	Char. 1262: 1 → 3	Char. 1587: 1 → 3
Char. 33: 0 → 1	Char. 757: 0 → 2	Char. 914: 3 → 1	Char. 1333: 1 → 3	Char. 1602: 1 → 0
Char. 38: 0 → 1	Char. 812: 0 → 3	Char. 948: 0 → 1	Char. 1365: 1 → 3	Char. 1614: 0 → 1
Char. 96: 0 → 1	Char. 814: 0 → 3	Char. 1009: 2 → 3	Char. 1377: 0 → 2	Char. 1704: 1 → 3
Char. 125: 0 → 1	Char. 816: 0 → 1	Char. 1025: 3 → 1	Char. 1398: 3 → 1	Char. 1743: 1 → 2
Char. 127: 0 → 1	Char. 856: 3 → 1	Char. 1037: 3 → 1	Char. 1455: 0 → 2	Char. 1746: 0 → 1
Char. 139: 0 → 1	Char. 875: 0 → 1	Char. 1094: 1 → 3	Char. 1467: 0 → 3	Char. 1755: 1 → 3
Char. 180: 0 → 1	Char. 877: 1 → 0	Char. 1206: 0 → 3	Char. 1474: 1 → 3	Char. 1788: 0 → 2
Char. 193: 0 → 1	Char. 878: 1 → 0	Char. 1242: 1 → 3	Char. 1531: 1 → 0	Char. 1819: 0 → 2
Char. 637: 0 → 2	Char. 882: 0 → 2	Char. 1245: 1 → 3	Char. 1539: 0 → 3	Char. 1833: 3 → 1

Char. 1839: 0 → 2	Char. 1977: 0 → 2	Char. 3201: 2 → 0	Char. 3407: 3 → 1	Char. 3825: 0 → 2
Char. 1845: 0 → 2	Char. 2013: 3 → 1	Char. 3217: 3 → 2	Char. 3428: 0 → 3	Char. 3887: 2 → 3
Char. 1848: 0 → 2	Char. 2029: 1 → 3	Char. 3227: 2 → 1	Char. 3462: 0 → 3	Char. 3891: 1 → 3
Char. 1872: 0 → 2	Char. 3139: 3 → 0	Char. 3281: 0 → 3	Char. 3521: 0 → 3	Char. 3906: 2 → 0
Char. 1885: 0 → 3	Char. 3148: 3 → 1	Char. 3290: 1 → 3	Char. 3526: 0 → 1	Char. 3922: 2 → 1
Char. 1921: 0 → 2	Char. 3149: 2 → 0	Char. 3317: 2 → 0	Char. 3572: 3 → 1	Char. 3954: 1 → 0
Char. 1923: 0 → 1	Char. 3168: 2 → 0	Char. 3330: 0 → 2	Char. 3617: 3 → 2	

Trichomycterus areolatus:

All trees:

Char. 33: 0 → 1	Char. 856: 3 → 1	Char. 1386: 0 → 2	Char. 1620: 0 → 2	Char. 1765: 1 → 3
Char. 62: 0 → 1	Char. 879: 0 → 1	Char. 1416: 1 → 3	Char. 1623: 0 → 2	Char. 1797: 0 → 3
Char. 96: 0 → 1	Char. 880: 0 → 3	Char. 1491: 3 → 1	Char. 1650: 1 → 3	Char. 1806: 3 → 1
Char. 353: 0 → 2	Char. 909: 0 → 2	Char. 1500: 1 → 3	Char. 1653: 0 → 2	Char. 1824: 3 → 1
Char. 418: 3 → 0	Char. 1039: 0 → 3	Char. 1536: 0 → 2	Char. 1666: 1 → 3	Char. 1844: 0 → 2
Char. 483: 2 → 0	Char. 1101: 1 → 3	Char. 1552: 0 → 2	Char. 1680: 0 → 2	Char. 1924: 1 → 3
Char. 485: 0 → 2	Char. 1242: 1 → 3	Char. 1560: 1 → 0	Char. 1690: 1 → 3	
Char. 505: 0 → 2	Char. 1318: 1 → 3	Char. 1571: 3 → 1	Char. 1704: 1 → 3	
Char. 740: 3 → 1	Char. 1326: 0 → 2	Char. 1581: 0 → 1	Char. 1740: 1 → 2	
Char. 845: 0 → 2	Char. 1377: 0 → 2	Char. 1599: 1 → 0	Char. 1741: 1 → 2	

Trichomycterus balios:

All trees:

Char. 34: 0 → 2	Char. 889: 3 → 0	Char. 1398: 3 → 1	Char. 1554: 1 → 3	Char. 1785: 0 → 2
Char. 57: 0 → 1	Char. 890: 0 → 1	Char. 1404: 1 → 3	Char. 1587: 1 → 3	Char. 1803: 1 → 3
Char. 108: 0 → 1	Char. 969: 0 → 2	Char. 1432: 1 → 3	Char. 1588: 1 → 3	Char. 1819: 0 → 1
Char. 163: 0 → 1	Char. 977: 1 → 0	Char. 1440: 3 → 1	Char. 1602: 1 → 3	Char. 1833: 3 → 1
Char. 311: 3 → 1	Char. 1246: 1 → 3	Char. 1453: 2 → 0	Char. 1641: 1 → 3	Char. 1839: 0 → 2
Char. 416: 3 → 0	Char. 1269: 0 → 1	Char. 1467: 0 → 3	Char. 1686: 0 → 2	Char. 1902: 2 → 0
Char. 878: 1 → 3	Char. 1302: 0 → 2	Char. 1473: 1 → 3	Char. 1711: 1 → 3	Char. 1927: 3 → 1
Char. 884: 0 → 2	Char. 1308: 0 → 2	Char. 1503: 1 → 3	Char. 1752: 0 → 2	Char. 1985: 2 → 0
Char. 888: 3 → 0	Char. 1344: 1 → 3	Char. 1549: 1 → 3	Char. 1770: 0 → 2	

Scoloplax distolothrix:

All trees:

Char. 28: 1 → 0	Char. 859: 0 → 3	Char. 902: 1 → 2	Char. 986: 1 → 3	Char. 1015: 3 → 1
Char. 771: 3 → 1	Char. 874: 3 → 0	Char. 966: 2 → 0	Char. 1000: 1 → 3	Char. 1025: 3 → 1

Scoloplax empousa:

All trees:

Char. 141: 0 → 1	Char. 816: 0 → 3	Char. 912: 1 → 3
Char. 148: 0 → 1	Char. 894: 3 → 1	Char. 967: 2 → 0

Astroblepus spB*:*

All trees:

Char. 54: 2 → 1	Char. 240: 0 → 2	Char. 987: 1 → 3	Char. 2951: 0 → 3	Char. 3049: 0 → 2
Char. 108: 0 → 1	Char. 515: 3 → 1	Char. 2691: 1 → 0	Char. 3004: 0 → 2	Char. 3094: 3 → 1
Char. 136: 5 → 3	Char. 768: 3 → 1	Char. 2739: 1 → 3	Char. 3034: 1 → 3	

Astroblepus spC:

All trees:

Char. 232: 0 → 1	Char. 1512: 3 → 0	Char. 1714: 3 → 1	Char. 2739: 1 → 0	Char. 2880: 3 → 1
Char. 448: 0 → 3	Char. 1554: 1 → 3	Char. 1810: 1 → 3	Char. 2760: 1 → 3	Char. 2886: 0 → 2
Char. 877: 0 → 1	Char. 1557: 1 → 3	Char. 1839: 0 → 2	Char. 2769: 1 → 3	Char. 2899: 1 → 3
Char. 880: 0 → 3	Char. 1560: 1 → 3	Char. 1866: 1 → 3	Char. 2773: 1 → 3	Char. 2910: 0 → 2
Char. 994: 0 → 2	Char. 1608: 3 → 1	Char. 1884: 1 → 3	Char. 2781: 1 → 3	Char. 2926: 2 → 0
Char. 1237: 1 → 3	Char. 1641: 1 → 3	Char. 1915: 0 → 2	Char. 2802: 1 → 3	Char. 2941: 1 → 3
Char. 1257: 0 → 1	Char. 1659: 1 → 3	Char. 1950: 2 → 3	Char. 2820: 1 → 3	Char. 2950: 1 → 3
Char. 1419: 1 → 3	Char. 1666: 1 → 0	Char. 2703: 1 → 3	Char. 2838: 0 → 2	Char. 2952: 1 → 3
Char. 1446: 1 → 3	Char. 1680: 0 → 2	Char. 2726: 3 → 0	Char. 2847: 1 → 3	Char. 2985: 3 → 1
Char. 1487: 1 → 3	Char. 1695: 3 → 1	Char. 2729: 3 → 0	Char. 2862: 1 → 3	Char. 2995: 1 → 3

Astroblepus spF:

All trees:

Char. 21: 0 → 1	Char. 2668: 2 → 0	Char. 2793: 1 → 3	Char. 2910: 0 → 1	Char. 3091: 0 → 2
Char. 853: 0 → 2	Char. 2737: 3 → 1	Char. 2811: 1 → 3	Char. 3046: 0 → 3	Char. 3127: 3 → 1
Char. 969: 0 → 2	Char. 2748: 3 → 0	Char. 2877: 1 → 3	Char. 3064: 0 → 2	

Hemipsilichthys nimius:

All trees:

Char. 146: 1 → 0	Char. 745: 0 → 2	Char. 1230: 0 → 2	Char. 1494: 0 → 2	Char. 1638: 0 → 1
Char. 370: 3 → 2	Char. 773: 3 → 1	Char. 1234: 0 → 2	Char. 1498: 0 → 2	Char. 1647: 3 → 1
Char. 374: 0 → 2	Char. 814: 0 → 1	Char. 1254: 0 → 2	Char. 1500: 1 → 2	Char. 1656: 1 → 0
Char. 440: 0 → 3	Char. 877: 3 → 0	Char. 1275: 3 → 1	Char. 1512: 3 → 1	Char. 1660: 1 → 0
Char. 467: 2 → 1	Char. 878: 1 → 3	Char. 1305: 0 → 3	Char. 1531: 1 → 3	Char. 1668: 0 → 1
Char. 473: 2 → 0	Char. 883: 0 → 2	Char. 1308: 0 → 2	Char. 1539: 0 → 2	Char. 1721: 3 → 0
Char. 517: 3 → 1	Char. 914: 0 → 2	Char. 1377: 0 → 2	Char. 1563: 0 → 2	Char. 1746: 0 → 3
Char. 518: 3 → 1	Char. 964: 3 → 1	Char. 1398: 3 → 1	Char. 1567: 3 → 1	Char. 1788: 0 → 2
Char. 571: 2 → 0	Char. 1000: 1 → 3	Char. 1455: 0 → 2	Char. 1575: 1 → 3	Char. 1842: 0 → 2
Char. 705: 1 → 0	Char. 1026: 0 → 1	Char. 1482: 3 → 1	Char. 1590: 0 → 2	Char. 1848: 3 → 1

Char. 1872: 0 → 2	Char. 1954: 0 → 2	Char. 1964: 0 → 2
Char. 1932: 3 → 1	Char. 1955: 2 → 0	Char. 3569: 3 → 1

Hemipsilichthys gobio:

All trees:

Char. 159: 2 → 1	Char. 789: 3 → 1	Char. 933: 1 → 0	Char. 1083: 2 → 0	Char. 1584: 0 → 2
Char. 167: 1 → 0	Char. 793: 1 → 3	Char. 935: 0 → 3	Char. 1090: 1 → 3	Char. 1605: 1 → 3
Char. 515: 3 → 1	Char. 796: 2 → 0	Char. 936: 1 → 3	Char. 1091: 1 → 0	Char. 1608: 0 → 3
Char. 538: 1 → 3	Char. 799: 1 → 0	Char. 939: 2 → 0	Char. 1095: 1 → 3	Char. 1650: 1 → 3
Char. 669: 0 → 1	Char. 803: 0 → 2	Char. 940: 0 → 2	Char. 1114: 2 → 3	Char. 1659: 1 → 3
Char. 675: 1 → 3	Char. 819: 1 → 3	Char. 941: 2 → 1	Char. 1115: 2 → 0	Char. 1680: 0 → 2
Char. 676: 1 → 2	Char. 824: 1 → 3	Char. 943: 0 → 3	Char. 1116: 2 → 0	Char. 1692: 0 → 2
Char. 678: 1 → 3	Char. 832: 1 → 3	Char. 947: 0 → 3	Char. 1124: 2 → 0	Char. 1704: 1 → 3
Char. 687: 2 → 1	Char. 836: 3 → 0	Char. 948: 0 → 1	Char. 1130: 2 → 0	Char. 1713: 1 → 3
Char. 716: 1 → 3	Char. 847: 2 → 3	Char. 952: 3 → 1	Char. 1147: 0 → 2	Char. 1734: 0 → 2
Char. 717: 3 → 1	Char. 848: 0 → 3	Char. 953: 1 → 3	Char. 1159: 1 → 3	Char. 1737: 2 → 3
Char. 718: 3 → 1	Char. 852: 0 → 3	Char. 968: 2 → 0	Char. 1242: 1 → 3	Char. 1758: 3 → 1
Char. 719: 3 → 1	Char. 856: 1 → 2	Char. 998: 0 → 1	Char. 1245: 1 → 3	Char. 1776: 3 → 1
Char. 725: 2 → 0	Char. 860: 1 → 0	Char. 1001: 3 → 0	Char. 1279: 1 → 3	Char. 1800: 0 → 3
Char. 726: 0 → 2	Char. 876: 3 → 1	Char. 1005: 0 → 2	Char. 1318: 1 → 3	Char. 1802: 1 → 3
Char. 731: 1 → 3	Char. 880: 0 → 3	Char. 1021: 0 → 3	Char. 1341: 1 → 0	Char. 1803: 1 → 0
Char. 741: 2 → 0	Char. 889: 3 → 0	Char. 1022: 1 → 0	Char. 1347: 1 → 3	Char. 1815: 3 → 1
Char. 743: 3 → 1	Char. 890: 0 → 1	Char. 1032: 1 → 3	Char. 1368: 1 → 3	Char. 1824: 3 → 1
Char. 744: 2 → 1	Char. 892: 0 → 1	Char. 1034: 2 → 0	Char. 1428: 3 → 1	Char. 1839: 0 → 2
Char. 746: 0 → 1	Char. 897: 0 → 1	Char. 1035: 2 → 0	Char. 1432: 1 → 3	Char. 1958: 0 → 2
Char. 749: 2 → 0	Char. 898: 0 → 1	Char. 1044: 3 → 0	Char. 1446: 1 → 3	Char. 3164: 1 → 3
Char. 754: 1 → 3	Char. 900: 0 → 1	Char. 1045: 2 → 1	Char. 1486: 0 → 2	Char. 3263: 2 → 1
Char. 756: 3 → 2	Char. 902: 1 → 3	Char. 1047: 1 → 3	Char. 1515: 0 → 2	Char. 3353: 2 → 0
Char. 758: 0 → 2	Char. 904: 0 → 2	Char. 1054: 1 → 3	Char. 1524: 1 → 0	Char. 3468: 2 → 0
Char. 766: 1 → 3	Char. 906: 3 → 1	Char. 1055: 2 → 0	Char. 1548: 0 → 1	Char. 3581: 3 → 2
Char. 767: 1 → 3	Char. 907: 2 → 1	Char. 1056: 0 → 2	Char. 1566: 0 → 2	Char. 3624: 2 → 3
Char. 772: 1 → 3	Char. 918: 1 → 3	Char. 1058: 1 → 0	Char. 1569: 3 → 1	
Char. 775: 2 → 0	Char. 921: 1 → 3	Char. 1059: 1 → 3	Char. 1572: 3 → 1	
Char. 779: 0 → 2	Char. 930: 1 → 3	Char. 1081: 2 → 0	Char. 1581: 0 → 2	

Harttia kronei:

All trees:

Char. 21: 0 → 1	Char. 37: 0 → 1	Char. 61: 0 → 1	Char. 129: 0 → 1	Char. 409: 2 → 0

Char. 662: 0 → 2

Char. 770: 3 → 1

Char. 771: 3 → 1

Char. 774: 0 → 2

Char. 779: 0 → 2

Char. 793: 1 → 3

Char. 813: 0 → 1

Char. 815: 0 → 3

Char. 855: 0 → 1

Char. 876: 3 → 0

Char. 914: 0 → 1

Char. 948: 0 → 2

Char. 963: 1 → 3

Char. 982: 0 → 2

Char. 1012: 2 → 0

Char. 1018: 1 → 3

Char. 1042: 1 → 3

Char. 1201: 1 → 3

Char. 1341: 1 → 3

Char. 1344: 1 → 3

Char. 1347: 1 → 3

Char. 1368: 1 → 3

Char. 1374: 1 → 0

Char. 1386: 0 → 3

Char. 1393: 3 → 1

Char. 1398: 3 → 1

Char. 1411: 2 → 0

Char. 1437: 0 → 2

Char. 1446: 1 → 3

Char. 1455: 0 → 1

Char. 1461: 0 → 1

Char. 1464: 1 → 3

Char. 1479: 1 → 3

Char. 1482: 3 → 1

Char. 1494: 0 → 2

Char. 1515: 0 → 2

Char. 1518: 1 → 3

Char. 1536: 0 → 2

Char. 1537: 0 → 2

Char. 1554: 1 → 3

Char. 1590: 0 → 1

Char. 1608: 0 → 1

Char. 1623: 0 → 2

Char. 1639: 0 → 2

Char. 1641: 1 → 3

Char. 1644: 0 → 1

Char. 1668: 0 → 3

Char. 1671: 1 → 3

Char. 1683: 0 → 3

Char. 1686: 1 → 3

Char. 1716: 1 → 3

Char. 1717: 1 → 3

Char. 1722: 1 → 3

Char. 1731: 0 → 1

Char. 1740: 1 → 2

Char. 1750: 0 → 1

Char. 1758: 3 → 1

Char. 1760: 3 → 0

Char. 1801: 0 → 2

Char. 1804: 1 → 3

Char. 1822: 0 → 1

Char. 1842: 0 → 1

Char. 1857: 0 → 2

Char. 1883: 0 → 1

Char. 1908: 0 → 2

Char. 1927: 3 → 1

Char. 1948: 1 → 3

Char. 1949: 0 → 2

Char. 1950: 2 → 0

Char. 1987: 3 → 1

Char. 1997: 1 → 3

Char. 3139: 3 → 1

Char. 3178: 0 → 2

Char. 3200: 1 → 3

Char. 3224: 2 → 0

Char. 3308: 3 → 1

Char. 3331: 3 → 1

Char. 3557: 1 → 0

Char. 3683: 2 → 1

Char. 3684: 1 → 0

Char. 3685: 1 → 2

Char. 3716: 1 → 0

Char. 3719: 3 → 1

Rineloricaria microlepidogaster:

All trees:

Char. 18: 1 → 0

Char. 30: 1 → 0

Char. 57: 2 → 1

Char. 96: 0 → 1

Char. 108: 2 → 1

Char. 200: 0 → 2

Char. 267: 3 → 0

Char. 293: 0 → 2

Char. 327: 3 → 1

Char. 372: 3 → 1

Char. 629: 1 → 0

Char. 637: 0 → 2

Char. 732: 3 → 1

Char. 808: 0 → 2

Char. 810: 0 → 1

Char. 867: 1 → 2

Char. 878: 1 → 0

Char. 883: 0 → 2

Char. 888: 3 → 1

Char. 964: 3 → 0

Char. 985: 0 → 2

Char. 1000: 1 → 3

Char. 1015: 3 → 0

Char. 1024: 0 → 1

Char. 1025: 3 → 0

Char. 1203: 0 → 2

Char. 1308: 0 → 1

Char. 1326: 0 → 2

Char. 1353: 1 → 3

Char. 1377: 0 → 3

Char. 1389: 0 → 3

Char. 1413: 1 → 0

Char. 1425: 0 → 1

Char. 1449: 1 → 0

Char. 1452: 0 → 3

Char. 1454: 3 → 1

Char. 1470: 1 → 3

Char. 1473: 1 → 3

Char. 1512: 3 → 1

Char. 1531: 1 → 3

Char. 1551: 0 → 3

Char. 1552: 0 → 2

Char. 1587: 1 → 3

Char. 1588: 1 → 0

Char. 1656: 1 → 3

Char. 1659: 1 → 0

Char. 1669: 2 → 0

Char. 1674: 0 → 2

Char. 1682: 1 → 3

Char. 1689: 0 → 3

Char. 1690: 1 → 3

Char. 1707: 1 → 3

Char. 1710: 1 → 0

Char. 1744: 1 → 0

Char. 1745: 3 → 1

Char. 1751: 1 → 3

Char. 1782: 1 → 3

Char. 1795: 1 → 0

Char. 1798: 0 → 3

Char. 1809: 1 → 3

Char. 1810: 1 → 0

Char. 1863: 0 → 3

Char. 1885: 1 → 3

Char. 1916: 2 → 0

Char. 1926: 1 → 3

Char. 1964: 0 → 2

Char. 1972: 3 → 1

Char. 1979: 1 → 3

Char. 1980: 1 → 0

Char. 1983: 0 → 2

Char. 1985: 2 → 0

Char. 2006: 1 → 3

Char. 3138: 2 → 3

Char. 3220: 2 → 0

Char. 3232: 1 → 0

Char. 3235: 0 → 3

Char. 3278: 2 → 0

Char. 3290: 1 → 3

Char. 3338: 2 → 1

Char. 3446: 2 → 0

Char. 3449: 2 → 0

Char. 3480: 2 → 3

Char. 3490: 1 → 3

Char. 3581: 3 → 1

Char. 3593: 2 → 0

Char. 3710: 1 → 0

Corydoras adolfoi:

All trees:

Char. 260: 0 → 2	Char. 1545: 3 → 1	Char. 2328: 3 → 0	Char. 2676: 0 → 2	Char. 3046: 0 → 2
Char. 421: 1 → 0	Char. 1680: 0 → 2	Char. 2400: 0 → 2	Char. 2763: 0 → 2	Char. 3068: 0 → 2
Char. 540: 1 → 3	Char. 1681: 0 → 2	Char. 2568: 1 → 3	Char. 2772: 0 → 2	Char. 3106: 3 → 1
Char. 1245: 0 → 3	Char. 1773: 0 → 3	Char. 2578: 1 → 3	Char. 2799: 1 → 3	Char. 3116: 0 → 2
Char. 1278: 1 → 0	Char. 2036: 2 → 0	Char. 2580: 0 → 2	Char. 2817: 0 → 2	Char. 3127: 3 → 1
Char. 1386: 0 → 2	Char. 2161: 2 → 0	Char. 2598: 3 → 1	Char. 2838: 0 → 2	
Char. 1536: 0 → 2	Char. 2220: 3 → 1	Char. 2619: 2 → 0	Char. 3005: 0 → 2	

Some trees:

Char. 792: 2 → 0	Char. 3100: 3 → 1	Char. 3131: 2 → 0

Corydoras aeneus macrosteus:

All trees:

Char. 64: 2 → 1	Char. 187: 0 → 1	Char. 264: 3 → 2	Char. 793: 1 → 3	Char. 3893: 3 → 0
Char. 89: 2 → 0	Char. 199: 1 → 0	Char. 546: 1 → 0	Char. 3620: 0 → 2	

Some trees:

Char. 995: 2 → 0	Char. 3275: 1 → 3	Char. 3791: 2 → 0

Corydoras aeneus microps:

All trees:

Char. 1: 0 → 1	Char. 71: 0 → 1	Char. 818: 0 → 3	Char. 882: 0 → 2	Char. 3656: 3 → 0
Char. 53: 2 → 1	Char. 90: 1 → 2	Char. 880: 3 → 1	Char. 890: 0 → 2	

Some trees:

Char. 3: 2 → 1	Char. 136: 8 → 7	Char. 881: 3 → 1
Char. 60: 1 → 0	Char. 171: 0 → 1	Char. 3647: 0 → 1

Corydoras spC:

All trees:

Char. 200: 1 → 0	Char. 1603: 1 → 3	Char. 2133: 0 → 2	Char. 2724: 3 → 1	Char. 3124: 2 → 0
Char. 251: 1 → 0	Char. 1627: 1 → 3	Char. 2232: 1 → 3	Char. 2728: 3 → 1	Char. 3155: 0 → 1
Char. 375: 3 → 1	Char. 1666: 1 → 3	Char. 2382: 0 → 2	Char. 2742: 3 → 0	Char. 3253: 2 → 0
Char. 902: 3 → 1	Char. 1681: 0 → 2	Char. 2389: 1 → 3	Char. 2784: 0 → 2	Char. 3317: 2 → 0
Char. 1042: 0 → 2	Char. 1692: 0 → 2	Char. 2454: 1 → 3	Char. 2796: 1 → 3	Char. 3347: 2 → 1
Char. 1344: 1 → 0	Char. 1842: 0 → 2	Char. 2487: 0 → 2	Char. 2901: 0 → 2	Char. 3425: 1 → 3
Char. 1404: 1 → 3	Char. 1958: 2 → 1	Char. 2511: 0 → 2	Char. 3046: 0 → 2	Char. 3689: 0 → 3
Char. 1464: 0 → 1	Char. 1980: 1 → 0	Char. 2520: 0 → 2	Char. 3079: 0 → 2	Char. 3758: 2 → 0
Char. 1491: 3 → 1	Char. 1992: 1 → 3	Char. 2634: 0 → 2	Char. 3109: 3 → 1	Char. 3764: 2 → 0

Some trees:

Char. 49: 2 → 1

Char. 108: 1 → 0

Char. 136: 8 → 7

Char. 166: 2 → 1

Char. 509: 2 → 1

Char. 995: 2 → 0

Char. 1374: 1 → 3

Char. 1608: 1 → 3

Char. 1611: 1 → 3

Char. 1617: 0 → 2

Char. 1659: 3 → 1

Char. 1704: 1 → 3

Char. 1863: 0 → 2

Char. 2048: 0 → 1

Char. 2058: 1 → 3

Char. 2433: 1 → 3

Char. 2463: 1 → 3

Char. 2907: 1 → 3

Char. 2916: 1 → 0

Char. 2935: 1 → 2

Char. 3008: 1 → 3

Char. 3025: 1 → 3

Char. 3115: 1 → 3

Corydoras spB*:*

All trees:

Char. 60: 0 → 1

Char. 73: 0 → 1

Char. 84: 0 → 1

Char. 115: 1 → 0

Char. 131: 2 → 1

Char. 200: 0 → 1

Char. 201: 0 → 1

Char. 257: 2 → 0

Char. 260: 0 → 1

Char. 263: 2 → 1

Char. 270: 2 → 0

Char. 283: 0 → 1

Char. 304: 3 → 0

Char. 326: 1 → 3

Char. 347: 1 → 0

Char. 363: 1 → 3

Char. 443: 1 → 3

Char. 447: 0 → 2

Char. 469: 2 → 0

Char. 470: 1 → 0

Char. 476: 2 → 0

Char. 490: 2 → 0

Char. 501: 1 → 3

Char. 512: 2 → 0

Char. 538: 1 → 3

Char. 562: 1 → 0

Char. 581: 0 → 3

Char. 684: 3 → 1

Char. 685: 3 → 0

Char. 744: 2 → 1

Char. 769: 3 → 1

Char. 801: 2 → 0

Char. 865: 2 → 0

Char. 894: 3 → 1

Char. 947: 1 → 3

Char. 972: 1 → 0

Char. 1039: 0 → 3

Char. 1100: 3 → 1

Char. 1109: 2 → 0

Char. 1161: 2 → 0

Char. 3248: 1 → 0

Char. 3262: 3 → 0

Char. 3356: 3 → 1

Char. 3437: 1 → 3

Char. 3701: 3 → 1

Char. 3881: 2 → 3

Char. 3915: 1 → 3

Some trees:

Char. 344: 3 → 1

Char. 882: 0 → 2

Char. 3174: 1 → 3

Corydoras spA*:*

All trees:

Char. 205: 0 → 1

Char. 243: 2 → 0

Char. 274: 0 → 2

Char. 418: 0 → 3

Char. 506: 3 → 1

Char. 744: 2 → 0

Char. 768: 3 → 1

Char. 773: 0 → 2

Char. 808: 2 → 0

Char. 812: 0 → 1

Char. 1039: 0 → 2

Char. 1279: 1 → 3

Char. 1293: 0 → 2

Char. 1305: 0 → 2

Char. 1332: 1 → 3

Char. 1344: 1 → 3

Char. 1359: 0 → 2

Char. 1458: 0 → 2

Char. 1537: 1 → 3

Char. 1540: 1 → 0

Char. 1570: 0 → 2

Char. 1588: 1 → 3

Char. 1593: 1 → 3

Char. 1611: 1 → 3

Char. 1626: 0 → 2

Char. 1629: 0 → 3

Char. 1638: 0 → 2

Char. 1656: 1 → 0

Char. 1710: 0 → 2

Char. 1723: 1 → 3

Char. 1749: 1 → 3

Char. 1764: 1 → 3

Char. 1806: 0 → 3

Char. 1809: 1 → 3

Char. 1828: 1 → 3

Char. 1881: 3 → 0

Char. 1885: 3 → 1

Char. 1992: 1 → 3

Char. 2065: 2 → 0

Char. 2094: 1 → 3

Char. 2109: 0 → 2

Char. 2121: 1 → 3

Char. 2161: 2 → 0

Char. 2238: 0 → 2

Char. 2262: 1 → 3

Char. 2271: 1 → 3

Char. 2289: 1 → 0

Char. 2337: 1 → 3

Char. 2403: 1 → 3

Char. 2412: 0 → 2

Char. 2473: 1 → 3

Char. 2475: 1 → 0

Char. 2490: 1 → 3

Char. 2517: 1 → 3

Char. 2523: 1 → 3

Char. 2548: 1 → 3

Char. 2592: 0 → 2

Char. 2595: 0 → 1

Char. 2604: 1 → 3

Char. 2664: 0 → 2

Char. 2679: 3 → 1

Char. 2680: 3 → 0

Char. 2745: 0 → 1

Char. 2754: 1 → 3

Char. 2793: 1 → 3

Char. 2802: 1 → 3

Char. 2823: 1 → 3

Char. 2859: 1 → 3

Char. 2898: 1 → 3

Char. 2908: 1 → 3

Char. 2916: 1 → 0

Char. 2920: 1 → 3

Char. 2933: 1 → 3

Char. 2974: 0 → 2

Char. 3085: 1 → 3

Char. 3103: 1 → 3	Char. 3158: 2 → 0	Char. 3551: 1 → 3		
Char. 3106: 1 → 3	Char. 3317: 2 → 0	Char. 3557: 1 → 3		

Some trees:

Char. 18: 0 → 1	Char. 1371: 2 → 0	Char. 2097: 1 → 0	Char. 2280: 1 → 3	Char. 2790: 1 → 3
Char. 89: 2 → 0	Char. 1608: 1 → 3	Char. 2145: 1 → 3	Char. 2313: 13 → 0	Char. 2892: 01 → 3
Char. 90: 1 → 2	Char. 1641: 1 → 3	Char. 2163: 1 → 3	Char. 2607: 0 → 2	Char. 2921: 1 → 3
Char. 1314: 3 → 1	Char. 1860: 0 → 2	Char. 2247: 1 → 3	Char. 2728: 1 → 3	Char. 3118: 1 → 3

Corydoras ambiacus:

All trees:

Char. 490: 2 → 0	Char. 575: 0 → 2	Char. 1039: 0 → 2	Char. 3626: 1 → 0

Some trees:

Char. 49: 1 → 2	Char. 205: 1 → 0	Char. 1299: 1 → 3	Char. 1617: 2 → 0	Char. 1813: 1 → 0
Char. 53: 1 → 2	Char. 890: 2 → 0	Char. 1416: 1 → 3	Char. 1674: 1 → 3	Char. 1827: 2 → 0
Char. 64: 2 → 1	Char. 1037: 0 → 3	Char. 1479: 1 → 3	Char. 1686: 3 → 1	Char. 1958: 2 → 0
Char. 85: 1 → 0	Char. 1044: 3 → 1	Char. 1572: 3 → 1	Char. 1704: 3 → 1	Char. 3160: 0 → 2
Char. 172: 0 → 1	Char. 1231: 0 → 2	Char. 1599: 3 → 1	Char. 1741: 0 → 2	Char. 3956: 0 → 2

Corydoras approuaguensis:

All trees:

Char. 185: 1 → 0	Char. 632: 3 → 1	Char. 1279: 1 → 3	Char. 1677: 0 → 2	Char. 1884: 3 → 1
Char. 188: 0 → 1	Char. 644: 1 → 0	Char. 1411: 2 → 0	Char. 1713: 0 → 2	Char. 1949: 2 → 0
Char. 238: 1 → 0	Char. 1024: 0 → 2	Char. 1555: 2 → 0	Char. 1794: 0 → 2	Char. 3416: 1 → 2
Char. 540: 1 → 3	Char. 1037: 0 → 1	Char. 1614: 1 → 3	Char. 1864: 3 → 1	

Some trees:

Char. 147: 3 → 2	Char. 195: 1 → 0	Char. 878: 3 → 1	Char. 1044: 3 → 1	Char. 3428: 3 → 1

Corydoras araguaiaensis:

All trees:

Char. 45: 2 → 1	Char. 57: 1 → 0	Char. 3590: 1 → 3

Some trees:

Char. 4: 0 → 1	Char. 139: 4 → 5	Char. 878: 3 → 1	Char. 3647: 0 → 3	Char. 3912: 1 → 3
Char. 66: 0 → 2	Char. 166: 1 → 2	Char. 890: 2 → 0	Char. 3731: 3 → 1	
Char. 131: 2 → 1	Char. 205: 1 → 0	Char. 3521: 0 → 3	Char. 3734: 1 → 3	

Corydoras arcuatus:

All trees:

Char. 625: 0 → 1	Char. 2769: 1 → 3	Char. 3321: 3 → 1	Char. 3392: 1 → 3
Char. 1416: 1 → 3	Char. 3181: 1 → 3	Char. 3380: 0 → 2	Char. 3422: 3 → 1

Some trees:

Char. 3521: 3 → 0

Corydoras armatus:

Some trees:

Char. 9: 1 → 2 Char. 78: 1 → 0 Char. 128: 7 → 56 Char. 178: 1 → 0

Char. 11: 0 → 2 Char. 111: 1 → 0 Char. 147: 3 → 2 Char. 188: 0 → 1

Corydoras atropersonatus:

All trees:

Char. 364: 3 → 1 Char. 1027: 1 → 3 Char. 3467: 0 → 2 Char. 3907: 2 → 3

Char. 815: 0 → 2 Char. 1039: 0 → 2 Char. 3479: 1 → 0

Some trees:

Char. 89: 0 → 2 Char. 168: 2 → 1 Char. 546: 0 → 2 Char. 3521: 0 → 3

Char. 128: 7 → 6 Char. 183: 1 → 0 Char. 813: 13 → 0 Char. 3713: 1 → 3

Corydoras boesemani:

All trees:

Char. 4: 1 → 0 Char. 90: 2 → 1 Char. 205: 0 → 1 Char. 442: 0 → 2 Char. 999: 3 → 1

Char. 89: 0 → 2 Char. 136: 8 → 7 Char. 436: 0 → 2 Char. 878: 3 → 1 Char. 1045: 2 → 0

Some trees:

Char. 147: 2 → 3 Char. 200: 0 → 1

Corydoras breei:

All trees:

Char. 63: 2 → 0 Char. 108: 1 → 0 Char. 476: 2 → 0 Char. 855: 0 → 2 Char. 910: 3 → 1

Char. 77: 2 → 1 Char. 419: 0 → 1 Char. 809: 3 → 1 Char. 894: 3 → 1

Corydoras brevirostris:

All trees:

Char. 3: 2 → 1 Char. 213: 03 → 2 Char. 435: 2 → 0 Char. 808: 2 → 0 Char. 3941: 0 → 2

Char. 111: 1 → 0 Char. 416: 1 → 3 Char. 444: 1 → 3 Char. 878: 13 → 0

Some trees:

Char. 2: 0 → 1 Char. 1043: 3 → 1 Char. 2503: 1 → 3 Char. 2802: 1 → 3 Char. 3158: 2 → 0

Char. 195: 0 → 1 Char. 2199: 1 → 3 Char. 2541: 3 → 1 Char. 2826: 1 → 3 Char. 3174: 3 → 1

Char. 264: 2 → 3 Char. 2250: 1 → 3 Char. 2610: 1 → 3 Char. 2829: 3 → 1 Char. 3521: 0 → 3

Char. 544: 0 → 2 Char. 2259: 3 → 1 Char. 2613: 1 → 3 Char. 2944: 0 → 3 Char. 3647: 0 → 3

Char. 546: 0 → 1 Char. 2328: 3 → 1 Char. 2637: 1 → 0 Char. 3070: 3 → 1 Char. 3731: 3 → 1

Char. 792: 0 → 2 Char. 2430: 0 → 2 Char. 2656: 2 → 0 Char. 3095: 3 → 1 Char. 3734: 1 → 3

Char. 809: 3 → 1 Char. 2481: 0 → 2 Char. 2727: 3 → 1 Char. 3100: 3 → 1

Corydoras britskii:

All trees:

Char. 0: 2 → 1 Char. 2: 0 → 1 Char. 19: 1 → 2 Char. 128: 6 → 4 Char. 185: 1 → 0

Char. 1: 0 → 1 Char. 11: 0 → 2 Char. 85: 1 → 0 Char. 147: 3 → 2 Char. 200: 1 → 3

Char. 441: 0 → 2	Char. 947: 3 → 1	Char. 3335: 0 → 2	Char. 3871: 3 → 1	Char. 3902: 0 → 2
Char. 850: 3 → 1	Char. 3262: 3 → 0	Char. 3341: 0 → 3	Char. 3884: 3 → 1	Char. 3906: 0 → 3
Char. 941: 3 → 1	Char. 3272: 1 → 2	Char. 3850: 0 → 2	Char. 3899: 0 → 3	Char. 3931: 0 → 2

Corydoras burgessi:

All trees:

Char. 260: 0 → 2	Char. 773: 0 → 3	Char. 895: 0 → 2
Char. 421: 1 → 0	Char. 881: 3 → 1	Char. 3785: 1 → 0

Some trees:

Char. 123: 1 → 0	Char. 509: 0 → 2	Char. 3321: 1 → 3
Char. 213: 0 → 3	Char. 878: 13 → 1	Char. 3713: 1 → 3

Corydoras caudimaculatus:

All trees:

Char. 264: 3 → 2	Char. 546: 1 → 0	Char. 809: 3 → 1	Char. 3503: 1 → 3
Char. 517: 3 → 1	Char. 792: 0 → 2	Char. 812: 0 → 2	Char. 3775: 1 → 0

Some trees:

Char. 890: 2 → 0	Char. 1043: 0 → 3

Corydoras cervinus:

All trees:

Char. 60: 0 → 1	Char. 581: 0 → 2	Char. 1287: 0 → 2	Char. 1494: 0 → 2	Char. 1686: 1 → 3
Char. 194: 0 → 1	Char. 621: 3 → 1	Char. 1299: 3 → 1	Char. 1519: 1 → 3	Char. 1740: 1 → 3
Char. 200: 1 → 0	Char. 770: 3 → 1	Char. 1302: 0 → 2	Char. 1533: 0 → 2	Char. 1755: 1 → 3
Char. 210: 0 → 1	Char. 852: 0 → 3	Char. 1320: 0 → 2	Char. 1536: 0 → 2	Char. 1758: 3 → 1
Char. 370: 3 → 1	Char. 914: 3 → 0	Char. 1344: 1 → 3	Char. 1566: 0 → 2	Char. 1761: 3 → 1
Char. 372: 3 → 1	Char. 995: 2 → 0	Char. 1365: 1 → 3	Char. 1620: 0 → 3	Char. 1833: 0 → 2
Char. 373: 3 → 1	Char. 1167: 0 → 2	Char. 1371: 0 → 2	Char. 1623: 0 → 2	Char. 1860: 0 → 2
Char. 528: 3 → 0	Char. 1215: 0 → 3	Char. 1422: 0 → 3	Char. 1635: 3 → 1	Char. 1912: 3 → 1
Char. 578: 2 → 0	Char. 1248: 1 → 0	Char. 1437: 0 → 2	Char. 1662: 0 → 2	Char. 3317: 2 → 0
Char. 579: 0 → 2	Char. 1260: 0 → 2	Char. 1438: 2 → 0	Char. 1669: 0 → 2	
Char. 580: 2 → 3	Char. 1272: 3 → 1	Char. 1455: 3 → 1	Char. 1683: 0 → 2	

Corydoras areio:

All trees:

Char. 45: 2 → 1	Char. 260: 0 → 1	Char. 421: 1 → 3	Char. 568: 0 → 2	Char. 912: 1 → 3
Char. 49: 0 → 1	Char. 281: 0 → 2	Char. 435: 0 → 2	Char. 645: 1 → 3	Char. 957: 1 → 3
Char. 112: 0 → 1	Char. 375: 3 → 2	Char. 509: 0 → 2	Char. 740: 3 → 1	Char. 966: 2 → 0
Char. 173: 1 → 2	Char. 405: 1 → 3	Char. 527: 3 → 2	Char. 774: 2 → 0	Char. 975: 0 → 2
Char. 174: 1 → 0	Char. 415: 3 → 0	Char. 545: 2 → 0	Char. 894: 1 → 3	Char. 1024: 0 → 2

Char. 3217: 1 → 3

Corydoras cochui:

All trees:

Char. 645: 1 → 3	Char. 963: 1 → 0	Char. 3235: 1 → 2	Char. 3596: 0 → 3	Char. 3893: 3 → 1
Char. 755: 1 → 3	Char. 983: 0 → 2	Char. 3308: 3 → 1	Char. 3602: 2 → 1	Char. 3934: 3 → 0
Char. 877: 1 → 3	Char. 995: 2 → 3	Char. 3380: 0 → 2	Char. 3764: 2 → 0	
Char. 881: 1 → 3	Char. 1044: 1 → 3	Char. 3554: 1 → 3	Char. 3784: 1 → 2	
Char. 912: 1 → 3	Char. 3226: 0 → 2	Char. 3590: 1 → 3	Char. 3800: 2 → 0	

Some trees:

Char. 883: 2 → 0

Corydoras coppenamensis:

All trees:

Char. 64: 1 → 2	Char. 137: 1 → 0	Char. 470: 1 → 3	Char. 890: 0 → 2	Char. 1101: 3 → 1
Char. 78: 0 → 1	Char. 183: 1 → 0	Char. 510: 1 → 3	Char. 898: 0 → 2	Char. 3255: 1 → 2
Char. 85: 0 → 1	Char. 188: 1 → 0	Char. 546: 0 → 1	Char. 941: 3 → 1	Char. 3392: 1 → 3
Char. 86: 0 → 1	Char. 264: 2 → 3	Char. 576: 3 → 1	Char. 1003: 3 → 1	
Char. 131: 2 → 1	Char. 437: 1 → 3	Char. 793: 1 → 3	Char. 1024: 0 → 2	

Some trees:

Char. 3: 1 → 2	Char. 54: 1 → 2	Char. 792: 2 → 0

Corydoras difluviatilis:

All trees:

Char. 28: 1 → 0	Char. 276: 0 → 1	Char. 809: 3 → 2	Char. 3221: 2 → 0	Char. 3775: 1 → 0
Char. 78: 0 → 1	Char. 396: 2 → 0	Char. 810: 0 → 2	Char. 3281: 0 → 2	Char. 3826: 2 → 0
Char. 80: 0 → 1	Char. 418: 0 → 2	Char. 812: 0 → 2	Char. 3515: 2 → 0	Char. 3832: 2 → 0
Char. 84: 0 → 1	Char. 421: 1 → 3	Char. 813: 1 → 3	Char. 3518: 0 → 3	Char. 3850: 0 → 2
Char. 106: 2 → 1	Char. 442: 0 → 2	Char. 895: 0 → 2	Char. 3590: 1 → 3	Char. 3912: 1 → 3
Char. 111: 1 → 0	Char. 508: 3 → 1	Char. 913: 0 → 2	Char. 3624: 2 → 0	Char. 3915: 1 → 3
Char. 137: 1 → 0	Char. 745: 2 → 0	Char. 963: 1 → 0	Char. 3640: 0 → 1	
Char. 173: 2 → 1	Char. 755: 1 → 3	Char. 1101: 3 → 1	Char. 3659: 0 → 2	
Char. 176: 2 → 01	Char. 792: 0 → 1	Char. 3220: 2 → 0	Char. 3695: 3 → 1	

Some trees:

Char. 2: 0 → 2	Char. 77: 2 → 3	Char. 108: 1 → 0	Char. 123: 1 → 0

Corydoras diphyes:

All trees:

Char. 0: 2 → 1	Char. 72: 0 → 1	Char. 84: 0 → 1	Char. 122: 0 → 1	Char. 136: 8 → 9
Char. 11: 0 → 1	Char. 73: 0 → 1	Char. 85: 1 → 0	Char. 131: 2 → 1	Char. 166: 2 → 1

Char. 195: 1 → 0	Char. 1245: 1 → 0	Char. 1750: 0 → 2	Char. 2577: 0 → 3	Char. 2950: 1 → 3
Char. 409: 0 → 2	Char. 1257: 0 → 2	Char. 1758: 1 → 3	Char. 2625: 0 → 2	Char. 2962: 0 → 2
Char. 418: 0 → 2	Char. 1275: 3 → 1	Char. 1824: 3 → 1	Char. 2715: 0 → 2	Char. 2989: 1 → 3
Char. 447: 0 → 2	Char. 1344: 1 → 0	Char. 1845: 0 → 2	Char. 2718: 0 → 3	Char. 3023: 3 → 1
Char. 508: 0 → 3	Char. 1410: 0 → 2	Char. 1881: 3 → 1	Char. 2734: 0 → 2	Char. 3043: 1 → 0
Char. 540: 1 → 3	Char. 1425: 3 → 1	Char. 1954: 0 → 1	Char. 2748: 1 → 3	Char. 3068: 0 → 2
Char. 572: 1 → 0	Char. 1494: 0 → 2	Char. 2044: 0 → 1	Char. 2778: 0 → 1	Char. 3109: 3 → 1
Char. 632: 3 → 0	Char. 1518: 0 → 2	Char. 2211: 0 → 1	Char. 2814: 0 → 2	Char. 3268: 2 → 3
Char. 867: 1 → 3	Char. 1548: 0 → 3	Char. 2223: 0 → 2	Char. 2844: 1 → 3	Char. 3880: 1 → 3
Char. 878: 1 → 3	Char. 1605: 0 → 1	Char. 2253: 1 → 3	Char. 2901: 0 → 2	Char. 3912: 1 → 3
Char. 879: 0 → 2	Char. 1617: 0 → 2	Char. 2301: 3 → 1	Char. 2910: 0 → 2	
Char. 890: 0 → 2	Char. 1620: 0 → 2	Char. 2304: 1 → 3	Char. 2926: 0 → 2	
Char. 959: 3 → 1	Char. 1734: 0 → 2	Char. 2421: 1 → 0	Char. 2932: 0 → 2	
Char. 1224: 0 → 3	Char. 1742: 1 → 3	Char. 2547: 0 → 2	Char. 2944: 0 → 2	

Some trees:

Char. 3: 2 → 1	Char. 1741: 0 → 2	Char. 2247: 1 → 3	Char. 2995: 1 → 3
Char. 1704: 1 → 3	Char. 1860: 0 → 2	Char. 2607: 0 → 2	

Corydoras ehrhardti:

Some trees:

Char. 33: 0 → 1	Char. 136: 8 → 7	Char. 3426: 1 → 2	Char. 3455: 3 → 2	Char. 3502: 1 → 2
Char. 64: 1 → 2	Char. 147: 3 → 2	Char. 3431: 1 → 2	Char. 3456: 1 → 3	Char. 3515: 2 → 0
Char. 73: 0 → 1	Char. 175: 1 → 0	Char. 3434: 0 → 2	Char. 3457: 2 → 3	Char. 3546: 1 → 0
Char. 102: 1 → 0	Char. 294: 1 → 3	Char. 3435: 2 → 0	Char. 3465: 2 → 0	

Corydoras elegans Belem:

All trees:

Char. 92: 1 → 0	Char. 510: 1 → 3	Char. 2163: 0 → 3	Char. 3074: 0 → 2
Char. 164: 1 → 2	Char. 904: 0 → 3	Char. 2728: 1 → 3	Char. 3698: 1 → 0
Char. 334: 2 → 0	Char. 1070: 3 → 1	Char. 2823: 1 → 3	

Corydoras elegans Peru*:*

All trees:

Char. 264: 2 → 3	Char. 543: 1 → 3	Char. 2223: 0 → 2	Char. 2907: 3 → 1	Char. 3596: 0 → 3
Char. 518: 3 → 1	Char. 808: 0 → 2	Char. 2637: 1 → 3	Char. 3217: 1 → 3	

Corydoras ellisae:

All trees:

Char. 2: 0 → 1	Char. 114: 1 → 0	Char. 131: 2 → 1	Char. 201: 1 → 0	Char. 416: 0 → 3
Char. 55: 1 → 0	Char. 118: 1 → 0	Char. 147: 2 → 3	Char. 373: 3 → 0	Char. 418: 3 → 1

Char. 472: 1 → 3 Char. 816: 1 → 3 Char. 913: 0 → 2 Char. 976: 1 → 3

Char. 538: 1 → 3 Char. 853: 2 → 0 Char. 914: 3 → 1 Char. 1100: 3 → 1

Char. 666: 3 → 0 Char. 870: 2 → 0 Char. 936: 1 → 3 Char. 3262: 3 → 1

Char. 758: 2 → 1 Char. 892: 0 → 2 Char. 969: 0 → 2 Char. 3605: 2 → 0

Corydoras ephippifer:

All trees:

Char. 793: 1 → 3 Char. 902: 1 → 3 Char. 931: 2 → 0 Char. 3612: 3 → 1

Some trees:

Char. 72: 0 → 1 Char. 139: 3 → 5 Char. 200: 1 → 0 Char. 755: 1 → 3 Char. 995: 0 → 2

Char. 77: 1 → 2 Char. 168: 2 → 1 Char. 264: 2 → 3 Char. 772: 1 → 3 Char. 1043: 3 → 1

Char. 123: 1 → 0 Char. 171: 0 → 1 Char. 417: 0 → 2 Char. 792: 0 → 2 Char. 3395: 1 → 3

Char. 131: 2 → 1 Char. 185: 1 → 0 Char. 506: 3 → 1 Char. 808: 2 → 0

Char. 137: 1 → 0 Char. 195: 1 → 0 Char. 546: 0 → 1 Char. 881: 1 → 0

Corydoras flaveolus:

All trees:

Char. 72: 0 → 1 Char. 420: 0 → 2 Char. 755: 1 → 3 Char. 1025: 1 → 0 Char. 3560: 1 → 3

Char. 85: 1 → 0 Char. 441: 0 → 2 Char. 849: 3 → 1 Char. 1027: 1 → 0 Char. 3590: 1 → 3

Char. 102: 1 → 0 Char. 443: 1 → 3 Char. 879: 0 → 3 Char. 1070: 3 → 0 Char. 3844: 2 → 0

Char. 137: 1 → 0 Char. 510: 1 → 3 Char. 912: 1 → 3 Char. 1103: 1 → 3 Char. 3881: 2 → 3

Char. 201: 0 → 1 Char. 528: 3 → 1 Char. 946: 0 → 2 Char. 3392: 1 → 3 Char. 3922: 2 → 3

Char. 260: 0 → 1 Char. 538: 1 → 3 Char. 972: 1 → 0 Char. 3443: 1 → 3

Char. 375: 3 → 1 Char. 540: 1 → 0 Char. 975: 0 → 2 Char. 3530: 1 → 3

Char. 414: 2 → 0 Char. 541: 0 → 2 Char. 987: 1 → 3 Char. 3534: 2 → 0

Some trees:

Char. 18: 0 → 1 Char. 89: 2 → 0 Char. 90: 1 → 2

Corydoras gracilis:

All trees:

Char. 77: 1 → 2 Char. 813: 1 → 3 Char. 1308: 0 → 2 Char. 1569: 3 → 1 Char. 1692: 0 → 1

Char. 90: 1 → 2 Char. 880: 3 → 1 Char. 1317: 1 → 3 Char. 1572: 3 → 1 Char. 1742: 1 → 0

Char. 112: 0 → 1 Char. 895: 0 → 3 Char. 1365: 1 → 3 Char. 1579: 1 → 3 Char. 1779: 1 → 3

Char. 200: 1 → 0 Char. 914: 3 → 1 Char. 1380: 3 → 2 Char. 1603: 1 → 0 Char. 1792: 1 → 3

Char. 242: 0 → 3 Char. 975: 0 → 2 Char. 1443: 1 → 3 Char. 1614: 3 → 1 Char. 1812: 3 → 1

Char. 275: 3 → 1 Char. 1070: 3 → 1 Char. 1494: 0 → 2 Char. 1620: 0 → 3 Char. 1830: 1 → 3

Char. 448: 0 → 2 Char. 1266: 1 → 3 Char. 1527: 0 → 1 Char. 1668: 0 → 3 Char. 1860: 0 → 2

Char. 470: 1 → 3 Char. 1285: 1 → 3 Char. 1545: 1 → 3 Char. 1680: 0 → 3 Char. 1923: 0 → 1

Char. 543: 1 → 3 Char. 1296: 3 → 1 Char. 1548: 0 → 3 Char. 1689: 1 → 3 Char. 1935: 0 → 2

Char. 3214: 0 → 2	Char. 3440: 3 → 1	Char. 3617: 3 → 1	Char. 3902: 0 → 2
Char. 3335: 0 → 2	Char. 3455: 0 → 1	Char. 3774: 0 → 3	Char. 3909: 3 → 1
Char. 3403: 3 → 1	Char. 3479: 1 → 3	Char. 3838: 2 → 0	Char. 3961: 3 → 1
Char. 3413: 1 → 3	Char. 3488: 2 → 0	Char. 3887: 0 → 2	Char. 3983: 3 → 0

Some trees:

Char. 1431: 1 → 3

Corydoras guapore:

All trees:

Char. 231: 0 → 3	Char. 1262: 1 → 3	Char. 1707: 1 → 3	Char. 2175: 1 → 3	Char. 2731: 0 → 1
Char. 275: 3 → 1	Char. 1266: 1 → 3	Char. 1713: 1 → 3	Char. 2199: 1 → 3	Char. 2737: 1 → 0
Char. 353: 0 → 2	Char. 1279: 1 → 3	Char. 1755: 1 → 3	Char. 2220: 3 → 0	Char. 2738: 3 → 1
Char. 408: 1 → 3	Char. 1293: 0 → 1	Char. 1801: 2 → 0	Char. 2232: 1 → 3	Char. 2748: 1 → 0
Char. 411: 2 → 0	Char. 1302: 0 → 2	Char. 1804: 1 → 0	Char. 2244: 1 → 3	Char. 2757: 1 → 3
Char. 444: 1 → 3	Char. 1308: 0 → 2	Char. 1812: 3 → 0	Char. 2257: 2 → 0	Char. 2775: 0 → 2
Char. 470: 1 → 3	Char. 1341: 0 → 2	Char. 1835: 1 → 3	Char. 2292: 1 → 3	Char. 2796: 1 → 3
Char. 480: 2 → 0	Char. 1344: 1 → 3	Char. 1860: 0 → 2	Char. 2301: 1 → 3	Char. 2826: 1 → 3
Char. 530: 3 → 1	Char. 1390: 0 → 2	Char. 1884: 3 → 0	Char. 2304: 1 → 3	Char. 2835: 0 → 1
Char. 543: 1 → 3	Char. 1470: 1 → 3	Char. 1885: 3 → 0	Char. 2313: 1 → 0	Char. 2848: 1 → 3
Char. 593: 1 → 3	Char. 1473: 1 → 3	Char. 1949: 3 → 1	Char. 2373: 0 → 2	Char. 2865: 1 → 3
Char. 594: 1 → 3	Char. 1488: 0 → 3	Char. 1981: 1 → 3	Char. 2385: 1 → 3	Char. 2895: 0 → 2
Char. 647: 2 → 0	Char. 1497: 1 → 0	Char. 1999: 2 → 0	Char. 2433: 0 → 1	Char. 2898: 1 → 3
Char. 717: 3 → 1	Char. 1515: 0 → 2	Char. 2053: 1 → 0	Char. 2445: 1 → 3	Char. 2907: 3 → 2
Char. 727: 0 → 2	Char. 1530: 0 → 3	Char. 2057: 3 → 1	Char. 2481: 1 → 3	Char. 2920: 1 → 3
Char. 732: 3 → 1	Char. 1539: 0 → 2	Char. 2058: 1 → 3	Char. 2503: 1 → 3	Char. 2933: 1 → 3
Char. 808: 0 → 2	Char. 1563: 0 → 2	Char. 2059: 0 → 3	Char. 2523: 1 → 3	Char. 2936: 2 → 0
Char. 865: 2 → 0	Char. 1572: 3 → 1	Char. 2065: 2 → 0	Char. 2526: 1 → 0	Char. 2986: 1 → 0
Char. 916: 0 → 2	Char. 1590: 0 → 2	Char. 2067: 3 → 1	Char. 2548: 1 → 3	Char. 3019: 1 → 3
Char. 935: 0 → 2	Char. 1593: 1 → 3	Char. 2070: 1 → 3	Char. 2574: 1 → 3	Char. 3031: 1 → 0
Char. 972: 1 → 0	Char. 1614: 3 → 1	Char. 2073: 1 → 3	Char. 2583: 0 → 1	Char. 3049: 0 → 2
Char. 1015: 3 → 1	Char. 1647: 3 → 1	Char. 2094: 1 → 3	Char. 2586: 3 → 1	Char. 3104: 0 → 2
Char. 1089: 1 → 3	Char. 1656: 1 → 3	Char. 2097: 0 → 1	Char. 2590: 2 → 0	Char. 3119: 2 → 0
Char. 1215: 0 → 1	Char. 1683: 0 → 3	Char. 2115: 0 → 2	Char. 2598: 1 → 3	Char. 3128: 2 → 0
Char. 1223: 2 → 3	Char. 1689: 1 → 3	Char. 2124: 1 → 3	Char. 2607: 0 → 1	Char. 3129: 1 → 3
Char. 1237: 1 → 3	Char. 1692: 0 → 3	Char. 2134: 1 → 3	Char. 2679: 3 → 1	Char. 3131: 0 → 1
Char. 1246: 0 → 1	Char. 1698: 0 → 2	Char. 2160: 3 → 1	Char. 2709: 1 → 3	Char. 3181: 1 → 3
Char. 1260: 0 → 2	Char. 1701: 3 → 1	Char. 2161: 2 → 0	Char. 2715: 0 → 2	Char. 3187: 2 → 0

Char. 3217: 1 → 3	Char. 3338: 2 → 3	Char. 3398: 1 → 0	Char. 3650: 0 → 2	Char. 3922: 2 → 0
Char. 3232: 0 → 2	Char. 3389: 3 → 1	Char. 3590: 1 → 3	Char. 3713: 3 → 1	Char. 3957: 2 → 0
Char. 3238: 1 → 3	Char. 3395: 1 → 3	Char. 3647: 1 → 0	Char. 3769: 0 → 3	Char. 3969: 0 → 2

Some trees:

Char. 1431: 1 → 3

Corydoras habrosus:

All trees:

Char. 33: 0 → 1	Char. 1284: 1 → 3	Char. 1765: 1 → 3	Char. 2526: 1 → 3	Char. 3022: 0 → 2
Char. 57: 1 → 2	Char. 1317: 3 → 1	Char. 1775: 0 → 3	Char. 2532: 1 → 2	Char. 3040: 1 → 3
Char. 116: 0 → 1	Char. 1323: 0 → 3	Char. 1792: 1 → 3	Char. 2568: 1 → 3	Char. 3043: 1 → 3
Char. 128: 7 → 8	Char. 1335: 0 → 2	Char. 1806: 0 → 3	Char. 2587: 0 → 2	Char. 3061: 1 → 3
Char. 137: 1 → 0	Char. 1368: 1 → 3	Char. 1821: 3 → 1	Char. 2604: 1 → 3	Char. 3124: 2 → 0
Char. 171: 0 → 1	Char. 1389: 0 → 1	Char. 1825: 0 → 3	Char. 2646: 1 → 3	Char. 3184: 0 → 3
Char. 211: 0 → 1	Char. 1428: 3 → 1	Char. 1845: 0 → 2	Char. 2658: 1 → 0	Char. 3194: 3 → 0
Char. 243: 3 → 2	Char. 1437: 0 → 2	Char. 2049: 1 → 3	Char. 2679: 3 → 1	Char. 3244: 2 → 0
Char. 518: 1 → 0	Char. 1443: 1 → 0	Char. 2223: 0 → 2	Char. 2691: 0 → 1	Char. 3321: 1 → 3
Char. 543: 3 → 1	Char. 1482: 1 → 3	Char. 2253: 1 → 0	Char. 2703: 1 → 3	Char. 3329: 3 → 1
Char. 572: 1 → 0	Char. 1536: 0 → 2	Char. 2349: 3 → 0	Char. 2766: 1 → 0	Char. 3350: 1 → 3
Char. 792: 0 → 2	Char. 1560: 1 → 3	Char. 2376: 0 → 1	Char. 2796: 1 → 3	Char. 3623: 1 → 3
Char. 809: 3 → 1	Char. 1590: 0 → 2	Char. 2389: 1 → 3	Char. 2811: 0 → 1	Char. 3659: 0 → 2
Char. 912: 1 → 3	Char. 1620: 0 → 2	Char. 2409: 1 → 3	Char. 2814: 0 → 1	Char. 3775: 1 → 0
Char. 1027: 1 → 0	Char. 1662: 0 → 2	Char. 2422: 1 → 3	Char. 2856: 1 → 0	Char. 3792: 2 → 1
Char. 1039: 0 → 2	Char. 1686: 1 → 0	Char. 2442: 0 → 2	Char. 2905: 1 → 3	Char. 3800: 2 → 3
Char. 1210: 3 → 0	Char. 1689: 1 → 3	Char. 2451: 3 → 1	Char. 2916: 1 → 3	Char. 3844: 2 → 0
Char. 1211: 0 → 3	Char. 1713: 0 → 2	Char. 2478: 1 → 3	Char. 2921: 1 → 3	Char. 3853: 2 → 0
Char. 1239: 0 → 1	Char. 1717: 1 → 3	Char. 2490: 1 → 3	Char. 2932: 0 → 2	Char. 3859: 2 → 0
Char. 1281: 0 → 2	Char. 1719: 0 → 2	Char. 2502: 3 → 1	Char. 3001: 3 → 1	

Some trees:

Char. 2: 0 → 1	Char. 1761: 3 → 1	Char. 2307: 1 → 3	Char. 2736: 1 → 3	Char. 3008: 1 → 3
Char. 168: 2 → 1	Char. 1788: 0 → 2	Char. 2493: 3 → 1	Char. 2760: 1 → 3	Char. 3070: 3 → 1
Char. 1043: 3 → 0	Char. 2072: 0 → 2	Char. 2523: 1 → 3	Char. 2907: 1 → 0	Char. 3076: 1 → 3
Char. 1362: 3 → 1	Char. 2100: 1 → 0	Char. 2652: 3 → 1	Char. 2910: 0 → 1	Char. 3121: 1 → 3

Corydoras imitator:

All trees:

Char. 344: 1 → 3	Char. 508: 3 → 1	Char. 894: 3 → 1	Char. 3488: 2 → 0

Some trees:

Char. 418: 0 → 2 Char. 509: 2 → 0

Corydoras julii:

All trees:

Char. 131: 2 → 1 Char. 878: 13 → 1 Char. 3407: 1 → 2 Char. 3485: 0 → 1 Char. 3671: 3 → 1

Char. 200: 01 → 2 Char. 1056: 2 → 0 Char. 3408: 3 → 1 Char. 3590: 1 → 3

Char. 201: 0 → 1 Char. 3178: 3 → 2 Char. 3456: 1 → 0 Char. 3656: 1 → 3

Some trees:

Char. 139: 45 → 4 Char. 143: 0 → 1 Char. 147: 3 → 2 Char. 3775: 1 → 0

Corydoras longipinnis:

All trees:

Char. 867: 1 → 3 Char. 1237: 1 → 3 Char. 1279: 1 → 3 Char. 1549: 1 → 3 Char. 3181: 1 → 3

Char. 879: 0 → 1 Char. 1244: 1 → 3 Char. 1310: 1 → 0 Char. 1671: 3 → 1

Char. 945: 2 → 0 Char. 1245: 1 → 3 Char. 1318: 1 → 3 Char. 1863: 2 → 0

Char. 1222: 1 → 3 Char. 1246: 1 → 3 Char. 1332: 1 → 0 Char. 1902: 2 → 0

Char. 1226: 3 → 2 Char. 1250: 1 → 3 Char. 1342: 1 → 3 Char. 1987: 3 → 1

Corydoras loretoensis:

All trees:

Char. 442: 0 → 1 Char. 1007: 3 → 1 Char. 3590: 1 → 3 Char. 3776: 1 → 0 Char. 3893: 3 → 1

Char. 774: 0 → 2 Char. 1100: 3 → 1 Char. 3625: 1 → 3 Char. 3837: 0 → 1

Some trees:

Char. 18: 0 → 1 Char. 137: 1 → 0 Char. 213: 0 → 1 Char. 881: 3 → 1 Char. 3521: 0 → 3

Char. 54: 2 → 1 Char. 139: 45 → 6 Char. 264: 23 → 2 Char. 894: 3 → 1 Char. 3713: 1 → 3

Char. 64: 2 → 1 Char. 147: 23 → 3 Char. 546: 01 → 0 Char. 905: 1 → 0 Char. 3785: 01 → 1

Char. 123: 1 → 0 Char. 166: 12 → 1 Char. 880: 3 → 1 Char. 1043: 3 → 0 Char. 3912: 1 → 3

Corydoras melanistius:

All trees:

Char. 112: 1 → 0 Char. 161: 0 → 1 Char. 870: 0 → 2 Char. 3680: 0 → 3

Char. 136: 7 → 8 Char. 188: 0 → 1 Char. 941: 3 → 1 Char. 3913: 2 → 0

Char. 143: 0 → 1 Char. 509: 2 → 0 Char. 3626: 1 → 3

Some trees:

Char. 264: 23 → 2 Char. 546: 01 → 0 Char. 995: 02 → 0 Char. 1043: 13 → 3 Char. 3395: 1 → 3

Corydoras nattereri Ribeira do Iguape*:*

All trees:

Char. 867: 1 → 3 Char. 904: 0 → 2 Char. 1422: 0 → 2 Char. 1566: 2 → 0 Char. 1750: 0 → 2

Char. 879: 0 → 2 Char. 1290: 0 → 2 Char. 1482: 1 → 3 Char. 1717: 3 → 1 Char. 1890: 1 → 3

Corydoras nattereri Guanabara*:*

All trees:

Char. 3653: 1 → 0

Some trees:

Char. 57: 1 → 0	Char. 84: 0 → 1	Char. 1202: 3 → 1	Char. 1207: 2 → 1
Char. 77: 2 → 1	Char. 1201: 3 → 2	Char. 1205: 2 → 0	Char. 1210: 3 → 2

Corydoras nattereri Tiete*:*

Some trees:

Char. 90: 1 → 2	Char. 114: 1 → 0	Char. 147: 3 → 2

Corydoras nattereri Bahia*:*

Some trees:

Char. 77: 2 → 1	Char. 112: 1 → 0	Char. 208: 0 → 1

Corydoras paleatus Guaiba*:*

All trees:

Char. 417: 3 → 1	Char. 956: 0 → 2	Char. 2131: 1 → 0	Char. 2605: 1 → 3
Char. 668: 3 → 0	Char. 1473: 3 → 1	Char. 2157: 0 → 2	Char. 3473: 2 → 0

Corydoras pantanalensis:

All trees:

Char. 57: 1 → 0	Char. 294: 1 → 3	Char. 3590: 1 → 3	Char. 3776: 1 → 3
Char. 64: 2 → 1	Char. 418: 0 → 3	Char. 3653: 1 → 3	Char. 3804: 2 → 0
Char. 71: 0 → 1	Char. 3309: 2 → 0	Char. 3659: 0 → 3	Char. 3844: 2 → 0
Char. 200: 1 → 0	Char. 3395: 1 → 0	Char. 3683: 0 → 2	Char. 3893: 3 → 0

Some trees:

Char. 77: 2 → 3

Corydoras pygmaeus:

All trees:

Char. 33: 0 → 1	Char. 209: 0 → 1	Char. 852: 0 → 3	Char. 1293: 0 → 2	Char. 1549: 1 → 3
Char. 63: 2 → 0	Char. 215: 0 → 1	Char. 914: 3 → 1	Char. 1338: 0 → 2	Char. 1554: 1 → 3
Char. 71: 0 → 1	Char. 243: 3 → 1	Char. 959: 3 → 1	Char. 1350: 1 → 3	Char. 1555: 2 → 0
Char. 73: 0 → 1	Char. 365: 3 → 1	Char. 963: 1 → 0	Char. 1380: 3 → 1	Char. 1594: 1 → 3
Char. 115: 1 → 0	Char. 376: 1 → 3	Char. 1036: 1 → 3	Char. 1386: 0 → 2	Char. 1602: 1 → 0
Char. 123: 1 → 0	Char. 515: 0 → 3	Char. 1045: 2 → 0	Char. 1395: 0 → 2	Char. 1620: 0 → 3
Char. 160: 1 → 2	Char. 518: 3 → 1	Char. 1224: 0 → 3	Char. 1404: 1 → 3	Char. 1635: 3 → 1
Char. 178: 0 → 1	Char. 529: 3 → 1	Char. 1227: 0 → 2	Char. 1449: 1 → 0	Char. 1636: 0 → 3
Char. 183: 0 → 1	Char. 582: 2 → 0	Char. 1234: 0 → 3	Char. 1467: 1 → 0	Char. 1658: 1 → 0
Char. 199: 1 → 0	Char. 792: 0 → 2	Char. 1257: 0 → 2	Char. 1494: 0 → 2	Char. 1665: 0 → 3
Char. 208: 0 → 1	Char. 809: 3 → 1	Char. 1285: 1 → 3	Char. 1539: 0 → 1	Char. 1668: 0 → 3

Char. 1671: 3 → 0	Char. 2058: 1 → 0	Char. 2547: 0 → 3	Char. 2984: 1 → 3	Char. 3504: 3 → 1
Char. 1683: 0 → 2	Char. 2079: 1 → 2	Char. 2580: 0 → 1	Char. 3067: 3 → 1	Char. 3572: 3 → 1
Char. 1710: 0 → 1	Char. 2121: 1 → 3	Char. 2592: 3 → 0	Char. 3115: 0 → 2	Char. 3638: 2 → 0
Char. 1716: 1 → 3	Char. 2140: 1 → 3	Char. 2610: 3 → 1	Char. 3136: 0 → 3	Char. 3644: 2 → 3
Char. 1737: 0 → 3	Char. 2181: 0 → 1	Char. 2628: 1 → 3	Char. 3158: 2 → 0	Char. 3692: 0 → 2
Char. 1804: 1 → 3	Char. 2298: 1 → 3	Char. 2655: 0 → 2	Char. 3174: 1 → 3	Char. 3782: 1 → 3
Char. 1813: 1 → 0	Char. 2322: 0 → 1	Char. 2697: 1 → 3	Char. 3238: 1 → 0	Char. 3794: 2 → 0
Char. 1834: 0 → 3	Char. 2334: 1 → 3	Char. 2713: 1 → 3	Char. 3244: 2 → 0	Char. 3823: 1 → 3
Char. 1862: 2 → 3	Char. 2355: 0 → 2	Char. 2728: 1 → 3	Char. 3305: 0 → 2	Char. 3841: 2 → 0
Char. 1924: 1 → 3	Char. 2380: 1 → 3	Char. 2814: 0 → 1	Char. 3323: 2 → 0	Char. 3888: 1 → 0
Char. 1984: 3 → 1	Char. 2386: 1 → 3	Char. 2856: 1 → 0	Char. 3371: 2 → 0	Char. 3915: 0 → 1
Char. 1985: 2 → 0	Char. 2409: 1 → 3	Char. 2859: 1 → 3	Char. 3392: 1 → 3	Char. 3918: 2 → 3
Char. 1996: 0 → 2	Char. 2475: 1 → 3	Char. 2874: 0 → 3	Char. 3404: 3 → 0	Char. 3970: 1 → 3
Char. 2008: 0 → 1	Char. 2487: 1 → 0	Char. 2892: 01 → 2	Char. 3431: 1 → 3	
Char. 2015: 3 → 1	Char. 2502: 3 → 1	Char. 2929: 0 → 2	Char. 3440: 3 → 1	
Char. 2056: 3 → 0	Char. 2529: 1 → 3	Char. 2983: 1 → 3	Char. 3497: 2 → 3	

Some trees:

Char. 2142: 1 → 0	Char. 2307: 3 → 1	Char. 2739: 1 → 0

Corydoras rabauti:

Some trees:

Char. 49: 2 → 1	Char. 108: 1 → 0	Char. 207: 0 → 1	Char. 3836: 0 → 2	Char. 3847: 2 → 3
Char. 64: 2 → 1	Char. 114: 0 → 1	Char. 3775: 1 → 0	Char. 3838: 2 → 0	Char. 3848: 1 → 3
Char. 71: 0 → 1	Char. 116: 0 → 1	Char. 3830: 1 → 3	Char. 3842: 3 → 0	Char. 3849: 3 → 2
Char. 72: 0 → 1	Char. 131: 2 → 1	Char. 3831: 3 → 1	Char. 3843: 3 → 0	Char. 3898: 1 → 3
Char. 77: 1 → 3	Char. 161: 0 → 1	Char. 3832: 2 → 3	Char. 3844: 2 → 0	Char. 3938: 3 → 1
Char. 80: 0 → 1	Char. 164: 1 → 2	Char. 3833: 0 → 2	Char. 3845: 0 → 2	
Char. 84: 0 → 1	Char. 169: 2 → 3	Char. 3834: 2 → 0	Char. 3846: 0 → 3	

Corydoras sanchesi:

All trees:

Char. 347: 1 → 3	Char. 1395: 0 → 2	Char. 1803: 3 → 1	Char. 2547: 0 → 3	Char. 2883: 3 → 1
Char. 436: 0 → 2	Char. 1596: 0 → 2	Char. 1836: 0 → 2	Char. 2565: 0 → 2	Char. 2910: 1 → 0
Char. 476: 2 → 0	Char. 1599: 3 → 1	Char. 2071: 2 → 0	Char. 2607: 0 → 2	Char. 3046: 0 → 2
Char. 991: 2 → 1	Char. 1617: 2 → 0	Char. 2124: 1 → 3	Char. 2709: 1 → 3	Char. 3070: 3 → 1
Char. 1221: 0 → 2	Char. 1671: 3 → 1	Char. 2301: 1 → 3	Char. 2715: 0 → 2	Char. 3121: 1 → 3
Char. 1269: 0 → 1	Char. 1719: 0 → 3	Char. 2397: 0 → 2	Char. 2742: 3 → 1	Char. 3136: 0 → 2
Char. 1284: 1 → 0	Char. 1761: 3 → 1	Char. 2503: 1 → 3	Char. 2757: 1 → 0	Char. 3171: 2 → 3
Char. 1338: 0 → 2	Char. 1764: 3 → 1	Char. 2505: 0 → 2	Char. 2868: 0 → 2	Char. 3217: 1 → 0

Char. 3253: 2 → 0	Char. 3534: 2 → 0	Char. 3774: 0 → 3	Char. 3966: 0 → 2	
Char. 3268: 2 → 0	Char. 3698: 1 → 3	Char. 3785: 1 → 0		
Char. 3443: 1 → 3	Char. 3758: 2 → 1	Char. 3928: 2 → 1		

Some trees:

Char. 4: 1 → 0	Char. 166: 2 → 1	Char. 2036: 2 → 0	Char. 2598: 3 → 1	Char. 3344: 2 → 3
Char. 49: 1 → 2	Char. 168: 2 → 1	Char. 2058: 1 → 0	Char. 2904: 1 → 3	Char. 3416: 1 → 3
Char. 64: 2 → 1	Char. 183: 1 → 0	Char. 2067: 3 → 1	Char. 2926: 0 → 2	Char. 3515: 2 → 0
Char. 86: 1 → 0	Char. 188: 1 → 0	Char. 2175: 3 → 1	Char. 3124: 2 → 0	Char. 3944: 1 → 0

Corydoras semiaquilus:

All trees:

Char. 112: 0 → 1	Char. 2121: 1 → 3	Char. 2523: 1 → 3	Char. 2841: 0 → 2	Char. 3211: 3 → 1
Char. 114: 1 → 0	Char. 2127: 1 → 0	Char. 2538: 1 → 3	Char. 2844: 1 → 3	Char. 3218: 2 → 0
Char. 200: 1 → 2	Char. 2150: 3 → 1	Char. 2548: 1 → 3	Char. 2850: 0 → 2	Char. 3233: 0 → 3
Char. 315: 1 → 3	Char. 2154: 0 → 1	Char. 2575: 1 → 3	Char. 2895: 0 → 3	Char. 3299: 3 → 2
Char. 352: 0 → 3	Char. 2207: 1 → 3	Char. 2607: 0 → 3	Char. 2899: 1 → 3	Char. 3380: 0 → 2
Char. 365: 3 → 1	Char. 2208: 1 → 0	Char. 2616: 1 → 3	Char. 2913: 1 → 3	Char. 3392: 1 → 3
Char. 378: 1 → 0	Char. 2214: 1 → 3	Char. 2637: 1 → 2	Char. 2953: 1 → 3	Char. 3401: 1 → 3
Char. 430: 0 → 2	Char. 2241: 3 → 1	Char. 2652: 3 → 1	Char. 2984: 1 → 3	Char. 3411: 3 → 1
Char. 441: 0 → 2	Char. 2274: 3 → 1	Char. 2668: 0 → 3	Char. 2992: 0 → 2	Char. 3415: 2 → 1
Char. 543: 1 → 3	Char. 2283: 0 → 1	Char. 2688: 1 → 3	Char. 2993: 3 → 1	Char. 3531: 3 → 1
Char. 594: 1 → 0	Char. 2313: 1 → 3	Char. 2697: 1 → 3	Char. 3008: 1 → 3	Char. 3848: 1 → 3
Char. 618: 1 → 0	Char. 2380: 1 → 3	Char. 2712: 2 → 0	Char. 3070: 3 → 1	Char. 3854: 1 → 3
Char. 1007: 3 → 2	Char. 2454: 1 → 3	Char. 2735: 1 → 3	Char. 3100: 1 → 3	Char. 3915: 0 → 3
Char. 1024: 0 → 1	Char. 2487: 1 → 2	Char. 2739: 1 → 0	Char. 3103: 1 → 3	
Char. 2056: 3 → 1	Char. 2500: 2 → 0	Char. 2754: 1 → 3	Char. 3197: 1 → 3	
Char. 2067: 3 → 1	Char. 2505: 0 → 3	Char. 2805: 1 → 3	Char. 3208: 0 → 1	

Some trees:

Char. 2139: 0 → 1	Char. 2307: 1 → 3	Char. 2772: 3 → 0	Char. 2829: 3 → 1

Corydoras splendens:

All trees:

Char. 40: 1 → 2	Char. 867: 1 → 3	Char. 3350: 1 → 3	Char. 3534: 2 → 0	Char. 3791: 0 → 2
Char. 123: 1 → 0	Char. 878: 3 → 1	Char. 3434: 0 → 2	Char. 3620: 0 → 2	Char. 3932: 2 → 0
Char. 188: 0 → 1	Char. 880: 3 → 1	Char. 3479: 1 → 3	Char. 3626: 3 → 1	
Char. 417: 0 → 2	Char. 3235: 1 → 3	Char. 3530: 1 → 3	Char. 3695: 3 → 1	

Some trees:

Char. 53: 1 → 2	Char. 60: 1 → 0	Char. 114: 0 → 1

Corydoras stenocephalus:

All trees:

Char. 244: 3 → 1	Char. 1236: 0 → 2	Char. 1510: 0 → 2	Char. 1612: 1 → 3	Char. 1728: 0 → 2
Char. 311: 1 → 3	Char. 1281: 0 → 2	Char. 1521: 0 → 3	Char. 1624: 1 → 0	Char. 1737: 0 → 2
Char. 398: 1 → 0	Char. 1287: 0 → 2	Char. 1542: 1 → 3	Char. 1642: 0 → 2	Char. 1810: 3 → 1
Char. 543: 1 → 3	Char. 1365: 1 → 3	Char. 1555: 0 → 2	Char. 1644: 0 → 2	Char. 1885: 0 → 2
Char. 544: 3 → 2	Char. 1423: 2 → 0	Char. 1590: 0 → 2	Char. 1719: 1 → 0	Char. 1886: 0 → 1
Char. 1224: 2 → 3	Char. 1434: 0 → 2	Char. 1596: 0 → 3	Char. 1725: 0 → 2	Char. 1923: 2 → 1

Corydoras trilineatus:

All trees:

Char. 376: 1 → 0	Char. 508: 3 → 1

Some trees:

Char. 1266: 1 → 3	Char. 1750: 0 → 2	Char. 1884: 1 → 3	Char. 2697: 1 → 3	Char. 3040: 1 → 3
Char. 1279: 3 → 1	Char. 1755: 1 → 3	Char. 2048: 0 → 1	Char. 2769: 1 → 3	Char. 3061: 1 → 3
Char. 1347: 3 → 1	Char. 1803: 3 → 1	Char. 2052: 0 → 2	Char. 2904: 1 → 3	Char. 3100: 3 → 1
Char. 1362: 3 → 1	Char. 1821: 3 → 1	Char. 2190: 1 → 3	Char. 2941: 0 → 2	Char. 3350: 1 → 3
Char. 1620: 0 → 2	Char. 1824: 3 → 1	Char. 2358: 0 → 2	Char. 2947: 1 → 3	
Char. 1639: 2 → 0	Char. 1830: 3 → 1	Char. 2418: 1 → 3	Char. 2989: 1 → 3	
Char. 1734: 0 → 2	Char. 1864: 3 → 1	Char. 2511: 0 → 2	Char. 3007: 1 → 3	

Corydoras weitzmani:

All trees:

Char. 71: 0 → 1	Char. 213: 0 → 2	Char. 2118: 0 → 2	Char. 2838: 0 → 2	Char. 3133: 1 → 3
Char. 73: 0 → 1	Char. 402: 3 → 1	Char. 2347: 1 → 0	Char. 2892: 1 → 3	Char. 3590: 1 → 3
Char. 102: 1 → 0	Char. 541: 0 → 2	Char. 2655: 0 → 2	Char. 2992: 0 → 2	Char. 3623: 1 → 3
Char. 131: 2 → 1	Char. 2067: 3 → 0	Char. 2781: 1 → 3	Char. 3070: 3 → 1	Char. 3963: 0 → 2
Char. 188: 1 → 0	Char. 2085: 1 → 3	Char. 2826: 1 → 3	Char. 3107: 1 → 0	

Some trees:

Char. 49: 2 → 1	Char. 143: 0 → 1	Char. 2193: 2 → 0
Char. 136: 9 → 7	Char. 147: 2 → 3	Char. 3049: 0 → 2

Corydoras xinguensis:

All trees:

Char. 54: 2 → 1	Char. 240: 0 → 2	Char. 2052: 0 → 2	Char. 2241: 3 → 1	Char. 2463: 1 → 3
Char. 73: 0 → 1	Char. 365: 3 → 1	Char. 2065: 2 → 0	Char. 2268: 1 → 3	Char. 2526: 1 → 2
Char. 112: 1 → 0	Char. 510: 1 → 3	Char. 2067: 3 → 1	Char. 2349: 3 → 1	Char. 2577: 0 → 2
Char. 172: 0 → 1	Char. 529: 3 → 1	Char. 2166: 0 → 2	Char. 2377: 2 → 0	Char. 2580: 0 → 2
Char. 213: 0 → 2	Char. 541: 0 → 2	Char. 2169: 1 → 0	Char. 2400: 0 → 2	Char. 2619: 2 → 0

Char. 2625: 0 → 3	Char. 2766: 1 → 3	Char. 2895: 0 → 2	Char. 2992: 0 → 2	Char. 3085: 1 → 3
Char. 2655: 0 → 2	Char. 2778: 0 → 3	Char. 2898: 0 → 3	Char. 2996: 1 → 3	Char. 3127: 3 → 1
Char. 2739: 1 → 0	Char. 2809: 1 → 3	Char. 2945: 1 → 0	Char. 3005: 0 → 2	
Char. 2757: 1 → 0	Char. 2811: 0 → 2	Char. 2983: 0 → 1	Char. 3046: 0 → 2	

Some trees:

Char. 2: 1 → 0	Char. 195: 01 → 0	Char. 2388: 3 → 1	Char. 2853: 3 → 1	Char. 3008: 3 → 1
Char. 49: 2 → 1	Char. 2072: 0 → 2	Char. 2493: 3 → 1	Char. 2877: 3 → 1	Char. 3076: 1 → 3
Char. 108: 1 → 0	Char. 2145: 3 → 1	Char. 2523: 1 → 3	Char. 2883: 3 → 1	
Char. 123: 1 → 0	Char. 2271: 1 → 3	Char. 2760: 1 → 3	Char. 2910: 1 → 0	

Aspidoras albater Cavalcante*:*

All trees:

Char. 72: 1 → 0	Char. 1636: 0 → 1	Char. 1773: 0 → 2	Char. 1865: 0 → 1	Char. 2368: 0 → 2
Char. 157: 0 → 1	Char. 1640: 1 → 3	Char. 1774: 3 → 2	Char. 1867: 3 → 1	Char. 2370: 3 → 1
Char. 251: 1 → 3	Char. 1650: 1 → 3	Char. 1775: 0 → 3	Char. 1869: 3 → 2	Char. 2377: 2 → 0
Char. 260: 0 → 1	Char. 1653: 0 → 3	Char. 1778: 0 → 1	Char. 1873: 3 → 0	Char. 2379: 3 → 1
Char. 376: 1 → 3	Char. 1657: 1 → 0	Char. 1779: 1 → 3	Char. 1884: 1 → 0	Char. 2397: 0 → 2
Char. 417: 0 → 3	Char. 1660: 3 → 2	Char. 1780: 0 → 3	Char. 1891: 0 → 1	Char. 2409: 1 → 3
Char. 995: 2 → 0	Char. 1683: 3 → 2	Char. 1785: 0 → 2	Char. 1896: 0 → 2	Char. 2418: 3 → 1
Char. 1214: 2 → 3	Char. 1691: 3 → 2	Char. 1787: 0 → 2	Char. 1900: 3 → 2	Char. 2463: 3 → 1
Char. 1236: 0 → 2	Char. 1700: 1 → 3	Char. 1790: 0 → 1	Char. 1905: 1 → 3	Char. 2496: 1 → 3
Char. 1244: 1 → 0	Char. 1706: 0 → 3	Char. 1791: 1 → 0	Char. 1915: 0 → 2	Char. 2523: 2 → 0
Char. 1245: 1 → 3	Char. 1707: 1 → 3	Char. 1794: 0 → 3	Char. 1918: 3 → 2	Char. 2538: 1 → 3
Char. 1246: 1 → 0	Char. 1717: 1 → 3	Char. 1795: 1 → 0	Char. 1925: 1 → 3	Char. 2580: 0 → 2
Char. 1288: 3 → 2	Char. 1723: 3 → 1	Char. 1804: 1 → 3	Char. 1927: 0 → 1	Char. 2623: 1 → 3
Char. 1506: 1 → 3	Char. 1728: 0 → 2	Char. 1808: 0 → 1	Char. 1928: 1 → 0	Char. 2658: 1 → 3
Char. 1518: 0 → 1	Char. 1729: 0 → 1	Char. 1810: 1 → 3	Char. 1947: 1 → 2	Char. 2679: 1 → 3
Char. 1524: 3 → 1	Char. 1732: 1 → 0	Char. 1812: 2 → 3	Char. 1957: 0 → 1	Char. 2694: 1 → 3
Char. 1545: 1 → 3	Char. 1735: 1 → 2	Char. 1818: 0 → 1	Char. 1959: 3 → 2	Char. 2703: 1 → 3
Char. 1594: 1 → 3	Char. 1739: 2 → 1	Char. 1828: 1 → 0	Char. 1965: 1 → 0	Char. 2728: 1 → 3
Char. 1596: 2 → 3	Char. 1741: 0 → 1	Char. 1830: 1 → 3	Char. 1968: 1 → 2	Char. 2748: 1 → 3
Char. 1601: 1 → 0	Char. 1746: 0 → 1	Char. 1833: 1 → 3	Char. 2103: 1 → 3	Char. 2749: 1 → 3
Char. 1602: 1 → 2	Char. 1750: 0 → 1	Char. 1834: 0 → 1	Char. 2150: 3 → 1	Char. 2805: 1 → 3
Char. 1610: 0 → 3	Char. 1752: 0 → 1	Char. 1842: 0 → 1	Char. 2178: 0 → 2	Char. 2820: 0 → 1
Char. 1612: 1 → 3	Char. 1754: 0 → 1	Char. 1851: 0 → 3	Char. 2241: 3 → 1	Char. 2841: 0 → 2
Char. 1624: 1 → 3	Char. 1766: 3 → 1	Char. 1858: 3 → 2	Char. 2244: 1 → 3	Char. 2898: 1 → 2
Char. 1627: 1 → 3	Char. 1767: 0 → 2	Char. 1860: 0 → 2	Char. 2268: 3 → 1	Char. 2916: 1 → 3
Char. 1633: 0 → 3	Char. 1769: 0 → 1	Char. 1861: 3 → 0	Char. 2328: 3 → 1	Char. 2926: 0 → 2

Char. 2932: 0 → 2	Char. 3005: 0 → 2	Char. 3097: 0 → 2	Char. 3133: 0 → 2	Char. 3530: 1 → 3
Char. 2983: 1 → 0	Char. 3008: 1 → 3	Char. 3112: 0 → 2	Char. 3158: 2 → 0	Char. 3725: 3 → 1
Char. 2992: 0 → 2	Char. 3094: 3 → 1	Char. 3115: 1 → 3	Char. 3455: 0 → 3	Char. 3788: 3 → 0

Some trees:

Char. 57: 1 → 0	Char. 77: 2 → 1	Char. 136: 4 → 5	Char. 509: 0 → 2	Char. 2307: 3 → 1

Aspidoras spA:

All trees:

Char. 2: 2 → 1	Char. 855: 0 → 2	Char. 1455: 0 → 2	Char. 1964: 0 → 2	Char. 2766: 1 → 3
Char. 60: 0 → 1	Char. 894: 3 → 1	Char. 1470: 1 → 3	Char. 2088: 0 → 2	Char. 2793: 1 → 3
Char. 85: 1 → 0	Char. 903: 1 → 3	Char. 1494: 0 → 2	Char. 2150: 3 → 1	Char. 2826: 1 → 3
Char. 116: 0 → 1	Char. 913: 0 → 2	Char. 1506: 1 → 3	Char. 2161: 2 → 0	Char. 2859: 1 → 3
Char. 166: 1 → 2	Char. 948: 2 → 3	Char. 1530: 0 → 3	Char. 2178: 0 → 2	Char. 2907: 3 → 1
Char. 169: 1 → 2	Char. 1025: 1 → 3	Char. 1549: 1 → 3	Char. 2226: 1 → 3	Char. 2916: 1 → 3
Char. 173: 0 → 1	Char. 1042: 0 → 3	Char. 1602: 1 → 3	Char. 2244: 1 → 3	Char. 2935: 0 → 2
Char. 195: 1 → 0	Char. 1209: 0 → 1	Char. 1681: 0 → 2	Char. 2319: 1 → 3	Char. 2938: 1 → 3
Char. 212: 0 → 1	Char. 1287: 3 → 1	Char. 1683: 3 → 1	Char. 2373: 0 → 2	Char. 2992: 0 → 2
Char. 334: 2 → 0	Char. 1309: 3 → 2	Char. 1686: 1 → 0	Char. 2409: 1 → 3	Char. 3013: 3 → 1
Char. 344: 1 → 3	Char. 1311: 0 → 2	Char. 1737: 0 → 2	Char. 2422: 1 → 3	Char. 3046: 0 → 2
Char. 404: 0 → 2	Char. 1333: 1 → 3	Char. 1740: 1 → 3	Char. 2483: 3 → 1	Char. 3071: 0 → 2
Char. 416: 3 → 1	Char. 1341: 0 → 3	Char. 1741: 0 → 2	Char. 2490: 1 → 3	Char. 3088: 0 → 2
Char. 424: 3 → 1	Char. 1359: 1 → 0	Char. 1742: 1 → 3	Char. 2556: 0 → 2	Char. 3097: 0 → 2
Char. 522: 0 → 2	Char. 1371: 2 → 0	Char. 1744: 1 → 3	Char. 2634: 0 → 2	Char. 3229: 0 → 2
Char. 543: 1 → 3	Char. 1374: 2 → 1	Char. 1769: 0 → 1	Char. 2646: 1 → 3	Char. 3262: 3 → 1
Char. 572: 1 → 3	Char. 1375: 1 → 3	Char. 1857: 2 → 0	Char. 2712: 1 → 0	Char. 3386: 3 → 1
Char. 757: 0 → 2	Char. 1385: 2 → 3	Char. 1860: 0 → 2	Char. 2727: 3 → 1	Char. 3569: 1 → 3
Char. 808: 2 → 0	Char. 1389: 0 → 1	Char. 1863: 0 → 2	Char. 2736: 1 → 3	Char. 3605: 1 → 0
Char. 813: 1 → 3	Char. 1416: 1 → 3	Char. 1910: 0 → 2	Char. 2742: 3 → 1	Char. 3865: 2 → 0
Char. 816: 0 → 1	Char. 1446: 3 → 1	Char. 1948: 3 → 1	Char. 2760: 1 → 3	

Some trees:

Char. 71: 0 → 1

Aspidoras eurycephalus Cavalcante*:*

All trees:

Char. 26: 0 → 1	Char. 193: 0 → 1	Char. 890: 0 → 2	Char. 3262: 3 → 1	Char. 3856: 3 → 0
Char. 33: 0 → 1	Char. 212: 0 → 1	Char. 898: 0 → 2	Char. 3401: 3 → 1	Char. 3859: 2 → 1
Char. 134: 1 → 2	Char. 311: 1 → 3	Char. 959: 1 → 0	Char. 3565: 2 → 0	
Char. 147: 2 → 1	Char. 792: 0 → 2	Char. 999: 1 → 3	Char. 3800: 2 → 0	

Some trees:

Char. 229: 1 → 2

Char. 1209: 0 → 1

Char. 1227: 0 → 2

Char. 1248: 1 → 0

Char. 1276: 2 → 0

Char. 1278: 1 → 3

Char. 1287: 3 → 1

Char. 1326: 2 → 0

Char. 1347: 1 → 3

Char. 1371: 2 → 0

Char. 1374: 2 → 0

Char. 1377: 2 → 0

Char. 1386: 0 → 2

Char. 1443: 1 → 3

Char. 1590: 0 → 2

Char. 1604: 3 → 1

Char. 1626: 1 → 0

Char. 1659: 0 → 2

Char. 1662: 0 → 2

Char. 1674: 0 → 2

Char. 1692: 2 → 0

Char. 1731: 1 → 0

Char. 1755: 1 → 3

Char. 1765: 1 → 3

Char. 1802: 3 → 1

Char. 1825: 3 → 1

Char. 1839: 0 → 2

Char. 1984: 1 → 3

Char. 1990: 2 → 0

Char. 2075: 1 → 2

Char. 2154: 0 → 2

Char. 2271: 0 → 2

Char. 2274: 3 → 1

Char. 2313: 1 → 3

Char. 2334: 1 → 3

Char. 2349: 1 → 0

Char. 2415: 1 → 0

Char. 2430: 0 → 2

Char. 2439: 0 → 2

Char. 2490: 1 → 3

Char. 2634: 0 → 2

Char. 2649: 0 → 2

Char. 2652: 3 → 1

Char. 2685: 3 → 1

Char. 2751: 0 → 2

Char. 2757: 0 → 2

Char. 2763: 0 → 2

Char. 2766: 1 → 3

Char. 2823: 1 → 3

Char. 2892: 0 → 2

Char. 2927: 1 → 3

Char. 2959: 0 → 2

Char. 2968: 0 → 2

Char. 2971: 1 → 3

Char. 2980: 0 → 2

Char. 3010: 0 → 2

Char. 3040: 3 → 1

Char. 3067: 3 → 1

Char. 3092: 0 → 2

Char. 3104: 0 → 2

Char. 3139: 3 → 1

Char. 3952: 1 → 0

Aspidoras spC:

All trees:

Char. 33: 0 → 1

Char. 62: 1 → 0

Char. 111: 1 → 0

Char. 134: 1 → 2

Char. 139: 5 → 4

Char. 147: 2 → 1

Char. 193: 0 → 1

Char. 197: 0 → 1

Char. 236: 0 → 2

Char. 264: 3 → 1

Char. 376: 1 → 3

Char. 419: 0 → 2

Char. 770: 3 → 1

Char. 792: 0 → 2

Char. 809: 3 → 1

Char. 816: 2 → 1

Char. 859: 0 → 2

Char. 995: 2 → 0

Char. 1103: 1 → 3

Char. 1260: 0 → 2

Char. 1293: 3 → 1

Char. 1338: 0 → 2

Char. 1341: 0 → 2

Char. 1389: 0 → 2

Char. 1428: 1 → 3

Char. 1443: 1 → 3

Char. 1465: 3 → 1

Char. 1473: 3 → 1

Char. 1491: 3 → 1

Char. 1506: 1 → 3

Char. 1518: 0 → 2

Char. 1536: 0 → 2

Char. 1540: 1 → 0

Char. 1659: 0 → 1

Char. 1737: 0 → 3

Char. 1741: 0 → 2

Char. 1752: 0 → 2

Char. 1776: 1 → 3

Char. 1830: 1 → 3

Char. 2030: 3 → 1

Char. 3488: 2 → 0

Some trees:

Char. 136: 6 → 5

Aspidoras poecilus Barra do Garças:

All trees:

Char. 78: 0 → 1

Char. 124: 1 → 0

Char. 197: 0 → 1

Char. 436: 2 → 0

Char. 442: 1 → 3

Char. 543: 1 → 3

Char. 877: 3 → 1

Char. 957: 1 → 3

Char. 1034: 2 → 0

Char. 1042: 0 → 3

Char. 1045: 2 → 0

Char. 3380: 2 → 0

Char. 3392: 1 → 3

Char. 3497: 2 → 3

Char. 3575: 0 → 2

Char. 3653: 1 → 3

Char. 3764: 2 → 0

Char. 3778: 0 → 1

Char. 3899: 1 → 3

Char. 3909: 3 → 0

Char. 3934: 3 → 1

Some trees:

Char. 1036: 1 → 3

Aspidoras psammatides:

All trees:

Char. 18: 0 → 1	Char. 540: 1 → 3	Char. 1299: 3 → 1	Char. 1482: 1 → 3	Char. 1707: 1 → 3
Char. 64: 2 → 0	Char. 792: 0 → 2	Char. 1341: 0 → 2	Char. 1506: 1 → 3	Char. 1804: 1 → 0
Char. 77: 1 → 0	Char. 867: 1 → 3	Char. 1380: 1 → 3	Char. 1533: 0 → 2	Char. 1854: 0 → 2
Char. 85: 1 → 0	Char. 897: 0 → 2	Char. 1389: 0 → 2	Char. 1566: 0 → 2	Char. 1881: 3 → 1
Char. 89: 2 → 0	Char. 987: 1 → 3	Char. 1416: 1 → 3	Char. 1590: 0 → 2	Char. 1935: 0 → 2
Char. 96: 1 → 0	Char. 1201: 1 → 3	Char. 1449: 1 → 0	Char. 1602: 1 → 0	
Char. 188: 0 → 1	Char. 1202: 3 → 0	Char. 1461: 1 → 0	Char. 1624: 1 → 0	
Char. 334: 2 → 0	Char. 1204: 2 → 3	Char. 1462: 2 → 0	Char. 1649: 0 → 2	
Char. 508: 3 → 1	Char. 1245: 1 → 3	Char. 1463: 1 → 3	Char. 1656: 1 → 3	

Some trees:

Char. 71: 0 → 1	Char. 136: 6 → 3	Char. 199: 1 → 0

Aspidoras raimundi:

All trees:

Char. 2: 2 → 1	Char. 417: 1 → 3	Char. 1209: 0 → 1	Char. 1602: 3 → 0	Char. 1848: 3 → 1
Char. 13: 0 → 1	Char. 436: 2 → 0	Char. 1263: 1 → 3	Char. 1604: 3 → 1	Char. 1854: 0 → 2
Char. 35: 1 → 0	Char. 490: 2 → 0	Char. 1326: 2 → 0	Char. 1629: 0 → 3	Char. 1983: 2 → 0
Char. 45: 2 → 1	Char. 572: 1 → 0	Char. 1371: 2 → 0	Char. 1689: 1 → 3	Char. 1993: 3 → 1
Char. 80: 1 → 0	Char. 625: 0 → 2	Char. 1380: 1 → 3	Char. 1801: 0 → 2	Char. 3389: 3 → 2
Char. 90: 2 → 1	Char. 853: 3 → 1	Char. 1386: 0 → 3	Char. 1802: 3 → 1	Char. 3446: 0 → 2
Char. 188: 0 → 1	Char. 947: 3 → 1	Char. 1461: 1 → 3	Char. 1813: 1 → 0	Char. 3602: 2 → 1
Char. 213: 0 → 3	Char. 948: 2 → 0	Char. 1542: 1 → 0	Char. 1823: 3 → 1	
Char. 375: 3 → 1	Char. 1015: 1 → 0	Char. 1596: 2 → 0	Char. 1833: 1 → 3	

Some trees:

Char. 57: 1 → 0	Char. 73: 0 → 1	Char. 77: 2 → 3

Aspidoras taurus:

All trees:

Char. 3: 2 → 1	Char. 132: 0 → 1	Char. 437: 3 → 2	Char. 1299: 3 → 1	Char. 1630: 0 → 2
Char. 4: 0 → 1	Char. 134: 1 → 2	Char. 440: 0 → 2	Char. 1449: 1 → 3	Char. 1641: 1 → 3
Char. 28: 1 → 0	Char. 139: 5 → 3	Char. 792: 0 → 2	Char. 1491: 3 → 1	Char. 1666: 1 → 3
Char. 45: 2 → 1	Char. 147: 2 → 1	Char. 901: 2 → 0	Char. 1524: 3 → 2	Char. 1671: 3 → 1
Char. 62: 1 → 0	Char. 154: 1 → 0	Char. 1007: 3 → 1	Char. 1543: 1 → 3	Char. 1689: 1 → 0
Char. 72: 1 → 0	Char. 193: 0 → 1	Char. 1201: 1 → 2	Char. 1548: 0 → 2	Char. 1692: 2 → 0
Char. 80: 1 → 2	Char. 373: 0 → 3	Char. 1212: 3 → 1	Char. 1608: 0 → 3	Char. 1695: 3 → 1
Char. 96: 1 → 0	Char. 376: 1 → 0	Char. 1236: 0 → 2	Char. 1620: 0 → 2	Char. 1713: 1 → 0
Char. 107: 1 → 0	Char. 409: 0 → 1	Char. 1251: 1 → 3	Char. 1623: 0 → 2	Char. 1800: 0 → 2

Char. 1802: 3 → 1	Char. 2442: 1 → 3	Char. 2694: 1 → 3	Char. 2871: 1 → 0	Char. 3094: 3 → 1
Char. 1809: 1 → 3	Char. 2451: 3 → 1	Char. 2728: 1 → 3	Char. 2932: 0 → 2	Char. 3103: 1 → 3
Char. 1848: 3 → 1	Char. 2505: 0 → 2	Char. 2748: 1 → 3	Char. 2941: 0 → 2	Char. 3206: 1 → 3
Char. 1935: 0 → 2	Char. 2526: 0 → 2	Char. 2749: 1 → 3	Char. 2944: 0 → 2	Char. 3208: 0 → 1
Char. 1975: 0 → 2	Char. 2532: 1 → 0	Char. 2772: 3 → 1	Char. 2962: 0 → 2	Char. 3740: 0 → 3
Char. 2094: 1 → 3	Char. 2550: 0 → 2	Char. 2820: 0 → 1	Char. 2986: 1 → 3	Char. 3743: 1 → 3
Char. 2250: 1 → 3	Char. 2565: 0 → 2	Char. 2832: 0 → 2	Char. 3004: 0 → 2	Char. 3879: 0 → 3
Char. 2310: 1 → 3	Char. 2571: 1 → 3	Char. 2835: 0 → 2	Char. 3005: 0 → 2	
Char. 2313: 1 → 2	Char. 2616: 1 → 3	Char. 2844: 1 → 3	Char. 3040: 3 → 1	
Char. 2334: 1 → 3	Char. 2637: 1 → 0	Char. 2862: 1 → 3	Char. 3085: 1 → 3	
Char. 2377: 2 → 0	Char. 2649: 0 → 3	Char. 2868: 1 → 0	Char. 3092: 0 → 2	

Some trees:

Char. 136: 6 → 3	Char. 199: 1 → 0	Char. 2829: 3 → 1

Aspidoras virgulatus:

All trees:

Char. 3238: 1 → 3	Char. 3665: 0 → 2	Char. 3774: 0 → 3	Char. 3797: 1 → 2

Scleromystax barbatus eigenmanni Itanhaem-Santos*:*

All trees:

Char. 71: 0 → 1	Char. 136: 6 → 4	Char. 468: 1 → 3	Char. 647: 2 → 0
Char. 131: 1 → 2	Char. 197: 1 → 0	Char. 646: 3 → 1	

Scleromystax barbatus kronei Ribeira do Iguape*:*

All trees:

Char. 66: 2 → 0	Char. 112: 1 → 0	Char. 815: 0 → 2
Char. 107: 1 → 0	Char. 128: 5 → 6	Char. 913: 0 → 1

Scleromystax barbatus Paranagua PRSC*:*

All trees:

Char. 121: 0 → 1	Char. 147: 2 → 3	Char. 914: 3 → 1	Char. 3897: 0 → 2

Scleromystax macropterus:

All trees:

Char. 54: 1 → 2	Char. 217: 1 → 2	Char. 225: 3 → 0	Char. 1237: 1 → 3	Char. 1839: 0 → 2
Char. 57: 0 → 1	Char. 218: 3 → 1	Char. 226: 0 → 2	Char. 1512: 0 → 2	Char. 2044: 1 → 0
Char. 77: 1 → 2	Char. 220: 0 → 2	Char. 229: 1 → 3	Char. 1530: 0 → 2	Char. 2199: 1 → 3
Char. 90: 1 → 2	Char. 221: 2 → 1	Char. 230: 1 → 3	Char. 1590: 0 → 1	Char. 2340: 0 → 2
Char. 123: 1 → 0	Char. 222: 1 → 3	Char. 614: 1 → 2	Char. 1608: 1 → 3	Char. 2397: 0 → 2
Char. 139: 5 → 4	Char. 223: 1 → 0	Char. 632: 1 → 0	Char. 1635: 3 → 1	Char. 2619: 2 → 0
Char. 147: 2 → 3	Char. 224: 3 → 1	Char. 1234: 3 → 1	Char. 1815: 1 → 0	Char. 2787: 1 → 3

Char. 2844: 1 → 3
Char. 2883: 1 → 3
Char. 2895: 2 → 0
Char. 2935: 3 → 1
Char. 3046: 0 → 2
Char. 3560: 0 → 1
Char. 3590: 1 → 3

Some trees:

Char. 2: 0 → 1
Char. 2139: 3 → 1

Scleromystax salmacis:

All trees:

Char. 3: 2 → 1
Char. 66: 2 → 0
Char. 70: 2 → 1
Char. 94: 2 → 1
Char. 96: 1 → 0
Char. 136: 6 → 5
Char. 376: 3 → 1
Char. 508: 3 → 1
Char. 813: 3 → 1
Char. 881: 3 → 2
Char. 957: 1 → 3
Char. 1027: 1 → 3
Char. 1039: 0 → 2
Char. 1242: 1 → 3
Char. 1278: 3 → 1
Char. 1293: 0 → 1
Char. 1317: 3 → 1
Char. 1519: 1 → 3
Char. 1542: 1 → 3
Char. 1668: 0 → 1
Char. 1683: 0 → 2
Char. 1821: 3 → 1
Char. 2047: 1 → 0
Char. 2048: 0 → 1
Char. 2145: 1 → 3
Char. 2150: 3 → 1
Char. 2196: 0 → 1
Char. 2235: 1 → 3
Char. 2250: 1 → 3
Char. 2274: 3 → 1
Char. 2433: 1 → 3
Char. 2439: 0 → 2
Char. 2493: 3 → 1
Char. 2523: 1 → 3
Char. 2580: 0 → 2
Char. 2640: 0 → 2
Char. 2709: 1 → 3
Char. 2887: 1 → 3
Char. 2927: 1 → 3
Char. 3076: 3 → 1
Char. 3775: 1 → 0
Char. 3848: 1 → 3
Char. 3944: 0 → 3

Callichthys callichthys RS:

Some trees:

Char. 65: 1 → 0
Char. 108: 0 → 1
Char. 188: 1 → 0
Char. 868: 0 → 3
Char. 902: 3 → 1
Char. 1686: 0 → 2
Char. 1836: 0 → 2
Char. 1851: 0 → 2
Char. 1897: 3 → 1
Char. 1905: 1 → 3
Char. 1924: 1 → 3
Char. 1954: 0 → 2

Callichthys fabricioi:

Some trees:

Char. 4: 0 → 1
Char. 144: 2 → 3
Char. 156: 0 → 3
Char. 169: 1 → 2
Char. 176: 2 → 0

Callichthys serralabium:

Some trees:

Char. 158: 1 → 2

Dianema longibarbis:

All trees:

Char. 147: 2 → 1
Char. 158: 1 → 2
Char. 543: 3 → 0
Char. 545: 1 → 2
Char. 790: 1 → 3

Dianema urostriatum:

All trees:

Char. 84: 1 → 0
Char. 91: 0 → 1
Char. 190: 1 → 0
Char. 544: 0 → 2
Char. 667: 0 → 1
Char. 669: 0 → 3
Char. 925: 3 → 2
Char. 3328: 1 → 2
Char. 3779: 1 → 3

Hoplosternum littorale:

All trees:

Char. 67: 0 → 1
Char. 86: 0 → 1
Char. 128: 7 → 4
Char. 139: 2 → 1
Char. 260: 0 → 2

Char. 263: 2 → 1	Char. 334: 2 → 3	Char. 854: 2 → 3	Char. 1070: 3 → 1	Char. 3575: 0 → 2
Char. 270: 2 → 0	Char. 335: 0 → 3	Char. 874: 3 → 1	Char. 1090: 1 → 3	Char. 3581: 0 → 2
Char. 290: 0 → 1	Char. 409: 2 → 0	Char. 889: 0 → 2	Char. 1103: 1 → 3	Char. 3768: 1 → 3
Char. 291: 2 → 1	Char. 418: 3 → 0	Char. 912: 1 → 3	Char. 3206: 1 → 0	Char. 3832: 2 → 3
Char. 292: 2 → 1	Char. 457: 3 → 0	Char. 914: 3 → 1	Char. 3217: 1 → 3	Char. 3934: 3 → 2
Char. 293: 0 → 1	Char. 526: 2 → 0	Char. 963: 1 → 3	Char. 3249: 0 → 1	Char. 3941: 0 → 3
Char. 297: 2 → 0	Char. 545: 1 → 3	Char. 981: 3 → 1	Char. 3417: 3 → 0	
Char. 299: 1 → 2	Char. 768: 3 → 1	Char. 1015: 3 → 0	Char. 3456: 0 → 1	
Char. 332: 3 → 1	Char. 812: 0 → 3	Char. 1036: 1 → 3	Char. 3536: 2 → 1	
Char. 333: 0 → 1	Char. 852: 0 → 3	Char. 1045: 2 → 0	Char. 3569: 3 → 1	

Hoplosternum magdalenae:

All trees:

Char. 19: 0 → 5	Char. 50: 0 → 1	Char. 93: 1 → 2	Char. 136: 5 → 6
Char. 37: 2 → 3	Char. 62: 1 → 0	Char. 133: 0 → 2	Char. 139: 2 → 1

Hoplosternum punctatum:

All trees:

Char. 19: 0 → 4	Char. 44: 1 → 0	Char. 91: 0 → 1

Lepthoplosternum altamazonicum:

All trees:

Char. 102: 1 → 2	Char. 869: 0 → 2	Char. 1209: 0 → 3	Char. 1488: 01 → 3	Char. 1695: 3 → 1
Char. 108: 0 → 1	Char. 885: 1 → 3	Char. 1245: 1 → 2	Char. 1500: 1 → 3	Char. 1707: 1 → 3
Char. 420: 0 → 2	Char. 898: 0 → 2	Char. 1246: 1 → 2	Char. 1515: 0 → 1	Char. 1740: 1 → 0
Char. 440: 1 → 0	Char. 902: 3 → 1	Char. 1248: 01 → 2	Char. 1557: 1 → 3	Char. 1744: 1 → 3
Char. 469: 2 → 0	Char. 904: 3 → 1	Char. 1353: 1 → 3	Char. 1558: 0 → 2	Char. 1759: 0 → 1
Char. 529: 3 → 1	Char. 915: 0 → 1	Char. 1365: 1 → 3	Char. 1605: 1 → 3	Char. 1874: 0 → 2
Char. 625: 0 → 1	Char. 948: 0 → 2	Char. 1374: 0 → 3	Char. 1686: 0 → 2	
Char. 813: 0 → 1	Char. 1025: 3 → 1	Char. 1413: 1 → 3	Char. 1687: 0 → 2	
Char. 815: 13 → 0	Char. 1036: 1 → 3	Char. 1419: 0 → 2	Char. 1688: 1 → 0	
Char. 867: 3 → 0	Char. 1045: 2 → 0	Char. 1455: 0 → 2	Char. 1690: 1 → 3	

Lepthoplosternum beni:

All trees:

Char. 106: 1 → 2	Char. 136: 6 → 7	Char. 177: 0 → 1

Lepthoplosternum pectorale:

All trees:

Char. 67: 0 → 1	Char. 175: 1 → 0	Char. 810: 0 → 2	Char. 882: 0 → 1	Char. 945: 0 → 2
Char. 144: 2 → 1	Char. 727: 0 → 2	Char. 814: 13 → 0	Char. 913: 0 → 3	Char. 1203: 0 → 2

Char. 1206: 0 → 3	Char. 1285: 1 → 3	Char. 1392: 1 → 3	Char. 1527: 0 → 3	Char. 1641: 1 → 3
Char. 1209: 0 → 1	Char. 1296: 3 → 1	Char. 1401: 0 → 2	Char. 1536: 0 → 2	Char. 3249: 1 → 3
Char. 1215: 2 → 3	Char. 1305: 0 → 1	Char. 1458: 1 → 2	Char. 1563: 0 → 2	Char. 3386: 3 → 1
Char. 1241: 0 → 2	Char. 1311: 1 → 3	Char. 1506: 1 → 3	Char. 1572: 3 → 1	Char. 3404: 3 → 2
Char. 1246: 1 → 0	Char. 1320: 0 → 2	Char. 1518: 3 → 1	Char. 1596: 1 → 3	Char. 3509: 3 → 1
Char. 1269: 1 → 3	Char. 1332: 1 → 3	Char. 1519: 1 → 3	Char. 1614: 0 → 2	Char. 3841: 2 → 0
Char. 1284: 1 → 3	Char. 1338: 0 → 2	Char. 1521: 0 → 2	Char. 1620: 0 → 2	

Lepthoplosternum stellatum:

All trees:

Char. 84: 2 → 1

Lepthoplosternum tordilho:

All trees:

Char. 61: 1 → 0	Char. 136: 6 → 7	Char. 147: 2 → 1	Char. 177: 0 → 1	Char. 505: 0 → 2
Char. 84: 2 → 1	Char. 139: 3 → 2	Char. 163: 1 → 0	Char. 474: 0 → 2	Char. 538: 3 → 1

Lepthoplosternum ucamara:

All trees:

Char. 19: 4 → 5	Char. 164: 2 → 1	Char. 581: 0 → 3	Char. 905: 3 → 1
Char. 100: 1 → 0	Char. 413: 2 → 0	Char. 851: 1 → 3	Char. 916: 2 → 0
Char. 102: 1 → 2	Char. 524: 1 → 3	Char. 902: 3 → 1	

Megalechis picta:

All trees:

Char. 80: 1 → 2	Char. 947: 3 → 1	Char. 1380: 3 → 1	Char. 1536: 0 → 2	Char. 1746: 0 → 2
Char. 106: 1 → 2	Char. 1006: 0 → 3	Char. 1392: 1 → 3	Char. 1543: 3 → 1	Char. 1755: 1 → 3
Char. 108: 0 → 1	Char. 1095: 1 → 0	Char. 1398: 3 → 1	Char. 1558: 0 → 2	Char. 1759: 0 → 1
Char. 156: 0 → 1	Char. 1162: 1 → 0	Char. 1404: 1 → 3	Char. 1579: 1 → 3	Char. 1761: 3 → 1
Char. 177: 0 → 1	Char. 1201: 1 → 3	Char. 1440: 3 → 1	Char. 1590: 3 → 1	Char. 1788: 0 → 2
Char. 376: 0 → 3	Char. 1218: 0 → 2	Char. 1443: 1 → 0	Char. 1593: 3 → 1	Char. 1821: 3 → 1
Char. 413: 2 → 0	Char. 1269: 0 → 2	Char. 1449: 3 → 0	Char. 1626: 3 → 0	Char. 1833: 3 → 1
Char. 432: 0 → 2	Char. 1272: 3 → 1	Char. 1461: 1 → 3	Char. 1641: 1 → 3	Char. 1842: 0 → 2
Char. 514: 0 → 1	Char. 1284: 1 → 3	Char. 1476: 0 → 2	Char. 1647: 3 → 1	Char. 1851: 0 → 2
Char. 518: 0 → 1	Char. 1287: 2 → 0	Char. 1503: 3 → 1	Char. 1704: 1 → 3	Char. 1955: 2 → 0
Char. 577: 0 → 2	Char. 1311: 1 → 3	Char. 1509: 0 → 3	Char. 1716: 1 → 3	Char. 1979: 2 → 0
Char. 727: 0 → 2	Char. 1338: 0 → 2	Char. 1519: 1 → 3	Char. 1722: 1 → 3	
Char. 913: 0 → 2	Char. 1374: 0 → 1	Char. 1527: 0 → 2	Char. 1744: 1 → 3	

Some trees:

Char. 1863: 0 → 2

Megalechis thoracata:

All trees:

Char. 85: 0 → 1	Char. 850: 0 → 2	Char. 1296: 3 → 1	Char. 1515: 0 → 2	Char. 1695: 3 → 0
Char. 190: 0 → 1	Char. 867: 3 → 1	Char. 1305: 0 → 2	Char. 1518: 3 → 1	Char. 1707: 1 → 3
Char. 365: 3 → 1	Char. 902: 3 → 1	Char. 1308: 1 → 0	Char. 1551: 0 → 2	Char. 1719: 1 → 3
Char. 374: 0 → 2	Char. 904: 3 → 1	Char. 1359: 3 → 2	Char. 1560: 1 → 3	Char. 1756: 0 → 1
Char. 418: 3 → 1	Char. 976: 1 → 0	Char. 1413: 1 → 3	Char. 1566: 0 → 2	Char. 1757: 3 → 0
Char. 508: 3 → 1	Char. 988: 0 → 2	Char. 1416: 1 → 3	Char. 1569: 3 → 1	Char. 1779: 1 → 3
Char. 532: 0 → 2	Char. 1206: 0 → 2	Char. 1419: 0 → 3	Char. 1578: 1 → 3	Char. 1797: 0 → 2
Char. 538: 3 → 1	Char. 1209: 0 → 2	Char. 1428: 3 → 1	Char. 1605: 1 → 3	Char. 1803: 1 → 3
Char. 539: 0 → 1	Char. 1212: 3 → 1	Char. 1452: 0 → 2	Char. 1649: 0 → 1	Char. 1839: 0 → 2
Char. 543: 1 → 3	Char. 1221: 0 → 2	Char. 1455: 0 → 2	Char. 1653: 0 → 2	Char. 1859: 2 → 0
Char. 666: 0 → 3	Char. 1233: 3 → 1	Char. 1458: 1 → 3	Char. 1656: 1 → 0	Char. 1883: 0 → 3
Char. 667: 3 → 0	Char. 1239: 3 → 1	Char. 1479: 3 → 1	Char. 1659: 1 → 3	Char. 1884: 0 → 3
Char. 676: 1 → 2	Char. 1263: 1 → 3	Char. 1506: 1 → 3	Char. 1686: 0 → 2	Char. 1916: 2 → 0

Corydoras amapaensis:

All trees:

Char. 311: 1 → 3	Char. 1411: 2 → 0	Char. 2172: 3 → 1	Char. 2508: 1 → 3	Char. 2907: 0 → 2
Char. 423: 2 → 0	Char. 1440: 0 → 1	Char. 2247: 1 → 3	Char. 2520: 0 → 2	Char. 2938: 3 → 1
Char. 815: 0 → 1	Char. 1642: 0 → 1	Char. 2262: 1 → 3	Char. 2634: 0 → 2	Char. 2980: 1 → 3
Char. 855: 0 → 2	Char. 1674: 0 → 2	Char. 2322: 0 → 2	Char. 2640: 1 → 3	Char. 2994: 3 → 1
Char. 985: 0 → 2	Char. 1681: 0 → 2	Char. 2334: 1 → 3	Char. 2651: 3 → 1	Char. 3013: 1 → 3
Char. 1007: 3 → 1	Char. 1773: 0 → 2	Char. 2352: 3 → 1	Char. 2745: 2 → 3	Char. 3022: 3 → 1
Char. 1026: 0 → 2	Char. 1794: 0 → 2	Char. 2391: 3 → 1	Char. 2751: 2 → 1	Char. 3046: 3 → 1
Char. 1215: 0 → 1	Char. 1803: 1 → 0	Char. 2409: 1 → 3	Char. 2752: 2 → 0	Char. 3052: 0 → 1
Char. 1218: 0 → 2	Char. 1813: 1 → 3	Char. 2422: 1 → 3	Char. 2787: 0 → 3	Char. 3092: 0 → 2
Char. 1241: 0 → 2	Char. 1821: 3 → 1	Char. 2451: 3 → 1	Char. 2799: 0 → 2	Char. 3296: 1 → 3
Char. 1272: 3 → 1	Char. 2071: 2 → 0	Char. 2481: 1 → 0	Char. 2826: 1 → 3	Char. 3874: 2 → 3
Char. 1281: 0 → 2	Char. 2146: 3 → 1	Char. 2498: 0 → 2	Char. 2841: 0 → 2	Char. 3907: 2 → 0
Char. 1290: 0 → 2	Char. 2169: 2 → 0	Char. 2499: 1 → 3	Char. 2853: 1 → 3	

Corydoras condisciplus:

All trees:

Char. 409: 0 → 2	Char. 442: 0 → 1	Char. 790: 1 → 3	Char. 3350: 1 → 3
Char. 435: 2 → 0	Char. 774: 0 → 2	Char. 882: 0 → 2	Char. 3389: 1 → 3

Some trees:

Char. 418: 02 → 0	Char. 509: 02 → 2

Corydoras ehrhardti LBP741 8893:

Some trees:

Char. 3262: 2 → 3	Char. 3428: 3 → 1	Char. 3913: 2 → 3

Corydoras elegans Pantanal:

All trees:

Char. 562: 3 → 1	Char. 3455: 0 → 2	Char. 3758: 2 → 0	Char. 3842: 0 → 1

Corydoras geoffroy:

All trees:

Char. 429: 0 → 2	Char. 1596: 0 → 1	Char. 2199: 1 → 3	Char. 2778: 0 → 1	Char. 3044: 2 → 0
Char. 470: 1 → 3	Char. 1623: 0 → 2	Char. 2200: 0 → 2	Char. 2784: 0 → 3	Char. 3050: 1 → 2
Char. 506: 3 → 1	Char. 1641: 1 → 3	Char. 2225: 1 → 3	Char. 2790: 1 → 3	Char. 3056: 2 → 0
Char. 744: 0 → 2	Char. 1665: 0 → 3	Char. 2271: 3 → 1	Char. 2799: 0 → 3	Char. 3061: 1 → 0
Char. 815: 0 → 3	Char. 1671: 3 → 1	Char. 2277: 1 → 3	Char. 2803: 0 → 2	Char. 3062: 1 → 0
Char. 856: 3 → 1	Char. 1677: 0 → 2	Char. 2283: 0 → 2	Char. 2821: 0 → 1	Char. 3078: 2 → 3
Char. 913: 0 → 3	Char. 1680: 0 → 2	Char. 2304: 1 → 3	Char. 2860: 2 → 1	Char. 3079: 1 → 0
Char. 968: 2 → 0	Char. 1683: 0 → 2	Char. 2394: 1 → 0	Char. 2874: 0 → 3	Char. 3085: 1 → 0
Char. 1224: 2 → 3	Char. 1713: 1 → 3	Char. 2481: 1 → 3	Char. 2897: 3 → 2	Char. 3095: 1 → 3
Char. 1230: 0 → 2	Char. 1731: 1 → 0	Char. 2514: 0 → 2	Char. 2907: 0 → 3	Char. 3098: 3 → 0
Char. 1248: 1 → 3	Char. 1742: 1 → 0	Char. 2515: 0 → 1	Char. 2920: 1 → 3	Char. 3104: 0 → 3
Char. 1279: 1 → 3	Char. 1776: 1 → 3	Char. 2526: 1 → 2	Char. 2931: 3 → 1	Char. 3117: 3 → 1
Char. 1308: 1 → 3	Char. 1824: 2 → 1	Char. 2568: 1 → 3	Char. 2950: 1 → 3	Char. 3128: 1 → 3
Char. 1326: 0 → 2	Char. 1827: 0 → 2	Char. 2571: 1 → 3	Char. 2956: 0 → 1	Char. 3553: 1 → 2
Char. 1332: 1 → 3	Char. 1867: 3 → 1	Char. 2608: 0 → 1	Char. 2972: 0 → 1	Char. 3590: 1 → 3
Char. 1341: 0 → 1	Char. 1983: 0 → 2	Char. 2617: 0 → 1	Char. 2987: 0 → 1	Char. 3602: 2 → 0
Char. 1389: 0 → 1	Char. 2044: 0 → 3	Char. 2631: 0 → 2	Char. 2991: 0 → 1	Char. 3642: 1 → 0
Char. 1437: 0 → 2	Char. 2109: 0 → 1	Char. 2687: 0 → 1	Char. 3003: 2 → 3	Char. 3879: 0 → 3
Char. 1488: 0 → 2	Char. 2127: 1 → 3	Char. 2718: 0 → 3	Char. 3011: 2 → 0	Char. 3922: 2 → 3
Char. 1522: 2 → 0	Char. 2163: 1 → 3	Char. 2733: 0 → 3	Char. 3016: 0 → 1	
Char. 1530: 0 → 2	Char. 2187: 1 → 3	Char. 2749: 1 → 3	Char. 3039: 3 → 0	

Some trees:

Char. 1362: 3 → 1

Corydoras gossei:

All trees:

Char. 442: 0 → 2	Char. 3515: 2 → 0	Char. 3656: 1 → 3	Char. 3782: 1 → 3
Char. 912: 1 → 3	Char. 3530: 1 → 2	Char. 3704: 1 → 3	Char. 3838: 2 → 0
Char. 3401: 1 → 3	Char. 3590: 1 → 3	Char. 3758: 2 → 1	

Some trees:

Char. 3321: 1 → 3

Corydoras guianensis:

All trees:

Char. 419: 0 → 3	Char. 809: 3 → 1	Char. 1037: 0 → 2	Char. 3497: 2 → 3
Char. 745: 2 → 0	Char. 957: 1 → 3	Char. 3309: 2 → 0	Char. 3686: 1 → 3

Some trees:

Char. 894: 3 → 1	Char. 1485: 1 → 3	Char. 2103: 1 → 3	Char. 2652: 3 → 1	Char. 3023: 3 → 1
Char. 1245: 0 → 2	Char. 1497: 1 → 3	Char. 2208: 3 → 1	Char. 2727: 3 → 1	Char. 3083: 0 → 2
Char. 1260: 0 → 2	Char. 1611: 3 → 1	Char. 2247: 1 → 3	Char. 2784: 0 → 2	Char. 3085: 1 → 3
Char. 1272: 3 → 1	Char. 1617: 2 → 0	Char. 2502: 3 → 2	Char. 2796: 1 → 3	Char. 3124: 2 → 0
Char. 1290: 0 → 2	Char. 1644: 0 → 2	Char. 2538: 3 → 1	Char. 2805: 1 → 3	Char. 3647: 0 → 2
Char. 1362: 3 → 1	Char. 1674: 3 → 1	Char. 2580: 0 → 1	Char. 2844: 1 → 3	Char. 3713: 1 → 3
Char. 1368: 1 → 3	Char. 1716: 3 → 1	Char. 2601: 0 → 2	Char. 2847: 1 → 3	Char. 3912: 1 → 3
Char. 1422: 0 → 2	Char. 2064: 1 → 3	Char. 2607: 0 → 2	Char. 2964: 2 → 0	
Char. 1455: 0 → 2	Char. 2097: 1 → 0	Char. 2619: 2 → 0	Char. 3004: 0 → 2	

Corydoras hastatus australe:

All trees:

Char. 224: 3 → 1	Char. 1299: 3 → 1	Char. 1659: 0 → 1	Char. 2130: 1 → 3	Char. 2421: 0 → 1
Char. 242: 0 → 3	Char. 1353: 1 → 3	Char. 1670: 3 → 1	Char. 2133: 1 → 3	Char. 2451: 3 → 0
Char. 307: 1 → 3	Char. 1362: 3 → 1	Char. 1671: 3 → 1	Char. 2178: 0 → 2	Char. 2460: 0 → 1
Char. 376: 1 → 0	Char. 1380: 3 → 0	Char. 1686: 3 → 0	Char. 2181: 0 → 3	Char. 2463: 3 → 1
Char. 417: 0 → 2	Char. 1404: 1 → 0	Char. 1719: 1 → 0	Char. 2187: 1 → 3	Char. 2466: 0 → 1
Char. 528: 3 → 0	Char. 1446: 1 → 3	Char. 1737: 0 → 2	Char. 2190: 1 → 3	Char. 2472: 1 → 0
Char. 544: 0 → 2	Char. 1452: 0 → 2	Char. 1761: 3 → 1	Char. 2214: 1 → 3	Char. 2478: 3 → 1
Char. 632: 3 → 1	Char. 1476: 2 → 0	Char. 1794: 0 → 2	Char. 2229: 3 → 1	Char. 2482: 0 → 2
Char. 744: 2 → 0	Char. 1509: 0 → 1	Char. 1797: 1 → 0	Char. 2250: 1 → 3	Char. 2568: 1 → 3
Char. 788: 0 → 2	Char. 1512: 1 → 0	Char. 1802: 1 → 3	Char. 2268: 3 → 1	Char. 2589: 1 → 0
Char. 793: 1 → 3	Char. 1519: 1 → 3	Char. 1809: 1 → 3	Char. 2271: 3 → 1	Char. 2592: 3 → 1
Char. 804: 2 → 0	Char. 1524: 1 → 3	Char. 1839: 0 → 2	Char. 2280: 1 → 3	Char. 2604: 1 → 3
Char. 987: 1 → 3	Char. 1536: 0 → 2	Char. 1848: 3 → 1	Char. 2283: 0 → 2	Char. 2629: 2 → 1
Char. 1007: 3 → 1	Char. 1579: 1 → 3	Char. 1851: 0 → 2	Char. 2286: 1 → 3	Char. 2646: 1 → 3
Char. 1043: 3 → 1	Char. 1587: 1 → 3	Char. 1857: 0 → 2	Char. 2305: 0 → 2	Char. 2658: 1 → 3
Char. 1233: 3 → 2	Char. 1602: 1 → 3	Char. 1869: 3 → 1	Char. 2340: 0 → 1	Char. 2680: 3 → 0
Char. 1248: 0 → 3	Char. 1605: 0 → 1	Char. 1935: 0 → 2	Char. 2349: 3 → 1	Char. 2703: 1 → 3
Char. 1251: 3 → 0	Char. 1611: 1 → 3	Char. 2036: 0 → 2	Char. 2376: 0 → 3	Char. 2724: 3 → 1
Char. 1261: 2 → 0	Char. 1641: 1 → 3	Char. 2086: 3 → 1	Char. 2394: 0 → 1	Char. 2727: 3 → 1
Char. 1263: 0 → 1	Char. 1644: 0 → 2	Char. 2088: 0 → 1	Char. 2415: 1 → 3	Char. 2742: 1 → 3

Char. 2766: 1 → 0	Char. 2953: 1 → 3	Char. 3023: 3 → 1	Char. 3347: 2 → 3	Char. 3668: 3 → 2
Char. 2787: 1 → 3	Char. 2980: 0 → 2	Char. 3037: 0 → 2	Char. 3419: 1 → 3	Char. 3677: 2 → 0
Char. 2820: 0 → 1	Char. 2984: 1 → 0	Char. 3073: 3 → 1	Char. 3431: 1 → 2	Char. 3842: 0 → 3
Char. 2853: 3 → 1	Char. 2998: 0 → 2	Char. 3076: 3 → 1	Char. 3491: 1 → 3	Char. 3844: 2 → 0
Char. 2910: 0 → 1	Char. 3005: 0 → 2	Char. 3094: 3 → 1	Char. 3557: 1 → 3	Char. 3884: 1 → 3
Char. 2926: 0 → 2	Char. 3011: 2 → 0	Char. 3130: 0 → 2	Char. 3587: 1 → 3	Char. 3915: 0 → 3
Char. 2929: 0 → 1	Char. 3016: 0 → 1	Char. 3139: 3 → 0	Char. 3644: 2 → 0	

Some trees:

Char. 2100: 1 → 3	Char. 2307: 3 → 0	Char. 2808: 0 → 2	Char. 2883: 3 → 1

Corydoras kanei:

All trees:

Char. 1221: 0 → 3	Char. 2066: 3 → 2	Char. 3139: 3 → 2	Char. 3222: 0 → 1	Char. 3503: 1 → 0
Char. 1226: 3 → 2	Char. 2067: 3 → 2	Char. 3140: 2 → 3	Char. 3233: 0 → 2	Char. 3699: 1 → 3
Char. 1227: 0 → 2	Char. 2068: 0 → 2	Char. 3176: 1 → 2	Char. 3236: 0 → 2	Char. 3700: 3 → 0
Char. 1229: 3 → 0	Char. 3091: 0 → 1	Char. 3208: 0 → 3	Char. 3243: 0 → 1	
Char. 1254: 2 → 0	Char. 3138: 2 → 3	Char. 3210: 1 → 3	Char. 3261: 1 → 0	

Some trees:

Char. 1734: 2 → 0	Char. 3043: 1 → 3

Corydoras lacerdai:

All trees:

Char. 3244: 2 → 0	Char. 3572: 3 → 1	Char. 3617: 3 → 1	Char. 3918: 2 → 0
Char. 3488: 2 → 0	Char. 3590: 1 → 3	Char. 3635: 2 → 0	

Corydoras leucomelas:

Some trees:

Char. 890: 0 → 2	Char. 1210: 3 → 0	Char. 1788: 0 → 2	Char. 2352: 3 → 1	Char. 2661: 1 → 3
Char. 1007: 3 → 1	Char. 1260: 0 → 2	Char. 1833: 3 → 1	Char. 2376: 0 → 3	Char. 2892: 1 → 0
Char. 1204: 2 → 0	Char. 1333: 3 → 1	Char. 2036: 2 → 0	Char. 2382: 2 → 0	Char. 2926: 2 → 1
Char. 1205: 2 → 0	Char. 1356: 0 → 2	Char. 2044: 1 → 0	Char. 2422: 1 → 3	Char. 2974: 0 → 3
Char. 1207: 2 → 0	Char. 1404: 1 → 3	Char. 2148: 2 → 0	Char. 2460: 0 → 2	
Char. 1208: 2 → 3	Char. 1428: 3 → 1	Char. 2334: 1 → 3	Char. 2523: 1 → 3	
Char. 1209: 1 → 0	Char. 1670: 3 → 1	Char. 2346: 1 → 3	Char. 2607: 0 → 2	

Corydoras melini:

All trees:

Char. 418: 0 → 2	Char. 912: 1 → 0	Char. 1251: 3 → 0	Char. 1473: 3 → 1	Char. 1608: 3 → 1
Char. 539: 0 → 2	Char. 913: 0 → 2	Char. 1356: 0 → 2	Char. 1530: 0 → 2	Char. 1670: 3 → 1
Char. 845: 0 → 2	Char. 1101: 3 → 1	Char. 1446: 3 → 1	Char. 1590: 0 → 2	Char. 1713: 0 → 2

Char. 1716: 3 → 1	Char. 1815: 1 → 3	Char. 2163: 3 → 1	Char. 2625: 0 → 2	Char. 2883: 3 → 1
Char. 1719: 0 → 2	Char. 1848: 3 → 1	Char. 2331: 1 → 0	Char. 2739: 1 → 0	Char. 2901: 0 → 2
Char. 1803: 3 → 1	Char. 1851: 0 → 2	Char. 2364: 0 → 2	Char. 2745: 0 → 2	Char. 2907: 1 → 0
Char. 1806: 0 → 2	Char. 2133: 0 → 2	Char. 2442: 0 → 2	Char. 2847: 1 → 3	Char. 3004: 0 → 2

Some trees:

Char. 1644: 0 → 2   Char. 2490: 3 → 1   Char. 2773: 1 → 3   Char. 2926: 0 → 2

Corydoras metae:

All trees:

Char. 239: 3 → 1	Char. 2178: 0 → 2	Char. 2487: 0 → 2	Char. 2721: 3 → 1	Char. 3076: 1 → 3
Char. 745: 2 → 0	Char. 2223: 0 → 2	Char. 2514: 0 → 2	Char. 2832: 0 → 2	Char. 3092: 2 → 0
Char. 816: 0 → 2	Char. 2229: 1 → 3	Char. 2517: 3 → 1	Char. 2841: 0 → 2	Char. 3115: 3 → 1
Char. 947: 1 → 3	Char. 2244: 1 → 0	Char. 2544: 0 → 3	Char. 2848: 1 → 3	Char. 3179: 3 → 0
Char. 2071: 2 → 0	Char. 2304: 1 → 3	Char. 2580: 0 → 1	Char. 2850: 0 → 2	Char. 3321: 1 → 3
Char. 2072: 0 → 2	Char. 2358: 0 → 2	Char. 2586: 1 → 3	Char. 2907: 1 → 3	Char. 3413: 1 → 3
Char. 2121: 1 → 3	Char. 2376: 0 → 1	Char. 2634: 0 → 2	Char. 2984: 1 → 3	Char. 3679: 1 → 3
Char. 2136: 1 → 3	Char. 2415: 3 → 1	Char. 2655: 0 → 2	Char. 2989: 1 → 3	Char. 3713: 1 → 3
Char. 2157: 0 → 2	Char. 2442: 0 → 1	Char. 2658: 1 → 0	Char. 3010: 0 → 2	Char. 3880: 1 → 3

Some trees:

Char. 544: 0 → 2   Char. 809: 3 → 1   Char. 2382: 2 → 0   Char. 3329: 3 → 1   Char. 3912: 1 → 3

Corydoras napoensis:

All trees:

Char. 808: 0 → 2   Char. 3725: 3 → 1

Corydoras narcissus:

All trees:

Char. 881: 3 → 0	Char. 1536: 0 → 2	Char. 1617: 0 → 2	Char. 1746: 2 → 0	Char. 3238: 1 → 3
Char. 1260: 0 → 2	Char. 1555: 0 → 2	Char. 1620: 0 → 3	Char. 1863: 2 → 0	
Char. 1347: 3 → 1	Char. 1590: 0 → 2	Char. 1666: 3 → 1	Char. 1978: 1 → 3	
Char. 1479: 3 → 1	Char. 1602: 0 → 1	Char. 1680: 0 → 3	Char. 1990: 0 → 2	

Corydoras nattereri juquiae Paranagua1*:*

All trees:

Char. 1043: 1 → 3   Char. 3434: 0 → 2

Corydoras nattereri juquiae Paranagua2*:*

All trees:

Char. 263: 2 → 0	Char. 690: 1 → 2	Char. 867: 1 → 0	Char. 877: 1 → 3	Char. 882: 2 → 1
Char. 284: 0 → 1	Char. 828: 0 → 2	Char. 869: 0 → 3	Char. 879: 0 → 1	Char. 883: 2 → 0
Char. 671: 0 → 1	Char. 844: 3 → 0	Char. 876: 3 → 1	Char. 881: 1 → 0	Char. 884: 0 → 2

Char. 888: 3 → 0 Char. 889: 0 → 3

Corydoras nattereri nattereri São João2:

All trees:

Char. 418: 2 → 0 Char. 1975: 1 → 0 Char. 3110: 1 → 0 Char. 3482: 3 → 0

Char. 1464: 3 → 1 Char. 2310: 1 → 3 Char. 3118: 3 → 1

Corydoras nattereri nattereri São João1:

All trees:

Char. 1270: 3 → 1 Char. 2599: 2 → 0

Corydoras nattereri nattereri Paraiba do Sul*:*

All trees:

Char. 1410: 0 → 2 Char. 2030: 3 → 1 Char. 2580: 2 → 0 Char. 2706: 0 → 2 Char. 3005: 0 → 2

Some trees:

Char. 1210: 3 → 0 Char. 3755: 3 → 0

Corydoras nattereri nattereri Guanabara HV11-75*:*

All trees:

Char. 1226: 3 → 2 Char. 1464: 3 → 1 Char. 1924: 3 → 1 Char. 3083: 0 → 2 Char. 3680: 0 → 1

Corydoras nattereri nattereri Macae*:*

All trees:

Char. 594: 1 → 3 Char. 1374: 0 → 2 Char. 1767: 1 → 3 Char. 2772: 1 → 0 Char. 2868: 0 → 2

Char. 814: 0 → 2 Char. 1581: 0 → 2 Char. 2619: 2 → 0 Char. 2814: 0 → 2 Char. 3121: 1 → 3

Char. 1210: 3 → 0 Char. 1611: 1 → 3 Char. 2656: 2 → 1 Char. 2820: 0 → 2

Corydoras nattereri nattereri Tiete HV11-76*:*

All trees:

Char. 1212: 1 → 2 Char. 1216: 0 → 1 Char. 1223: 2 → 3 Char. 1225: 0 → 2 Char. 1227: 0 → 2

Char. 1215: 0 → 1 Char. 1221: 0 → 3 Char. 1224: 0 → 3 Char. 1226: 3 → 2 Char. 3262: 3 → 2

Some trees:

Char. 2044: 1 → 0 Char. 3755: 3 → 0

Corydoras nijsseni:

All trees:

Char. 443: 3 → 1 Char. 904: 0 → 3 Char. 3887: 0 → 2 Char. 3928: 2 → 3

Char. 813: 1 → 3 Char. 1070: 3 → 1 Char. 3925: 3 → 1

Corydoras ourastigma:

All trees:

Char. 373: 3 → 1 Char. 545: 2 → 0 Char. 1278: 3 → 1 Char. 1299: 3 → 1 Char. 1392: 1 → 3

Char. 417: 3 → 1 Char. 1227: 0 → 2 Char. 1290: 0 → 2 Char. 1302: 0 → 2 Char. 1422: 0 → 2

Char. 418: 3 → 1 Char. 1239: 0 → 2 Char. 1296: 3 → 1 Char. 1356: 0 → 2 Char. 1437: 0 → 2

Char. 1446: 3 → 1	Char. 1557: 0 → 2	Char. 1744: 1 → 3	Char. 1849: 0 → 2	Char. 1984: 3 → 1
Char. 1449: 3 → 0	Char. 1641: 1 → 3	Char. 1773: 1 → 2	Char. 1861: 3 → 1	Char. 2031: 3 → 1
Char. 1518: 0 → 2	Char. 1656: 1 → 3	Char. 1802: 1 → 3	Char. 1872: 0 → 2	
Char. 1524: 1 → 3	Char. 1662: 0 → 2	Char. 1822: 0 → 2	Char. 1884: 0 → 2	
Char. 1545: 0 → 2	Char. 1731: 1 → 0	Char. 1842: 0 → 2	Char. 1932: 3 → 1	

Some trees:

Char. 1362: 3 → 1

Corydoras paleatus Argentina:

All trees:

Char. 437: 1 → 3	Char. 879: 0 → 1	Char. 1395: 0 → 2	Char. 2568: 3 → 1	Char. 3056: 2 → 0
Char. 867: 1 → 3	Char. 1039: 0 → 1	Char. 2526: 3 → 1	Char. 3041: 2 → 0	

Some trees:

Char. 1860: 0 → 2

Corydoras paleatus CW24 MA61:

All trees:

Char. 264: 3 → 2	Char. 416: 3 → 0	Char. 508: 0 → 3	Char. 546: 1 → 0	Char. 3698: 1 → 3
Char. 344: 3 → 1	Char. 417: 3 → 0	Char. 509: 0 → 2	Char. 562: 1 → 3	
Char. 408: 1 → 3	Char. 418: 0 → 2	Char. 518: 0 → 1	Char. 1737: 0 → 2	
Char. 413: 2 → 0	Char. 470: 1 → 3	Char. 529: 1 → 3	Char. 2532: 3 → 1	

Corydoras paleatus Long Fin MA1:

All trees:

Char. 1750: 0 → 2

Corydoras panda:

All trees:

Char. 476: 2 → 0	Char. 1422: 0 → 2	Char. 1803: 3 → 1	Char. 2460: 0 → 3	Char. 2923: 0 → 2
Char. 518: 1 → 0	Char. 1458: 0 → 2	Char. 1821: 3 → 1	Char. 2487: 0 → 3	Char. 3497: 2 → 3
Char. 540: 1 → 3	Char. 1509: 0 → 2	Char. 1845: 0 → 2	Char. 2556: 0 → 2	Char. 3515: 2 → 0
Char. 1226: 3 → 2	Char. 1512: 3 → 1	Char. 2067: 3 → 2	Char. 2580: 0 → 3	Char. 3535: 0 → 3
Char. 1234: 0 → 3	Char. 1558: 0 → 2	Char. 2142: 0 → 2	Char. 2658: 1 → 3	Char. 3775: 1 → 0
Char. 1248: 0 → 2	Char. 1614: 3 → 1	Char. 2208: 3 → 1	Char. 2679: 3 → 1	Char. 3915: 1 → 0
Char. 1294: 0 → 2	Char. 1626: 0 → 2	Char. 2256: 0 → 2	Char. 2703: 1 → 3	Char. 3920: 3 → 2
Char. 1338: 0 → 2	Char. 1674: 3 → 1	Char. 2304: 1 → 3	Char. 2775: 0 → 2	Char. 3945: 2 → 3
Char. 1389: 0 → 2	Char. 1764: 3 → 1	Char. 2331: 1 → 0	Char. 2784: 0 → 1	
Char. 1416: 1 → 3	Char. 1802: 3 → 1	Char. 2379: 1 → 0	Char. 2814: 0 → 2	

Some trees:

Char. 1833: 3 → 1	Char. 2097: 1 → 3	Char. 2523: 1 → 3	Char. 2652: 3 → 1

Corydoras polystictus Caceres:

All trees:

Char. 416: 1 → 3	Char. 816: 0 → 2	Char. 957: 1 → 3	Char. 3785: 1 → 0	Char. 3914: 0 → 3
Char. 437: 1 → 3	Char. 904: 0 → 2	Char. 3737: 2 → 0	Char. 3865: 2 → 0	

Some trees:

Char. 890: 02 → 2	Char. 905: 1 → 0	Char. 1043: 03 → 0

Corydoras pulcher:

All trees:

Char. 294: 1 → 3	Char. 435: 2 → 0	Char. 809: 3 → 1	Char. 3461: 2 → 0	Char. 3626: 1 → 0

Some trees:

Char. 264: 3 → 2	Char. 546: 01 → 0	Char. 792: 0 → 2	Char. 878: 13 → 3	Char. 3428: 3 → 1
Char. 417: 0 → 2	Char. 755: 1 → 3	Char. 808: 2 → 0	Char. 880: 1 → 3	
Char. 506: 3 → 1	Char. 772: 1 → 3	Char. 867: 3 → 1	Char. 3416: 1 → 3	

Corydoras punctatus:

All trees:

Char. 264: 3 → 2	Char. 546: 1 → 0

Some trees:

Char. 878: 3 → 1	Char. 1039: 3 → 0	Char. 3880: 1 → 3
Char. 880: 1 → 3	Char. 1043: 0 → 3	Char. 3934: 3 → 1

Corydoras reticulatus:

All trees:

Char. 242: 3 → 1	Char. 1299: 1 → 3	Char. 1386: 0 → 2	Char. 1566: 0 → 2	Char. 3548: 3 → 2
Char. 429: 0 → 2	Char. 1302: 0 → 2	Char. 1533: 0 → 2	Char. 1701: 1 → 3	Char. 3775: 1 → 0

Corydoras robineae:

All trees:

Char. 240: 0 → 2	Char. 539: 0 → 2	Char. 1455: 0 → 2	Char. 1680: 0 → 2	Char. 1809: 1 → 3
Char. 416: 0 → 1	Char. 572: 1 → 3	Char. 1617: 2 → 0	Char. 1716: 1 → 3	Char. 3853: 2 → 0
Char. 433: 3 → 1	Char. 1437: 0 → 2	Char. 1671: 3 → 1	Char. 1792: 1 → 3	

Corydoras schwartzi:

All trees:

Char. 264: 3 → 2	Char. 1231: 0 → 2	Char. 1488: 0 → 2	Char. 2041: 3 → 1	Char. 2696: 3 → 0
Char. 508: 3 → 1	Char. 1245: 0 → 2	Char. 1602: 1 → 3	Char. 2042: 1 → 3	Char. 2766: 1 → 3
Char. 546: 1 → 0	Char. 1368: 1 → 3	Char. 1779: 1 → 3	Char. 2043: 3 → 0	Char. 2823: 3 → 1
Char. 792: 0 → 2	Char. 1395: 0 → 2	Char. 1788: 0 → 2	Char. 2058: 1 → 0	Char. 3023: 3 → 1
Char. 1224: 0 → 2	Char. 1428: 3 → 1	Char. 1809: 3 → 1	Char. 2679: 3 → 1	Char. 3115: 3 → 1

Some trees:

Char. 2343: 1 → 3	Char. 2424: 0 → 2			

Corydoras seussi:

All trees:

Char. 429: 0 → 2	Char. 545: 1 → 3	Char. 580: 2 → 0	Char. 3692: 0 → 2
Char. 508: 3 → 1	Char. 572: 1 → 0	Char. 3256: 3 → 1	

Some trees:

Char. 418: 0 → 2	Char. 880: 1 → 3	Char. 890: 2 → 0	Char. 3416: 1 → 3
Char. 867: 3 → 1	Char. 881: 1 → 3	Char. 1037: 0 → 2	Char. 3428: 3 → 1

Corydoras simulatus:

All trees:

Char. 239: 3 → 0	Char. 372: 3 → 1	Char. 645: 1 → 3	Char. 952: 3 → 1	Char. 3602: 2 → 0
Char. 240: 0 → 3	Char. 376: 1 → 3	Char. 646: 3 → 1	Char. 969: 0 → 2	Char. 3698: 1 → 0
Char. 244: 3 → 0	Char. 380: 1 → 3	Char. 661: 3 → 0	Char. 974: 0 → 2	Char. 3874: 2 → 0
Char. 245: 0 → 1	Char. 398: 1 → 0	Char. 664: 0 → 3	Char. 1000: 3 → 1	Char. 3932: 2 → 0
Char. 246: 1 → 0	Char. 421: 1 → 3	Char. 672: 1 → 3	Char. 1024: 0 → 3	Char. 3938: 3 → 1
Char. 248: 0 → 2	Char. 470: 1 → 3	Char. 687: 2 → 0	Char. 1026: 0 → 3	
Char. 260: 0 → 3	Char. 526: 2 → 3	Char. 756: 3 → 1	Char. 1070: 3 → 1	
Char. 311: 1 → 3	Char. 572: 1 → 0	Char. 895: 0 → 3	Char. 1094: 3 → 1	
Char. 368: 3 → 1	Char. 608: 1 → 0	Char. 914: 3 → 1	Char. 1145: 0 → 2	
Char. 370: 3 → 1	Char. 630: 0 → 1	Char. 936: 1 → 3	Char. 1197: 3 → 1	

Corydoras sodalis:

All trees:

Char. 418: 0 → 2	Char. 1206: 0 → 2	Char. 1638: 0 → 2	Char. 1731: 1 → 3	Char. 1842: 0 → 2
Char. 445: 1 → 0	Char. 1341: 0 → 2	Char. 1680: 0 → 2	Char. 1752: 1 → 3	Char. 1845: 0 → 2
Char. 530: 3 → 2	Char. 1450: 1 → 3	Char. 1716: 1 → 3	Char. 1801: 2 → 0	Char. 1990: 0 → 2
Char. 536: 0 → 2	Char. 1636: 0 → 3	Char. 1728: 0 → 2	Char. 1839: 0 → 2	Char. 3309: 2 → 0

Corydoras tukano:

All trees:

Char. 792: 0 → 2	Char. 813: 1 → 3	Char. 904: 0 → 1	Char. 3392: 1 → 3	Char. 3644: 2 → 0
Char. 793: 3 → 1	Char. 816: 0 → 2	Char. 959: 3 → 0	Char. 3456: 1 → 0	
Char. 808: 2 → 0	Char. 880: 1 → 3	Char. 1025: 1 → 3	Char. 3545: 3 → 1	
Char. 809: 3 → 1	Char. 901: 2 → 0	Char. 1027: 1 → 3	Char. 3629: 2 → 3	

Corydoras undulatus:

All trees:

Char. 293: 0 → 1	Char. 416: 3 → 1	Char. 506: 3 → 1	Char. 3223: 2 → 0	Char. 3847: 2 → 0
Char. 294: 1 → 3	Char. 418: 3 → 1	Char. 3202: 3 → 1	Char. 3226: 2 → 0	

Corydoras urucu:

All trees:

Char. 540: 1 → 3	Char. 1210: 3 → 0	Char. 2376: 0 → 2	Char. 2757: 1 → 0
Char. 809: 3 → 1	Char. 1438: 0 → 2	Char. 2541: 3 → 1	Char. 2916: 1 → 0
Char. 1039: 3 → 1	Char. 1674: 1 → 3	Char. 2595: 0 → 2	Char. 3083: 0 → 2
Char. 1209: 1 → 3	Char. 2051: 1 → 0	Char. 2736: 1 → 3	Char. 3106: 3 → 1

Some trees:

Char. 2352: 1 → 3	Char. 2926: 0 → 2	Char. 3043: 1 → 3

Corydoras wotroi:

All trees:

Char. 902: 3 → 0	Char. 1333: 3 → 1	Char. 2097: 1 → 0	Char. 2658: 1 → 3	Char. 3019: 1 → 3
Char. 912: 1 → 3	Char. 1681: 0 → 2	Char. 2131: 3 → 1	Char. 2661: 1 → 3	Char. 3083: 0 → 2
Char. 946: 0 → 2	Char. 1682: 1 → 3	Char. 2139: 1 → 0	Char. 2736: 1 → 3	Char. 3094: 1 → 0
Char. 1045: 2 → 0	Char. 1779: 1 → 3	Char. 2220: 3 → 1	Char. 2745: 0 → 3	Char. 3174: 3 → 1
Char. 1209: 1 → 3	Char. 2076: 1 → 3	Char. 2319: 1 → 3	Char. 2766: 1 → 3	Char. 3647: 0 → 3
Char. 1213: 2 → 1	Char. 2079: 1 → 0	Char. 2376: 0 → 2	Char. 2805: 1 → 3	Char. 3731: 3 → 1
Char. 1218: 0 → 1	Char. 2080: 0 → 2	Char. 2499: 3 → 1	Char. 2814: 0 → 2	Char. 3734: 1 → 3
Char. 1225: 0 → 2	Char. 2083: 2 → 0	Char. 2568: 1 → 3	Char. 2865: 1 → 3	Char. 3775: 1 → 0
Char. 1314: 3 → 1	Char. 2091: 0 → 2	Char. 2652: 3 → 1	Char. 2980: 1 → 0	

Some trees:

Char. 1203: 1 → 3	Char. 1479: 3 → 1	Char. 2268: 1 → 3	Char. 3031: 2 → 0	Char. 3912: 1 → 3
Char. 1356: 0 → 1	Char. 1659: 1 → 0	Char. 2367: 3 → 1	Char. 3321: 3 → 1	Char. 3944: 1 → 3
Char. 1380: 1 → 3	Char. 1695: 1 → 3	Char. 2424: 2 → 0	Char. 3344: 23 → 2	
Char. 1440: 3 → 1	Char. 2100: 1 → 0	Char. 3008: 3 → 1	Char. 3521: 0 → 3	

Aspidoras spB*:*

All trees:

Char. 275: 3 → 1	Char. 1226: 3 → 2	Char. 1572: 3 → 1	Char. 1686: 1 → 3	Char. 3238: 1 → 3
Char. 416: 3 → 1	Char. 1254: 2 → 0	Char. 1573: 2 → 0	Char. 1695: 3 → 1	Char. 3323: 1 → 0
Char. 506: 3 → 1	Char. 1277: 3 → 1	Char. 1581: 0 → 2	Char. 1764: 1 → 3	Char. 3443: 1 → 3
Char. 812: 0 → 2	Char. 1386: 0 → 2	Char. 1603: 0 → 2	Char. 1845: 0 → 2	Char. 3575: 0 → 2
Char. 916: 0 → 2	Char. 1416: 1 → 3	Char. 1617: 0 → 2	Char. 1857: 2 → 0	Char. 3800: 2 → 0
Char. 941: 3 → 1	Char. 1438: 0 → 2	Char. 1641: 1 → 3	Char. 1860: 0 → 2	
Char. 1225: 0 → 2	Char. 1494: 0 → 2	Char. 1642: 0 → 2	Char. 3139: 3 → 1	

Scleromystax prionotos Itapeuna-SP*:*

All trees:

Char. 902: 3 → 1

Scleromystax prionotos Ribeira do Iguape*:*

All trees:

Char. 294: 1 → 3 Char. 368: 3 → 2 Char. 3919: 2 → 0

Callichthys callichthys SP*:*

Some trees:

Char. 712: 3 → 1 Char. 1035: 2 → 1 Char. 1551: 0 → 2 Char. 1590: 3 → 2 Char. 1653: 0 → 2
Char. 869: 0 → 1 Char. 1036: 1 → 3 Char. 1569: 3 → 0 Char. 1622: 0 → 2 Char. 1656: 1 → 3
Char. 884: 0 → 1 Char. 1037: 3 → 0 Char. 1588: 1 → 3 Char. 1642: 0 → 2 Char. 1761: 3 → 0

Corydoras treitlii:

All trees:

Char. 1005: 0 → 2 Char. 1614: 3 → 1 Char. 1719: 1 → 0 Char. 1862: 2 → 0
Char. 1359: 3 → 1 Char. 1656: 3 → 1 Char. 1833: 0 → 2 Char. 3764: 2 → 3

Corydoras zygatus:

Some trees:

Char. 3456: 1 → 0 Char. 3653: 1 → 3

Node 146: Trichomycteridae

All trees:

Char. 12: 0 → 2 Char. 525: 3 → 1 Char. 1281: 0 → 1 Char. 1545: 1 → 3 Char. 1698: 0 → 1
Char. 162: 0 → 1 Char. 544: 0 → 2 Char. 1455: 0 → 1 Char. 1558: 0 → 2 Char. 1701: 3 → 1
Char. 358: 1 → 3 Char. 547: 3 → 1 Char. 1476: 0 → 3 Char. 1575: 1 → 3 Char. 1842: 0 → 3
Char. 365: 3 → 1 Char. 768: 3 → 1 Char. 1479: 1 → 0 Char. 1590: 0 → 2 Char. 1846: 1 → 3
Char. 376: 1 → 3 Char. 792: 02 → 1 Char. 1486: 0 → 2 Char. 1593: 1 → 0 Char. 1881: 3 → 1
Char. 437: 3 → 1 Char. 814: 0 → 1 Char. 1519: 1 → 3 Char. 1612: 1 → 3 Char. 1960: 0 → 2
Char. 476: 2 → 0 Char. 981: 3 → 1 Char. 1533: 0 → 1 Char. 1644: 0 → 2 Char. 1976: 3 → 1
Char. 506: 3 → 0 Char. 1025: 3 → 0 Char. 1537: 0 → 2 Char. 1668: 0 → 2

Node 147:

All trees:

Char. 18: 0 → 1 Char. 160: 0 → 2 Char. 1560: 3 → 1 Char. 1692: 3 → 0 Char. 1980: 3 → 1
Char. 28: 0 → 1 Char. 905: 3 → 1 Char. 1581: 3 → 0 Char. 1749: 0 → 1 Char. 1984: 1 → 3
Char. 105: 0 → 2 Char. 960: 0 → 2 Char. 1603: 3 → 1 Char. 1821: 1 → 3
Char. 114: 0 → 2 Char. 964: 1 → 3 Char. 1608: 1 → 0 Char. 1866: 3 → 1
Char. 120: 0 → 1 Char. 1044: 1 → 3 Char. 1626: 0 → 1 Char. 1912: 1 → 3
Char. 158: 0 → 1 Char. 1263: 1 → 0 Char. 1659: 0 → 1 Char. 1949: 1 → 0

Node 148: Scoloplacidae

All trees:

Char. 1: 0 → 1 Char. 3: 0 → 2 Char. 11: 0 → 2 Char. 12: 0 → 1 Char. 13: 0 → 1

Char. 15: 0 → 2
Char. 18: 1 → 0
Char. 21: 0 → 1
Char. 25: 3 → 1
Char. 30: 1 → 0
Char. 33: 0 → 1
Char. 45: 0 → 1
Char. 53: 0 → 1
Char. 58: 1 → 2
Char. 61: 0 → 2
Char. 62: 0 → 1
Char. 63: 2 → 0
Char. 65: 1 → 0
Char. 70: 1 → 2
Char. 91: 0 → 1
Char. 105: 2 → 0
Char. 112: 0 → 2
Char. 115: 0 → 2
Char. 118: 2 → 3
Char. 136: 5 → 8
Char. 153: 0 → 1
Char. 154: 0 → 2
Char. 158: 1 → 3
Char. 162: 0 → 1
Char. 173: 0 → 1
Char. 176: 0 → 2
Char. 180: 0 → 1
Char. 191: 3 → 1
Char. 193: 0 → 1
Char. 195: 0 → 4
Char. 200: 0 → 1
Char. 202: 1 → 0
Char. 645: 3 → 0
Char. 646: 3 → 0
Char. 647: 0 → 1
Char. 649: 1 → 3
Char. 650: 3 → 2
Char. 687: 2 → 0
Char. 773: 3 → 1
Char. 813: 0 → 3
Char. 819: 1 → 3
Char. 847: 2 → 0
Char. 849: 3 → 1
Char. 851: 0 → 1
Char. 860: 1 → 3
Char. 916: 0 → 2
Char. 918: 1 → 3
Char. 936: 1 → 3
Char. 939: 2 → 0
Char. 965: 2 → 0
Char. 975: 0 → 3
Char. 977: 1 → 3
Char. 978: 1 → 3
Char. 979: 1 → 3
Char. 981: 3 → 1
Char. 990: 0 → 1
Char. 1036: 1 → 0
Char. 1090: 1 → 3
Char. 1093: 3 → 1
Char. 1112: 0 → 2
Char. 1115: 2 → 0

Node 149:

All trees:

Char. 34: 0 → 2
Char. 40: 0 → 3
Char. 442: 1 → 3
Char. 444: 1 → 3
Char. 744: 2 → 3
Char. 877: 3 → 0
Char. 960: 2 → 0
Char. 1016: 0 → 1
Char. 1023: 1 → 3
Char. 1070: 3 → 0
Char. 1341: 1 → 0
Char. 1342: 1 → 3
Char. 1344: 1 → 0
Char. 1375: 1 → 3
Char. 1404: 1 → 0
Char. 1500: 1 → 0
Char. 1521: 0 → 3
Char. 1539: 0 → 1
Char. 1555: 2 → 0
Char. 1579: 1 → 3
Char. 1608: 0 → 3
Char. 1669: 2 → 0
Char. 1749: 1 → 0
Char. 1963: 2 → 0
Char. 1973: 1 → 3
Char. 1975: 1 → 3
Char. 1984: 3 → 1
Char. 1985: 2 → 0
Char. 1995: 1 → 3

Node 150:

All trees:

Char. 19: 0 → 6
Char. 32: 0 → 1
Char. 43: 2 → 1
Char. 60: 01 → 2
Char. 101: 0 → 2
Char. 118: 0 → 2
Char. 137: 0 → 2
Char. 138: 0 → 2
Char. 252: 3 → 1
Char. 435: 2 → 0
Char. 773: 0 → 3
Char. 914: 3 → 0
Char. 957: 1 → 3
Char. 1512: 0 → 3
Char. 1639: 2 → 0
Char. 1661: 2 → 3
Char. 1701: 3 → 0
Char. 1776: 1 → 3
Char. 2655: 3 → 1
Char. 2656: 0 → 1
Char. 2668: 0 → 2
Char. 2731: 0 → 1
Char. 2790: 1 → 3
Char. 2814: 3 → 1
Char. 2921: 1 → 3
Char. 2956: 0 → 1
Char. 2987: 0 → 3
Char. 3076: 3 → 1
Char. 3142: 0 → 1
Char. 3198: 0 → 3
Char. 3201: 2 → 3
Char. 3206: 1 → 0
Char. 3235: 1 → 0
Char. 3241: 3 → 1
Char. 3305: 0 → 2
Char. 3344: 2 → 0
Char. 3425: 1 → 3
Char. 3430: 2 → 1
Char. 3480: 3 → 2
Char. 3491: 3 → 2
Char. 3613: 0 → 3
Char. 3617: 3 → 0

Node 151:

All trees:

Char. 30: 0 → 1
Char. 47: 1 → 0
Char. 58: 0 → 1
Char. 65: 0 → 1
Char. 87: 0 → 2
Char. 90: 0 → 2
Char. 93: 0 → 12
Char. 136: 0 → 5
Char. 166: 0 → 1
Char. 167: 0 → 1

Char. 168: 0 → 1	Char. 553: 1 → 0	Char. 1542: 3 → 1	Char. 1627: 0 → 1
Char. 363: 3 → 1	Char. 877: 1 → 3	Char. 1559: 3 → 1	Char. 1773: 1 → 0
Char. 517: 1 → 3	Char. 915: 1 → 0	Char. 1569: 1 → 3	Char. 1806: 3 → 0
Char. 541: 2 → 0	Char. 1009: 2 → 0	Char. 1605: 02 → 1	Char. 1978: 3 → 1

Node 152:

All trees:

Char. 755: 3 → 1	Char. 881: 0 → 2	Char. 888: 3 → 1	Char. 1044: 3 → 1	Char. 2775: 0 → 2
Char. 874: 3 → 1	Char. 882: 0 → 2	Char. 1037: 3 → 1	Char. 2725: 0 → 3	
Char. 875: 0 → 1	Char. 883: 0 → 1	Char. 1038: 3 → 1	Char. 2757: 0 → 1	

Node 153: Astroblepidae

All trees:

Char. 22: 1 → 2	Char. 255: 1 → 3	Char. 903: 0 → 1	Char. 1575: 1 → 0	Char. 1821: 3 → 1
Char. 46: 0 → 3	Char. 315: 1 → 0	Char. 963: 1 → 0	Char. 1588: 1 → 3	Char. 1842: 0 → 1
Char. 49: 2 → 1	Char. 374: 0 → 3	Char. 1008: 1 → 0	Char. 1594: 1 → 3	Char. 1848: 3 → 1
Char. 54: 0 → 2	Char. 375: 3 → 0	Char. 1009: 0 → 2	Char. 1629: 3 → 0	Char. 1863: 0 → 2
Char. 87: 2 → 0	Char. 409: 2 → 0	Char. 1015: 3 → 0	Char. 1647: 3 → 1	Char. 1872: 0 → 2
Char. 95: 0 → 1	Char. 418: 3 → 1	Char. 1263: 0 → 3	Char. 1660: 3 → 0	Char. 1902: 2 → 0
Char. 109: 0 → 1	Char. 470: 3 → 0	Char. 1266: 1 → 3	Char. 1672: 0 → 3	Char. 1912: 3 → 1
Char. 117: 0 → 1	Char. 475: 2 → 0	Char. 1284: 1 → 3	Char. 1677: 0 → 3	Char. 1918: 3 → 0
Char. 160: 2 → 1	Char. 509: 0 → 1	Char. 1323: 0 → 1	Char. 1683: 0 → 3	Char. 1932: 3 → 1
Char. 163: 0 → 1	Char. 518: 3 → 0	Char. 1335: 0 → 3	Char. 1707: 1 → 3	Char. 1947: 1 → 3
Char. 166: 1 → 0	Char. 525: 3 → 0	Char. 1350: 1 → 3	Char. 1710: 1 → 0	Char. 1949: 0 → 3
Char. 167: 1 → 0	Char. 584: 1 → 3	Char. 1386: 0 → 3	Char. 1711: 1 → 3	Char. 1954: 0 → 1
Char. 168: 1 → 0	Char. 593: 3 → 1	Char. 1392: 1 → 3	Char. 1722: 1 → 3	Char. 1955: 2 → 0
Char. 182: 0 → 1	Char. 618: 1 → 3	Char. 1422: 0 → 2	Char. 1727: 3 → 1	Char. 1993: 3 → 1
Char. 184: 0 → 1	Char. 732: 3 → 1	Char. 1443: 1 → 0	Char. 1741: 1 → 3	Char. 1997: 1 → 3
Char. 186: 2 → 3	Char. 770: 3 → 1	Char. 1452: 0 → 3	Char. 1755: 1 → 3	Char. 2030: 3 → 1
Char. 243: 3 → 0	Char. 815: 0 → 3	Char. 1537: 0 → 2	Char. 1760: 3 → 1	Char. 2031: 1 → 3
Char. 251: 3 → 1	Char. 889: 3 → 1	Char. 1538: 3 → 1	Char. 1804: 1 → 0	

Node 154:

All trees:

Char. 10: 1 → 0	Char. 91: 0 → 1	Char. 506: 3 → 1	Char. 685: 3 → 1	Char. 1015: 3 → 1
Char. 14: 0 → 1	Char. 120: 1 → 0	Char. 508: 3 → 1	Char. 727: 0 → 2	Char. 1025: 3 → 1
Char. 34: 0 → 1	Char. 173: 0 → 2	Char. 531: 1 → 0	Char. 815: 0 → 1	Char. 1281: 03 → 2
Char. 37: 0 → 3	Char. 174: 0 → 1	Char. 544: 0 → 2	Char. 849: 3 → 1	Char. 1317: 1 → 3
Char. 63: 2 → 0	Char. 275: 1 → 3	Char. 553: 0 → 1	Char. 910: 3 → 1	Char. 1335: 0 → 2

Char. 1386: 0 → 2
Char. 1458: 0 → 3
Char. 1488: 0 → 1
Char. 1540: 0 → 1
Char. 1558: 0 → 2
Char. 1559: 1 → 3
Char. 1614: 0 → 1
Char. 1629: 3 → 1
Char. 1632: 3 → 1
Char. 1662: 03 → 2
Char. 1672: 0 → 1
Char. 1728: 0 → 2
Char. 1750: 0 → 3
Char. 1752: 0 → 1
Char. 1759: 0 → 1
Char. 1795: 1 → 3
Char. 1830: 0 → 1
Char. 1833: 3 → 1
Char. 1836: 0 → 1
Char. 1851: 0 → 2
Char. 3155: 0 → 2
Char. 3194: 1 → 3
Char. 3229: 0 → 2
Char. 3235: 0 → 2
Char. 3358: 0 → 2
Char. 3395: 3 → 1
Char. 3426: 1 → 0
Char. 3491: 2 → 0
Char. 3590: 3 → 1
Char. 3623: 3 → 0
Char. 3653: 2 → 0

Node 155: Loricariidae

All trees:

Char. 16: 0 → 2
Char. 33: 0 → 2
Char. 46: 0 → 4
Char. 108: 0 → 2
Char. 133: 0 → 2
Char. 134: 0 → 3
Char. 169: 02 → 1
Char. 195: 0 → 2
Char. 196: 0 → 1
Char. 416: 3 → 1
Char. 542: 0 → 2
Char. 856: 3 → 1
Char. 887: 0 → 1
Char. 909: 0 → 2
Char. 1037: 3 → 1
Char. 1635: 3 → 1
Char. 1660: 3 → 1
Char. 1686: 0 → 1
Char. 1815: 0 → 3
Char. 1885: 0 → 1
Char. 3178: 1 → 0
Char. 3268: 2 → 0
Char. 3437: 1 → 3
Char. 3551: 1 → 3

Node 156:

All trees:

Char. 66: 2 → 1
Char. 86: 0 → 1
Char. 115: 0 → 1
Char. 116: 0 → 1
Char. 148: 0 → 1
Char. 180: 0 → 1
Char. 199: 0 → 1
Char. 202: 1 → 0
Char. 264: 3 → 0
Char. 311: 3 → 1
Char. 370: 3 → 1
Char. 374: 0 → 3
Char. 816: 0 → 1
Char. 894: 3 → 1
Char. 904: 0 → 1
Char. 915: 0 → 3
Char. 1044: 3 → 1
Char. 1094: 1 → 3
Char. 1262: 1 → 3
Char. 1269: 0 → 1
Char. 1320: 0 → 3
Char. 1453: 2 → 0
Char. 1491: 3 → 1
Char. 1521: 0 → 1
Char. 1538: 3 → 1
Char. 1560: 1 → 3
Char. 1603: 1 → 0
Char. 1605: 1 → 0
Char. 1627: 1 → 0
Char. 1701: 0 → 1
Char. 1746: 0 → 1
Char. 1755: 1 → 3
Char. 1779: 1 → 3
Char. 1902: 2 → 0
Char. 1978: 1 → 3
Char. 3137: 2 → 0
Char. 3187: 2 → 1
Char. 3226: 2 → 3
Char. 3248: 1 → 0
Char. 3256: 3 → 1
Char. 3291: 0 → 2
Char. 3383: 3 → 0
Char. 3386: 1 → 3
Char. 3421: 0 → 3
Char. 3439: 0 → 2
Char. 3504: 1 → 3
Char. 3638: 2 → 3

Node 157:

All trees:

Char. 241: 3 → 1
Char. 543: 3 → 1
Char. 773: 0 → 3
Char. 880: 3 → 1
Char. 895: 0 → 2
Char. 2149: 2 → 0
Char. 2150: 1 → 3
Char. 2175: 3 → 1
Char. 2247: 1 → 3
Char. 2298: 1 → 3
Char. 2349: 3 → 1
Char. 2367: 3 → 1
Char. 2574: 1 → 3
Char. 2592: 0 → 2
Char. 2796: 1 → 3
Char. 3023: 3 → 1

Some trees:

Char. 2259: 3 → 0
Char. 2484: 1 → 3
Char. 2661: 1 → 3

Node 158:

All trees:

Char. 2379: 1 → 3	Char. 2538: 3 → 1	Char. 2728: 3 → 1		

Some trees:

Char. 509: 0 → 2	Char. 1043: 3 → 1	Char. 2148: 0 → 2	Char. 2313: 3 → 1	Char. 3344: 2 → 3

Node 159:

All trees:

Char. 188: 0 → 1	Char. 2298: 3 → 1	Char. 2793: 1 → 3	Char. 2868: 1 → 0
Char. 2131: 1 → 3	Char. 2610: 3 → 1	Char. 2823: 1 → 3	Char. 3088: 0 → 2

Some trees:

Char. 813: 1 → 13	Char. 1542: 1 → 3	Char. 1704: 1 → 3	Char. 2139: 3 → 1	Char. 2538: 1 → 3
Char. 1279: 1 → 3	Char. 1647: 3 → 1	Char. 1833: 1 → 3	Char. 2271: 1 → 13	Char. 2598: 1 → 3
Char. 1392: 1 → 3	Char. 1650: 1 → 3	Char. 1851: 2 → 0	Char. 2382: 0 → 2	Char. 2929: 0 → 2
Char. 1440: 1 → 3	Char. 1695: 3 → 1	Char. 2097: 3 → 1	Char. 2388: 3 → 13	Char. 3031: 0 → 2

Node 160:

All trees:

Char. 85: 1 → 0	Char. 1518: 0 → 1	Char. 2295: 1 → 3	Char. 2667: 1 → 3	Char. 3174: 1 → 3
Char. 90: 1 → 2	Char. 1545: 1 → 3	Char. 2301: 3 → 1	Char. 2721: 1 → 3	Char. 3338: 2 → 0
Char. 143: 0 → 1	Char. 1764: 1 → 3	Char. 2379: 0 → 1	Char. 2898: 1 → 0	Char. 3485: 1 → 0
Char. 1308: 0 → 3	Char. 1773: 1 → 0	Char. 2421: 1 → 0	Char. 2980: 0 → 1	Char. 3569: 1 → 3
Char. 1452: 0 → 2	Char. 2036: 0 → 2	Char. 2484: 1 → 3	Char. 3100: 1 → 3	Char. 3713: 3 → 1

Some trees:

Char. 77: 1 → 2	Char. 1371: 2 → 0	Char. 1659: 3 → 1	Char. 2208: 1 → 3	Char. 2808: 0 → 2
Char. 1043: 3 → 03	Char. 1512: 1 → 3	Char. 1830: 1 → 3	Char. 2415: 1 → 3	Char. 3008: 1 → 13
Char. 1278: 3 → 1	Char. 1608: 1 → 3	Char. 1949: 2 → 0	Char. 2418: 3 → 1	Char. 3944: 0 → 1
Char. 1347: 1 → 3	Char. 1611: 1 → 3	Char. 2071: 2 → 0	Char. 2424: 0 → 2	

Node 161:

All trees:

Char. 136: 6 → 8	Char. 1285: 1 → 3	Char. 1572: 1 → 3	Char. 2259: 1 → 3
Char. 416: 3 → 1	Char. 1446: 1 → 3	Char. 1594: 1 → 3	Char. 2517: 1 → 3

Some trees:

Char. 1716: 1 → 3	Char. 1802: 1 → 3	Char. 1803: 1 → 3	Char. 2367: 1 → 3

Node 162:

All trees:

Char. 4: 0 → 1	Char. 241: 0 → 3	Char. 543: 1 → 3	Char. 1881: 3 → 1	Char. 2433: 0 → 1
Char. 86: 0 → 1	Char. 408: 1 → 3	Char. 1398: 3 → 1	Char. 2268: 3 → 1	Char. 3040: 3 → 1
Char. 147: 2 → 3	Char. 413: 2 → 0	Char. 1767: 1 → 0	Char. 2298: 1 → 3	Char. 3127: 1 → 3

Some trees:

Char. 77: 1 → 2	Char. 1599: 1 → 3	Char. 2142: 1 → 0	Char. 3076: 3 → 1	
Char. 168: 1 → 2	Char. 1713: 1 → 0	Char. 2728: 1 → 3		

Node 163: *Hoplisoma*

All trees:

Char. 57: 0 → 1	Char. 1773: 0 → 1	Char. 2586: 3 → 1	Char. 3043: 0 → 1	Char. 3455: 0 → 3
Char. 178: 0 → 1	Char. 1949: 3 → 02	Char. 2592: 3 → 0	Char. 3109: 1 → 3	Char. 3515: 0 → 2
Char. 183: 0 → 1	Char. 2253: 0 → 1	Char. 2601: 1 → 0	Char. 3171: 0 → 2	Char. 3842: 0 → 3
Char. 185: 0 → 1	Char. 2301: 1 → 3	Char. 2757: 0 → 1	Char. 3197: 1 → 3	Char. 3874: 2 → 0
Char. 1626: 1 → 0	Char. 2388: 02 → 3	Char. 2773: 1 → 3	Char. 3223: 2 → 0	Char. 3912: 3 → 1
Char. 1758: 3 → 1	Char. 2481: 1 → 0	Char. 2983: 1 → 0	Char. 3419: 1 → 3	

Some trees:

Char. 1659: 0 → 3	Char. 2760: 1 → 3	Char. 2772: 3 → 0	Char. 2835: 0 → 1	Char. 3133: 0 → 1

Node 164:

All trees:

Char. 242: 0 → 3	Char. 1572: 3 → 1	Char. 2271: 3 → 1	Char. 3073: 3 → 1	Char. 3647: 1 → 0
Char. 418: 3 → 0	Char. 1801: 2 → 0	Char. 2472: 1 → 3	Char. 3127: 0 → 1	
Char. 518: 3 → 1	Char. 1924: 1 → 3	Char. 2487: 1 → 0	Char. 3371: 2 → 0	
Char. 1380: 3 → 1	Char. 2056: 3 → 1	Char. 2938: 0 → 1	Char. 3422: 1 → 3	
Char. 1476: 1 → 3	Char. 2064: 3 → 1	Char. 3013: 1 → 3	Char. 3545: 0 → 3	

Some trees:

Char. 2139: 0 → 3

Node 165:

All trees:

Char. 3: 0 → 2	Char. 972: 0 → 1	Char. 2065: 0 → 2	Char. 3079: 1 → 0	Char. 3290: 1 → 3
Char. 18: 1 → 0	Char. 1025: 3 → 1	Char. 2074: 2 → 3	Char. 3109: 0 → 1	Char. 3443: 3 → 1
Char. 85: 0 → 1	Char. 1432: 1 → 3	Char. 2124: 3 → 1	Char. 3128: 1 → 2	Char. 3600: 0 → 1
Char. 224: 0 → 3	Char. 1605: 1 → 0	Char. 2207: 1 → 2	Char. 3129: 3 → 1	Char. 3668: 0 → 3
Char. 275: 1 → 3	Char. 1674: 0 → 3	Char. 2668: 0 → 2	Char. 3165: 0 → 3	Char. 3775: 0 → 1
Char. 409: 2 → 0	Char. 1710: 1 → 0	Char. 2680: 1 → 3	Char. 3232: 3 → 0	Char. 3779: 1 → 3
Char. 540: 3 → 1	Char. 1830: 0 → 1	Char. 2865: 3 → 1	Char. 3259: 1 → 3	Char. 3785: 3 → 1
Char. 813: 0 → 1	Char. 1975: 1 → 0	Char. 3067: 1 → 3	Char. 3266: 1 → 3	

Node 166: Corydoradinae

All trees:

Char. 12: 0 → 1	Char. 21: 0 → 1	Char. 32: 0 → 2	Char. 47: 0 → 2	Char. 59: 0 → 1
Char. 13: 0 → 1	Char. 29: 0 → 2	Char. 36: 0 → 1	Char. 50: 0 → 1	Char. 67: 0 → 1
Char. 19: 0 → 1	Char. 31: 0 → 1	Char. 42: 0 → 1	Char. 58: 1 → 2	Char. 69: 0 → 1

Char. 70: 1 → 2

Char. 77: 0 → 1

Char. 87: 2 → 1

Char. 90: 2 → 1

Char. 91: 0 → 1

Char. 94: 0 → 2

Char. 95: 0 → 1

Char. 96: 0 → 1

Char. 101: 0 → 1

Char. 103: 0 → 1

Char. 110: 0 → 1

Char. 120: 1 → 0

Char. 131: 01 → 2

Char. 136: 5 → 6

Char. 137: 0 → 1

Char. 138: 0 → 1

Char. 148: 0 → 1

Char. 154: 0 → 2

Char. 155: 0 → 1

Char. 156: 0 → 1

Char. 167: 1 → 2

Char. 181: 0 → 1

Char. 192: 0 → 1

Char. 195: 0 → 1

Char. 199: 0 → 1

Char. 200: 0 → 1

Char. 202: 1 → 0

Char. 304: 1 → 3

Char. 311: 3 → 1

Char. 364: 1 → 3

Char. 397: 3 → 1

Char. 470: 3 → 1

Char. 515: 3 → 0

Char. 530: 1 → 3

Char. 593: 3 → 1

Char. 605: 2 → 0

Char. 607: 2 → 0

Char. 647: 0 → 2

Char. 755: 3 → 1

Char. 850: 0 → 3

Char. 854: 2 → 0

Char. 881: 0 → 3

Char. 947: 0 → 3

Char. 1027: 0 → 1

Char. 1037: 3 → 0

Char. 1054: 1 → 3

Char. 1095: 1 → 3

Char. 1311: 13 → 0

Char. 1341: 1 → 0

Char. 1476: 0 → 1

Char. 1512: 0 → 1

Char. 1540: 0 → 1

Char. 1543: 3 → 1

Char. 1557: 1 → 0

Char. 1659: 1 → 0

Char. 1665: 3 → 0

Char. 1686: 0 → 1

Char. 1727: 3 → 0

Char. 1741: 1 → 0

Char. 1775: 3 → 0

Char. 1797: 0 → 1

Char. 1927: 3 → 0

Char. 1949: 0 → 3

Char. 1997: 1 → 3

Char. 2086: 1 → 3

Char. 2091: 1 → 0

Char. 2103: 3 → 1

Char. 2109: 3 → 0

Char. 2199: 3 → 1

Char. 2203: 3 → 0

Char. 2217: 1 → 0

Char. 2225: 3 → 1

Char. 2269: 3 → 0

Char. 2382: 1 → 0

Char. 2421: 3 → 0

Char. 2460: 1 → 0

Char. 2478: 0 → 13

Char. 2547: 1 → 0

Char. 2562: 3 → 1

Char. 2563: 2 → 0

Char. 2587: 2 → 0

Char. 2617: 1 → 0

Char. 2655: 3 → 0

Char. 2658: 3 → 1

Char. 2713: 3 → 1

Char. 2743: 0 → 1

Char. 2814: 3 → 0

Char. 2826: 3 → 1

Char. 2941: 1 → 0

Char. 2942: 1 → 0

Char. 2953: 0 → 1

Char. 2971: 0 → 1

Char. 2983: 0 → 1

Char. 3112: 1 → 0

Char. 3181: 3 → 1

Char. 3192: 3 → 2

Char. 3194: 1 → 3

Char. 3209: 2 → 1

Char. 3226: 2 → 0

Char. 3331: 3 → 1

Char. 3350: 0 → 1

Char. 3392: 0 → 1

Char. 3421: 0 → 3

Char. 3428: 0 → 3

Char. 3449: 2 → 0

Char. 3456: 0 → 1

Char. 3479: 3 → 1

Char. 3491: 3 → 1

Char. 3504: 1 → 3

Char. 3534: 1 → 2

Char. 3629: 0 → 2

Char. 3644: 0 → 2

Char. 3683: 2 → 0

Char. 3769: 3 → 0

Char. 3770: 2 → 0

Char. 3782: 0 → 1

Char. 3818: 1 → 3

Char. 3850: 2 → 0

Char. 3887: 2 → 0

Char. 3900: 1 → 0

Char. 3902: 3 → 0

Char. 3906: 2 → 0

Char. 3939: 3 → 0

Char. 3951: 3 → 1

Some trees:

Char. 2772: 1 → 3

Node 167: Callichthyidae

All trees:

1. Char. 17: 0 → 1
2. Char. 41: 0 → 1
3. Char. 44: 0 → 1
4. Char. 45: 0 → 2
5. Char. 51: 0 → 1
6. Char. 52: 0 → 1
7. Char. 53: 0 → 2
8. Char. 54: 0 → 2
9. Char. 75: 0 → 1
10. Char. 97: 0 → 1
11. Char. 104: 0 → 1
12. Char. 105: 2 → 1
13. Char. 107: 0 → 1
14. Char. 114: 2 → 1
15. Char. 115: 0 → 1
16. Char. 134: 0 → 1
17. Char. 140: 0 → 1
18. Char. 141: 0 → 2
19. Char. 164: 0 → 1
20. Char. 173: 0 → 2
21. Char. 176: 0 → 2
22. Char. 180: 0 → 2
23. Char. 182: 0 → 2
24. Char. 184: 0 → 2
25. Char. 189: 0 → 1
26. Char. 224: 1 → 0
27. Char. 373: 3 → 0
28. Char. 413: 0 → 2
29. Char. 475: 2 → 0
30. Char. 529: 2 → 3
31. Char. 645: 3 → 1
32. Char. 889: 3 → 0
33. Char. 939: 2 → 0
34. Char. 958: 2 → 0
35. Char. 966: 2 → 0

36. Char. 980: 1 → 3
37. Char. 1000: 1 → 3
38. Char. 1016: 0 → 3
39. Char. 1042: 1 → 0
40. Char. 1094: 1 → 3
41. Char. 1101: 1 → 3
42. Char. 1103: 0 → 1
43. Char. 1531: 1 → 0
44. Char. 1537: 0 → 1
45. Char. 1629: 3 → 0
46. Char. 1671: 1 → 3
47. Char. 1752: 0 → 1
48. Char. 2268: 1 → 3
49. Char. 2322: 1 → 0
50. Char. 2328: 1 → 3
51. Char. 2340: 1 → 0
52. Char. 2394: 0 → 3
53. Char. 2496: 0 → 1
54. Char. 2497: 2 → 0
55. Char. 2500: 0 → 2
56. Char. 2517: 3 → 1
57. Char. 2583: 1 → 0
58. Char. 2590: 0 → 2
59. Char. 2598: 0 → 1
60. Char. 2607: 1 → 0
61. Char. 2680: 0 → 1
62. Char. 2691: 1 → 0
63. Char. 2702: 0 → 3
64. Char. 2778: 1 → 0
65. Char. 2820: 1 → 0
66. Char. 2821: 1 → 0
67. Char. 2929: 1 → 0
68. Char. 3088: 1 → 0
69. Char. 3123: 0 → 3
70. Char. 3131: 2 → 0
71. Char. 3178: 1 → 3
72. Char. 3217: 3 → 1
73. Char. 3232: 1 → 3
74. Char. 3278: 2 → 0
75. Char. 3287: 1 → 3
76. Char. 3332: 1 → 0
77. Char. 3386: 1 → 3
78. Char. 3419: 3 → 1
79. Char. 3446: 2 → 0
80. Char. 3506: 2 → 0
81. Char. 3515: 1 → 0
82. Char. 3579: 1 → 3
83. Char. 3581: 3 → 0
84. Char. 3626: 0 → 3
85. Char. 3636: 1 → 0
86. Char. 3758: 3 → 2
87. Char. 3788: 0 → 3
88. Char. 3815: 2 → 0
89. Char. 3817: 1 → 0
90. Char. 3838: 0 → 2
91. Char. 3853: 0 → 2
92. Char. 3880: 3 → 1
93. Char. 3955: 2 → 0
94. Char. 3972: 3 → 0

Node 168:

All trees:

Char. 33: 0 → 1
Char. 260: 0 → 1
Char. 813: 1 → 3
Char. 878: 3 → 1
Char. 957: 1 → 3
Char. 3256: 3 → 1
Char. 3902: 0 → 2

Some trees:

Char. 77: 1 → 2

Node 169:

All trees:

Char. 185: 1 → 0
Char. 201: 0 → 1
Char. 774: 0 → 2
Char. 1302: 0 → 2
Char. 1305: 0 → 1
Char. 1377: 0 → 2
Char. 1386: 0 → 2
Char. 1449: 1 → 3
Char. 1587: 1 → 3
Char. 1593: 1 → 3
Char. 1656: 1 → 3
Char. 1719: 0 → 3
Char. 1758: 1 → 3
Char. 1848: 3 → 1
Char. 2244: 1 → 3
Char. 2274: 3 → 1
Char. 2310: 1 → 3
Char. 2472: 3 → 1
Char. 2496: 1 → 3
Char. 2586: 1 → 3
Char. 2605: 1 → 3
Char. 2727: 3 → 1
Char. 2790: 1 → 3
Char. 2920: 1 → 3
Char. 3013: 3 → 1
Char. 3068: 0 → 2
Char. 3073: 1 → 3
Char. 3083: 0 → 2
Char. 3092: 0 → 2
Char. 3112: 0 → 3
Char. 3389: 3 → 0
Char. 3629: 2 → 3
Char. 3656: 1 → 3
Char. 3671: 3 → 1
Char. 3820: 0 → 2
Char. 3907: 2 → 3

Some trees:

Char. 60: 0 → 1
Char. 78: 0 → 1
Char. 123: 1 → 0
Char. 509: 0 → 2
Char. 1374: 0 → 1
Char. 1614: 3 → 1
Char. 1809: 1 → 3
Char. 2044: 0 → 1
Char. 2307: 3 → 1
Char. 2523: 1 → 2
Char. 2772: 0 → 3
Char. 2935: 0 → 1
Char. 3791: 0 → 2
Char. 3966: 0 → 2

Node 170:

All trees:

Char. 116: 0 → 1
Char. 169: 2 → 1
Char. 376: 1 → 3
Char. 390: 2 → 0
Char. 408: 1 → 3
Char. 3329: 3 → 1

Some trees:

Char. 3: 2 → 1

Node 171:

All trees:

Char. 66: 2 → 0
Char. 136: 6 → 8
Char. 417: 0 → 3
Char. 508: 3 → 0
Char. 518: 1 → 0
Char. 562: 3 → 1
Char. 878: 3 → 1
Char. 880: 3 → 1
Char. 881: 3 → 1
Char. 902: 3 → 1
Char. 1044: 3 → 1

Some trees:

Char. 2: 0 → 1
Char. 234: 0 → 2
Char. 254: 3 → 1
Char. 344: 1 → 3
Char. 1043: 3 → 1

Node 172:

All trees:

Char. 139: 5 → 6
Char. 188: 0 → 1
Char. 200: 1 → 0
Char. 243: 3 → 2
Char. 251: 1 → 0
Char. 745: 2 → 0
Char. 793: 1 → 3
Char. 877: 3 → 1

Some trees:

Char. 529: 3 → 1

Node 173:

All trees:

Char. 3458: 1 → 3
Char. 3626: 3 → 1
Char. 3804: 2 → 0
Char. 3928: 2 → 3

Some trees:

Char. 1233: 3 → 1
Char. 1251: 3 → 1
Char. 1314: 3 → 1
Char. 1572: 1 → 3
Char. 1686: 1 → 3
Char. 3683: 0 → 2
Char. 3684: 1 → 0
Char. 3966: 0 → 2

Node 174:

All trees:

Char. 881: 3 → 1
Char. 1326: 0 → 2
Char. 1449: 1 → 3
Char. 1473: 3 → 1
Char. 1575: 1 → 3
Char. 1614: 3 → 1
Char. 1620: 0 → 3
Char. 1639: 2 → 3
Char. 1641: 1 → 3
Char. 1647: 3 → 1
Char. 1669: 0 → 2
Char. 1674: 3 → 1
Char. 1711: 1 → 3
Char. 2150: 3 → 2
Char. 2151: 0 → 2
Char. 2157: 0 → 2
Char. 2226: 1 → 3
Char. 2244: 1 → 3
Char. 2283: 0 → 1
Char. 2289: 1 → 3
Char. 2349: 3 → 1
Char. 2403: 1 → 3
Char. 2415: 1 → 0
Char. 2469: 1 → 3
Char. 2475: 1 → 3
Char. 2559: 1 → 3
Char. 2613: 1 → 3
Char. 2616: 1 → 3
Char. 2643: 1 → 3
Char. 2656: 2 → 0
Char. 2703: 1 → 3
Char. 2742: 3 → 1
Char. 2766: 1 → 0
Char. 2770: 1 → 3
Char. 2773: 3 → 1
Char. 2793: 1 → 3
Char. 2799: 1 → 3
Char. 2844: 1 → 3
Char. 2892: 1 → 3
Char. 2895: 0 → 2
Char. 2938: 1 → 3
Char. 2959: 0 → 2
Char. 3005: 0 → 2
Char. 3013: 3 → 1
Char. 3029: 1 → 3
Char. 3100: 1 → 3
Char. 3112: 0 → 1

Some trees:

Char. 867: 1 → 3
Char. 880: 3 → 1
Char. 1043: 3 → 1
Char. 1608: 1 → 0
Char. 1704: 1 → 3
Char. 2523: 1 → 2
Char. 2760: 1 → 3
Char. 2808: 0 → 2

Node 175:

All trees:

Char. 19: 2 → 1	Char. 102: 1 → 2	Char. 178: 1 → 0	Char. 3389: 3 → 1	Char. 3909: 3 → 1
Char. 88: 0 → 1	Char. 155: 1 → 2	Char. 3341: 3 → 0	Char. 3820: 0 → 2	

Some trees:

Char. 53: 2 → 1

Char. 60: 0 → 1

Node 176:

All trees:

Char. 49: 2 → 1	Char. 995: 2 → 0	Char. 3458: 0 → 1	Char. 3884: 1 → 3

Some trees:

Char. 139: 5 → 3	Char. 890: 0 → 2

Node 177:

All trees:

Char. 240: 0 → 2	Char. 1404: 1 → 3	Char. 1802: 3 → 1	Char. 2349: 3 → 1	Char. 2844: 1 → 3
Char. 543: 3 → 1	Char. 1425: 0 → 3	Char. 2118: 0 → 2	Char. 2394: 3 → 1	Char. 2871: 1 → 3
Char. 1037: 0 → 2	Char. 1512: 3 → 0	Char. 2136: 1 → 3	Char. 2409: 1 → 3	Char. 2956: 0 → 3
Char. 1242: 1 → 3	Char. 1617: 2 → 0	Char. 2170: 1 → 3	Char. 2454: 1 → 3	Char. 3001: 3 → 1
Char. 1266: 1 → 3	Char. 1665: 0 → 2	Char. 2244: 3 → 0	Char. 2487: 0 → 3	Char. 3005: 0 → 2
Char. 1296: 1 → 3	Char. 1740: 1 → 3	Char. 2307: 1 → 3	Char. 2505: 0 → 3	Char. 3013: 3 → 1
Char. 1362: 3 → 1	Char. 1776: 3 → 1	Char. 2313: 3 → 1	Char. 2829: 3 → 1	Char. 3028: 3 → 1

Some trees:

Char. 1440: 3 → 1	Char. 2085: 3 → 1	Char. 2150: 1 → 3	Char. 2676: 2 → 0
Char. 1659: 1 → 0	Char. 2100: 1 → 0	Char. 2193: 2 → 0	Char. 3008: 3 → 1
Char. 1695: 1 → 3	Char. 2149: 2 → 0	Char. 2268: 1 → 3	

Node 178:

All trees:

Char. 1851: 0 → 2	Char. 2932: 0 → 2	Char. 3850: 0 → 2
Char. 2484: 3 → 1	Char. 3088: 2 → 0	Char. 3853: 2 → 0

Some trees:

Char. 1716: 3 → 1	Char. 3049: 0 → 2	Char. 3329: 1 → 3	Char. 3912: 1 → 3
Char. 2400: 0 → 2	Char. 3124: 2 → 0	Char. 3344: 23 → 3	

Node 179:

Some trees:

Char. 2: 1 → 0	Char. 1039: 0 → 3	Char. 1296: 3 → 1	Char. 1668: 0 → 3	Char. 2253: 1 → 0
Char. 200: 01 → 0	Char. 1043: 3 → 0	Char. 1365: 1 → 3	Char. 1674: 3 → 1	Char. 2295: 3 → 1
Char. 213: 0 → 1	Char. 1203: 3 → 1	Char. 1497: 1 → 3	Char. 1804: 1 → 0	Char. 2304: 1 → 3
Char. 880: 3 → 1	Char. 1254: 0 → 2	Char. 1503: 1 → 3	Char. 2148: 0 → 2	Char. 2388: 13 → 1

Char. 2793: 3 → 1 Char. 2920: 1 → 3 Char. 3321: 1 → 3 Char. 3329: 3 → 1

Node 180:

Some trees:

Char. 2: 1 → 0 Char. 168: 2 → 1 Char. 881: 3 → 1 Char. 3402: 1 → 3

Char. 3: 2 → 1 Char. 171: 0 → 1 Char. 3268: 2 → 3 Char. 3647: 0 → 1

Char. 88: 0 → 1 Char. 792: 0 → 2 Char. 3275: 1 → 3

Node 181:

All trees:

Char. 3268: 2 → 0 Char. 3329: 3 → 1 Char. 3774: 0 → 3

Char. 3321: 1 → 3 Char. 3758: 2 → 1 Char. 3928: 2 → 1

Some trees:

Char. 143: 1 → 0 Char. 208: 0 → 1 Char. 3344: 2 → 3

Node 182:

All trees:

Char. 808: 2 → 0 Char. 812: 0 → 2 Char. 3253: 2 → 0 Char. 3443: 1 → 3 Char. 3515: 2 → 0

Some trees:

Char. 66: 0 → 2 Char. 147: 23 → 2 Char. 200: 1 → 0

Node 183:

All trees:

Char. 78: 0 → 1 Char. 169: 2 → 3 Char. 808: 2 → 0 Char. 3281: 0 → 2

Char. 122: 0 → 1 Char. 421: 1 → 3 Char. 809: 3 → 1 Char. 3389: 1 → 0

Char. 146: 1 → 4 Char. 442: 0 → 1 Char. 912: 1 → 3 Char. 3623: 1 → 3

Char. 156: 1 → 2 Char. 792: 0 → 2 Char. 987: 1 → 3 Char. 3629: 2 → 3

Node 184:

All trees:

Char. 33: 0 → 1 Char. 128: 7 → 6 Char. 164: 1 → 2 Char. 172: 0 → 1

Char. 116: 0 → 1 Char. 161: 0 → 1 Char. 171: 0 → 1 Char. 187: 0 → 1

Node 185:

All trees:

Char. 3235: 1 → 3 Char. 3272: 1 → 3 Char. 3783: 0 → 3 Char. 3885: 1 → 0

Node 186:

All trees:

Char. 2766: 1 → 0 Char. 2799: 1 → 3 Char. 3121: 1 → 3 Char. 3168: 2 → 0 Char. 3422: 3 → 1

Some trees:

Char. 2652: 1 → 3

Node 187:

All trees:

Char. 3671: 3 → 1

Some trees:

Char. 1461: 1 → 3	Char. 2169: 1 → 2	Char. 2634: 0 → 2	Char. 2877: 3 → 1	Char. 3850: 0 → 2
Char. 1809: 3 → 1	Char. 2289: 1 → 0	Char. 2676: 0 → 2	Char. 2883: 3 → 1	Char. 3853: 2 → 0
Char. 1830: 3 → 1	Char. 2367: 3 → 1	Char. 2685: 1 → 3	Char. 2907: 1 → 0	
Char. 1863: 0 → 2	Char. 2388: 13 → 1	Char. 2712: 1 → 3	Char. 2910: 1 → 0	
Char. 2136: 1 → 3	Char. 2415: 3 → 1	Char. 2754: 1 → 3	Char. 2929: 2 → 3	
Char. 2150: 1 → 3	Char. 2605: 1 → 3	Char. 2853: 3 → 1	Char. 3008: 3 → 1	

Node 188:

All trees:

Char. 136: 6 → 7	Char. 415: 2 → 3	Char. 1512: 1 → 3	Char. 3272: 2 → 0
Char. 139: 5 → 6	Char. 416: 1 → 0	Char. 1797: 1 → 3	Char. 3278: 0 → 2
Char. 188: 0 → 1	Char. 977: 1 → 0	Char. 1835: 1 → 3	Char. 3503: 1 → 0

Node 189:

All trees:

Char. 506: 3 → 0	Char. 915: 0 → 2	Char. 1511: 1 → 3	Char. 1862: 2 → 0
Char. 545: 1 → 2	Char. 987: 1 → 3	Char. 1741: 0 → 2	Char. 1884: 1 → 0
Char. 758: 0 → 2	Char. 1398: 3 → 1	Char. 1773: 0 → 1	Char. 1923: 0 → 2
Char. 853: 0 → 2	Char. 1455: 0 → 3	Char. 1813: 1 → 3	Char. 3238: 1 → 3

Node 190:

All trees:

Char. 223: 1 → 3	Char. 242: 0 → 2	Char. 416: 3 → 1	Char. 743: 3 → 1
Char. 224: 0 → 2	Char. 274: 0 → 1	Char. 440: 0 → 2	Char. 3416: 1 → 3
Char. 238: 3 → 0	Char. 373: 0 → 3	Char. 669: 0 → 1	Char. 3755: 3 → 0

Node 191:

All trees:

Char. 529: 3 → 2	Char. 774: 0 → 2	Char. 1042: 0 → 1	Char. 3253: 2 → 0	Char. 3653: 1 → 3
Char. 625: 0 → 1	Char. 849: 3 → 1	Char. 1051: 1 → 3	Char. 3272: 1 → 2	Char. 3850: 0 → 3
Char. 666: 2 → 3	Char. 890: 0 → 2	Char. 1101: 3 → 1	Char. 3371: 2 → 0	
Char. 732: 3 → 1	Char. 916: 0 → 2	Char. 1104: 3 → 1	Char. 3617: 3 → 1	
Char. 744: 2 → 0	Char. 966: 0 → 2	Char. 1190: 0 → 2	Char. 3629: 2 → 3	

Node 192: *Corydoras*

All trees:

Char. 7: 0 → 1	Char. 118: 0 → 1	Char. 128: 7 → 6	Char. 173: 2 → 1	Char. 201: 0 → 1
Char. 55: 0 → 1	Char. 122: 0 → 1	Char. 133: 0 → 1	Char. 174: 0 → 1	Char. 435: 2 → 0

Char. 469: 2 → 0	Char. 2073: 1 → 3	Char. 2731: 0 → 1	Char. 3118: 1 → 3	Char. 3647: 1 → 2
Char. 517: 3 → 1	Char. 2153: 3 → 1	Char. 2811: 0 → 1	Char. 3119: 1 → 3	Char. 3692: 0 → 2
Char. 539: 0 → 2	Char. 2394: 3 → 1	Char. 2853: 3 → 1	Char. 3235: 1 → 3	Char. 3734: 1 → 3
Char. 894: 3 → 1	Char. 2472: 1 → 0	Char. 2980: 0 → 1	Char. 3347: 2 → 0	Char. 3743: 1 → 3
Char. 1009: 0 → 1	Char. 2685: 1 → 3	Char. 2996: 1 → 3	Char. 3437: 1 → 2	Char. 3826: 2 → 0
Char. 2052: 0 → 1	Char. 2710: 1 → 3	Char. 3014: 2 → 3	Char. 3593: 2 → 0	

Some trees:

Char. 2097: 3 → 0 Char. 2883: 3 → 1

Node 193:

All trees:

Char. 71: 1 → 0 Char. 133: 1 → 0 Char. 274: 1 → 3 Char. 380: 1 → 3 Char. 470: 1 → 3

Node 194:

All trees:

Char. 1036: 1 → 3 Char. 1045: 2 → 0 Char. 1101: 3 → 1

Some trees:

Char. 1043: 1 → 3 Char. 3853: 2 → 0

Node 195:

All trees:

Char. 123: 1 → 0	Char. 745: 0 → 2	Char. 1695: 3 → 1	Char. 2526: 1 → 3	Char. 3040: 3 → 1
Char. 128: 7 → 8	Char. 1398: 3 → 1	Char. 2268: 3 → 1	Char. 2586: 1 → 3	Char. 3092: 0 → 2
Char. 139: 6 → 5	Char. 1566: 0 → 2	Char. 2328: 3 → 1	Char. 2587: 0 → 2	
Char. 168: 1 → 2	Char. 1599: 1 → 3	Char. 2418: 3 → 1	Char. 2721: 1 → 3	
Char. 543: 1 → 3	Char. 1659: 3 → 1	Char. 2466: 3 → 1	Char. 2938: 1 → 2	

Some trees:

Char. 4: 0 → 1	Char. 2196: 0 → 1	Char. 2808: 0 → 2
Char. 1320: 3 → 1	Char. 2760: 3 → 1	Char. 3174: 1 → 3

Node 196:

Some trees:

Char. 114: 1 → 0	Char. 1290: 0 → 2	Char. 1599: 3 → 1	Char. 2868: 0 → 2	Char. 3049: 0 → 2
Char. 185: 1 → 0	Char. 1422: 0 → 2	Char. 1989: 0 → 3	Char. 2897: 3 → 2	Char. 3070: 1 → 3
Char. 1045: 2 → 0	Char. 1425: 3 → 1	Char. 2340: 0 → 2	Char. 2951: 0 → 1	
Char. 1221: 0 → 2	Char. 1455: 0 → 3	Char. 2347: 1 → 0	Char. 2984: 1 → 3	

Node 197:

All trees:

Char. 72: 0 → 1 Char. 166: 2 → 1

Node 198:

All trees:

Char. 447: 0 → 2	Char. 814: 0 → 2	Char. 1636: 0 → 3
Char. 812: 0 → 2	Char. 1573: 2 → 0	Char. 3262: 3 → 2

Some trees:

Char. 1704: 1 → 3

Node 199:

All trees:

Char. 64: 2 → 1	Char. 1717: 1 → 3	Char. 2094: 1 → 3	Char. 2409: 1 → 3	Char. 3221: 2 → 0
Char. 243: 2 → 0	Char. 1723: 1 → 3	Char. 2148: 0 → 2	Char. 2601: 0 → 3	Char. 3684: 1 → 0
Char. 593: 1 → 3	Char. 1927: 0 → 3	Char. 2150: 3 → 2	Char. 2619: 0 → 2	Char. 3698: 1 → 3
Char. 945: 0 → 2	Char. 1984: 3 → 1	Char. 2169: 1 → 3	Char. 2933: 1 → 3	Char. 3881: 2 → 3
Char. 985: 0 → 1	Char. 1996: 0 → 2	Char. 2232: 3 → 1	Char. 3013: 3 → 1	
Char. 1716: 1 → 3	Char. 2065: 2 → 0	Char. 2262: 1 → 3	Char. 3031: 3 → 1	

Some trees:

Char. 108: 0 → 1	Char. 1404: 3 → 1	Char. 2106: 3 → 1	Char. 2208: 3 → 1

Node 200:

All trees:

Char. 28: 1 → 0	Char. 157: 0 → 1	Char. 1375: 1 → 3	Char. 1612: 1 → 3	Char. 2568: 1 → 3
Char. 66: 0 → 2	Char. 188: 1 → 0	Char. 1428: 1 → 3	Char. 2470: 3 → 1	
Char. 112: 0 → 1	Char. 200: 0 → 1	Char. 1467: 1 → 0	Char. 2484: 1 → 3	
Char. 147: 2 → 3	Char. 1293: 0 → 3	Char. 1587: 1 → 3	Char. 2538: 3 → 1	

Some trees:

Char. 1884: 1 → 3	Char. 2280: 1 → 3	Char. 2749: 1 → 3	Char. 2921: 1 → 3
Char. 2072: 0 → 2	Char. 2613: 1 → 3	Char. 2790: 1 → 3	Char. 3118: 1 → 3

Node 201:

All trees:

Char. 2067: 3 → 1	Char. 2548: 1 → 3	Char. 2623: 1 → 3	Char. 2908: 1 → 3	Char. 3650: 0 → 2
Char. 2283: 0 → 2	Char. 2580: 0 → 2	Char. 2802: 1 → 3	Char. 2926: 3 → 1	
Char. 2415: 1 → 3	Char. 2601: 1 → 3	Char. 2895: 0 → 2	Char. 2984: 1 → 0	

Node 202:

All trees:

Char. 1329: 0 → 2	Char. 1599: 1 → 3	Char. 1924: 1 → 3	Char. 2403: 1 → 0	Char. 2805: 1 → 3
Char. 1437: 0 → 2	Char. 1608: 3 → 1	Char. 2133: 0 → 2	Char. 2469: 1 → 3	Char. 2865: 1 → 3
Char. 1476: 1 → 0	Char. 1647: 3 → 1	Char. 2244: 1 → 0	Char. 2658: 1 → 3	Char. 2953: 1 → 3
Char. 1491: 3 → 1	Char. 1713: 1 → 3	Char. 2310: 1 → 3	Char. 2703: 1 → 3	Char. 2980: 0 → 2
Char. 1518: 3 → 1	Char. 1740: 3 → 1	Char. 2385: 1 → 3	Char. 2790: 1 → 3	Char. 3116: 0 → 2

Char. 3119: 1 → 3 Char. 3425: 1 → 3 Char. 3865: 2 → 0 Char. 3880: 1 → 3 Char. 3938: 3 → 1

Some trees:

Char. 2307: 1 → 3 Char. 2808: 0 → 2 Char. 2883: 3 → 1

Node 203:

All trees:

Char. 264: 3 → 2 Char. 1279: 1 → 3 Char. 1482: 1 → 3 Char. 1611: 1 → 3 Char. 1809: 1 → 3

Char. 365: 3 → 1 Char. 1377: 0 → 2 Char. 1537: 1 → 0 Char. 1638: 0 → 1

Char. 1212: 3 → 1 Char. 1464: 0 → 1 Char. 1578: 1 → 3 Char. 1801: 2 → 0

Node 204:

All trees:

Char. 49: 2 → 1 Char. 1344: 1 → 3 Char. 1845: 0 → 2 Char. 3302: 3 → 1 Char. 3689: 0 → 1

Char. 131: 2 → 1 Char. 1410: 0 → 2 Char. 1848: 3 → 1 Char. 3380: 0 → 3 Char. 3713: 3 → 1

Char. 441: 0 → 2 Char. 1626: 1 → 3 Char. 1881: 3 → 1 Char. 3389: 3 → 0 Char. 3850: 0 → 2

Char. 443: 1 → 3 Char. 1639: 2 → 3 Char. 3226: 0 → 2 Char. 3557: 1 → 3 Char. 3946: 0 → 2

Char. 987: 1 → 3 Char. 1641: 1 → 3 Char. 3253: 2 → 0 Char. 3625: 1 → 3 Char. 3947: 2 → 0

Node 205: *Gastrodermus*

All trees:

Char. 45: 2 → 1 Char. 139: 5 → 4 Char. 1740: 1 → 3 Char. 2274: 3 → 1

Char. 60: 0 → 1 Char. 995: 2 → 0 Char. 1884: 1 → 3 Char. 2613: 1 → 3

Char. 64: 2 → 0 Char. 1246: 1 → 0 Char. 2136: 1 → 0 Char. 3115: 1 → 0

Char. 86: 0 → 1 Char. 1392: 1 → 3 Char. 2229: 1 → 3 Char. 3329: 3 → 0

Some trees:

Char. 2: 0 → 1

Node 206:

All trees:

Char. 241: 0 → 3 Char. 1377: 0 → 2 Char. 2071: 2 → 0 Char. 2673: 1 → 3 Char. 3046: 0 → 1

Char. 274: 0 → 2 Char. 1393: 3 → 1 Char. 2139: 0 → 3 Char. 2773: 1 → 3 Char. 3368: 2 → 0

Char. 435: 2 → 0 Char. 1440: 3 → 1 Char. 2196: 0 → 1 Char. 2838: 0 → 2 Char. 3775: 1 → 0

Char. 506: 3 → 1 Char. 1627: 1 → 3 Char. 2259: 1 → 0 Char. 2871: 1 → 0 Char. 3785: 1 → 3

Char. 508: 3 → 1 Char. 1740: 3 → 0 Char. 2392: 2 → 0 Char. 2943: 3 → 1

Char. 517: 3 → 1 Char. 1758: 3 → 1 Char. 2587: 0 → 2 Char. 2993: 3 → 1

Char. 540: 1 → 3 Char. 1830: 1 → 3 Char. 2619: 2 → 0 Char. 3010: 0 → 1

Char. 769: 3 → 1 Char. 2064: 3 → 1 Char. 2640: 0 → 1 Char. 3025: 3 → 1

Node 207:

All trees:

Char. 57: 0 → 2 Char. 116: 0 → 1 Char. 128: 7 → 8 Char. 147: 2 → 3 Char. 390: 2 → 0

Char. 421: 1 → 3 Char. 1416: 1 → 3 Char. 2133: 0 → 1 Char. 2394: 3 → 0 Char. 3070: 3 → 1

Char. 867: 1 → 3 Char. 1474: 1 → 3 Char. 2241: 3 → 1 Char. 2490: 1 → 3 Char. 3119: 1 → 2

Char. 902: 3 → 1 Char. 1476: 1 → 2 Char. 2328: 3 → 1 Char. 2589: 3 → 1 Char. 3653: 1 → 0

Char. 1375: 1 → 3 Char. 1686: 1 → 3 Char. 2367: 1 → 3 Char. 2757: 0 → 1 Char. 3704: 1 → 3

Char. 1398: 3 → 1 Char. 1824: 3 → 1 Char. 2389: 1 → 3 Char. 2802: 1 → 3 Char. 3820: 0 → 2

Some trees:

Char. 1278: 3 → 1 Char. 2097: 3 → 0

Node 208:

Some trees:

Char. 264: 3 → 2 Char. 867: 3 → 1 Char. 880: 1 → 3 Char. 3683: 2 → 0 Char. 3684: 0 → 1

Node 209:

All trees:

Char. 1269: 0 → 2 Char. 1574: 1 → 3 Char. 3219: 0 → 1 Char. 3374: 3 → 1 Char. 3629: 2 → 3

Char. 1374: 0 → 2 Char. 1821: 3 → 1 Char. 3221: 0 → 2 Char. 3380: 0 → 3

Node 210:

All trees:

Char. 1215: 0 → 2 Char. 1416: 1 → 3 Char. 3428: 3 → 1

Some trees:

Char. 1860: 0 → 2

Node 211:

All trees:

Char. 543: 3 → 1 Char. 1380: 1 → 3 Char. 2379: 0 → 1

Node 212:

All trees:

Char. 880: 1 → 3 Char. 1563: 0 → 2 Char. 2070: 1 → 3 Char. 2400: 0 → 2 Char. 3092: 2 → 0

Char. 882: 2 → 1 Char. 1602: 0 → 2 Char. 2072: 2 → 0 Char. 2487: 0 → 2

Char. 1375: 3 → 1 Char. 1646: 0 → 3 Char. 2151: 0 → 2 Char. 2613: 3 → 1

Char. 1377: 0 → 2 Char. 1683: 0 → 2 Char. 2340: 0 → 2 Char. 2853: 3 → 1

Node 213:

All trees:

Char. 224: 3 → 1 Char. 879: 0 → 2 Char. 1293: 3 → 1 Char. 2044: 0 → 1 Char. 2829: 1 → 3

Char. 418: 0 → 2 Char. 987: 1 → 3 Char. 1599: 3 → 1 Char. 2088: 0 → 2 Char. 2832: 0 → 2

Char. 506: 3 → 1 Char. 1201: 1 → 3 Char. 1949: 2 → 0 Char. 2580: 0 → 2 Char. 2980: 0 → 2

Char. 867: 1 → 3 Char. 1218: 0 → 2 Char. 1975: 0 → 1 Char. 2697: 3 → 1 Char. 3106: 1 → 0

Node 214:

All trees:

Char. 870: 0 → 3

Char. 877: 1 → 3

Char. 881: 1 → 3

Char. 912: 1 → 3

Char. 1227: 0 → 2

Char. 1320: 1 → 0

Char. 1374: 0 → 2

Char. 1389: 0 → 2

Char. 1416: 1 → 3

Char. 1446: 1 → 3

Char. 1500: 1 → 0

Char. 1540: 1 → 0

Char. 1545: 1 → 3

Char. 1549: 1 → 3

Char. 1581: 0 → 2

Char. 1632: 3 → 1

Char. 1659: 1 → 0

Char. 1689: 1 → 3

Char. 1701: 3 → 1

Char. 1719: 0 → 1

Char. 1767: 1 → 3

Char. 1812: 1 → 3

Char. 1948: 1 → 3

Char. 2103: 3 → 1

Char. 2112: 0 → 2

Char. 2149: 2 → 0

Char. 2161: 2 → 0

Char. 2163: 1 → 3

Char. 2214: 1 → 3

Char. 2220: 3 → 1

Char. 2299: 0 → 2

Char. 2319: 1 → 3

Char. 2343: 0 → 1

Char. 2347: 1 → 0

Char. 2367: 1 → 3

Char. 2370: 3 → 1

Char. 2383: 1 → 3

Char. 2394: 3 → 1

Char. 2398: 0 → 2

Char. 2399: 3 → 1

Char. 2469: 1 → 3

Char. 2502: 3 → 1

Char. 2503: 1 → 3

Char. 2571: 1 → 3

Char. 2574: 1 → 3

Char. 2575: 1 → 3

Char. 2578: 1 → 3

Char. 2598: 3 → 1

Char. 2712: 1 → 3

Char. 2757: 1 → 3

Char. 2773: 3 → 1

Char. 2805: 1 → 3

Char. 2865: 1 → 3

Char. 2959: 0 → 2

Char. 3007: 1 → 3

Char. 3095: 1 → 3

Char. 3106: 1 → 3

Char. 3124: 2 → 0

Char. 3629: 2 → 3

Char. 3907: 2 → 0

Some trees:

Char. 883: 2 → 0

Char. 1362: 3 → 1

Char. 2307: 1 → 3

Char. 2652: 1 → 3

Char. 2727: 1 → 3

Char. 2892: 1 → 3

Node 215:

All trees:

Char. 1221: 0 → 2

Char. 1263: 0 → 2

Char. 1279: 1 → 3

Char. 1411: 2 → 0

Char. 1440: 03 → 2

Char. 1563: 0 → 2

Char. 1569: 3 → 1

Char. 1620: 0 → 2

Char. 1681: 0 → 2

Char. 3284: 2 → 1

Node 216:

Some trees:

Char. 251: 1 → 3

Char. 1227: 0 → 2

Char. 1285: 3 → 1

Char. 1398: 1 → 3

Char. 1473: 3 → 1

Char. 1668: 3 → 1

Char. 1690: 1 → 3

Char. 1716: 3 → 1

Char. 1731: 1 → 3

Char. 1782: 1 → 3

Char. 2097: 1 → 3

Char. 2163: 3 → 1

Char. 2175: 3 → 1

Char. 2271: 1 → 3

Char. 2400: 0 → 2

Char. 2598: 3 → 1

Char. 2736: 1 → 3

Char. 2739: 1 → 3

Char. 2766: 1 → 3

Char. 2923: 0 → 2

Char. 3004: 0 → 2

Char. 3043: 1 → 3

Char. 3049: 0 → 2

Char. 3344: 3 → 2

Char. 3422: 3 → 1

Char. 3497: 2 → 3

Char. 3515: 2 → 0

Char. 3535: 0 → 3

Char. 3671: 3 → 1

Char. 3785: 1 → 3

Node 217:

All trees:

Char. 3419: 1 → 3

Some trees:

Char. 136: 6 → 4

Char. 1230: 0 → 2

Char. 1341: 0 → 2

Char. 1375: 1 → 3

Char. 1389: 0 → 2

Char. 1713: 1 → 3

Char. 1737: 0 → 2

Char. 1744: 1 → 3

Char. 1815: 1 → 3

Char. 1821: 1 → 3

Char. 1824: 1 → 3

Char. 1975: 0 → 1

Char. 1983: 2 → 0

Node 218:

All trees:

Char. 1512: 1 → 3
Char. 1537: 1 → 3
Char. 1596: 0 → 2
Char. 1812: 0 → 2
Char. 3820: 0 → 2
Char. 3856: 0 → 3
Char. 3963: 0 → 2

Some trees:

Char. 77: 1 → 2

Node 219:

All trees:

Char. 12: 1 → 0
Char. 35: 0 → 1
Char. 49: 2 → 1
Char. 80: 0 → 1
Char. 84: 0 → 1
Char. 118: 0 → 1
Char. 1254: 0 → 2
Char. 1276: 0 → 2
Char. 1428: 3 → 1
Char. 1524: 1 → 3
Char. 1572: 1 → 3
Char. 1716: 1 → 3

Some trees:

Char. 57: 0 → 1

Node 220: *Aspidoras*

All trees:

Char. 2: 01 → 2
Char. 13: 1 → 0
Char. 21: 1 → 0
Char. 29: 2 → 1
Char. 72: 0 → 1
Char. 90: 1 → 2
Char. 154: 2 → 1
Char. 745: 2 → 0
Char. 881: 3 → 0
Char. 902: 3 → 1
Char. 903: 0 → 1
Char. 912: 1 → 0
Char. 948: 0 → 2
Char. 959: 3 → 1
Char. 963: 1 → 3
Char. 968: 2 → 0
Char. 972: 1 → 0
Char. 976: 1 → 3
Char. 999: 3 → 1
Char. 1233: 3 → 0
Char. 1237: 1 → 3
Char. 1251: 3 → 1
Char. 1272: 3 → 1
Char. 1287: 0 → 3
Char. 1326: 0 → 2
Char. 1374: 0 → 2
Char. 1392: 1 → 3
Char. 1452: 0 → 3
Char. 1467: 1 → 0
Char. 1500: 1 → 0
Char. 1560: 1 → 3
Char. 1603: 1 → 0
Char. 1611: 1 → 3
Char. 1647: 3 → 1
Char. 1670: 3 → 1
Char. 1674: 3 → 0
Char. 1683: 0 → 3
Char. 1692: 0 → 2
Char. 1710: 0 → 1
Char. 1719: 01 → 3
Char. 1723: 1 → 3
Char. 1749: 1 → 0
Char. 1752: 1 → 0
Char. 1792: 1 → 3
Char. 1812: 13 → 0
Char. 1821: 3 → 1
Char. 1824: 3 → 1
Char. 1857: 0 → 2
Char. 1933: 1 → 3
Char. 1934: 1 → 3
Char. 1983: 0 → 2
Char. 1984: 3 → 1
Char. 1996: 0 → 2

Some trees:

Char. 1278: 3 → 1
Char. 1802: 1 → 3

Node 221:

All trees:

Char. 137: 1 → 0
Char. 169: 2 → 1
Char. 201: 0 → 1
Char. 470: 1 → 3
Char. 532: 1 → 3
Char. 632: 3 → 1
Char. 1263: 0 → 1
Char. 2679: 3 → 1
Char. 2685: 1 → 3
Char. 2853: 3 → 1
Char. 3194: 3 → 0
Char. 3401: 1 → 3

Some trees:

Char. 1362: 3 → 1
Char. 1704: 1 → 3

Node 222:

All trees:

Char. 33: 0 → 1
Char. 123: 1 → 0
Char. 890: 0 → 2
Char. 1296: 3 → 1
Char. 1347: 1 → 3

Char. 1552: 0 → 2
Char. 1617: 0 → 2
Char. 1755: 1 → 3
Char. 1776: 1 → 3
Char. 1801: 0 → 2
Char. 1839: 0 → 2
Char. 2346: 1 → 3
Char. 2382: 0 → 2
Char. 2469: 1 → 3
Char. 2499: 3 → 1
Char. 2731: 0 → 1
Char. 2886: 0 → 2
Char. 2889: 0 → 2
Char. 2898: 1 → 0
Char. 2947: 1 → 3
Char. 3230: 2 → 0
Char. 3407: 1 → 3

Some trees:

Char. 128: 7 → 8
Char. 509: 0 → 2

Node 223:

All trees:

Char. 274: 0 → 2
Char. 344: 1 → 3
Char. 1045: 2 → 0
Char. 1323: 0 → 2
Char. 1374: 2 → 0
Char. 1545: 1 → 3
Char. 1751: 1 → 3
Char. 3308: 3 → 1
Char. 3722: 3 → 1
Char. 3954: 1 → 0
Char. 3966: 0 → 2

Some trees:

Char. 509: 0 → 2

Node 224:

All trees:

Char. 251: 1 → 0
Char. 417: 0 → 1
Char. 508: 3 → 1
Char. 816: 0 → 2
Char. 853: 0 → 3
Char. 870: 0 → 2
Char. 1015: 3 → 1
Char. 1272: 1 → 3
Char. 1293: 0 → 3
Char. 1317: 3 → 1
Char. 1503: 3 → 1
Char. 1587: 1 → 3
Char. 1602: 1 → 3
Char. 1647: 1 → 3
Char. 1671: 3 → 1
Char. 1750: 0 → 2
Char. 1792: 3 → 1
Char. 1992: 1 → 3
Char. 3262: 3 → 1
Char. 3534: 2 → 1

Some trees:

Char. 1036: 1 → 3

Node 225:

All trees:

Char. 3217: 1 → 2
Char. 3595: 3 → 1
Char. 3608: 1 → 3
Char. 3638: 2 → 0
Char. 3653: 1 → 3
Char. 3671: 3 → 1
Char. 3804: 2 → 0
Char. 3814: 0 → 2

Node 226: *Scleromystax*

All trees:

Char. 49: 2 → 0
Char. 54: 2 → 1
Char. 131: 2 → 1
Char. 197: 0 → 1
Char. 376: 1 → 3
Char. 421: 1 → 3
Char. 543: 1 → 3
Char. 793: 1 → 3
Char. 816: 0 → 1
Char. 1095: 3 → 1
Char. 1234: 0 → 3
Char. 1375: 1 → 3
Char. 1398: 3 → 1
Char. 1404: 1 → 3
Char. 1512: 1 → 0
Char. 1539: 0 → 2
Char. 1641: 1 → 0
Char. 1885: 3 → 1
Char. 1927: 0 → 3
Char. 1992: 1 → 0
Char. 2214: 1 → 3
Char. 2268: 3 → 1
Char. 2347: 1 → 0
Char. 2433: 0 → 1
Char. 2451: 3 → 1
Char. 2658: 1 → 0
Char. 2790: 1 → 3
Char. 2895: 0 → 2
Char. 2974: 0 → 3
Char. 3268: 2 → 1
Char. 3443: 1 → 3
Char. 3503: 1 → 2
Char. 3752: 2 → 0

Some trees:

Char. 2307: 3 → 1
Char. 2883: 3 → 1

Node 227:

All trees:

Char. 3: 2 → 0	Char. 21: 1 → 2	Char. 204: 0 → 1	Char. 3262: 3 → 1
Char. 7: 0 → 1	Char. 89: 2 → 0	Char. 440: 0 → 2	Char. 3535: 0 → 1
Char. 9: 1 → 2	Char. 128: 78 → 5	Char. 529: 3 → 1	Char. 3743: 1 → 3
Char. 18: 0 → 1	Char. 139: 5 → 6	Char. 854: 0 → 2	Char. 3766: 0 → 3

Node 228:

All trees:

Char. 112: 0 → 1	Char. 813: 1 → 3	Char. 3192: 2 → 3
Char. 177: 0 → 1	Char. 890: 0 → 2	Char. 3560: 1 → 0

Node 229:

All trees:

Char. 85: 1 → 0	Char. 90: 1 → 2	Char. 106: 2 → 1

Node 230:

All trees:

Char. 251: 1 → 3	Char. 1395: 0 → 2	Char. 1776: 1 → 3	Char. 2394: 3 → 1	Char. 2809: 1 → 3
Char. 543: 3 → 1	Char. 1416: 1 → 3	Char. 1792: 1 → 3	Char. 2424: 0 → 2	Char. 2832: 0 → 2
Char. 972: 1 → 0	Char. 1449: 1 → 0	Char. 1803: 1 → 0	Char. 2451: 1 → 0	Char. 2848: 1 → 3
Char. 995: 2 → 0	Char. 1461: 1 → 0	Char. 1992: 0 → 3	Char. 2472: 3 → 0	Char. 2853: 1 → 3
Char. 1043: 3 → 1	Char. 1500: 1 → 3	Char. 1996: 0 → 2	Char. 2529: 1 → 3	Char. 2974: 3 → 1
Char. 1209: 0 → 1	Char. 1579: 1 → 3	Char. 2056: 1 → 3	Char. 2532: 1 → 3	Char. 3007: 1 → 0
Char. 1212: 3 → 1	Char. 1624: 1 → 0	Char. 2130: 1 → 3	Char. 2652: 3 → 1	Char. 3013: 3 → 1
Char. 1326: 0 → 2	Char. 1671: 3 → 1	Char. 2175: 1 → 3	Char. 2685: 3 → 1	Char. 3040: 3 → 1
Char. 1350: 1 → 3	Char. 1707: 1 → 3	Char. 2292: 1 → 3	Char. 2755: 1 → 3	Char. 3068: 0 → 2
Char. 1356: 0 → 2	Char. 1749: 1 → 3	Char. 2325: 0 → 2	Char. 2769: 1 → 3	Char. 3070: 3 → 1
Char. 1362: 1 → 3	Char. 1750: 0 → 2	Char. 2361: 0 → 1	Char. 2793: 1 → 3	Char. 3719: 3 → 1

Node 231:

All trees:

Char. 525: 3 → 1	Char. 912: 1 → 3

Node 232: *Callichthys*

Some trees:

Char. 57: 1 → 2	Char. 147: 2 → 1	Char. 687: 2 → 0	Char. 1003: 3 → 1	Char. 1103: 1 → 3
Char. 76: 0 → 1	Char. 169: 3 → 1	Char. 695: 0 → 2	Char. 1009: 0 → 2	Char. 1152: 0 → 2
Char. 80: 1 → 2	Char. 669: 0 → 3	Char. 725: 2 → 0	Char. 1025: 3 → 1	Char. 1206: 0 → 2
Char. 104: 1 → 0	Char. 683: 3 → 0	Char. 812: 0 → 1	Char. 1093: 3 → 1	Char. 1209: 0 → 1
Char. 136: 5 → 2	Char. 686: 3 → 1	Char. 913: 0 → 2	Char. 1095: 1 → 0	Char. 1216: 0 → 2

Char. 1217: 3 → 1
Char. 1294: 0 → 2
Char. 1296: 3 → 0
Char. 1320: 0 → 2
Char. 1323: 3 → 1
Char. 1329: 0 → 1
Char. 1347: 1 → 3
Char. 1377: 0 → 3
Char. 1393: 3 → 1
Char. 1428: 3 → 1
Char. 1479: 3 → 0
Char. 1515: 0 → 2
Char. 1539: 0 → 2
Char. 1543: 3 → 1
Char. 1557: 1 → 3
Char. 1566: 0 → 2
Char. 1593: 3 → 0
Char. 1599: 1 → 3
Char. 1608: 0 → 1
Char. 1629: 0 → 1
Char. 1632: 3 → 1
Char. 1647: 3 → 1
Char. 1683: 0 → 1
Char. 1690: 1 → 3
Char. 1711: 1 → 3
Char. 1725: 0 → 1
Char. 1746: 0 → 1
Char. 1758: 3 → 0
Char. 1759: 0 → 3
Char. 1803: 1 → 0
Char. 1804: 1 → 3
Char. 1810: 1 → 3
Char. 1812: 3 → 2
Char. 1818: 0 → 1
Char. 1819: 0 → 1
Char. 1833: 3 → 1
Char. 1872: 0 → 2
Char. 1888: 0 → 2
Char. 1932: 3 → 1
Char. 1935: 0 → 2
Char. 1947: 1 → 3
Char. 1949: 0 → 3
Char. 1955: 2 → 0
Char. 1959: 3 → 1
Char. 1965: 1 → 3
Char. 1977: 0 → 2

Node 233: Callichthyini

All trees:

Char. 30: 1 → 0
Char. 39: 0 → 1
Char. 92: 1 → 0
Char. 126: 0 → 1
Char. 133: 0 → 2
Char. 162: 0 → 1
Char. 188: 0 → 1
Char. 260: 0 → 1
Char. 541: 0 → 3
Char. 544: 0 → 2
Char. 685: 3 → 1
Char. 753: 2 → 0
Char. 854: 2 → 1
Char. 894: 3 → 1
Char. 912: 1 → 2
Char. 914: 3 → 2
Char. 1239: 0 → 3
Char. 1281: 0 → 1
Char. 1344: 1 → 3
Char. 1548: 0 → 1
Char. 1668: 0 → 3
Char. 1727: 3 → 1

Node 234: Callichthyinae

All trees:

Char. 6: 0 → 1
Char. 8: 0 → 1
Char. 11: 0 → 3
Char. 18: 1 → 2
Char. 24: 0 → 1
Char. 26: 0 → 1
Char. 34: 0 → 1
Char. 38: 0 → 1
Char. 49: 0&2 → 1
Char. 56: 0 → 1
Char. 57: 0 → 1
Char. 74: 0 → 1
Char. 82: 0 → 1
Char. 88: 0 → 1
Char. 98: 0 → 1
Char. 109: 0 → 1
Char. 113: 0 → 1
Char. 117: 0 → 1
Char. 125: 0 → 1
Char. 144: 0 → 2
Char. 145: 0 → 1
Char. 179: 0 → 1
Char. 193: 0 → 1
Char. 214: 0 → 1
Char. 305: 1 → 3
Char. 421: 1 → 3
Char. 437: 3 → 1
Char. 440: 0 → 1
Char. 532: 1 → 0
Char. 572: 1 → 0
Char. 584: 1 → 3
Char. 604: 2 → 0
Char. 646: 3 → 1
Char. 773: 0 → 1
Char. 815: 0 → 13
Char. 849: 3 → 1
Char. 859: 0 → 1
Char. 904: 0 → 3
Char. 916: 0 → 2
Char. 935: 0 → 2
Char. 967: 2 → 0
Char. 979: 1 → 3
Char. 1215: 0 → 1
Char. 1309: 3 → 0
Char. 1318: 1 → 0
Char. 1323: 0 → 3
Char. 1389: 0 → 1
Char. 1524: 1 → 0
Char. 1590: 0 → 3
Char. 1593: 1 → 3
Char. 1596: 0 → 1
Char. 1626: 1 → 3
Char. 3268: 2 → 1
Char. 3275: 1 → 3
Char. 3326: 0 → 1
Char. 3625: 1 → 3
Char. 3686: 1 → 3
Char. 3698: 1 → 3
Char. 3716: 1 → 3
Char. 3816: 1 → 3
Char. 3957: 2 → 0
Char. 3965: 0 → 1

Node 235: *Dianema*

All trees:

Char. 14: 0 → 1
Char. 15: 2 → 1
Char. 61: 1 → 2
Char. 81: 0 → 1
Char. 128: 7 → 6
Char. 132: 1 → 0
Char. 154: 1 → 2
Char. 192: 0 → 3
Char. 195: 0 → 1
Char. 215: 0 → 1

Node 236:

All trees:

Char. 4: 0 → 1
Char. 57: 1 → 2
Char. 102: 2 → 3
Char. 156: 0 → 1

Node 237:

All trees:

Char. 10: 1 → 0
Char. 82: 1 → 2
Char. 154: 0 → 1

Node 238: Hoplosternini

All trees:

Char. 60: 0 → 1
Char. 84: 0 → 1
Char. 85: 0 → 1
Char. 102: 1 → 2
Char. 127: 0 → 1
Char. 129: 0 → 1
Char. 161: 0 → 1
Char. 190: 0 → 1
Char. 212: 0 → 1
Char. 529: 3 → 0
Char. 543: 1 → 3
Char. 547: 3 → 1
Char. 667: 3 → 0
Char. 901: 2 → 0
Char. 1037: 3 → 1

Node 239: *Lepthoplosternum*

All trees:

Char. 4: 0 → 1
Char. 65: 1 → 0
Char. 136: 5 → 6
Char. 158: 1 → 2
Char. 159: 1 → 2
Char. 192: 0 → 2
Char. 193: 1 → 2
Char. 199: 0 → 1
Char. 314: 0 → 2
Char. 372: 3 → 1
Char. 437: 1 → 3
Char. 848: 0 → 2
Char. 870: 02 → 3
Char. 888: 3 → 1
Char. 917: 3 → 1
Char. 946: 3 → 1
Char. 952: 3 → 1
Char. 982: 0 → 3
Char. 1215: 1 → 2
Char. 1269: 0 → 1
Char. 1356: 0 → 3
Char. 1485: 1 → 3
Char. 1542: 1 → 3
Char. 1650: 1 → 3
Char. 1659: 1 → 0
Char. 1683: 0 → 3
Char. 1830: 0 → 2
Char. 1978: 1 → 3

Node 240:

All trees:

Char. 181: 0 → 1
Char. 343: 0 → 1
Char. 359: 0 → 3
Char. 380: 1 → 3
Char. 403: 3 → 1
Char. 411: 2 → 0
Char. 416: 3 → 0
Char. 421: 3 → 0
Char. 424: 3 → 0
Char. 472: 1 → 3
Char. 475: 0 → 2
Char. 480: 2 → 1
Char. 518: 3 → 0
Char. 525: 3 → 0
Char. 527: 2 → 1
Char. 528: 1 → 0
Char. 546: 1 → 3
Char. 718: 3 → 1
Char. 726: 0 → 2
Char. 853: 0 → 1
Char. 889: 0 → 13
Char. 905: 1 → 3
Char. 930: 1 → 3
Char. 947: 0 → 3
Char. 963: 1 → 3
Char. 986: 1 → 3
Char. 1006: 2 → 0
Char. 1035: 2 → 0
Char. 1046: 1 → 3
Char. 1070: 3 → 0
Char. 1159: 1 → 3
Char. 1240: 2 → 0
Char. 1262: 1 → 3
Char. 1263: 0 → 1
Char. 1341: 1 → 3
Char. 1350: 1 → 3
Char. 1419: 1 → 0
Char. 1446: 1 → 3
Char. 1448: 2 → 1
Char. 1449: 1 → 3
Char. 1458: 0 → 1
Char. 1514: 3 → 1
Char. 1516: 2 → 1
Char. 1522: 2 → 0
Char. 1549: 1 → 3
Char. 1587: 1 → 3
Char. 1612: 1 → 3
Char. 1643: 3 → 1
Char. 1669: 2 → 0
Char. 1674: 0 → 1
Char. 1682: 1 → 3
Char. 1710: 1 → 03
Char. 1776: 1 → 3
Char. 1782: 1 → 3
Char. 1785: 0 → 3
Char. 1831: 0 → 2
Char. 1835: 1 → 0
Char. 1860: 0 → 3
Char. 1870: 0 → 2
Char. 1884: 1 → 0
Char. 1890: 1 → 3
Char. 1909: 0 → 2
Char. 1910: 0 → 2
Char. 1915: 0 → 2
Char. 1927: 3 → 1
Char. 1933: 1 → 3
Char. 1950: 2 → 0
Char. 1979: 1 → 2
Char. 3249: 0 → 1
Char. 3326: 1 → 3

Char. 3359: 0 → 2	Char. 3398: 1 → 3	Char. 3485: 1 → 2	Char. 3569: 3 → 1	Char. 3587: 1 → 3

Node 241:

All trees:

Char. 163: 0 → 1

Node 242:

All trees:

Char. 85: 0 → 1	Char. 153: 0 → 1

Node 243:

All trees:

Char. 80: 1 → 2	Char. 139: 2 → 3	Char. 173: 2 → 1

Node 244:

All trees:

Char. 156: 0 → 3	Char. 732: 1 → 3	Char. 986: 3 → 2

Node 245: *Megalechis*

All trees:

Char. 60: 0 → 1	Char. 1203: 0 → 2	Char. 1611: 1 → 3	Char. 1689: 1 → 0	Char. 1926: 1 → 3
Char. 67: 0 → 1	Char. 1277: 3 → 1	Char. 1627: 1 → 3	Char. 1751: 1 → 3	Char. 1983: 2 → 0
Char. 203: 0 → 1	Char. 1375: 1 → 3	Char. 1635: 3 → 1	Char. 1752: 1 → 3	
Char. 408: 3 → 1	Char. 1389: 1 → 3	Char. 1665: 3 → 1	Char. 1824: 3 → 1	
Char. 886: 0 → 3	Char. 1482: 3 → 1	Char. 1681: 2 → 0	Char. 1857: 0 → 2	

Node 246:

All trees:

Char. 406: 1 → 3	Char. 1581: 0 → 2	Char. 2208: 1 → 3	Char. 2655: 0 → 2	Char. 2936: 2 → 0
Char. 447: 0 → 2	Char. 1626: 1 → 3	Char. 2328: 3 → 1	Char. 2679: 3 → 1	Char. 2973: 1 → 3
Char. 1051: 3 → 1	Char. 1689: 1 → 0	Char. 2349: 2 → 1	Char. 2773: 1 → 3	Char. 2989: 1 → 0
Char. 1056: 0 → 2	Char. 1728: 0 → 2	Char. 2457: 0 → 1	Char. 2814: 0 → 2	Char. 3284: 2 → 1
Char. 1365: 1 → 3	Char. 1924: 1 → 3	Char. 2497: 0 → 1	Char. 2823: 1 → 0	Char. 3503: 1 → 0
Char. 1380: 3 → 1	Char. 1979: 1 → 3	Char. 2505: 0 → 1	Char. 2877: 1 → 3	Char. 3928: 2 → 3
Char. 1419: 2 → 0	Char. 2086: 3 → 1	Char. 2517: 1 → 3	Char. 2892: 0 → 2	
Char. 1542: 1 → 3	Char. 2097: 0 → 1	Char. 2588: 3 → 1	Char. 2927: 1 → 3	

Node 247:

All trees:

Char. 375: 3 → 0	Char. 418: 3 → 1	Char. 1209: 0 → 1	Char. 1656: 1 → 3	Char. 1746: 0 → 2
Char. 397: 1 → 3	Char. 594: 1 → 3	Char. 1296: 3 → 1	Char. 1666: 1 → 3	Char. 1886: 0 → 1
Char. 415: 2 → 0	Char. 770: 3 → 1	Char. 1632: 3 → 1	Char. 1725: 0 → 2	

Node 248:

All trees:

Char. 508: 3 → 1	Char. 904: 0 → 1	Char. 1027: 1 → 3	Char. 3575: 0 → 2	Char. 3910: 2 → 0
Char. 792: 0 → 2	Char. 959: 3 → 1	Char. 3471: 3 → 0	Char. 3797: 1 → 3	Char. 3925: 3 → 1
Char. 809: 3 → 1	Char. 1025: 1 → 3	Char. 3536: 2 → 0	Char. 3800: 2 → 1	

Node 249:

All trees:

Char. 3440: 3 → 1	Char. 3632: 0 → 2

Node 250:

All trees:

Char. 656: 2 → 1	Char. 914: 3 → 1	Char. 1549: 1 → 3	Char. 1734: 0 → 2	Char. 1845: 0 → 2
Char. 705: 1 → 3	Char. 915: 0 → 2	Char. 1635: 3 → 1	Char. 1737: 0 → 2	
Char. 808: 2 → 0	Char. 1285: 3 → 1	Char. 1653: 0 → 2	Char. 1767: 1 → 3	
Char. 894: 1 → 0	Char. 1548: 0 → 1	Char. 1682: 1 → 3	Char. 1804: 1 → 3	

Node 251:

All trees:

Char. 509: 0 → 2

Node 252:

All trees:

Char. 1416: 1 → 3	Char. 2094: 3 → 1	Char. 2376: 3 → 1	Char. 3040: 1 → 3
Char. 1452: 0 → 2	Char. 2301: 3 → 1	Char. 2454: 1 → 3	Char. 3046: 2 → 0
Char. 1728: 0 → 2	Char. 2337: 1 → 3	Char. 2727: 1 → 3	

Node 253:

All trees:

Char. 509: 0 → 2	Char. 2142: 3 → 1	Char. 2605: 1 → 3	Char. 2769: 1 → 3
Char. 1410: 0 → 2	Char. 2355: 0 → 2	Char. 2610: 1 → 3	Char. 2808: 2 → 0
Char. 1491: 3 → 1	Char. 2421: 1 → 3	Char. 2661: 1 → 3	Char. 2838: 0 → 2
Char. 1596: 0 → 2	Char. 2571: 1 → 3	Char. 2757: 1 → 0	Char. 2989: 1 → 3

Node 254:

All trees:

Char. 1530: 0 → 2	Char. 1551: 0 → 2	Char. 1794: 1 → 3	Char. 1951: 2 → 0	Char. 3073: 1 → 3

Node 255:

All trees:

Char. 442: 0 → 2	Char. 1329: 0 → 2	Char. 1515: 0 → 2	Char. 1848: 3 → 1	Char. 3338: 2 → 3
Char. 543: 3 → 1	Char. 1374: 0 → 1	Char. 1749: 1 → 3	Char. 1948: 1 → 3	Char. 3350: 1 → 3
Char. 1269: 0 → 2	Char. 1446: 1 → 3	Char. 1755: 1 → 3	Char. 1992: 1 → 3	Char. 3471: 3 → 0
Char. 1293: 0 → 2	Char. 1452: 0 → 2	Char. 1761: 3 → 1	Char. 3232: 0 → 3	Char. 3638: 2 → 0

Char. 3659: 0 → 3	Char. 3798: 1 → 0

Some trees:

Char. 1278: 3 → 1

Node 256:

All trees:

Char. 1272: 3 → 1	Char. 2304: 3 → 1	Char. 2466: 0 → 2	Char. 2577: 0 → 3	Char. 2775: 0 → 2
Char. 1611: 3 → 1	Char. 2415: 3 → 1	Char. 2496: 1 → 3	Char. 2607: 0 → 2	Char. 3052: 0 → 2
Char. 1830: 3 → 1	Char. 2451: 3 → 0	Char. 2550: 0 → 2	Char. 2763: 0 → 1	

Some trees:

Char. 1479: 3 → 1	Char. 2149: 02 → 2	Char. 2331: 1 → 0	Char. 3029: 3 → 1
Char. 2085: 13 → 3	Char. 2150: 13 → 1	Char. 2367: 3 → 1	

Node 257:

All trees:

Char. 274: 0 → 2	Char. 510: 1 → 3	Char. 3217: 1 → 3	Char. 3407: 1 → 3	Char. 3874: 2 → 0
Char. 365: 3 → 1	Char. 581: 0 → 3	Char. 3238: 1 → 0	Char. 3479: 1 → 3	
Char. 508: 3 → 2	Char. 959: 3 → 1	Char. 3389: 3 → 1	Char. 3838: 2 → 0	

CHAPTER II:

Taxonomic review of *Hoplisoma nattereri* Steindachner, 1876 (Siluriformes: Callichthyidae)

The taxonomy of *Hoplisoma nattereri* is reviewed in order to elucidate its synonymy and investigate the presence of cryptic diversity under this name. Geographic distribution of *Hoplisoma nattereri* is restricted to the coastal rivers from the southern portion of the State of Espírito Santo to the Baía de Paranaguá in the State of Paraná and also including the rio Tietê in the State of São Paulo, Brazil. *Hoplisoma triseriatus* is considered a valid species diagnosed based on its variegated coloration pattern. Geographic distribution of *H. triseriatus* range from the coastal rivers of the southern portion of the State of Bahia, around Santa Cruz Cabrália, to the State of Espírito Santo, around Vitória, Brazil. *Corydoras juquiaae* is removed from the synonymy of *Hoplisoma nattereri* and transferred to *Scleromystax juquiaae*, new combination. *Scleromystax prionotos* is considered a junior synonym of *S. juquiaae*. All these species are illustrated in this paper. In addition, the original figure of *S. juquiaae* prepared but never published by Rudolph von Ihering is reproduced here. Phylogenetic relationships of *Hoplisoma nattereri* and *H. triseriatus* are discussed and also the morphometric and genetic distance of some of the populations sampled.

A taxonomia de *Hoplisoma nattereri* foi revisada a fim de elucidar sua sinonímia e investigar a presença de diversidade críptica sob este nome. A distribuição geográfica de *H. nattereri* é restrita aos rios costeiros da região sul do Estado do Espírito Santo até a Baía de Paranaguá, Estado do Paraná, e também incluindo o rio Tietê, Estado de São Paulo, Brasil. *Hoplisoma triseriatus* é considerada uma espécie válida diagnosticada com base em seu padrão de coloração variegado. A distribuição geográfica de *H. triseriatus* inclui os rios costeiros da região sul do Estado da Bahia, em torno de Santa Cruz Cabrália, até o Estado do Espírito Santo, por volta de Vitória, Brasil. *Corydoras juquiaae* é removido da sinonímia de

Hoplisoma nattereri e transferido para *Scleromystax juquiaae*, nova combinação. *Scleromystax prionotos* é considerado um sinônimo júnior de *S. juquiaae*. Todas estas espécies são ilustradas neste artigo. Adicionalmente, a figura original de *Corydoras juquiaae* preparada, mas nunca publicada, por Rudolph von Ihering é aqui reproduzida. As relações filogenéticas *Hoplisoma nattereri* e *H. triseriatus* foram discutidas como assim também a sua morfometría e a distância genética de algumas das populações amostradas.

Key words. *Corydoras nattereri*, *Corydoras juquiaae*, *Corydoras nattereri triseriatus*, *Scleromystax prionotos*.

Introduction

The genus *Hoplisoma* was resurrected from the synonymy of *Corydoras* La Cépède, 1803 by Vera-Alcaraz (Chapter I, this volume), who performed a phylogenetic analysis of the Callichthyidae and recovered the genus *Corydoras* as paraphyletic. In order to reconcile this situation a revalidation of the genera *Hoplisoma* Swainson, 1838 and *Gastrodermus* Cope, 1878 was necessary to accommodate most species formerly recognized in *Corydoras*. *Hoplisoma* was diagnosed based in 34 synapomorphies, from which morphological characters are: anterior projection of metapterygoid intermediate in size, posterior margin denticulations of the pectoral spine oriented distally, antero-dorsal ridge of the basipterygium orientated mesially, and lateral process of the basipterygium with a large posterior expansion.

Hoplisoma nattereri was originally described by Steindachner (1876) based in a single specimen from the vicinity of Rio Janeiro, around Paraíba do Sul and Jequitinhonha Rivers, Brazil. This species was characterized as having a narrow stripe along midline of body and the pectoral girdle not developed on the abdomen. The taxonomic revisions of Nijssen & Isbrücker (1980a, 1980b) and the catalogues of Isbrücker (2001), Reis (2003), Ferraris (2007), and Eschmeyer (2013) considered *Corydoras juquiaae* Ihering, 1907 and *Corydoras nattereri triseriatus* Ihering, 1911 as junior synonyms of this species. These species are also characterized by having a narrow lateral stripe on midline of body. A preliminary revision of the type specimens of these species and the study of the taxonomic procedures involving type designation of *Corydoras juquiaae* revealed a necessity to review the taxonomy of *Hoplisoma nattereri* in order to elucidate its synonymy. In addition, the existence of cryptic diversity under this name is also investigated considering the wide geographical distribution that this species exhibits in Brazil, ranging from the rio João de Tiba in the State of Bahia to the Baía de Paranaguá basin in the State of Paraná and also including the rio Tietê in the State of São Paulo.

Material and Methods

Specimens were analyzed in visits or by loans from the following institutions: CAS (California Academy of Sciences, San Francisco), LBP (Laboratório de Biologia e Genética de Peixes, Botucatu), MBML (Coleção Zoológica, Museu de Biologia Professor Mello Leitão, Santa Teresa), MCP (Museu de Ciências e Tecnologia da Pontifícia Universidade Católica do Rio Grande do Sul, Porto Alegre), MCZ (Museum of Comparative Zoology, Cambridge), MNRJ (Museu Nacional, Rio de Janeiro), and MZUSP (Museu de Zoologia da Universidade de São Paulo, São Paulo).

External morphology and coloration were studied based on alcohol preserved specimens. Bone and cartilage were studied based on double stained and cleared specimens according to the techniques of Taylor and Van Dyke (1985). Morphometric and meristic data were taken following Reis (1997). The prepectoral distance was added and measurements were taken using digital calipers to the nearest centesimal. Morphometrics are summarized in Tables 1 and 2 as percentages of standard length (SL) and head length (HL), meristics are also included on tables. Most of the osteological nomenclature follows Reis (1998). Terminology of head skeleton follows Arratia (2003) and includes the following structures: parietal instead of frontal, postparieto-supraoccipital instead of supraoccipital, hyomandibula instead of hyomandibular. Other terminology includes: scapulocoracoid instead of coracoids according to Lundberg (1970), pterotic branch instead of postero-lateral branch according to Arratia & Gayet (1995), and compound pterotic instead of pterotic plus post-temporo-supracleithrum according to Aquino &

Schaefer (2002). Terminology of mouth barbels follows Britto & Lima (2003), maxillary barbel refers to the structure associated to the maxilla, and mental barbels include the fleshy structures of the lower lip associated to the dentary. Nomenclature of lateral-line system follows Webb (1989), and includes the following canals on the head and trunk: the supraorbital (contained in the nasal and parietal), infraorbital (contained in the infraorbital bone series), preopercular (contained in compound pterotic and preopercle), otic (contained in the sphenotic), postotic-temporal (contained in the compound pterotic), and trunk canals (free ossicles in the body or ossicles contained in the dermal lateral plates of the body). Siluriformes lack the supratemporal canal (Lekander, 1949), and most Loricarioidea (except Nematogenyidae) lost the mandibular canal (Schaefer, 1990).

Phylogenetic relationships of the *Hoplisoma nattereri* clade are discussed based in the consensus cladogram obtained by Vera-Alcaraz (Chapter I, figs. 20-21, this volume). This cladogram was obtained by a Cladistic parsimony analysis under a Total Evidence approach based in a matrix of 144 terminals and 3985 characters of morphology, behavior, and mitochondrial and molecular genes. For *Hoplisoma nattereri* it includes specimens sampled from the following rivers: Jucuruçu, Paraíba do Sul, Macaé, São João, Macacu (tributary to the Baía de Guanabara), Tietê, Ribeira do Iguape, and tributaries to the Baía de Paranaguá. Principal Component Analysis (PCA) is performed using the software PAST (Hammer *et al*., 2001) in order to detect differences between populations sampled. The specimens used in this analysis are indicated in parentheses in the examined material. PCA is performed on the co-variance matrices of log transformed data of the 21 measurements taken. Uncorrected pairwise distances were calculated using the software Sequencher 4.7 (Gene Codes Corporation). DNA markers chosen are *12s RNA* and *16s RNA*. Size of the nucleotide fragments of *12s RNA* range from 321 to 386 basepairs; calculations were done after alignment and based in overlapping fragments ranging from 317 to 386 basepairs, differences accounted includes nucleobase mismatch and gap insertion. The same were accounted for the *16s RNA*, with nucleotide fragments ranging from 472 to 565 basepairs that yields overlapping fragments from 462 to 565 basepairs.

Results

***Hoplisoma nattereri* (Steindachner, 1876)**

Fig. 1, 2, 3, Table 1

Corydoras nattereri Steindachner, 1876: 143, pl. 11 (fig. 1). Type locality: Affluent of Rio Parahyba, 3 mi. up, Rio de Janeiro, Brazil. Neotype: MCZ 8229, designated by Nijssen & Isbrücker (1980a: 3).

FIGURE 1

Diagnosis. *Hoplisoma nattereri* can be distinguished from its congeners excepting *H. acrensis*, *H. baderi*, *H. bifasciatus*, *H. boesemani*, *H. bondi*, *H. coppenamensis*, *H. gomezi*, *H. habrosus*, *H. haraldschultzi*, *H. isbrueckeri*, *H. julii*, *H. leopardus*, *H. noelkempffi*, *H. ornatus*, *H. pinheiroi*, *H. pulcher*, *H. robinae*, *H. sipaliwini*, *H. spectabilis*, *H. sterbai*, and *H. trilineatus* by having a narrow dark stripe along midline of body, on junction between dorso- and ventro-lateral plates (*vs*. midline of body plain or spotted, without a conspicuous lateral stripe). It is distinguished from *H. acrensis*, *H. gomezi*, and *H. trilineatus* by having the dorsal fin with very small black chromatophores uniformly distributed and densely arranged on its anteriormost portion (*vs*. large black spot on dorsalmost portion); from *H. baderi*, *H. bondi*, *H. coppenamensis*, *H. julii*, *H. sipaliwini*, and *H. sterbai* by having the latero-dorsal portion of body below dorsal-fin insertion with a conspicuous dark mark (*vs*. plain in *H. baderi* and with several spots in remaining species); from *H. bifasciatum*, *H. haraldschultzi*, *H. isbrueckeri*, *H. pinheiroi*, *H. pulcher*, *H. robinae*, *H. spectabilis*, *H. leopardus*, *H. noelkempffi*, and *H. ornatus* by having a short snout (*vs*. elongate snout); from *H. boesemani* by having the caudal fin with very small black dots uniformly distributed (*vs*. with transversal wide bands); and from *H. habrosus* by having the lateral stripe of trunk straight and beginning around middle of dorsal-fin base (*vs*. lateral stripe wavy and beginning on cleithrum).

Description. Morphometric and meristic data in Table 1. Body elongated, compressed, largest width at pectoral girdle, largest height at posterior margin of nuchal plate. Dorsal profile of body convex from snout tip to posterior margin of mesethmoid, straight from parietal to nuchal plate, slightly concave from dorsal-fin origin to adipose-fin origin, markedly concave from adipose-fin base to caudal-fin base. Ventral profile of body convex from snout tip to anal-fin base, slightly concave from anal-fin base to caudal-fin base.

Head compressed, roughly triangular in dorsal view, snout rounded. Mouth inferior; lower lip laminar entirely bordering mouth, deeply notched medially; mesial mental barbel conical, very short; lateral mental barbel short, slightly longer than maxillary barbel; maxillary barbel short, reaching around branchial gills opening; small rounded papillae on lower lip and barbels. Eye small, rounded, dorso-laterally placed, interorbital space wide. Mesethmoid short, roughly pentagonal; anterior tip long, lateral cornua extremely small, posterior portion externally exposed, posterior margin wide, postero-lateral process long. Lateral ethmoid scarcely developed anterior to nasal capsule; nasal capsule dorso-laterally located near eye orbit, internareal space wide. Parietal width intermediate, slightly smaller than half bone length; fontanel small, anterior opening closed (some smaller specimens with very small opening), posterior opening slightly entering postparieto-supraoccipital. Posterior process of postparieto-supraoccipital long, almost equals its width at base; posterior tip slightly concave, covered by nuchal plate anterior margin. Sphenotic compact, slightly longer than wide, ventral margin nearly straight, orbital cavity notch little developed. Infraorbital bones externally exposed, with minute, sparsed odontodes; anterior expansion of infraorbital bone 1 large, slightly smaller than half length remaining portion of bone, little developed ventrally; infraorbital bone 2 little expanded posteriorly, contacting sphenotic, dorsal keel for sphenotic articulation present. Postero-dorsal ridge of hyomandibula around opercle articulation condile elongate, externally exposed; dorsal ridge of hyomandibula rounded between compound pterotic and opercle, covered by thick layer of skin. Interopercle triangular, little expanded anteriorly, externally exposed. Opercle dorso-ventrally elongated, slender, greatest width about half its length, posterior margin strongly concave.

Dermal plates entirely covering lateral sides of body, with minute sparsed odontodes; one odontode row distinctly aligned on posterior plate margin. Four to eight lateral platelets covering base of caudal-fin rays, two to four dorsally, two to four ventrally. Two to four dorsal and one to three ventral platelets at middorsal and midventral lines before the caudal fin. Dorsal-fin rays II,7(8) or II,8(73), anterior spinelet small, second spine large, strong, pungent, locking mechanism functional; ossified portion of second dorsal spine slightly shorter than adjacent branched rays, adpressed distal tip slightly surpassing base of last branched dorsal-fin ray; small denticulations oriented distally on posterior margin. First two branched rays slightly longer than ossified portion of dorsal-fin spine, exceeding portion about one-fourth ossified portion (see sexual dimorphism). Pectoral-fin rays I,6(1), I,7(40), I,8(43), or I,9(4); spine strong, pungent, locking mechanism functional; ossified portion of adpressed spine slightly surpasses pelvic-fin insertion; small denticulations oriented distally on inner margin, some denticulations bifid. Spurious rays and first branched ray almost reaching middle of pelvic fin (see sexual dimorphism). Antero-ventral margin of cleithrum externally exposed; scapulocoracoid medial expansion little developed, postero-lateral portion externally exposed. Arrector fossa oval, small, about one-fourth ventral surface of girdle. Pelvic-fin rays i,4(1), i,5(84), i,6(1). Anal-fin rays i,5(8), i,6(36), i,7(2), ii,5(36), or ii,6(1); origin around adipose-fin insertion. Caudal-fin rays i,9,i(1), i,10,1(3), i,12,i(86), or i,13,i(1); bilobed; four(4) upper and three(4) lower procurrent rays. Free vertebrae 21(1) or 22(3). Ribs 6(3) or 7(1); first pair conspicuously longer, robust, strongly articulated to first free vertebrae, distal tip connected to basipterygia lateral arm; remaining elements shorter, weak, articulated to free vertebrae by connective tissue.

TABLE 1

Supraorbital branch reaching nasal capsule; nasal slender, laminar, tips curved laterally, inner margin articulated to frontal (articulated to mesethmoid on some larger individuals), two(7) or three(2) sensory pores, first on anterior tip, second (if present) near posterior tip, third on posterior tip. Epiphysial branch short, pore opening near main canal coalesced on parietal. Infraorbital branch near midline of sphenotic, three infraorbital tubules, two tubules coalesced on infraorbital bone 1. Compound pterotic with preopercular branch short, pore opening near main canal, distant from anterior margin of bone; pore 3 opened on posterior tip of preopercle. Pterotic branch long, reaching ventral margin of bone. Trunk lateral-line reduced;

two(8) or three(1) latero-sensory tubules on trunk; first ossicle tubular; second ossicle laminar, ventral expansion larger than dorsal expansion, about twice its size; third tubule coalesced with third dorso-lateral plate.

Four branchiostegal rays, size decreasing posteriorly; first two outer rays longer, distal tips connected to branchiostegal cartilage; last two inner rays shorter, fourth ray about half length first ray. Parurohyal compact, length almost equals its width. Five ceratobranchials, size increasing posteriorly; ceratobranchial 1 process small on antero-proximal portion; postero-dorsal surface of ceratobranchial 5 toothed, 47(1), 48(2), or 55(1) teeth aligned in one row. Four epibranchials, epibranchial 2 longest, epibranchial 4 widest; process of epibranchial 2 small and pointed placed on its postero-proximal laminar expansion; process of epibranchial 3 uncinate placed on its postero-proximal laminar expansion. Two wide pharyngobranchials; posterior margin of pharingobranchial 3 laminar, largely developed. Upper tooth plate oval; 51(1), 55(1), 58(1), or 59(1) teeth aligned in two rows on postero-ventral surface, 18(1) or 21(3) teeth on anterior row, 33(1), 34(1), 37(1), or 38(1) teeth on posterior row.

Coloration in alcohol. Ground coloration of head dark brown dorsally, pale brown or yellow laterally, yellow ventrally. Head and mouth barbels covered with black chromatophores uniformly distributed; denser concentration on dorsum of head; opercle marks bigger. Ground color of body pale brown latero-dorsally, yellow latero-ventrally, light yellow or white on ventral region of head and abdomen. Nuchal plate and dorso-lateral plates below nuchal plate, dorsal spine, first and second branched dorsal rays dark brown. Distinct dark brown stripe on midline of body, beginning at vertical line just posterior to dorsal-fin origin and ending at caudal peduncle. Lateral region of body covered with black chromatophores uniformly distributed; denser concentration on dorso-lateral plates. Dorsal, adipose, caudal, pectoral, and anal fins pale brown. Pelvic fin yellow. All fins covered with black chromatophores uniformly distributed on rays; black dots on dorsal and adipose membranes; denser concentration on anterior margin of dorsal fin; black dots on dorsal margin of pectoral and pelvic fins.

Sexual dimorphism. Male specimens smaller than females (larger male 45.0 mm SL; larger female 58.6 mm SL). Males with first and second branched dorsal-fin rays slightly elongated, exceeding about one-third the ossified portion of the dorsal-fin spine. Urogenital papilla of males slightly elongated. Pectoral fin of males slightly elongated, ossified portion of spine reaching about half the pelvic fin or slightly shorter, spurious rays of pectoral-fin spine and first branched rays reaching to the distal tip of last branched pelvic-fin ray or slightly shorter. Males with small hypertrophied odontodes on infraorbital bones, preopercle, interopercle, ventral portion of opercle, and dorsal margin of the pectoral-fin spine (Fig. 2).

FIGURE 2

Distribution. Coastal rivers of southeastern Brazil in the states of Espírito Santo, Minas Gerais, Rio de Janeiro, São Paulo, and Paraná. The following rivers are included: Pongal, Itapemirim, Itabapoana, Paraíba do Sul, Macaé, São João, streams tributary to the Baía de Guanabara and to the Baíaa de Sepetiba, Ribeira do Iguape, and streams tributary to the Baía de Paranaguá. Also present in the rio Tietê in the State of São Paulo, tributary to the upper rio Paraná, Paraguay-Paraná basin (Fig. 3).

FIGURE 3

Material examined. Type material: MCZ 8229, 40.8 mm SL (1 alc, 40.8 mm SL), Affluent of Rio Parahyba, 3 mi. up, Rio de Janeiro, Brazil, neotype of *Corydoras nattereri* Steindachner, 1876 designated by Nijssen & Isbrücker (1980a: 3). MZUSP 1984, 1 alc, 30.3 mm SL; MZUSP 5326, 1 alc, 30.4 mm SL; MZUSP 5327, 1 alc, 32.2 mm SL; MZUSP 5328, 1 alc, 33.5 mm SL; MZUSP 5329, 1 alc, 38.4 mm SL; MZUSP 5330, 1 alc, 50.5 mm SL; all paralectotypes of *Corydoras juquiaae* Ihering, 1907, rio Juquiá, Poço Grande, State of São Paulo, Brazil. Non-type material: **Brazil:** State of Espírito Santo: MBML 1367, 7 of 14 alc, 28.8-38.2 mm SL, Guarapari, rio Banqueta. MBML 1433, 20 of 226 alc, 26.1-31.3 mm SL, Alfredo Chaves, córrego Torotoma. MBML 3228, 20 of 42 alc, 32.3-45.0 mm SL, Anchieta, rio Grande. MBML 3236, 11 of 22 alc, 30.6-43.9 mm SL, Anchieta, rio Grande. MCP 27744, 4 alc, 29.8-31.6 mm SL, Alfredo Chaves, córrego Cachoeira Alta. MCP 29496, 6 alc, 24.5-31.5 mm SL, Alfredo Chaves, córrego Cachoeira Alta. MNRJ 22368, 10 alc, 29.6-39.5 mm SL, Mimoso do Sul, córrego do Farol. MNRJ 38298, 1 alc, 27.6 mm SL, Mimoso do Sul, ribeirão das

Flores. State of Minas Gerais: MCP 34457, 1 alc, 42.6 mm SL (1, 42.6 mm SL), Muriaé, córrego Boa Vista. MNRJ 14239, 17 of 18 alc, 46.2-58.5 mm SL (2, 47.0-58.6 mm SL), Além Paraíba, rio Paraíba do Sul. MNRJ 14251, 6 alc, 36.6-38.5 mm SL (4, 38.0-38.8 mm SL), Volta Grande, rio Paraíba do Sul. MNRJ 38928, 15 of 29 alc, 20.4-43.5 mm SL (3, 31.4-40.5 mm SL), Mar de Espanha, afluente do rio Muriaé. State of Rio de Janeiro: LBP 2574-17106, 1 alc, 46.7 mm SL, Macaé, tributary to rio Aduelas. LBP 5777, 11 alc, 27.3-34.2 mm SL, Comendador Levy Gasparian, rio Paraibuna. MCP 20658, 29 alc, 25.4-49.7 mm SL (8, 37.5-43.0 mm SL), 4 c&s, 25.2-52.6 mm SL, Cachoeiras de Macacu, rio Macacu. MNRJ 14235, 6 alc, 27.0-44.0 mm SL (2, 39.7-44.5 mm SL), Três Rios, córrego Bemposta. MNRJ 17968, 8 alc, 19.3-46.0 mm SL (2, 39.0-45.9 mm SL), Rio Claro, córrego Patricia. MNRJ 17992, 15 of 37 alc, 29.7-49.0 mm SL (3, 36.9-44.0 mm SL), São João da Barra, lagoa Feia. MNRJ 18002, 11 alc, 24.8-45.83 mm SL (3, 40.4-45.8 mm SL), Macaé, Lagoa Feia. MNRJ 19591, 20 alc, 16.5-50.63 mm SL (4, 36.0-41.4 mm SL), Petrópolis, rio Santo Antônio. MNRJ 20047, 13 alc, 31.4-50.6 mm SL (2, 37.2-50.6 mm SL), Itaguaí, Campos da UFRRJ. MNRJ 20293, 19 alc, 23.1-43.4 mm SL, Magé, rio Paraíso. MNRJ 24379, 15 of 24 alc, 32.1-49.1 mm SL, Nova Iguaçu, rio Barreiras. MNRJ 37043, 10 alc, 32.0-46.9 mm SL, Cachoeira de Macacu, tributário do rio Soarinho. MNRJ 37470, 23 alc, 30.8-45.0 mm SL, Casimiro de Abreu, córrego Aldeia Velha. MNRJ 37493, 19 alc, 32.6-42.8 mm SL (4, 34.6-42.4 mm SL), Casimiro de Abreu, córrego Aldeia Velha. MNRJ 37573, 3 alc, 34.9-46.4 mm SL, Casimiro de Abreu, córrego Aldeia Velha. MNRJ 38926, 7, 27.5-39.7 mm SL, Petrópolis (correct county probably Areal or São Jose do Rio Preto), rio Preto. MNRJ 39001, 18 alc, 33.6-39.9 mm SL, Piabeta, afluente do rio Inhomirim. MZUSP 42488, 13 alc, 28.8-48.1 mm SL, (6, 33.1-47.9 mm SL), Niterói, rio Bonito. MZUSP 42495, 5 alc, 29.7-36.9 mm SL, Nova Iguaçu, rio Tinguá. MNRJ 39227, 2 alc, 25.6-36.3 mm SL, unknown locality. MNRJ 39242, 7 alc, 26.4-33.3 mm SL, unknown locality. State of Sao Paulo: LBP 2909, 7 alc, 22.2-26.8 mm SL, Salesópolis, rio Tietê. LBP 3480-16042, 1 alc, 50.7 mm SL, Itaboraí, rio Macacu. LBP 6466-29094, 1 alc, 54.8 mm SL, Guararema, rio Paraíba do Sul. LBP 6794, 16 alc, 22.4-45.4 mm SL, Salesópolis, riacho Paraitinguinha (Tietê Basin). LBP 7392-35383, 5 alc, 37.9-54.0 mm SL, Itapeúna, rio Jaguary (Ribeira do Iguape Basin). LBP 1266, 5 of 10 alc, 38.4-47.5 mm SL (5, 38.4-47.5 mm SL), Miracatú, rio Fau (Ribeira do Iguape basin). MCP 12833, 39 alc, 24.2-44.2 mm SL (9), 2 c&s, 24.9-34.2 mm SL, Sete Barras, tributário do rio Ribeira do Iguape. MCP 14980, 3 alc, 27.9-53.9 mm SL (2, 35.6-53.7 mm SL), 1 c&s, 46.8 mm SL, Iporanga, rio Iporanga (Ribeira do Iguape basin). MCP 25530, 1 alc, 38.0 mm SL (1, 38.0 mm SL), Biritiba Mirim, rio Tietê. MCP 20656, 20 alc, 23.1-43.1 mm SL (6, 31.1-43.0 mm SL), 2 c&s, 31.6-41.3 mm SL, Salesópolis, riacho Paraitinguinha. MCP 20657, 7 alc, 20.3-23.5 mm SL, Taiaçupeba, ribeirão Vargem Grande. MCP 20659, 4 alc, 33.4-39.3 mm SL (2, 34.7-38.5 mm SL), Biritiba Mirim, rio Tietê. MCP 20660, 6 alc, 30.7-42.2 mm SL (3, 33.8-41.6 mm SL), Mogi da Cruzes, tributário do rio Tietê. MHNG 2587.012, 1 alc, 48.0 mm SL (1, 48.0 mm SL), Salesópolis, riacho Paraitinguinha. MZUSP 4013, 2 of 57 alc, 47.3-51.6 mm SL (plus 18 *Scleromystax prionotos*), Miracatú, riacho afluente do rio São Lourenço (Ribeira do Iguape basin). MZUSP 36570, 6 alc, 36.5-48.2 mm SL, Eldorado, Ribeira do Iguape basin. MZUSP 38646, 4 alc, 38.9-42.5 mm SL, Pariquera-Açu, riacho Pariquera-Mirim (Ribeira do Iguape basin). State of Paraná: LBP 618, 8 of 18 alc, 40.8-49.0 mm SL (4, 39.6-49.2 mm SL), Morretes, rio Passa-Sete (Baía de Paranaguá Basin). LBP 778-

8301, 1 alc, 40.7 mm SL. Morretes, rio Marumbi (Baía de Paranaguá Basin). LBP 903-9697, 3 alc, 37.9-40.5 mm SL, Morretes, rio Marumbi (Baía de Paranaguá Basin).

Hoplisoma triseriatus **(Ihering, 1911)**

Fig. 3, 4, Table 2

Corydoras nattereri triseriatus Ihering, 1911: 386. Type locality: Rio Doce, State of Espírito Santo, Brazil. Lectotype: MZUSP 342, designated by Britski (1969: 207).

FIGURE 4

Diagnosis. *Hoplisoma triseriatus* can be distinguished from its congeners except *H. acrensis*, *H. baderi*, *H. bifasciatus*, *H. boesemani*, *H. bondi*, *H. coppenamensis*, *H. gomezi*, *H. habrosus*, *H. haraldschultzi*, *H. isbrueckeri*, *H. julii*, *H. leopardus*, *H. nattereri*, *H. noelkempffi*, *H. ornatus*, *H. pinheiroi*, *H. pulcher*, *H. robinae*, *H. sipaliwini*, *H. spectabilis*, *H. sterbai*, and *H. trilineatus* by having a narrow dark stripe along midline of body, on the junction between dorso- and ventro-lateral plates (*vs*. midline of body plain or spotted, without a conspicuous lateral stripe). It can be distinguished from *H. acrensis*, *H. gomezi*, and *H. trilineatus* by having the dorsal fin with dark brown spots on rays or with transverse bands (*vs*. large spot on dorsalmost portion in *H. acrensis*, *H. gomezi*, *H. trilineatus*); from *H. baderi*, *H. julii*, and *H. sterbai* by having the latero-dorsal portion of body with dark brown irregular blotches or continuous vermiculate marks (*vs*. plain in *H. baderi*, with rounded spots in *H. julii*, aligned in several rows in *H. sterbai*); from *H. bifasciatum*, *H. haraldschultzi*, *H. isbrueckeri*, *H. pinheiroi*, *H. pulcher*, *H. robinae*, *H. spectabilis*, *H. leopardus*, *H. noelkempffi*, and *H. ornatus* by having a short snout (*vs*. elongate snout); from *H. boesemani*, *H. bondi*, *H. coppenamensis*, and *H. sipaliwini* by having the dorsal-fin spine hyaline or with an inconspicuous pale brown pigmentation (*vs*. with a distinct dark brown or black pigmentation appearing as a vertical bar); from *H. habrosus* by having the trunk with a lateral stripe straight and starting around middle of dorsal-fin base (*vs*. lateral stripe wavy and starting on cleithrum), from *H. nattereri* by having the head with irregular blotches and the ventro-lateral plates with irregular spots aligned as an oblique stripe from dorsal portion of first plate to the middle portion of plate around anal-fin insertion (*vs*. blotches on head and oblique stripe on body absent, several very small black chromatophores uniformly distributed on head and on dorsal portion of ventro-lateral plates).

Description. Morphometric and meristic data in Table 2. Body elongated, compressed, largest width at pectoral girdle, largest height at posterior margin of nuchal plate. Dorsal profile of body convex from snout tip to posterior margin of mesethmoid, straight from parietal to nuchal plate, slightly concave from dorsal-fin origin to adipose-fin origin, markedly concave from adipose-fin base to caudal-fin base. Ventral profile of body convex from snout tip to anal-fin base, slightly concave from anal-fin base to caudal-fin base.

Head compressed, roughly triangular in dorsal view, snout rounded. Mouth inferior; lower lip laminar entirely bordering mouth, deeply notched medially; mesial mental barbel conical, very short; lateral mental barbel short, slightly shorter than maxillary barbel; maxillary barbel short, reaching around branchial gills opening; small rounded papillae on lower lip and barbels. Eye small, rounded, dorso-laterally placed, interorbital space wide. Mesethmoid short, roughly pentagonal; anterior tip long, lateral cornua extremely small, posterior portion externally exposed, posterior margin wide, postero-lateral process long. Lateral ethmoid scarcely developed anterior to nasal capsule; nasal capsule dorso-laterally located near eye orbit, internareal space wide. Parietal width intermediate, slightly smaller than half bone length; fontanel small, anterior opening closed, posterior opening slightly entering postparieto-supraoccipital. Posterior process of postparieto-supraoccipital long, almost equals its width at base; posterior tip slightly concave, covered by nuchal plate anterior margin. Sphenotic compact, slightly longer than wide, ventral margin nearly straight, orbital cavity notch little developed. Infraorbital bones externally exposed, with minute, sparsed odontodes; anterior expansion of infraorbital bone 1 large, slightly smaller than half length remaining portion of bone, little developed ventrally; infraorbital bone 2 little expanded posteriorly, contacting sphenotic, dorsal keel for sphenotic articulation present. Postero-dorsal ridge of hyomandibula around opercle articulation condile elongated, externally exposed; dorsal ridge of hyomandibula oval between compound pterotic and opercle, covered by thick layer of skin. Interopercle triangular, little expanded anteriorly, covered by thick layer of skin. Opercle dorso-ventrally elongated, slender, greatest width about half its length, posterior margin strongly concave.

Dermal plates entirely covering lateral sides of body, with minute sparsed odontodes, one odontode row distinctly aligned on posterior plate margin. Eight platelets covering base of caudal-fin rays, four dorsally, four ventrally. Three dorsal and two to three ventral platelets at middorsal and midventral lines before the caudal fin. Dorsal-fin rays II,8(19), anterior spinelet small, second spine large, strong, pungent, locking mechanism functional; ossified portion of second dorsal spine slightly shorter than adjacent branched rays, adpressed distal tip slightly surpassing base of last branched dorsal-fin ray; very small denticulations oriented distally on posterior margin. First two branched rays slightly longer than ossified portion of dorsal spine, exceeding portion about one-fourth ossified portion (see sexual dimorphism). Pectoral-fin rays I,7(7) or I,8(12), spine strong, pungent, locking mechanism functional; ossified portion of adpressed spine slightly surpasses pelvic-fin insertion; small denticulations oriented distally on inner margin, some denticulations bifid. Spurious rays and first branched ray almost reaching middle of pelvic fin (see sexual dimorphism). Antero-ventral margin of cleithrum externally exposed; scapulocoracoid medial expansion little developed, postero-lateral portion externally exposed. Arrector fossa oval, small, about one-third ventral surface of girdle. Pelvic-fin rays i,5(19). Anal-fin rays i,5(1), i,6(11), ii,4(2), ii,5(4) or ii,6(1), below or slightly posterior to adipose-fin insertion. Caudal-fin rays i,12,i(16) or i,13,i(1), bilobed; four(2) upper and three(2) lower procurrent rays. Free vertebrae 21(1). Ribs 6(1); first pair conspicuously longer, robust, strongly articulated to first free vertebrae, distal tip connected to basipterygia lateral arm; remaining elements shorter, weak, articulated to free vertebrae by connective tissue.

TABLE 2

Supraorbital branch reaching nasal capsule; nasal slender, laminar, tips curved laterally, inner margin articulated to frontal and mesethmoid, two(1) or three(1) sensory pores, first on anterior tip, second (if present) near posterior tip, third on posterior tip. Epiphysial branch short, pore opening near main canal coalesced on parietal. Infraorbital branch near midline of sphenotic, three infraorbital tubules, two tubules coalesced on infraorbital bone 1. Compound pterotic with preopercular branch short, pore opening near main canal, distant from anterior margin of bone; pore 3 opened on posterior tip of preopercle. Pterotic branch long, reaching ventral margin of bone. Trunk lateral-line reduced; two(1) or three(1) latero-sensory tubules on trunk; first ossicle tubular; second ossicle laminar, ventral expansion larger than dorsal expansion, about three times its size; third tubule coalesced with third dorso-lateral plate.

Four branchiostegal rays, size decreasing posteriorly; first two outer rays longer, distal tips connected to branchiostegal cartilage; last two inner rays shorter, fourth ray about half length first ray. Parurohyal compact, length almost equals its width. Five ceratobranchials, size increasing posteriorly; ceratobranchial 1 process small on antero-proximal portion; postero-dorsal surface of ceratobranchial 5 toothed, 36(1) teeth aligned in one row. Four epibranchials; epibranchial 2 longest, epibranchial 4 widest; process of epibranchial 2 small and pointed placed on its postero-proximal laminar expansion; process of epibranchial 3 triangular and oriented dorsally placed on its postero-proximal laminar expansion. Two wide pharyngobranchials; posterior margin of pharingobranchial 3 laminar, largely developed. Upper tooth plate oval; 40(1) teeth aligned in two rows on postero-ventral surface, 12(1) teeth on anterior row, 28(1) teeth on posterior row.

Coloration in alcohol. Ground coloration of head pale brown dorsally, pale brown or yellow laterally, yellow ventrally. Head and mouth barbels spotted, several dark brown spots scattered on lateral of head, spots aligned on posterior margin of opercle; dorsum and lateral of head blotched, dark brown spots grouped as irregular blotches or dark brown continuous vermicular marks scattered, denser concentration on dorsum and antero-lateral portion. Ground color of trunk pale brown dorsally, yellow laterally, light yellow or white on head ventral region and abdomen. Nuchal plate and dorso-lateral plates below nuchal plate, dorsal spine, first and second branched dorsal rays dark brown. Distinct dark brown stripe on midline of body, beginning at vertical line just posterior to dorsal fin insertion and ending at caudal peduncle. Lateral region of body blotched; several dark brown irregular spots concentrated on dorso-lateral plates; dark brown irregular spots aligned as oblique stripe on ventro-lateral plates, beginning at dorsal portion of first plate and ending at middle of plate near anal-fin insertion. All fins hyaline with scattered pale brown dots concentrated on rays or several transversal bands on dorsal and caudal fins.

Sexual dimorphism. Same as *Hoplisoma nattereri*, see above.

Distribution. Coastal rivers from eastern Brazil in the State of Espírito Santo and the southern portion of the State of Bahia. The following river basins are included: João de Tiba, Jucuruçu, Itanhém, Mucuri, Itaúnas, Barra Seca, Doce, and Santa Maria (Fig. 3).

Material examined. Type material: MZUSP 342, 33.8 mm SL (1, 33.8 mm SL), rio Doce, State of Espírito Santo, Brazil, lectotype of *Corydoras nattereri triseriatus* Ihering, 1911 designated by Britski (1969: 207). MZUSP 5343, 1 alc, 29.2 mm SL; MZUSP 5344, 1 alc, 29.9 mm SL; MZUSP 5345, 1 alc, 30.1 mm SL, (1, 30.1 mm SL); MZUSP 5346, 1 alc, 31.1 mm SL; MZUSP 5349, 1 alc, 31.0 mm SL; MZUSP 5353, 1 alc, 31.9 mm SL; all paralectotypes, same data as lectotype. Non-type material: **Brazil:** State of Bahia: MCP 18041, 13 alc, 25.7-33.8 mm SL (3, 30.8-34.3 mm SL), 2 c&s, 25.1-31.7 mm SL, Itamaraju, rio Jucuruçu. MCP 36696, 2 alc, 33.3-35.8 mm SL, Eunápolis, córrego afluente do rio João de Tiba. MCP 36720, 23 alc, 16.2-26.2 mm SL (plus 3 *Scleromystax prionotos*), Alcobaça (Teixeira Freitas is the correct county), córrego afluente do rio Itanhaém. MNRJ 22365, 1 alc, 35.5 mm SL (1, 35.5 mm SL), Mucuri, rio Mucuri. MZUSP 39089, 20 of 58 alc, 25.8-38.2 mm SL, Eunápolis, rio Santa Cruz. MZUSP 51796, 13 alc, 23.1-34.4 mm SL, Argolo, rio Mucuri. USNM 279269, 10 alc, 27.7-37.3 mm SL (4, 33.0-36.9 mm SL), Eunápolis, rio Santa Cruz. USNM 302324, 9 alc, 21.8-35.1 mm SL, (plus 1 *Scleromystax prionotos*), Itamaraju, rio Jucuruçu. State of Espírito Santo: MBML 1204, 7 alc, 31.9-37.1 mm SL, Montanha, rio do Sul. MBML 2994, 10 of 19 alc, 31.1-43.7 mm SL, Cariacica, córrego São Miguel. MBML 3015, 10 of 21 alc, 22.3-42.0 mm SL, Linhares, rio Riacho. MCP 13483, 4 alc, 40.4-44.7 mm SL (3, 40.4-44.7 mm SL), Colatina, rio Santa Maria. MCP 36772, 4 alc, 21.1-29.2 mm SL (1), Pinheiros, córrego Palmares. MNRJ 5364, 17 alc, 18.1-36.3 mm SL, Linhares, rio Barra Seca. MNRJ 22376, 6 alc, 31.4-39.9 mm SL, Santa Tereza, rio Santa Maria. MNRJ 37693, 5 of 12 alc, 31.7-42.3 mm SL (1, 40.5 mm SL), Pinheiros, rio do Sul. MNRJ 40120, 1 alc, 25.7 mm SL (plus 1 *Scleromystax prionotos*), 3 tis, 20.2-26.1 mm SL, Sooretama, rio Barra Seca.

Discussion

Literature is contradictory regarding the valid type designation for *Corydoras juquiaae* Ihering, 1907. This species was originally described by Ihering (1907) based in several specimens from the rio Juquiá, State of São Paulo, Brazil.

However, no type designation was made in the publication. *Corydoras juquiaae* was described as having a dusky lateral band on body which is darker posteriorly, an elongated snout, postparieto-supraoccipital wide and short, and the scapulocoracoid little developed on the abdomen. The first synonym proposition was done by Regan (1912), who regarded *C. juquiaae* as a junior synonym of *C. nattereri* based in the examination of four specimens, two from Rio de Janeiro and two from the rio Juquiá (reported as cotypes of *juquiaae*). Ellis (1913) revised the species of Callichthyidae known by that date and recognized *C. juquiaae* as a valid species of *Corydoras*. She was the first author that listed in a formal publication a syntype of *C. juquiaae* as a type, thus accidentally designating it as lectotype (reported as IUM 10996, stored at CAS as IUM 10796 and now catalogued as CAS 16016). Gosline (1940) followed Regan's work and recognized *C. juquiaae* as junior synonym of *C. nattereri*. However, Britski (1969) questioned the identity of the specimen listed by Ellis as being part of the type series of Ihering considering that no document supports the transference of specimens from MZUSP to CAS. Based in this situation, he designated DZSASP 1984 (now catalogued as MZUSP 1984) as the lectotype of *Corydoras juquiaae*. This author spelled the taxon name as *C. juquiae*. Nijssen & Isbrücker (1980a) perceived that museum jars of *Hoplisoma nattereri* are usually mixed with specimens of a distinct form characterized by having a blunt snout and a serrated pectoral spine. These authors revised the identity of *Hoplisoma nattereri* and described the blunt snouted species as new taxa named *Scleromystax prionotos*. They also reported that the holotype of *Corydoras nattereri* was lost from the Vienna Museum and designated MCZ 8229 as the neotype of this species. These authors recognized Britski's lectotype designation as valid and proposed *C. juquiaae* as junior synonyms of *C. nattereri*. Subsequent revisions and catalogues followed this interpretation (Nijssen & Isbrücker, 1980b; Isbrücker, 2001). The catalogues of Reis (2003), Ferraris (2007), and Eschmeyer (2013) also agree in placing Ihering taxon under synonymy of *Hoplisoma nattereri*; however, they consider the Ellis procedure as a valid lectotype designation.

As exposed above, the original publication of Ihering (1907) did not report a holotype for *Corydoras juquiaae*. By that date, explicit type designation was not usual in ichthyology. However, it is possible that he had recognized one specimen as the type (=holotype), since he photographed one specimen for a later paper never published (Fig. 5). In the presentation of his 1907 paper, Rudolph von Ihering stated that preliminary notes are published to quickly divulge diagnoses of the new species discovered and that full descriptions and illustrations will be presented in a larger revision to be published in the Volume VII of the “Revista do Museu Paulista”. That paper, however, was never published. Ihering also mentioned that some specimens of several species were sent for examination to Carl H. Eigenmann (Indiana University), who provided a large portion of the diagnoses. In addition, he also mentioned that cotypes were shown to C. Tate Regan (British Museum of Natural History). However, we are required to base our conclusions on what was published. In this case, Ellis procedure is documented and this should be interpreted as a valid type designation, despite of being intentional or not, and we need to base our later nomenclatural conclusions on the basis of this designation (Carl Ferraris, pers. comm.). Taking this in consideration, Ellis lectotype designation is valid and because it is anterior to Britski´s designation the latter is considered invalid. This interpretation was also conceived in Reis (2003), Ferraris (2007), and Eschmeyer (2013). The specimen analyzed by Eigenmann and Ellis is currently stored at CAS 16016 and is labeled as lectotype. This specimen was analyzed during a visit to the CAS and was corroborated as a *Scleromystax* species based on its snout elongated and acuminated, postparieto-supraoccipital process short, and pectoral spine with strong serrations oriented proximally. In fact, this specimen was listed as a paratype of *Scleromystax prionotos* by Nijssen & Isbrücker (1980a). Taking this in consideration, *Corydoras juquiaae* Ihering, 1907 is removed from the synonymy of *Hoplisoma nattereri* Steindachner, 1907. Considering that this name is a valid available name for the Corydoradinae, *Corydoras prionotos* Nijssen & Isbrücker, 1980 is transferred as a junior synonym of *Scleromystax juquiaae* (Ihering, 1907), **NEW COMBINATION**. I was able to discuss this situation with Heraldo A. Britski and José L. de Figueiredo during my visit to the MZUSP. They showed me some of the printed plates of the unpublished Volume VIII of the “Revista do Museu Paulista”, where *Corydoras juquiaae* Ihering, 1907 was to be finally illustrated. I take this opportunity to reproduce the figure of Ihering specimen (Fig. 5). In addition, photographs of the specimen stored at CAS, lectotype of *Corydoras juquiaae*, is also shown on Fig. 6. This clearly shows that Ihering described a species totally different from *Hoplisoma nattereri*. However, its identity was obscured by the fact that it was never illustrated and that the type series was composed of mixed specimens, only two larger specimens of *Scleromystax* (now stored at CAS and NWM, which are also paratypes of *S. prionotos*) and eight smaller specimens of *Hoplisoma nattereri* (which are now stored at MZUSP and BMNH).

FIGURE 5

FIGURE 6

Ihering (1911) described *Corydoras nattereri triseriatus* based in several specimens from the rio Doce, State of Espírito Santo, Brazil. This subspecies was characterized as having a variegate coloration pattern which consists of a lateral stripe, vermiculations on head and dorso-lateral plates, an elongated mark on posterior portion of the ventro-lateral plates, and transversal bands on dorsal and caudal fins. Regan (1912) considered this taxon as a possible junior synonym of *Corydoras paleatus* (Jenyns, 1842), and Ellis (1913) was the first author that proposed this taxon as a valid species. However, Nijssen & Isbrücker (1980a, 1980b), Reis (2003), Ferraris (2007), and Eschmeyer (2013) considered as a junior synonym of *Hoplisoma nattereri*. This taxon is considered here as a valid species diagnosed by its variegated coloration pattern. Additional characters that distinguish this species from *H. nattereri* are: ceratobranchial 5 with 36 teeth aligned on its postero-dorsal margin (*vs*. 47-55 teeth); upper tooth plate with 40 teeth aligned in two rows on its postero-ventral surface (*vs*. 51-59 teeth); hyomandibular postero-dorsal ridge wide, its width about half its length (*vs*. narrow, its width evidently smaller than half length); epibranchial 3 with a triangular laminar expansion on its posterior margin (*vs*. laminar expansion uncinate); vertebrae with neural and haemal spines smooth (*vs*. with laminar expansions restricted to the proximal portion of spine); arrector fossa opened (*vs*. partially closed by expansions of cleithrum and scapulocoracoid); and basipterygium lateral process with a small posterior expansion (*vs*. large posterior expansion).

According to the phylogenetic hypothesis of Vera-Alcaraz (Chapter I, this volume), *Hoplisoma nattereri* and *H. triseriatus* were recovered in a clade together with *H. paleatus* and other species having male specimens with distinct sexual dimorphism in the dorsal and pectoral fins, which are characterized by small to very large elongations of their anteriormost rays. The phylogenetic relationships of this clade are described as follows (Chapter I, figs. 20-21, clade 172): (*H. flaveolus* (*Hoplisoma* spA + (*Hoplisoma* spB (*H. cochui* + *H. tukano*)) + (*H. diphyes* (*H. paleatus* (*H. nattereri* Paraíba do Sul / Macaé / São João / Guanabara / Tietê (*H. nattereri* Ribeira do Iguape / Paranaguá (*H. longipinnis* (*H. ehrhardti* + *H. ehrhardti* LBP + *H. triseriatus*)))))))). According to this cladogram, *H. nattereri* was recovered as paraphyletic; with the population from Ribeira do Iguape and Paranaguá more related to a clade containing *H. longipinnis*, *H. ehrhardti*, and *H, triseriatus*; at the same time this clade is the sister group of the *H. nattereri* sampled from the rio Tietê and the coastal rivers of the states of Espírito Santo and Rio de Janeiro. However, no diagnostic characters were found to distinguish the southernmost population from the eastern population. Principal Component Analysis of the morphometric data is shown on Fig. 7, which suggests homogeneous morphology between the populations of *H. nattereri* sampled from coastal rivers (ES and RJ) and Tietê (dark green) and those sampled from Ribeira do Iguape and Paranaguá (pale green). Moreover, a broadly overlapping pattern can be also observed between *H. nattereri* (green) and *H. triseriatus* (red). The first component has 73.1% of variance and the eigenvectors are all positive, the second and third components are 8.9% and 3.7%, respectively. The loading variables that contributed most heavily for these axes are highlighted in bold in Table 3. The *Hoplisoma nattereri* populations are compared by uncorrected pairwise distances of their genes *12s RNA* and *16s RNA*, percentages of the genetic distances are shown on Tables 3 and 4, respectively. Genetic distance between the RJ coastal rivers and the Tietê samples range from 0.00% to 0.78% for the *12s RNA* and 0.00% to 0.53% for the *16s RNA*, and between these samples and the Ribeira do Iguape and Paranaguá samples range from 0.58% to 3.74% for the *12s RNA* and 0.84% to 3.56% for the *16s RNA*. Higher values are found only when comparing one sample from the Baía de Paranaguá with remaining samples. Excepting that sample, genetic distances are considered low between remaining samples to judge them as different species. However, denser samples from the southernmost populations are needed in order to corroborate these findings.

FIGURE 7

TABLE 3

TABLE 4

TABLE 5

Comparative material. Same as Vera-Alcaraz (Chapter I, this volume). The following material was also analyzed: *Scleromystax juquiaae*: CAS 16016 (ex IUM 10796), 50.0 mm SL, lectotype of *Corydoras juquiaae* designated by Ellis (1913: 403), rio Juquiá, Poço Grande, State of São Paulo, Brazil. MNRJ 10537, 51.3 mm SL, holotype of *Scleromystax prionotos*, Lagoa Juparanã, rio Doce system, Linhares, State of Espírito Santo, Brazil.

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Figures

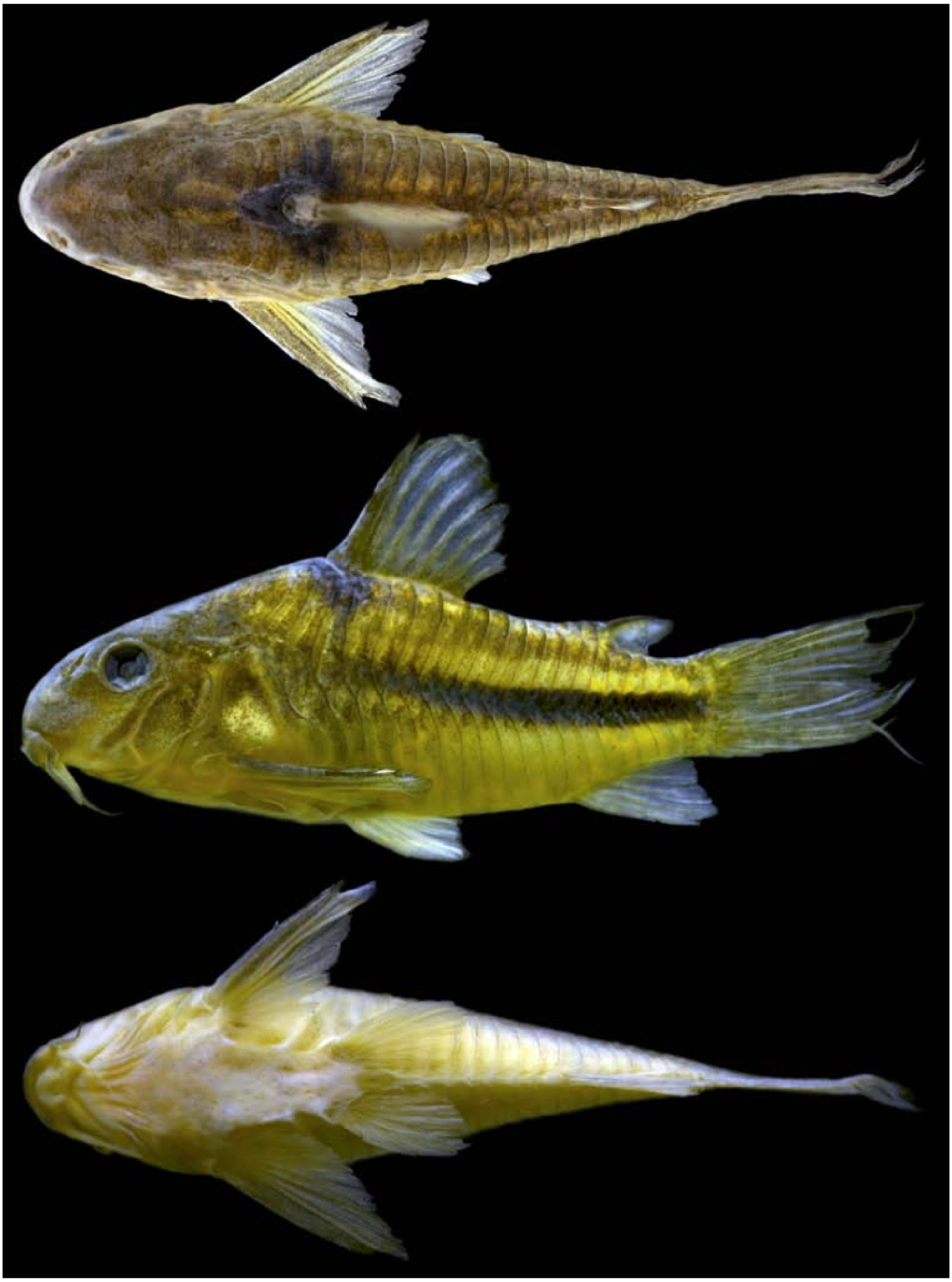

Fig. 1. Dorsal, lateral, and ventral views of *Hoplisoma nattereri*, MNRJ 37493, 42.4 mm SL, female specimen, Brazil, State of Rio de Janeiro, Casimiro de Abreu, córrego Aldeia Velha.

Fig. 2. Dorsal, lateral, and ventral views of *Hoplisoma nattereri*, MNRJ 37493, 36.8 mm SL, male specimen, Brazil, State of Rio de Janeiro, Casimiro de Abreu, córrego Aldeia Velha.

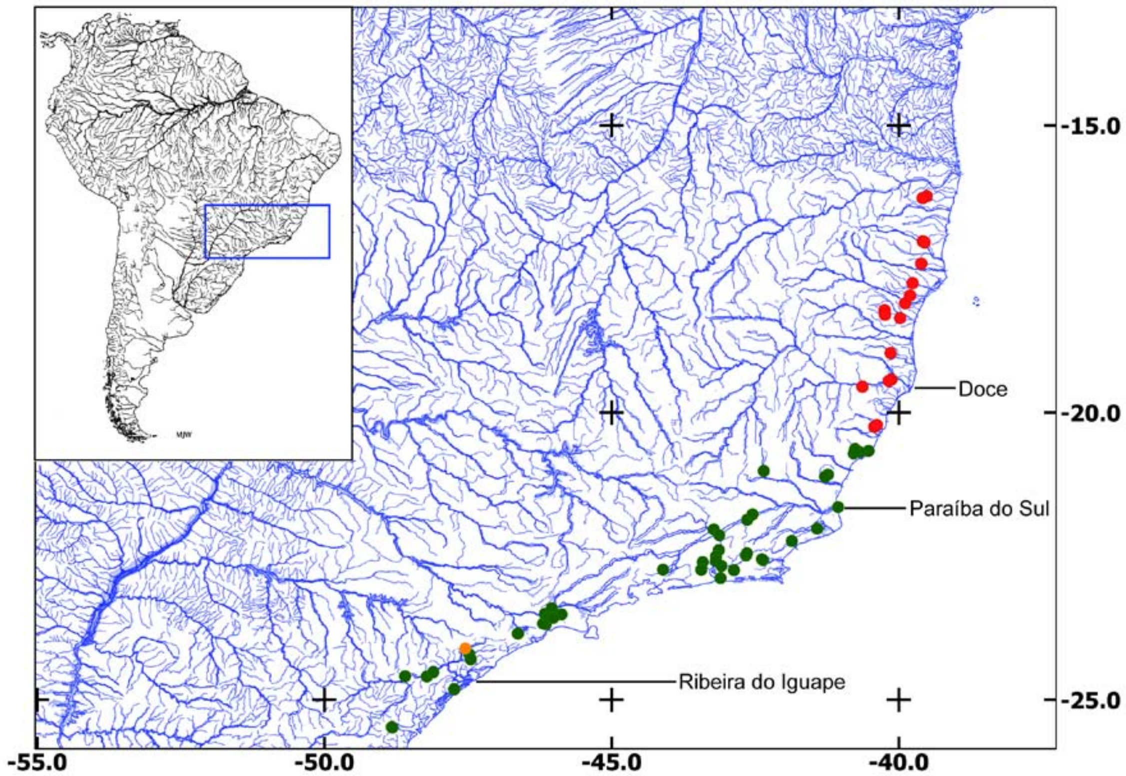

Fig. 3. Geographic distribution of *Hoplisoma nattereri* (green circles), its type locality is the rio Paraíba do Sul, State of Rio de Janeiro, Brazil, and *H. triseriatus* (red circles), its type locality is the rio Doce, State of Espíritu Santo, Brazil. The orange circle shows the approximate type locality of *Scleromystax juquiaae*, rio Juquiá, State of São Paulo, Brazil.

Fig. 4. Dorsal, lateral, and ventral views of *Hoplisoma triseriatus*, MNRJ 37693, 40.7 mm SL, female specimen, Brazil, State of Espírito Santo, Pinheiros, rio do Sul.

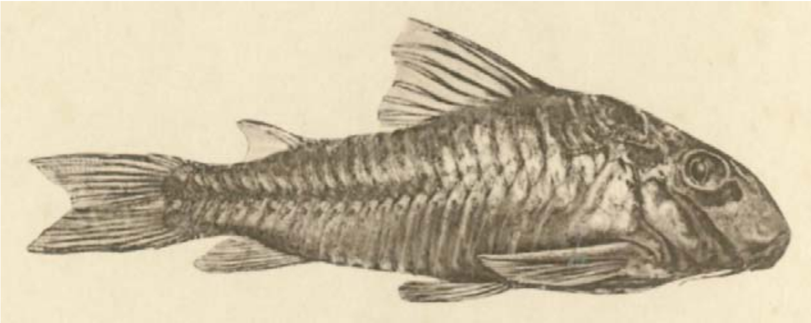

Fig. 5. Illustration the syntype of *Corydoras juquiaae* prepared by Ihering but never published. This figure was intended to appear in the "Revista do Museu Paulista" Vol. VII (printed plates reads Est. VI, Peixes Nematognathas do Brazil, Revista do Museu Paulista. Vol. VIII).

Fig. 6. Dorsal, lateral, and ventral views of the lectotype of *Scleromystax juquiaae*, CAS 16016, 50.0 mm SL, female specimen, Brazil, State of São Paulo, rio Juquiá. Photo credit: California Academy of Sciences Ichthyology Section.

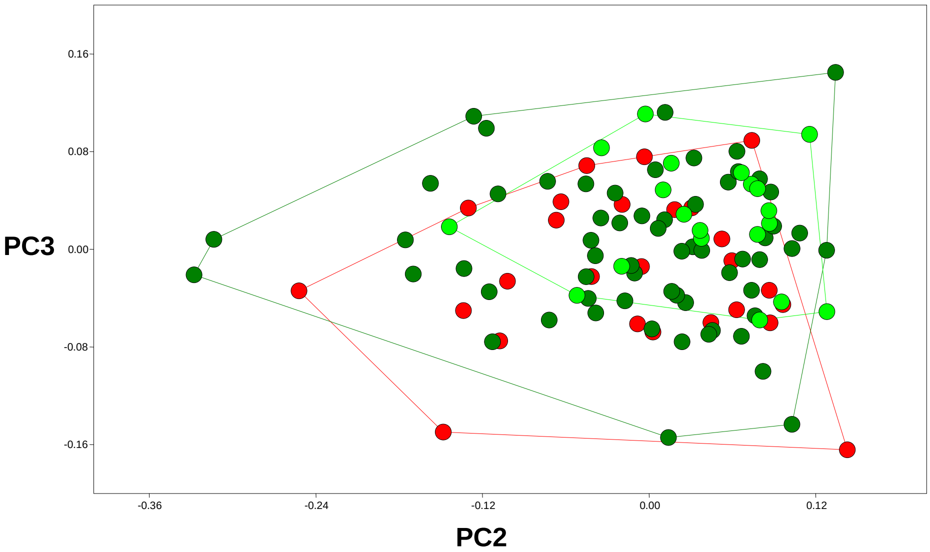

Fig. 7. Plots of scores obtained by Principal Components Analysis. Dark green circles = *Hoplisoma nattereri* sampled from the coastal rivers from the states of Espíritu Santo and Rio de Janeiro. Pale green circles = *Hoplisoma nattereri* sampled from the rio Ribeira do Iguape and Baía de Paranaguá. Red circles = *Hoplisoma triseriatus* sampled from the coastal rivers from the states of Bahia and Espíritu Santo.

Table 1. Morphometric and meristic data of *Hoplisoma nattereri*. n = number of specimens, SD = standard deviation.

	Coastal rivers from the states of Espíritu Santo and Rio de Janeiro					Tietê					Ribeira do Iguape and Baía de Paranaguá				
	n	**Minimum**	**Maximum**	**Mean**	**SD**	**n**	**Minimum**	**Maximum**	**Mean**	**SD**	**n**	**Minimum**	**Maximum**	**Mean**	**SD**
Standard length	47	31.4	58.6	40.2	5.6	15	31.1	48.0	37.8	4.4	23	29.8	53.7	40.1	6.5
Percents of Standard length															
Predorsal distance	47	39.0	52.2	49.2	2.3	15	40.6	51.6	48.1	2.8	23	42.3	50.4	47.8	2.0
Preadipose distance	47	79.9	88.4	83.9	1.8	15	75.3	84.5	82.8	2.3	23	80.5	84.3	82.7	1.0
Prepectoral distance	47	27.3	35.6	30.3	1.5	15	28.7	31.4	30.2	0.7	23	27.4	32.1	29.9	1.3
Prepelvic distance	47	45.6	52.9	48.6	1.7	15	47.6	50.9	48.8	0.9	23	45.1	48.7	47.3	1.1
Preanal distance	47	78.1	83.4	80.4	1.3	15	73.9	81.5	78.7	1.9	23	76.2	83.6	79.6	1.5
Length of dorsal-fin base	47	18.2	24.7	20.9	1.4	15	18.5	22.0	20.4	1.1	23	17.7	21.6	20.3	1.0
Dorsal to adipose distance	47	16.6	25.2	20.9	1.9	15	18.2	24.5	21.7	1.7	23	18.1	23.9	21.2	1.4
Head depth	47	29.9	38.0	34.6	1.7	15	32.5	37.2	34.3	1.5	23	29.9	42.2	33.1	2.2
Depth of body	47	31.8	40.4	36.6	1.7	15	34.0	38.9	36.3	1.4	23	31.0	36.6	34.5	1.4
Depth of caudal peduncle	47	11.5	15.8	13.7	0.9	15	12.6	15.3	14.0	0.8	23	11.9	14.4	13.0	0.6
Maximum cleithral width	47	25.9	31.9	28.2	1.3	15	27.3	31.7	28.9	1.2	23	24.7	29.4	26.9	1.1
Length of dorsal-fin spine	47	17.7	28.8	23.2	2.4	15	20.0	26.1	23.1	1.8	23	20.4	27.4	23.6	1.9
Length of adipose-fin spine	47	5.5	11.7	8.5	1.1	15	7.6	11.0	9.1	1.1	23	6.5	11.2	8.8	1.2
Length of pectoral-fin spine	47	21.6	28.9	25.5	1.8	15	21.7	29.9	26.3	2.1	23	23.5	31.0	26.6	2.1
Head length	47	37.6	45.6	42.1	2.3	15	39.4	44.7	41.7	1.5	23	38.1	45.0	41.8	1.6
Length of maxillary barbell	47	7.1	20.3	13.9	2.8	15	11.3	19.9	15.9	2.5	23	10.1	19.2	15.6	2.1
Percents of Head length															
Snout length	47	31.0	38.8	34.9	1.7	15	32.4	38.4	35.7	2.0	23	32.4	37.1	35.1	1.3
Least interorbital distance	47	28.7	39.2	35.3	2.2	15	32.1	37.7	35.2	1.6	23	30.7	36.5	32.9	1.5
Least internareal distance	47	15.5	23.4	19.7	1.8	15	15.5	19.0	17.7	1.1	23	17.0	21.8	19.0	1.3
Horizontal orbit diameter	47	13.3	22.4	17.1	1.7	15	15.2	20.6	17.3	1.5	23	15.1	22.4	19.6	1.6
Counts															
Trunk latero-sensory canals	47	1	3	1.6	0.6	15	1	2	1.1	0.4	23	1	2	1.6	0.5
Dorso-lateral body plates	47	22	24	23.0	0.4	15	23	25	23.9	0.5	23	23	25	23.8	0.6
Ventro-lateral body plates	47	19	21	20.3	0.6	15	20	23	21.3	0.7	23	20	22	21.0	0.6
Plates along dorsal-fin base	47	5	7	6.2	0.5	15	5	7	6.1	0.6	23	6	7	6.9	0.3
Plates last dorsal ray-adipose fin	47	7	9	8.3	0.7	15	7	9	8.0	0.8	23	7	9	8.5	0.6
Plates adipose-caudal fins	47	7	9	8.0	0.4	15	8	9	8.6	0.5	23	6	10	8.2	0.8
Preadipose platelets	47	2	4	3.0	0.7	15	2	4	3.1	0.6	23	2	4	3.2	0.5

Table 2. Morphometric and meristic data of *Hoplisoma triseriatus*. n = number of specimens, SD = standard deviation.

	n	Minimum	Maximum	Mean	SD
Standard length	26	29.2	44.7	35.5	4.1
Percents of Standard length					
Predorsal distance	26	40.3	81.6	48.3	7.3
Preadipose distance	26	40.0	85.4	81.6	8.6
Prepectoral distance	26	27.6	46.4	30.4	3.5
Prepelvic distance	26	46.0	52.3	48.3	1.4
Preanal distance	26	77.7	82.5	80.2	1.2
Length of dorsal-fin base	26	19.4	23.5	20.7	0.9
Dorsal to adipose distance	26	18.4	24.1	20.7	1.7
Head depth	26	30.1	49.4	33.2	3.6
Depth of body	26	31.2	37.2	34.4	1.5
Depth of caudal peduncle	26	12.2	15.2	14.0	0.7
Maximum cleithral width	26	25.9	30.6	27.7	1.3
Length of dorsal-fin spine	26	19.5	26.4	22.6	1.8
Length of adipose-fin spine	26	5.5	11.0	8.6	1.3
Length of pectoral-fin spine	26	21.5	30.1	26.3	2.3
Head length	26	36.3	44.6	41.2	1.9
Length of maxillary barbel	26	8.0	19.2	14.2	2.9
Percents of Head length					
Snout length	26	31.7	38.7	35.4	1.9
Least interorbital distance	26	27.2	39.4	32.8	2.8
Least internareal distance	26	16.2	24.8	19.8	2.1
Horizontal orbit diameter	26	16.6	21.2	18.8	1.3
Counts					
Trunk latero-sensory canals	26	1	3	2	0.6
Dorso-lateral body plates	26	23	25	23	0.6
Ventro-lateral body plates	26	20	22	21	0.6
Plates along dorsal-fin base	26	6	7	7	0.5
Plates last dorsal ray-adipose fin	26	7	9	8	0.5
Plates adipose-caudal fins	26	7	9	8	0.5
Preadipose platelets	26	2	5	3	0.8

Table 3. Variable loadings for the Principal Component Analysis, the modular higher eigenvectors of Principal Component axes 2 and 3 are shown in bold.

	Axis 1	Axis 2	Axis 3
Standard length	0.2	0.0	-0.1
Predorsal distance	0.2	0.0	0.0
Preadipose distance	0.2	0.0	-0.1
Prepectoral distance	0.2	0.0	-0.1
Prepelvic distance	0.2	0.0	-0.1
Preanal distance	0.2	0.0	-0.1
Length of dorsal-fin base	0.2	**-0.1**	0.0
Dorsal to adipose distance	0.3	0.0	**-0.5**
Depth of body	0.3	0.0	0.0
Depth of caudal peduncle	0.2	0.0	0.0
Maximum cleithral width	0.3	0.0	-0.1
Length of dorsal-fin spine	0.2	**-0.1**	**0.2**
Length of adipose-fin spine	0.2	**-0.1**	**0.8**
Length of pectoral-fin spine	0.2	**-0.1**	**0.2**
Head length	0.2	0.0	0.0
Snout length	0.2	**-0.1**	0.1
Length of maxillary barbel	0.2	1.0	0.1
Head depth	0.3	**-0.1**	0.0
Least interorbital distance	0.2	0.0	0.1
Least internareal distance	0.2	**-0.1**	0.1

Table 4. Percentage of genetic distance for the *12s RNA* among samples of *Hoplisoma nattereri*.

	Samples	1	2	3	4	5	6	7	8	9	10	11
1	Paraíba do Sul	x	0.52	0.52	0.26	0.26	0.00	0.26	0.26	0.93	1.15	3.43
2	Macaé	0.52	x	0.52	0.26	0.78	0.52	0.78	0.78	1.25	1.15	3.12
3	São João 1	0.52	0.52	x	0.26	0.78	0.52	0.78	0.78	0.93	0.58	2.80
4	São João 2	0.26	0.26	0.26	x	0.52	0.26	0.52	0.52	1.25	0.86	3.12
5	Guanabara	0.26	0.78	0.78	0.52	x	0.26	0.00	0.00	1.25	1.44	3.74
6	Guanabara HV11-75	0.00	0.52	0.52	0.26	0.26	x	0.26	0.26	0.93	1.15	3.43
7	Tietê	0.26	0.78	0.78	0.52	0.00	0.26	x	0.00	1.25	1.44	3.74
8	Tietê HV11-76	0.26	0.78	0.78	0.52	0.00	0.26	0.00	x	1.25	1.44	3.74
9	Ribeira do Iguape	0.93	1.25	0.93	1.25	1.25	0.93	1.25	1.25	x	0.32	2.49
10	Paranaguá 1	1.15	1.15	0.58	0.86	1.44	1.15	1.44	1.44	0.32	x	2.18
11	Paranaguá 2	3.43	3.12	2.80	3.12	3.74	3.43	3.74	3.74	2.49	2.18	x

Table 5. Percentage of genetic distance for the *16s RNA* among samples of *Hoplisoma nattereri*.

	Samples	1	2	3	4	5	6	7	8	9	10	11
1	Paraíba do Sul	X	0.53	0.35	0.35	0.00	0.00	0.00	0.00	1.46	1.65	3.56
2	Macaé	0.53	X	0.18	0.18	0.53	0.53	0.53	0.53	0.84	1.03	3.35
3	São João 1	0.35	0.18	X	0.00	0.35	0.35	0.35	0.35	1.05	1.24	3.56
4	São João 2	0.35	0.18	0.00	X	0.35	0.35	0.35	0.35	1.05	1.24	3.56
5	Guanabara	0.00	0.53	0.35	0.35	X	0.00	0.00	0.00	1.46	1.65	3.56
6	Guanabara HV11-75	0.00	0.53	0.35	0.35	0.00	X	0.00	0.00	1.46	1.65	3.56
7	Tietê	0.00	0.53	0.35	0.35	0.00	0.00	X	0.00	1.46	1.65	3.56
8	Tietê HV11-76	0.00	0.53	0.35	0.35	0.00	0.00	0.00	X	1.46	1.65	3.56
9	Ribeira do Iguape	1.46	0.84	1.05	1.05	1.46	1.46	1.46	1.46	X	1.08	3.34
10	Paranaguá 1	1.65	1.03	1.24	1.24	1.65	1.65	1.65	1.65	1.08	X	3.25
11	Paranaguá 2	3.56	3.35	3.56	3.56	3.56	3.56	3.56	3.56	3.34	3.25	X

CONCLUSÕES GERAIS

Este trabalho contribui ao conhecimento da sistemática da família Callichthyidae porque explica num contexto filogenético a evidência morfológica, comportamental, e molecular de um total de 111 espécies de cascudos. Além disso, 95 novos caracteres fenotípicos são aqui propostos. Também, foram geradas sequências de DNA para um 62% dos terminais analisados, os quais estarão disponíveis no GenBank em breve.

A sistemática da família Callichthyidae foi estudada mediante uma análise filogenética usando a metodologia Cladística sob uma abordagem de Evidência Total. Esta análise de Evidência Total corroborou o monofiletismo da família Callichthyidae, subfamílias Callichthyinae e Corydoradinae, e todos os gêneros reconhecidos atualmente como válidos exceto *Aspidoras*, *Corydoras*, e *Hoplosternum*. Para conciliar esta situação, mudanças taxonômicas são aqui propostas os quais incluem a revalidação de *Hoplisoma* e *Gastrodermus*, e a transferência das espécies *Aspidoras virgulatus* e *Corydoras lacerdai* para o gênero *Scleromystax*. Não obstante, não são propostas mudanças taxonômicas para as espécies de *Hoplosternum*. Foi decidido esperar e incluir numa nova análise dados moleculares faltantes para as espécies deste gênero antes de tomar uma decisão final, por enquanto, este táxon e referido temporariamente como "*Hoplosternum*". Uma nova classificação para a família Callicthyidae é proposta com base nos resultados desta tese, uma lista sumarizando estes resultados e incluindo as sinonímias contendo estas mudanças é fornecida na Tabela 1.

Este trabalho propõe novas hipóteses filogenéticas para a família. O gênero *Corydoras* como atualmente reconhecido é separado em três clados monofiléticos. *Hoplisoma*, o maior clado de Corydoradinae, é irmão de *Aspidoras* mais *Scleromystax*. *Gastrodermus*, um clado contendo espécies anãs e outras espécies de tamanho intermediário (ambas com espinho peitoral serrado), é irmão do agrupamento acima citado. Finalmente, *Corydoras* é restrito às espécies de tamanho maior, espinho peitoral serrado e focinho notavelmente alongado, é irmão dos restantes Corydoradinae. Dentro de Callichthyinae, dois grandes clados são recuperados e propostos com o status de tribos. Callichthyini inclui *Callichthys* como irmão de *Lepthoplosternum* mais *Megalechis*. Hoplosternini inclui "*Hoplosternum*" e *Dianema.*

Tabela 1. Gêneros componentes da família Callichthyidae segundo os resultados desta tese. Nomes sinônimos e espécies tipo também são informados.

Gênero	Sinônimos
Callichthyinae Bonaparte, 1838	
Callichthys Scopoli, 1777 (espécie tipo: *Silurus callichthys* Linnaeus, 1758)	
	Callichthys Meuschen, 1778 (espécie tipo: *Silurus callichthys* Linnaeus, 1758)
	Callichthys Linck, 1790 (espécie tipo: *Silurus callichthys* Linnaeus, 1758)
	Cataphractus Bloch, 1794 (espécie tipo: *Silurus callichthys* Linnaeus, 1758)
Dianema Cope, 1871 (espécie tipo: *Dianema longibarbis* Cope, 1872)	
	Decapogon Eigenmann & Eigenmann, 1888 (espécie tipo: *Callichthys adspersus* Steindachner, 1877)
"Hoplosternum" Gill, 1858 (espécie tipo: *Callichthys laevigatus* Valenciennes, 1836)	
	Cascadura Ellis, 1913 (espécie tipo: *Cascadura maculocephala* Ellis, 1913)
	Cataphractops Fowler, 1915 (espécie tipo: *Callichthys melampterus* Cope, 1872)
	Ellisichthys Miranda Ribeiro, 1920 (espécie tipo: *Cascadura maculocephala* Ellis, 1913)
	Diasternum Franz, 2001 (espécie tipo: *Hoplosternum punctatum* Meek & Hildebrand, 1916)
Lepthoplosternum Reis, 1997 (espécie tipo: *Callichthys pectoralis* Boulenger, 1895)	
Megalechis Reis, 1997 (espécie tipo: *Callichthys thoracatus* Valenciennes, 1840)	
Corydoradinae Hoedeman, 1952	
Aspidoras Ihering, 1907 (espécie tipo: *Aspidoras rochai* Ihering, 1907)	
Corydoras La Cépède, 1803 (espécie tipo: *Corydoras geoffroy* La Cepède, 1803)	
	Cordorinus Rafinesque, 1815 (espécie tipo: *Corydoras geoffroy* La Cepède, 1803)
Gastrodermus Cope, 1878 (espécie tipo: *Corydoras elegans* Steindachner, 1877)	
	Microcorydoras Myers, 1953 (espécie tipo: *Corydoras hastatus* Eigenmann & Eigenmann, 1888)
Hoplisoma Swainson, 1838 (espécie tipo: *Cataphractus punctatus* Bloch, 1794)	
	Brochis Cope, 1871 (espécie tipo: *Brochis coeruleus* Cope, 1872)
	Chaenothorax Cope, 1878 (espécie tipo: *Chaenothorax bicarinatus* Cope, 1878)
	Osteogaster Cope, 1894 (espécie tipo: *Corydoras eques* Steindachner, 1877)
Scleromystax Günther, 1864 (espécie tipo: *Callichthys barbatus* Quoy & Gaimard, 1824)	

A revisão taxonômica de *Hoplisoma nattereri* revelou a presencia de duas espécies validas: *H. nattereri* e *H. triseriatus*. Estas espécies são diagnosticadas, descritas, e ilustradas com base em material abrangendo toda a sua distribuição geográfica. Alem disso, dados morfométricos e moleculares das populações de *H. nattereri* são avaliadas. O nome *Corydoras juquiaae* Ihering, 1907 é removido da sinonímia de *H. nattereri* e transferido para *Scleromystax*. *Corydoras prionotos* Nijssen & Isbrücker, 1980 é considerada sinônimo júnior de *Scleromystax juquiaae* (Ihering, 1907), **nova combinação**.