TAXONOMIA DOS ANFÍBIOS DA ORDEM GYMNOPHIONA DA AMAZÔNIA BRASILEIRA

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MUSEU PARAENSE EMÍLIO GOELDI
UNIVERSIDADE FEDERAL DO PARÁ
PROGRAMA DE PÓS-GRADUAÇÃO EM ZOOLOGIA
MESTRADO EM ZOOLOGIA

Taxonomia Dos Anfíbios Da Ordem Gymnophiona Da Amazônia Brasileira

Adriano Oliveira Maciel

Dissertação apresentada ao Programa de Pós-graduação em Zoologia, Curso de Mestrado, do Museu Paraense Emílio Goeldi e Universidade Federal do Pará como requisito parcial para obtenção do grau de mestre em Zoologia.

Orientador: Marinus Steven Hoogmoed

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Com os seres vivos, parece que a natureza se exercita no artificialismo. A vida destila e filtra.

Gaston Bachelard

“De que o mel é doce é coisa que me nego a afirmar, mas que parece doce eu afirmo plenamente.”

Raul Seixas

À MINHA FAMÍLIA

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SUMÁRIO

RESUMO

São conhecidas 89 espécies de Gymnophiona para a região Neotropical sendo para a maioria dessas a taxonomia ainda mal definida. Alguns gêneros são claramente parafiléticos e em nível de espécies a falta de novas coletas e a dificuldade aí implícita, pela natureza fossorial desses anfíbios impedem o conhecimento sobre a variação nos caracteres utilizados para as definições taxonômicas.

Este trabalho foi implementado para fornecer conhecimento sobre a variação não geográfica e geográfica em caracteres morfológicos externos das espécies da Amazônia brasileira, além de atualizar as informações sobre a distribuição delas.

Foram analisados 623 espécimes provenientes de dez coleções zoológicas nacionais e duas do exterior. Foram reconhecidas 16 espécies de Gymnophiona para a Amazônia brasileira, sendo duas formas *incertae sedis*.

Caecilia marcusi Wake, 1984 é sinonimizada com *C. mertensi* Taylor, 1973 em base na análise de material recentemente coletado em diferentes localidades no Brasil, além de um dos parátipos de *C. marcusi* (ZSM 82/1982) e fotos detalhadas do holótipo de *C. mertensi*. Uma espécie nova do gênero, até então monoespecífico, *Rhinatrema* Duméril & Bibron 1841 e outra do gênero *Microcaecilia* são descritas.

É constatada baixa variação geográfica nos caracteres examinados. A análise multivariada apontou baixa variação quanto à morfometria entre as populações estudadas de *Caecilia gracilis* e *C. tentaculata*.

São apresentados alguns problemas na diagnose de espécies a partir de comentários sobre espécimes que permanecem como *incertae sedis*.

São apresentadas a distribuição das espécies em mapas e discussões sobre o seu status de conservação.

ABSTRACT

Eighty nine species of Gymnophiona are known to occur in the Neotropical region, most of them with a poorly resolved taxonomy. Some genera are clearly non-monophyletic. At the species level, the lack of museum specimens, mainly due to the difficulty of collection, do not allow for study of variation in characters usually used in taxonomic decisions.

This study was implemented to evaluate and provide knowledge on the non-geographic and geographic variation in external morphologic traits in the Gymnophiona species from Brazilian Amazonia.

A total of 623 specimens from 10 Brazilian and 2 international collections were analyzed. To this point 16 Gymnophiona species are recognized in Brazilian Amazonia, two are regarded as *incertae sedis*.

Caecilia marcusi Wake, 1984 is synonymized with *C. mertensi* Taylor, 1973 on the basis of analyzed material from several Brazilian localities, of one paratype of *C. marcusi* and from digital photographs of the holotype of *C. mertensi.* A new species of *Rhinatrema* and one of *Microcaecilia* are described. Little geographic variation was found among examined characters.

Multivariate analysis showed low variation in morphometric traits between populations of *Caecilia gracilis* and *Caecilia tentaculata.* Problems in species diagnosis are evident by the fact that for some specimens specific identification was not possible, and they were left as *incertae sedis*. The distribution and conservation status of all identified species recognized here are discussed.

1. INTRODUÇÃO

A ordem Gymnophiona inclui os anfíbios que são caracterizados principalmente por terem o corpo alongado sem membros, olhos cobertos por pele ou por camada óssea, um par de tentáculos sensoriais e um crânio bem ossificado. Todas essas características refletem o hábito fossorial predominante dentro do grupo com exceção de algumas espécies aquáticas ou parcialmente aquáticas da subfamília Typhlonectinae na América do Sul e da família Ichthyophiidae no sudeste da Ásia (Nussbaum & Wilkinson 1989; Kupfer et al. 2005).

A distribuição atual de Gymnophiona é basicamente pantropical abrangendo o México na América do norte, América Central exceto ilhas do Caribe, América do Sul, Leste equatorial e oeste da África, Índia, Ilhas Seychelles, Sudeste da Ásia e região Indo-Malasia (Hedges et al., 1993; Duellman & Trueb, 1994; Zug et al 2001). De acordo com registros fósseis a ordem Gymnophiona possuía uma distribuição ainda na Pangéia pelo fim do Triássico, sendo apenas dois gêneros viventes, *Dermophis* e *Gymnopis*, remanescentes de um ancestral da Laurásia. Todas as outras cecílias possuem ancestrais da Gondwana e ficaram restritas a fragmentos desse bloco, com exceção de Ichthyophidae que provavelmente tenha se dispersado através da placa indiana o que explicaria a ocorrência dessa família na Índia, Sudeste da Ásia e região Indo-Malasia (Evans & Sigogneau-Russell, 2001; Savage & Wake, 2001).

Duas famílias de Gymnophiona ocorrem na América do Sul (Fig. 1): Rhinatrematidae, com distribuição restrita ao escudo guianense e representada pelos gêneros *Epicrionops* e *Rhinatrema*, e Caeciliidae, ocorrendo em grande parte do continente, sendo que a região amazônica concentra a maior diversidade, devido em boa parte ao gênero *Caecilia* para o qual são reconhecidas 33 espécies, apesar da ocorrência de outros 12 gêneros que agrupam 37 espécies em todo o continente: *Atretochoana* (1), *Brasilotyphlus* (1), *Chthonerpeton* (8), *Dermophis* (2), *Luetkenotyphlus* (1), *Microcaecilia* (5), *Mimosiphonops* (2), *Nectocaecilia* (1), *Oscaecilia* (7), *Potomotyphlus* (1), *Siphonops* (5) e *Typhlonectes* (3) (Frost, 2009).

Figura 1. Espécies pertencentes às duas famílias de Gymnophiona que ocorrem na América do Sul. Em cima, da esquerda pra direita: *Siphonops paulensis* e *Typhlonectes natans* (Caeciliidae); embaixo: *Rhinatrema bivittatum* (Rhinatrematidae) e *Caecilia gracilis* (Caeciliidae).

HISTÓRICO DA TAXONOMIA E FILOGENIA DE GYMNOPHIONA

Dunn (1942) realizou o primeiro grande trabalho sobre taxonomia de Gymnophiona dos neotrópicos, dentro do qual descreveu sete novas espécies e reconheceu a ocorrência de 44 espécies dentro de 6 gêneros, além de uma forma considerada como *incertae sedis*, *Siphonops syntremus* Cope, hoje *Gymnopis syntrema* (Cope, 1866).

Desde a publicação de Dunn (1942) até a década de 60 do século passado nenhuma outra publicação de mesma proporção havia sido realizada até a publicação de Taylor (1968). Durante décadas, a maior parte do conhecimento sobre este grupo de anfíbios se baseou na monografia de Taylor (1968) que em sua monumental revisão taxonômica das espécies do mundo todo descreveu duas novas famílias (Ichthyophidae e Typhlonectidae), 13 novos gêneros e 40 novas espécies, além de apresentar alguns dados de história natural e um sumário da literatura relevante. Um ano após sua revisão, Taylor (1969) descreveu uma nova família, Scolecomorphidae da África e dividiu a família Caeciliidae em duas subfamílias: Caeciliinae e Dermophiinae. Apesar da revisão de Taylor, o conhecimento sobre a diversidade de Gymnophiona ainda permaneceu escasso. Na década de 70 duas novas famílias foram descritas: Rhinatrematidae da América do Sul a partir de um grupo de espécies anteriormente agrupadas em Ichthyophidae (Nussbaum, 1977) e Uraeotyphlidae da Índia (Duellman & Trueb, 1994).

Himstedt (1996) publicou uma monografia a respeito de Gymnophiona em que descreveu a morfologia externa e interna, fisiologia, reprodução, ontogenia, ecologia e etologia do grupo apresentando uma revisão da taxonomia de Gymnophiona após (Taylor 1968), concluindo que a indefinição da taxonomia do grupo é prejudicada pela presença de poucos caracteres disponíveis para a distinção das espécies. Himstedt (1996) não fez modificações no arranjo taxonômico de Gymnophiona, aceitando desse modo os trabalhos de Duellman & Trueb (1994) e de Nussbaum & Wilkinson (1989) como base de seu capitulo sobre taxonomia.

Algumas propostas de filogenia de Gymnophiona foram apresentadas nos anos 80 (Wake, 1985, 1986; Laurent, 1986; Lescure et al, 1986), e em seguida analisadas e criticadas por Nussbaum & Wilkinson (1989), os quais evidenciaram a insuficiência de dados e o uso inadequado de métodos de estudar a filogenia do grupo e apresentaram uma classificação que reconheceu as seis famílias referidas anteriormente (Caeciliidae, Ichthyophiidae, Rhinatrematidae, Scolecomorphidae, Typhlonectidae, Uraeotyphlidae) apesar de apontarem indícios da instabilidade taxonômica de duas famílias, considerando a possibilidade de Caeciliidae ser um grupo parafilético em relação a Typhlonectidae, o que também foi sugerido por Hedges et al. (1993) em sua filogenia com base em DNA mitocondrial.

Segundo (Wilkinson & Nussbaum, 2006), de 1989 até 2006 um único gênero e 16 espécies foram descritas, a maioria da Ásia e da África, mas algumas da região neotropical (e.g. *Chthonerpeton noctinectes* Silva, Britto-Pereira & Caramaschi, 2003; *C. arii* Cascon & Lima-Verde, 1994; *Oscaecilia osae* Lahanas & Savage, 1992) cinco espécies foram removidas de sinonímia e outras cinco espécies foram sinonimizadas (e.g. *Typhlonectes anguillaformis* Taylor, 1968, *T. cunhai* Cascon, Lima-Verde & Benevides Marques 1991; *T. obesus* Taylor, 1968; *Nectocaecilia ladigesi* Taylor, 1968). Em geral, a taxonomia em nível de gênero e espécie ainda precisa ser refinada e estabilizada para que as relações filogenéticas dentro da ordem sejam estabelecidas (Wilkinson & Nussbaum, 2006).

A mais recente proposta das relações filogenéticas dentro do grupo Gymnophiona (Frost et al, 2006) reconhece apenas três famílias (Caeciliidae, Ichthyophidae e Rhinatrematidae), considerando Typhlonectidae e Scolecomorphidae como subfamílias de Caeciliidae (respectivamente Caeciliinae e Typhlonectinae) e Uraeotyphlidae sinônimo de Ichthyophidae. Algumas dessas proposições já haviam sido feitas em trabalhos baseando-se em morfologia e em métodos moleculares (Wake, 1977; Nussbaum, 1979; Hedges et al., 1993; Wake, 1993a; Gower et al., 2002; Wilkinson et al., 2003).

Apesar de todas as proposições de relações filogenéticas existentes a maior parte das espécies ainda é conhecida apenas pelo holótipo ou por pequena série tipo, o que ocasiona uma taxonomia instável para Gymnophiona (Gower e Wilkinson, 2005).

TAXONOMIA DE GYMNOPHIONA NA REGIÃO NEOTROPICAL

Estudos sobre a taxonomia de Gymnophiona na região neotropical são muito pontuais e são citados a seguir de forma sintetizada. Dunn (1942) fez a primeira revisão das espécies das Américas reconhecendo 44 Gymnophiona neotropicais. Roze & Solano (1963) publicaram um resumo sobre as cecílias da Venezuela descrevendo duas espécies e apresentando novo registro para o país. Taylor (1968) revisou todas as espécies de Gymnophiona, reconhecendo 87 espécies para os neotrópicos, muitos deles novos. Savage & Wake (1972, 2001) revisaram a sistemática das espécies da América Central fornecendo base para revisões taxonômicas dos quatro gêneros presentes nessa região, um deles (*Gymnopis*) endêmico dali. Taylor & Peters (1974) estudaram as espécies do Ecuador fornecendo dados importantes sobre variação nos caracteres externos. Nussbaum & Hoogmoed (1979) revisaram as espécies ocorrentes no Suriname, descrevendo uma nova espécie de *Microcaecilia*. Lynch (1999) revisou as espécies da Colômbia fornecendo notas taxonômicas, uma chave para identificação e discutindo a variação em caracteres morfológicos externos.

Alguns grupos de espécies neotropicais encontram-se relativamente bem estudados, a exemplo de espécies de Typhlonectinae da América do Sul com uma série de resoluções taxonômicas, entre sinonímias e alocações genéricas (Wilkinson, 1988, 1989, 1991, 1996; Wilkinson & Nussbaum 1999).

Atualmente são reconhecidas 89 espécies neotropicais (Frost, 2009).

CARACTERES UTILIZADOS NA TAXONOMIA DE GYMNOPHIONA

Os principais caracteres morfológicos externos usados para a distinção dos gêneros e das espécies de Gymnophiona são os caracteres relativos à segmentação do corpo (tipo de anéis presentes), posição do par de tentáculos na cabeça em relação aos olhos e à narina (Fig. 2), presença ou ausência de olhos, presença ou ausência de cauda (Taylor, 1968; Nussbaum & Wilkinson, 1989).

Os anéis podem ser classificados das seguintes formas: - anéis da região nucal (no máximo dois anéis delimitados anterior- e posteriormente por sulcos que podem circundar o corpo parcial ou inteiramente, geralmente são mais largos que os anéis corporais); - anéis corporais primários (anéis semelhantes aos da região nucal, porém levemente mais estreitos e delimitados por sulcos que, dependendo da espécie, podem circundar o corpo por completo); - anéis secundários (anéis formados pela presença de sulcos secundários que podem se encontrar dentro dos anéis primários de muitas espécies, geralmente presentes na região posterior do corpo) (Fig. 2).

Quatro tipos de séries dentárias são considerados (Fig. 3): premaxilar-maxilar (agrupando os dentes inseridos na premaxila e no maxilar); prevomeropalatino (agrupando os dentes inseridos no vômer e no palatino); esplenial (dentes inferiores da mandíbula); dentário (dentes do dentário). No gênero *Brasilotyphlus* está presente um diastema entre os dentes vomerianos e os dentes palatinos, sendo nesse caso tratados como séries independentes.

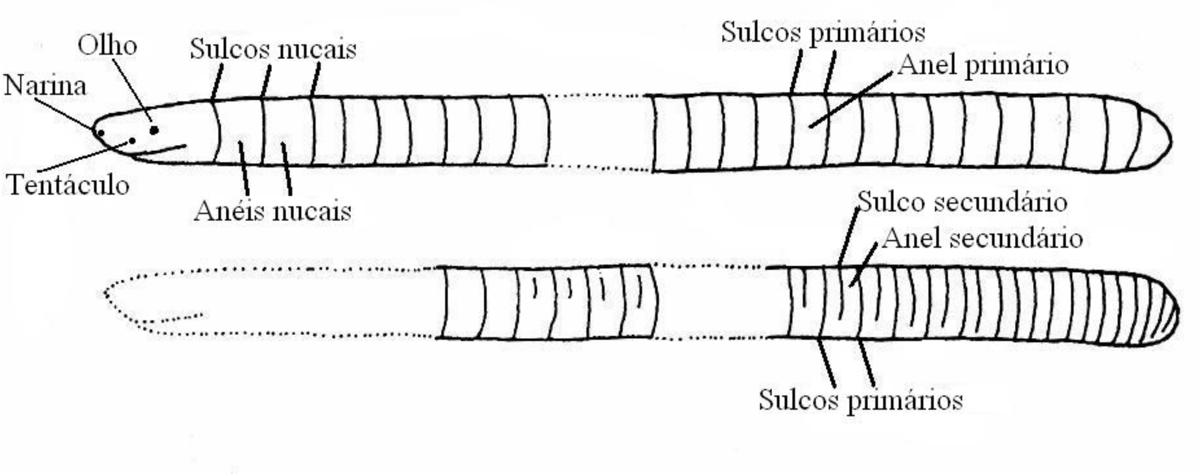

Fig. 2. Posicionamento das narinas, olhos e tentáculos na cabeça de uma Gymnophiona e dos diferentes tipos de sulcos e anéis. Acima a representação de uma espécie com apenas anéis corporais primários e abaixo apresentando anéis secundários. (Modificado de Lynch, 1999).

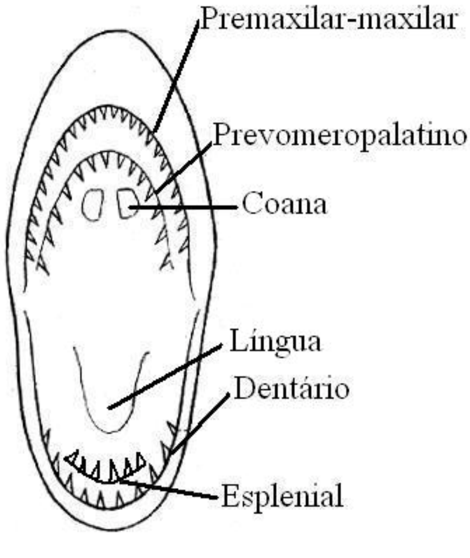

Fig. 3. Séries dentárias de Gymnophiona. (Modificado de Roze & Solano, 1963).

Este estudo teve como objetivo fornecer conhecimento sobre a variação morfológica sexual, intrapopulacional e geográfica em caracteres morfométricos e merísticos, além de caracteres qualitativos para as espécies de Gymnophiona da Amazônia brasileira e assim avaliar o status taxonômico dessas espécies.

Foram analisados 623 espécimes provenientes de nove coleções zoológicas nacionais e duas do exterior. Foram reconhecidas 16 espécies de Gymnophiona para a Amazônia brasileira, sendo duas formas apenas identificadas ao nível de gênero.

Este trabalho é apresentado a seguir em formato de artigo em língua inglesa, seguindo as normas da revista Zootaxa.

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TAXONOMY AND DISTRIBUTION OF GYMNOPHIONA OF BRAZILIAN AMAZONIA WITH A KEY TO THEIR IDENTIFICATION

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ABSTRACT

Based on 623 specimens of Gymnophiona, 16 species were recognized for Brazilian Amazonia. Geographical variation in characters is low and is mainly restricted to the number of annuli. Two new species are described, one of *Rhinatrema*, another one of *Microcaecilia*. *Caecilia marcusi* is synonimized with *C. mertensi* on the basis of recently collected material in Brazil and comparison of type specimens. Two species are only identified as *Microcaecilia* and one as *Brasilotyphlus.* New distribution data for most species are presented.

Key words: Gymnophiona, Brazil, Amazonia, taxonomy, distribution

RESUMO

A partir da análise de 623 espécimes de Gymnophiona depositados em coleções nacionais e estrangeiras foram reconhecidas 16 espécies para a Amazônia Brasileira. A variação geográfica é baixa, mais concentrada na variação de contagem dos anéis corporais. Duas espécies novas são descritas, uma pertencente ao gênero *Rhinatrema* e outra ao gênero *Microcaecilia*. *Caecilia marcusi* é sinonimizada a *C. mertensi* com base na análise de espécimes mais recentemente coletados no Brasil e estudo do material típico. Duas espécies de *Microcaecilia* e uma de *Brasilotyphlus* permanecem com identificação apenas a nível genérico. São apresentadas ampliações no conhecimento sobre a distribuição da maioria das espécies.

Palavras chave: Gymnophiona, Brasil, Amazônia, taxonomia, distribuição

INTRODUCTION

Since Dunn (1942) and Taylor (1968) few researchers worked on the taxonomy of Neotropical caecilians, an effort which is hampered by the fact that most species are only known from a few specimens e.g. *Caecilia armata* Dunn, 1942 and *Oscaecilia hypereumeces* Taylor, 1968 known by one and two specimens respectively, and without specific collecting locality. However, this situation is not exceptional and applies to several species in other parts of the distribution of Gymnophiona as well (Giri et al., 2003; Batha & Prashanth, 2004; Gower & Wilkinson, 2005; Gower, Giri & Wilkinson, 2007; Gower et al., 2007).

Recently, however, it turned out that some species in at least part of their distribution can be abundant (Moodie, 1978; Péfaur et al, 1987; Gorzula & Celsa Señaris, 1998; Measey & Di-Bernardo, 2003; Measey, 2004; Lynch & Acosta 2004; data for *Caecilia gracilis* in Maciel et al, unpublished; data here presented for some species).

Some groups of Neotropical species are actually relatively well known, like species of Typhlonectinae with a series of taxonomic resolutions after Taylor (1968) (Wilkinson, 1988, 1989, 1991, 1996; Wilkinson & Nussbaum 1999). Savage & Wake (1972, 2001) studied the systematics of Central American caecilians and provided a basis for taxonomic revisions for the four genera known from that region, one of which (*Gymnopis*) is endemic. Lynch (1999) revised the caecilians of Colombia, providing some taxonomic notes, and discussing variation in external morphological characters.

The taxonomic position of *Caecilia*, the most diverse Neotropical genus is problematic. It is considered paraphyletic to *Oscaecilia* (Nussbaum & Wilkinson, 1989), which contains nine species. Another unresolved relationship concerns *Microcaecilia*, which can be considered paraphyletic to *Brasilotyphlus* (Nussbaum pers. comm.; Maciel et al., in press).

We here attempt to evaluate the taxonomic status of the species of Gymnophiona in Brazilian Amazonia, studying sexual, intra- and interpopulational variation in external morphological characters, morphometrics and meristics.

Sixteen species were recognized for Brazilian Amazonia, of which 14 were diagnosed and two are considered *incertae sedis* for diverse reasons. Two new species are described; one *Rhinatrema* and one *Microcaecilia*, and we propose the synonimization between *Caecilia marcusi* and *C. mertensi*. The few data on geographic variation of most species reveals no marked difference between populations. Distribution maps are provided for all taxa.

MATERIAL AND METHODS

Specimens analyzed

A total of 623 specimens (Appendix 1) from the following Brazilian and foreign zoological collections was studied. CHUNB-Coleção de Herpetologia da Universidade de Brasília, HUFMA – Coleção Herpetológica da Universidade Federal do Maranhão, IEPA–Instituto de Pesquisas Científicas e Tecnológicas do Estado do Amapá, INPA – Coleção Herpetológica do Instituto Nacional de Pesquisas Amazônicas, MNRJ – Museu Nacional do Rio de Janeiro, MPEG - Museu Paraense Emílio Goeldi, MZUSP - Museu de Zoologia da Universidade de São Paulo, PUCMG – Museu de Ciências Naturais, Pontifícia Universidade Católica de Minas Gerais, RMNH - Rijksmuseum van Natuurlijke Historie, Leiden, The Netherlands, UFACF – Coleção Zoológica da Universidade Federal do Acre, campus Cruzeiro do Sul, UFMT – Coleção Zoológica da Universidade Federal do Mato Grosso, ZSM – Zoologisches Staatssammlung, Munich, Germany. Museum acronyms follow Leviton et al. (1985), corrected and updated by Frost (2008), except for the following collections, which are not mentioned by those authors: IEPA, HUFMA, PUCMG and UFMT.

Synonymies

For each species, an abbreviated synonymy is presented, listing references that refer to Brazil, with the exception of *Caecilia mertensi*, where all known references are mentioned.

Morphometric and meristic characters

The following characters were studied for the specimens. MORPHOMETRIC: **BH**-body height at mid body; **BW**–body width at mid body; **EE**–distance between eyes; **EJA**–distance eye-jaw angle; **EMM**–distance eye-margin mouth; **EN**–distance eye-nostril; **ET**–distance eye-tentacle; **HH**–head height at jaw articulation; **HL**–Head length; **HW**–head width at the jaw articulation; **NN**–distance between nostrils; **NJA**–distance nostril-angle of jaw; **NMM**–distance nostril-margin of the mouth; **NTS**–distance nostril-tip of the snout; **SP**–projection of snout beyond mouth; **TL**–head + body length (head + body length + tail length in *Rhinatrema*); **TJA**–distance from tentacle to the angle of jaw; **TMM**–distance from tentacle to margin of the mouth; **TN**–distance from tentacle to nostril; **TT**–distance between tentacles; **WNC**–width at the first nuchal collar; **WTR**–width of the body at five folds anterior to the opening of the cloaca; **WV**–width of the body at vent. MERISTIC: **AD**–anal denticulations; **AIV**–annulus interrupted by the vent; **CSA**–secondary annuli completely encircling the body; **CPA**–primary annuli completely encircling the body; **PA**–primary annuli; **SA**–secondary annuli; **SI**–annulus where first scale appear; **TBA**–total body annuli (when referring to *Rhinatrema*). **TAA**–tail annuli counted posterior to the vent; **TAL**–tail length; **TAW**–tail width; DENTITION: **DT**–dentary teeth; **PMT**–premaxillary-maxillary teeth; **PPT**–prevomerine-palatine teeth (when diastema between PVT and PT is absent); **PT**–palatine teeth; **PVT**–prevomerine teeth; **ST**–splenial teeth.

Some of the morphometric data are specific for a group of species, e.g., tail measurements are restricted to Rhinatrematidae.

Annulation characters

We use fold or annulus to refer to the region between two grooves (narrow lines that may encircle the body completely). The grooves in the nuchal region are called nuchal grooves and the region between two grooves nuchal collar; primary annuli are the annuli of the body and secondary annuli are present inside the primary annuli delimited by secondary grooves, generally in the posteriormost region of the body of some species. This nomenclature follows Taylor (1968) and Wilkinson & Nussbaum (1989).

Study of Sexual, Intra-population and Geographic variation

Each species with sufficient (or sufficiently large) samples was subjected to an Analysis of variance (ANOVA) to test for sexual dimorphism in TL and Analysis of Covariance (ANCOVA) with TL as covariate and sex as the factor to evaluate sexual dimorphism at a level of 5% probability. Sexual differences in qualitative data (e.g. colour, presence or absence of anal glands) are described in the taxon accounts.

Morphometric and meristic data (mean ± standard deviation; range; number of specimens) were calculated for each species and presented in comparative tables.

Part of the results about variation is presented under “Description” in the species accounts. When necessary the sexual, intra-populational and geographic variation is discussed in more detail under “Variation” where also the results and discussion about statistic analyses are provided.

To study geographic variation in external morphological characters (morphometric data) we defined Operational Taxonomic Units (OTUs) on the basis of distance between the sampled populations and sometimes on general data known about zoogeography (Guianan fauna different from that of area south of Amazonas).

Principal Component analysis (PCA) was applied to the total data and the scores from the first factor were saved. To reduce the effect of size variation within the samples, each of the characters was regressed on the PCA factor 1 values, and then the residuals of each regression were used as characters in the Discriminant analysis as employed by Strauss (1985) and Reis et al (1990).

A Stepwise Discriminant Function Analysis (SDFA) was applied to verify whether the groups defined a priori could be discriminated and which are the morphometric characters that most contribute to the divergence among the geographic groups (Tabanick & Fidel, 2001). As there are only few meristic characters, mostly with little variation (e.g. AIV and AD) these data were not included in the multivariate procedures. Due to the small sample size of most species, multivariate statistics were applied only to two species which are better represented in the collections, viz. *Caecilia tentaculata* and *C. gracilis*. Populations with a low number of specimens and at a great distance from other groups were not included in the SDFA and were only compared in the tables presenting meristic and morphometric data.

Three OTUs of *C. gracilis* were chosen to be used in the SFAD (Fig. 1). The first one grouping 19 specimens from ten localities in eastern Amazonia, near Belém (PA). The second one contains 65 specimens from a transition area between cerrado and caatinga in the Municipality of Urbano Santos, state of Maranhão (MA). The third OTU groups eleven specimens from a region of cerrado in Palmas, state of Tocantins (TO).

For *C. tentaculata* we defined three OTUs (Fig. 2). The first one groups 20 specimens from five localities in the Brazilian part of the Guiana Shield (PAGS), four in the state of Pará and one in the state of Amapá. The second OTU groups 13 specimens from five localities in the Marajó-Belém region and Carajás (PAB). The third OTU is formed by 25 specimens from three localities in the state of Mato Grosso (MT), located in transition areas between Amazon forest and cerrado.

Tooth series counts were excluded from the dimorphism analysis and the multivariate statistics because of the variability of these characters due to teeth replacement and difficulty to count the teeth in some specimens, which could even cause marked differences in counts between different researchers. Additionally photos of fetal teeth of two species (one specimen of each only) of *Microcaecilia* were made.

Typhlonectes compressicauda data were excluded from the multivariate statistic analysis because of the high individual variation resulting from the capacity of compressing the body.

Distribution

Distribution maps based on material studied (closed symbols) and on localities from the literature (open symbols), are provided for each taxon. The name of each locality numbered in the maps is provided in the legends to the maps.

RESULTS

We identified the following 16 species for the Brazilian Amazonian region:

Caeciliidae

Brasilotyphlus braziliensis (Dunn, 1945)

Brasilotyphlus guarantanus Maciel, Mott & Hoogmoed (in press)

Brasilotyphlus sp. *incertae sedis*

Caecilia gracilis Shaw, 1802

Caecilia mertensi Taylor, 1973

Caecilia tentaculata Linnaeus, 1758

Microcaecilia taylori Nussbaum & Hoogmoed, 1979

Microcaecilia unicolor Duméril, 1863

Microcaecilia sp. nov.

Microcaecilia sp. *incertae sedis*

Nectocaecilia petersii (Boulenger, 1882)

Potomotyphlus kaupii (Berthold, 1859)

Siphonops annulatus (Mikan, 1820)

Typhlonectes compressicauda (Duméril & Bibron, 1841)

Rhinatrematidae

Rhinatrema bivittatum (Guérin-Méneville, 1838)

Rhinatrema sp. nov.

TAXON ACCOUNTS

CAECILIIDAE

***Brasilotyphlus* Taylor 1968**

Diagnosis (from Maciel et al, in press**)–**Maximum TL 305 mm. Dermal scales present. Eye not visible externally, if present solidly covered by skull bone. Tentacle small, widely separated from nostril, closer to angle of mouth; the tentacular opening in the position where the eye would be expected, may be visible from above. Nostrils visible from above. Terminal shield present. A weak vertical keel present or not on the terminal part of the body; no tail. Dentition in four series, ST absent; maxillary teeth may reach the level of the choanae or posterior of them; the teeth are monocuspid, except PVT and

PT, which are bicuspid. A large diastema between the PT and PVT, the latter series forming a short semicircle. Tongue attached anteriorly to floor of mouth; no narial plugs on tongue.

Remarks–Maciel et al. (in press) recently described the second species of the genus. The diastema between prevomerine and palatine teeth is the only known character in which *Brasilotyphlus* differs from *Microcaecilia* (Maciel et al, in press). This slight difference and the amount of character states shared between species in both genera suggests that these two genera are synonymous (Wilkinson et al, 2009, in press; Maciel et al., in press).

A specimen from Roraima state, Brazil (MPEG 7779) seems to belong to an undescribed species of *Brasilotyphlus*, and probably belongs to a species that Ronald Nussbaum is working on (Nussbaum pers. comm.) We have not included this specimen in our studies.

***Brasilotyphlus braziliensis* Dunn 1945**

Gymnopis braziliensis Dunn 1945: 1.

Brasilotyphlus braziliensis Taylor, 1968: 342; Taylor, 1971: Hoogmoed, 1979: 273; Frost, 1985: 625; Rodrigues et al., 2004; Senaris & MacCullough, 2005:23; Frost, 2008.

Brazilotyphlus: Lescure & Renous, 1988: 24.

Brasilotyphlus: Lescure & Renous, 1988: 30.

Diagnosis–Maximum TL 260 mm. PA 142–147. SA 23–36. A weak vertical keel present on the terminal part of the body in most specimens. Maxillary teeth may reach the level of the anterior border of the choanae, but do not extend posteriorly of them. Dermal scales present in most of the annuli; first scales behind the 25th PA.

Description– TL up to 260 mm (Taylor, 1968). TL 43–48.7 times (46.14 ± 2.5; n = 5) BW. Head longer than wide; slightly narrower than body. Snout projecting distinctly beyond mouth. Nostrils subcircular and visible from above. Eyes not visible. Tentacles small, laterally positioned, near margin of mouth, closer to angle of the mouth than to nostril, tentacles may be visible from above. TT larger than NN. Nuchal grooves may be distinct dorsally and ventrally, except third groove that ventrally is incomplete; the second collar partially fused below with the first primary fold; a dorsal transverse groove is present on both collars, less pronounced on the first one. Body semi-cylindrical, slightly wider than deep. Width along the body may vary slightly.

PA 142-147; completely encircling the body, except for the two anterior annuli that are ventrally fused, for some annuli ventrally incomplete at midbody and the annulus interrupted by the cloaca. SA 23-36, at the most seven of these are complete. Terminal shield present on the posteriormost part of the body. No annulus posterior to the cloaca. Opening of cloaca transverse, may be slightly irregularly shaped; e.g. eleven anal denticulations in MZUSP 63097, five anterior and six posterior. Dermal scales starting at 25th annulus, maximally five rows of scales per body fold (Taylor, 1971); in MZUSP 63097 SI on the annulus 36 and at most five rows of dermal scales per fold at the posteriormost part of the body. Size of dermal scales and number of rows per fold increasing posteriorly. Tongue without narial plugs, anteriorly attached to floor of mouth. Four series of teeth (PMT, PVT, PT, DT). PMT monocuspid, forming a series with maximally 25 teeth, little variation in size, posterior maxillary teeth slightly smaller, extending to the level of the posterior border of the choanae. Maximally twelve, bicuspid, equally sized, PVT. Maximally 14 bicuspid PT, forming a slightly curved series, teeth smaller than PMT. Maximally 18 monocuspid DT, approximately same size as PMT series. A distinct diastema between PVT and PT.

Colour-In preservative brownish with the lateral and ventral surface of the body slightly lighter than the dorsum (Taylor, 1971). This pattern was also observed in a rather recently collected specimen (Maciel et al, in press).

Variation–Insufficient data for sexual, intra-, and interpopulational statistic analyses. For variation in measurements and meristic characters see Table 1.

Distribution–Type locality (municipality of Manaus, state of Amazonas, Brazil). Also known from 70 km north of Manaus, Reserva do Gavião INPA/WWF, state of Amazonas, Brazil (Fig. 3). Frost (1985, 2008), Rodrigues et al. (2004) and Senaris & MacCullough (2005) incorrectly included Amapá and, in the case of Rodrigues et al., (2004), also Roraima in the distribution. The material on which that record probably was based (MZUSP 57073–57079; 64829) are misidentified specimens of *Microcaecila* sp.

Brasilotyphlus guarantanus Maciel, Mott & Hoogmoed (in press)

Brasilotyphlus guarantanus Maciel et al. (in press):

Diagnosis (from Maciel et al, in press)–Maximum TL of 305 mm. PA 151–170; SA absent except in three specimens with two incomplete secondary folds (MPEG 22387; UFMT 5589, 6648). Two paired anal glands may be present in the cloaca. A weak vertical keel is present on the terminal part of the body of most specimens (in 27 of the 48 type specimens). Maxillary teeth may reach the level of posterior border of choanae or extend posteriorly of them. Dermal scales present in posterior part of body only; scales starting between annulus 154 and 160. Differing from *B. braziliensis* in having a higher number of PA, a lower number of SA, and PMT extending posteriorly of choanae.

Description-Maximum TL 305 mm (UFMT 22383). TL 47.2 to 76.1 times (56.9 ± 6.1; n = 41) BW. Head longer than wide; slightly narrower than the body. Snout projecting distinctly beyond mouth. Nostril subcircular. Eyes not visible. Tentacles small, laterally positioned, near margin of mouth, closer to angle of the mouth than to nostril, tentacles may be visible from above. TT larger than NN. Two collars, third nuchal groove ventrally incomplete, the second collar partially fused below with the first primary body folds; a dorsal transverse groove is present on both collars, less pronounced on the first one. Body semi-cylindrical, slightly wider than deep. Width along the body may vary slightly.

PA 151–170; completely encircling the body, except for at most the three anterior body annuli that ventrally are not separated by grooves and thus ventrally are continuous with the second collar, and the annulus interrupted by the cloaca. SA incomplete 0-3. Opening of the cloaca transverse, sometimes slightly irregularly shaped. AD 10-13; generally about as many on the anterior as on the posterior edge of the cloaca (e.g. five anterior and six posterior in the holotype MPEG 22382). Paired anal glands were only found in two males of the 48 specimens analyzed. Terminal shield on posteriormost part of body; generally no annulus posterior to cloaca. Weak vertical keel may be present on terminal shield. Dermal scales start between annuli 154 and 160; at most two rows of dermal scales per fold. Tongue anteriorly attached to floor of mouth, no narial plugs on tongue. Four series of teeth (PMT, PVT, PT, DT). PMT monocuspid, maximally 25, little variation in size, but posterior maxillary teeth slightly smaller, extending to the level of the posterior border of the choanae or posteriorly of them. Maximally 13. bicuspid PVT; teeth smaller than PMT. At most 14 bicuspid PT; smaller than PMT. A distinct diastema between PVT and PT series. DT monocuspid, maximally 21, approximately same size as PMT.

Colour–In life, *B. guarantanus* is lavender and there are two patterns of body coloration. In one the body is dark lavender and gradually lighter towards the head. In the other the body is entirely light lavender. In preserved specimens color is grayish or brownish. The venter and the lateral surface are slightly lighter than the dorsum along the entire body. The area surrounding the cloaca is less pigmented as well, as are the mandible and part of the head. A very thin longitudinal ventral line appears in the posterior half of the body of some specimens.

Variation-Males have larger and longer heads than females (Maciel et al; in press). There are insufficient data (all but one specimens are from the same locality) to analyze geographic variation. For variation see description and Table 1.

Distribution–Brazil (northern state of Mato Grosso and southern Pará). (Fig. 3).

Caecilia Linnaeus, 1758

Diagnosis-Maximum TL 1767 mm (Salgar, 2007). SA present or not. Dermal scales present; subdermal scales may be present. Eye visible and generally in an open socket, except in *Caecilia gracilis*, which may have eyes under skull bones. Tentacles below nostrils, closer to nostrils than to eyes and to angle of mouth. Terminal shield present or not, posterior to the cloaca; no keel on body terminus. Dentition in four series, monocuspid; maxillary teeth extending posteriorly to the level of the choanae; No diastema between PVT and PT. Fetal teeth in multiple rows in lower jaw. Tongue attached anteriorly to the floor of the mouth, with two narial plugs.

Caecilia gracilis Shaw 1802

Caecilia gracilis Shaw, 1802: 597; Dunn, 1942: 515; Taylor, 1968: 385; Hoogmoed, 1979: 273; Frost, 1985: 621; Azevedo-Ramos et al., 2004; Frost, 2008.

Caecilia cf. *gracilis* Galatti et al 2007:93.

Diagnosis–Maximum TL 735 mm. PA 177-208, SA 11-52. Eyes in an open orbit or under bone. Dermal scales present; SI between annulus 41 and 141; at most two rows of scales per fold. Very slender *Caecilia*; TL may reach 90 times the BW. Terminal shield present.

Description–TL to 735 mm (MPEG 1428). TL/BW 30.9–90.6 times (63.6 ± 12.6; n = 95). Head longer than wide, HL/HW 1.3–1.8 (1.6 ± 0.1; n = 104). The head may be slightly narrower than body. Snout projecting distinctly beyond the mouth (i.e. 1.7 mm in MPEG 3898). Nostril subcircular and may be visible from above. Eyes generally visible, in an open orbit, but some specimens may have both (HUFMA 654; MPEG 1429) or one of the eyes covered by a fine bony layer (MPEG 1361 on the left side). Protrusible tentacles, positioned anteriorly in the head, below the nostrils, near the margin of the mouth, much closer to the nostrils than to the angle of the mouth, and not visible from above. EE larger than TT and NN. Nuchal grooves may be distinct dorsally, laterally and ventrally, except the third nuchal groove which ventrally is incomplete and thus the second collar ventrally are partially fused with the first primary body fold; a dorsal transverse groove is present on each of both collars, less pronounced on the first one; some specimens may have indistinct or only partially distinct collars. Body semi-cylindrical, slightly wider than deep. PA 177–208, incomplete, interrupted dorsally and ventrally, except for the posteriormost primary annuli (at most 14, 9.7 ± 2.5; n = 12) which are complete; from the general region where the secondary annuli appear, to the level of the cloaca, the primary annuli dorsally are complete. SA 11-52; at most nine complete (5.5 ± 2; n = 92). Cloaca transverse, may be slightly irregular; anal denticulations 9-16 (12.2 ± 5.2; n = 77); generally an approximately similar number in posterior and anterior edge of the cloaca (e.g. six anterior and six posterior in MPEG

16002). Paired anal glands sometimes present; found only in two males of 101 specimens studied. Unsegmented terminal shield posteriorly of cloaca; in some specimens slightly depressed. SI between annulus 41 and 141 (89.5 ± 40.2; n = 4); at most two rows of dermal scales per fold. Dermal scales and number of rows per fold increasing, in size and in number, from anterior to posterior. Tongue anteriorly not completely attached to floor of mouth; two narial plugs. Four series of teeth, all monocuspid. PMT maximally 20 with variation in size, posterior maxillary teeth smaller, extending posteriorly of the level of the choanae, like the PPT. PPT maximally 19, posterior ones smaller; teeth smaller than PMT. DT maximally 19, approximately same size as PMT; posterior ones smaller. ST maximally 6, approximately same size as PPT. Usually the highest number of splenials in *C. gracilis* is four, except in one specimen (HUFMA 624) from a population in a transition area in the state of Maranhão, Brazil, which has six splenials.

Colour–In life, specimens may be lavender, dark blue or grayish blue. The head is slightly lighter than the rest of the body. The venter is slightly lighter than the dorsum. Grooves in the posteriormost part of the body in a number of specimens with white lines. A narrow light line links the eyes and the tentacles of some specimens.

Variation- Variation- No significant sexual dimorphism in morphometric and meristic characters (Maciel et al; unpublished). Comparisons of meristic and morphometric characters of populations reveal no great variations between populations sampled (Tab. 2). Primary and secondary annuli counts vary slightly among the populations, but the most eastern population of *C. gracilis* (Urbano Santos, state of Maranhão) presented a lower mean number of primary annuli than the other populations and even a lower minimum and maximum number for this character (Tab. 2).

The stepwise discriminant analysis of morphometric characters selected five variables (BW, BH, EN, ET, SP) that contribute most to differences between the OTUs (Fig. 4; Tab. 3). This analysis revealed a significant difference among the geographic units in morphometric data (Wilks's Lambda 0.600 p = 0.000). Despite this significant difference, only a low separation was observed in the two canonical axes of the SDFA (Fig. 4).

The first discriminant function is responsible for 63.9% and the first and second together for 100% of the total variation. A total of 79% correct classifications were produced, 77% Jackknifed (Tab. 4).

The first axis of the SDFA is better represented by EN, body depth, ET and SP showing a weak separation of the MA (Maranhão) OTU from the TO (Tocantins) and PA (Belém) OTUs (Fig. 4). The second axis is better represented by BW and EN, showing a partial separation of the TO OTU from the MA and PA OTUs.

MZUSP 57070 from Marabá, Pará, Brazil with TL 135 mm has approximately 60 fetal teeth in the lower jaw, arranged in numerous rows (Fig. 5). Specimens of other populations, of about the same size, or even smaller have an adult dentition (e.g. MRT 6975 from Palmas, Tocantins with TL 139 mm; HUFMA 636 from Urbano Santos, Maranhão, with TL 112 mm), which may represent a geographic variation in the size when maturity is reached.

Distribution–Guyana, Suriname, French Guiana, Peru, Brazil (states of Amapá, Amazonas, Maranhão, Pará and Tocantins). (Fig. 6).

Natural history–*C. gracilis* was reported to be preyed upon by birds and snakes. Taylor (1968) mentioned the hawk *Leucopternis albicollis* and the snake *Anilius scytale* (L.) as predators. Maciel et al (unpublished data) found earthworms in 92 % of the digestive tracts containing preys in a series of 59 dissected specimens of *C. gracilis* from Urbano Santos, Maranhão, which suggests a specialized diet.

Remarks–Nussbaum & Wilkinson (1989) recognized that the genus *Caecilia* could be paraphyletic because some specimens of *C. gracilis* have eyes under bone like *Oscaecilia*. This character state is present in low frequency in different populations of *C. gracilis*, showing a conservative pattern in this character in the wide distribution of this species.

Taylor (1972) stated that *C. gracilis* has a scale inception "near the end of the body, preceding the few secondaries a short distance", and also suggests a geographic variation in SI and "character of the squamulae" between a specimen from Iquitos, Peru and specimens from French Guiana, although he did not clarify what is the geographic variation. Our data show that SI in *C. gracilis* is more variable than Taylor (1972) suggested, since in some specimens the SI is not near the end of the body.

Caecilia mertensi Taylor 1973

Caecilia mertensi Taylor, 1973: 210; Frost, 1985: 621; Wilkinson, 2004; Frost, 2008.

Caecilia marcusi Wake, 1985: 215; Reichle & Köhler, 1996: 208; De la Riva et al., 2000: 52; Köhler, 2000: 58; Cortez et al., 2004; Glaw & Franzen, 2006:156; Frost, 2008.

Diagnosis-A *Caecilia* reaching 510 mm TL. PA 139–157; SA 25–48. Eye visible in open socket. Dermal scales present; scale inception between annulus 22 and 95; at most four rows of scales per fold. Terminal shield present.

Description-Maximum TL 510 mm. TL/BW 31.7–51 (41.7 ± 5.4; n = 32). Head longer than wide, HL 1.2–1.7 times HW (1.5 ± 0.1; n = 36); slightly narrower than body. Snout projecting distinctly beyond mouth (e.g. 2.5 mm in MPEG 25178). Nostrils subcircular, may be visible from above. Eyes visible in open socket. Protrusible tentacles, positioned anteriorly in head, below nostrils, near margin of mouth, much closer to nostrils than to angle of mouth, not visible from above. EE larger than TT and NN. Nuchal grooves distinct dorsally, laterally and ventrally in most specimens, except the third nuchal groove which ventrally is incomplete; the second nuchal collar ventrally partially fused with the first primary fold; a dorsal transverse groove on each of both collars, less pronounced on the first one; there may be a ventral transverse groove on the first collar in some specimens (e.g. UFMT 6290); some specimens may have indistinct collars or collars that are only partially distinct. Body semi-cylindrical, slightly wider than deep. Width along the body may vary slightly.

PA 139–157, incomplete, interrupted dorsally and ventrally, except for the posteriormost PA (at most eight, 4.2 ± 1.6; n = 29) which are complete. From the general region where the SA appear, to the level of the cloaca, the annuli are dorsally complete. SA 25-48; at most four are complete (0.6 ± 1; n = 32; including data from Taylor, 1973). Unsegmented terminal shield posteriorly of cloaca, depressed in some specimens. No annulus posterior to cloaca. Cloaca transverse, may be slightly irregularly shaped; AD 9-17 (12.5 ± 5.4; n = 26); generally an approximately similar number in posterior and anterior edge of the cloaca (e.g. seven anterior and six posterior in MPEG 25178). Paired anal glands only found in three males and one female of 32 specimens studied. SI between annulus 22 and 95; at most four rows of dermal scales per fold. Dermal scales and number of rows per fold increasing in size and in number, from anteriorly to posteriorly. No strong relation between SI and TL, but the smallest specimens have a higher SI value than the others (Fig. 7). No apparent relation between the number of SA and SI (Fig. 7) like in *Microcaecilia taylori*. No sexual dimorphism in SI. Tongue not completely attached anteriorly to floor of mouth; two narial plugs. Four series of teeth, all monocuspid. PMT maximally 21 with notable variation in size, posterior maxillary teeth smaller, extending posteriorly of the level of choanae like the PPT series. PPT maximally 23, posterior teeth smaller. teeth smaller than PMT. DT maximally 24, approximately same size as PMT; posterior teeth smaller. ST maximally four, approximately same size as PPT.

Colour-The colour in life may be grayish blue or dark lavender. The lateral and ventral surfaces of the body are slightly lighter than the dorsum. The dark colour of the dorsum extends laterally and ventrally in the primary grooves of most specimens. Tip of the tongue blackish, darker than the rest. Some specimens have whitish venter with scattered dark blotches of irregular size and shape of approximate the colour of the dorsum.

Variation-Insufficient data for sexual, intra-, and interpopulational statistic analyses. For variation in measurements and meristic characters see (Tab. 5).

Distribution–Bolivia (Cochabamba and El Beni); Brazil (states of Acre, Mato Grosso, and Rondônia) (Fig. 8).

Remarks- Taylor (1973) described *Caecilia mertensi* from a single specimen with the doubtful locality "Seychelles isle". However, Taylor supposed that "South America" was the type-locality considering the distribution of the genus *Caecilia*.

Wake (1985) described *Caecilia marcusi* based on four specimens collected in the District of Cochabamba, Bolivia, and compared them with the holotype of *C. mertensi* Taylor, 1973. Wake (1985) considered the specimens from Bolivia as a new taxon that differed from the holotype of *C. mertensi* in head shape, teeth counts and colour of preserved specimens.

Comparisons of morphometric data of bivariate plots of head measures and total length of the type specimens of *Caecilia marcusi*, the holotype of *C. mertensi*, and specimens recently collected in Brazil showed no apparent difference among these specimens (Fig. 9). The statement of Wake (1985), that *C. marcusi* has a “more dorsal naris” could represent a simple individual variation, related to preservation. Observing photographs of the holotype of *C. mertensi* in Taylor (1973) and recent photos provided by CAS we noted some injuries on the head of the type, which could have caused misinterpretation of some characters.

Teeth count variation among specimens from a single population may be caused by the difficulty to count teeth due to differences in preservation, tooth replacement, or even researcher bias e.g., examining a paratype of *C. marcusi* (ZSM 82/1982), we counted more PMT and DT than Wake (1985). The colour and also the pattern of body colouration may vary among live or preserved specimens. On the basis of direct comparison of most material available we have reached the conclusion that *C. marcusi* is a synonym of *C. mertensi* and that this taxon is distributed in Amazonian Bolivia and western Amazonian Brazil.

***Caecilia tentaculata* Linnaeus 1758**

Caecilia tentaculata Linnaeus, 1758: 229; Dunn, 1942: 480; Taylor, 1968: 555; Frost, 1985: 622; Lescure & Marty, 2000: 292; Coloma et al, 2004; Frost, 2008.

Diagnosis–Maximum TL 850 mm. PA 112–131. SA 12–44. Eye visible; not covered by bone. Dermal scales present. SI between annulus 6 and 47, at most two rows of dermal scales per fold. Terminal shield present.

Description–Maximum TL 850 mm (Taylor, 1973). TL 22.2–46.8 times (33.6 ± 5.3; n = 58) BW. Head longer than wide, HL/HW 1.1–1.6 (1.3 ± 0.1; n = 64). The head may be slightly narrower than body. Snout projecting distinctly beyond the mouth (e.g. 3.9 mm in MPEG 18160). Nostrils subcircular and may be visible from above. Eyes visible, in an open orbit. Protrusible tentacles, positioned anteriorly in the head, below the nostrils, near the margin of the mouth, much closer to the nostrils than to the angle of the mouth (e.g. TMM = 1.9 mm; TN = 2.3 mm; TJA = 8.9 mm in MPEG 18160) and not visible dorsally. EE larger than TT and NN (e.g. EE = 6.4 mm; TT = 4.3 mm; NN = 3.5 mm; MPEG 18159). Nuchal grooves may be distinct dorsally, laterally and ventrally, except the third nuchal groove which ventrally is incomplete; the second collar ventrally is fused with the first primary body fold; a dorsal transverse groove is present on teach of both collars, less pronounced on the first one; some specimens may have indistinct or partially distinct nuchal grooves and thus also the collars are indistinct. Body semi-cylindrical, slightly wider than deep, (e.g. BW = 14.1 mm; BH = 13.4 mm in MPEG 18160). PA 112–131, most incomplete, interrupted dorsally and ventrally, except the posteriormost PA (at most eight, 4.9 ± 1.7; n = 47) that are complete; from the general region where the SA appear, to the level of the cloaca, the PA dorsally are complete. SA 12–44; at most 5 complete (2.4 ± 1.3; n = 69). Cloaca transverse, may be slightly irregular; AD 10–17 (13.2 ± 6.2; n = 49); generally approximately similar number in posterior and anterior edge of cloaca (e.g. eight anterior and eight posterior in MPEG 23542). Paired anal glands may be present in both males and females; found in 38 of the 66 specimens studied. Unsegmented terminal shield posteriorly of cloaca; in some specimens depressed. SI between annulus 6 and 47; at most two rows of dermal scales per fold. Dermal scales and rows per fold increasing, both in size and in number, from anteriorly to posteriorly. Tongue anteriorly not completely attached to floor of mouth; two narial plugs. Four series of teeth, all monocuspid. PMT maximally 22, with notable variation in size, posterior maxillary teeth smaller, extending posteriorly of level of choanae like the PPT series. PPT maximally 20, smaller than PMT, posterior ones smallest. DT maximally 20, approximately same size as PMT; posterior teeth smaller. ST at most four, approximately same size as PPT.

Colour–In preserved and in live specimens the body shows different tonalities of gray or blue. The lateral and ventral surface of the body slightly lighter than the dorsum. The dark colour of the dorsum extends laterally and ventrally in the primary grooves of most specimens. There are two different patterns of ventral colouration that occur in all populations here studied. The first is a whitish venter with scattered dark blotches of irregular size and shape approximating colour of dorsum. The other pattern is a uniform venter slightly lighter than dorsum (Fig. 10). Both patterns also occur in specimens from Suriname (Nussbaum & Hoogmoed, 1979).

Variation-There are no significant differences between the sexes for any morphometric or meristic character. A similar result was obtained in a study about sexual dimorphism in a population of *Caecilia gracilis* in Maranhão, Brazil (Maciel et al; unpublished data) (see above).

Comparison of the meristic and morphometric characters of populations reveals no great variations between the populations sampled here (Tab. 6). Variation in primary and secondary annuli counts is similar among the studied populations. The total variation of the studied populations in these characters (PA 114-131; SA 23-44) was not different from data of fifteen *C. tentaculata* from Napo, Ecuador (PA 115-122; SA 23-45) (Taylor, 1973).

The stepwise discriminant analysis of morphometric characters showed four variables (TL, HL, TMM, NN) that most contribute to the OTUs´ divergence (Fig. 4; Tab. 7). This analysis revealed a significant difference among the OTUs in morphometric data (Wilks's Lambda 0.577 p = 0.000). The first discriminant function is responsible for 74.8 % and the first and second together for 100% of the total variation. A total of 60%

correct classifications were produced, 55% Jackknifed (Tab. 8). The first axis of the SDFA is better represented by HL and NN, reflecting a weak separation of the OTU MT (Mato Grosso) from the PAB (Marajó-Belém-Carajás) and PAGS (Brazilian Guiana) OTUs (Fig. 4). The second axis is better represented by TL and TMM, but it does not show any separation among the OTUs.

Distribution-Brazil (states of Acre, Amapá, Amazonas, Maranhão, Mato Grosso, and Pará), Colombia, Ecuador, French Guiana, Guyana, Peru, Suriname and Venezuela. (Fig. 11)

Remarks-Taylor (1972) removed *Caecilia albiventris* Daudin, 1803 from the synonymy of *C. tentaculata* on the basis of the presence of diminutive subdermal scales in *C. albiventris* and the colour pattern of the belly. Subsequently Taylor & Peters (1974) accepted this division and provided photos of a specimen of *C. albiventris* from eastern Ecuador. Frost (1985, 2008) listed *C. albiventris* as a valid species with a distribution in Suriname and eastern Ecuador. The meristic data of *C. albiventris* are well within the range known for *C. tentaculata*, and we have observed a large variation in the pattern of the belly, which thus does not separate the two supposed taxa either. Apparently only the presence or absence of subdermal scales seems to differentiate these two taxa.

Another name about which there is some uncertainty is *Caecilia pressula* Taylor, 1968, which was described from seven specimens collected in Guyana. Taylor (1968) recognized these specimens as distinct of *C. tentaculata* on the basis of a poor diagnosis: “body strongly compressed for most of its length”. As this taxon falls outside the scope of our study, we can not decide whether it is really different from *C. tentaculata*.

Lynch (1999) doubted whether *Caecilia guntheri* Dunn, 1942 and *C. volcani* Taylor, 1969 were really different from *C. tentaculata*.

Lynch (1999) provided some localities for this species in Chocoan Colombia, which we did not use in our map, because most likely these are *Caecilia isthmica* Cope, 1877 (cf. Savage & Wake, 2001, Frost, 2008), and *C. tentaculata* is consired as having a cis-Andean distribution.

Microcaecilia

Diagnosis–Maximum TL 318 mm. Dermal scales present; subdermal scales may be present. Eye visible or not (visible only in a juvenile specimen of *M. albiceps* Boulenger 1882; Wilkinson pers. comm.). Tentacle small, widely separated from nostril, closer to angle of the mouth; the tentacular opening in the position where the eye would be expected. Nostrils visible from above. A terminal shield, not segmented by annuli, may be present posterior to the cloaca, or may be absent as in *M. supernumeraria* Taylor 1969. A weak vertical keel may be present on the terminal shield. No tail. Dentition in three series, splenials absent; maxillary teeth may extend to the level of the choanae or posteriorly of them; the teeth are monocuspid, except PPT, which may be bicuspid. No diastema between PT and PVT. Fetal teeth in a single row in the lower jaw. Tongue attached anteriorly to the floor of the mouth; no narial plugs on the tongue.

Microcaecilia taylori Nussbaum & Hoogmoed, 1979

Microcaecilia sp. "A" Hoogmoed, 1979: 273.

Microcaecilia taylori Nussbaum & Hoogmoed, 1979: 245; Frost, 1985: 623; Reynolds et al, 2004a; Frost, 2008.

Microcaecilia sp. Caldwell & Araújo, 2005: 6.

Diagnosis (modified from Nussbaum & Hoogmoed 1979): Maximum TL 225 mm. PA 113-130. SA 0-21. Eye not visible. PMT and DT monocuspid; PPT mono- or bicuspid, even in the same specimen, the second condition prevailing in all specimens which have both conditions; maxillary teeth extend posteriorly of level of choanae; a weak vertical keel may be present in terminal region of body. A small terminal shield. Dermal scales start between annulus 34 and 121.

Description–Maximum TL 225 mm (MPEG 22157). TL 25.7 to 52.4 times (39.8 ± 4; n = 89) BW. Head longer than wide, slightly narrower than the body. Snout projecting distinctly beyond mouth. Nostrils subcircular; may be visible from above. Eyes not visible, not even in the smallest juveniles. Tentacle small, laterally positioned, near margin of mouth, closer to the angle of the mouth than to the nostrils, may be visible from above. TT larger than NN. Nuchal grooves may be distinct dorsally and ventrally, except the third which ventrally is incomplete; the second nuchal collar partially fused below with the first primary fold; a dorsal transverse groove is present on the collars, less pronounced on the first one. Body semi-cylindrical, slightly wider than deep. Width along the body may slightly vary.

PA 114-130; completely encircling the body, except the anteriormost annulus that is ventrally fused with the collar, some ventrally incomplete annuli at midbody and the annulus interrupted by the cloaca. SA 0-21, at most six complete. Paired anal glands in two male specimens of 95 specimens analyzed. A terminal shield on posteriormost part of body; generally no annulus posterior to cloaca, but sometimes there is one. Weak vertical keel may be present on terminal shield. Opening of cloaca transverse, sometimes slightly irregularly shaped. AD 9-16; generally about as many on the anterior as on the posterior edge of the cloaca (e.g. six anterior and six posterior in MPEG 23365). Dermal scales starting between annulus 34 and 121; at most nine rows per fold. No marked variation of SI in relation to TL, but the smallest specimens (e.g. MPEG 7352; 22171; 22172; 22783) did not have scales, showing ontogenetic development in this character (Fig. 12). No marked relation between number of SA and SI, but specimens with higher number of SA have a low SI (Fig. 12). There is no apparent sexual difference in SI (Fig. 12). Tongue anteriorly attached to floor of mouth, no narial plugs on tongue. Three series of teeth (PMT, PPT, DT), except in small juveniles in which PPT may be absent. PMT monocuspid, maximally 30 (Nussbaum & Hoogmoed, 1979) with little variation in size, but posterior maxillary teeth slightly smaller, extending to level of posterior border of the choanae or posteriorly of them. Maximally 30 PPT (Nussbaum & Hoogmoed, 1979), which may be mono- and bicuspid in one specimen or only bicuspid (Fig. 13), teeth smaller than PMT, no apparent variation in size. . DT monocuspid, maximally 23, approximately of same size as PMT. Fetal teeth in small juveniles (MPEG 22171 with TL 77 mm and MPEG 22172 with TL 78mm). MPEG 22171 has the three typical tooth series of *Microcaecilia*; the counts did not differ much from adult counts, with 18 monocuspid PMT, 16 mono- or bicuspid PPT and 18 DT with two flattened cusps (fetal teeth). MPEG 22172 has only two tooth series; 16 mono- or bicuspid PMT and 12 DT with two flattened cusps as in MPEG 22171. A scanning electronic microscope photo shows two flattened cusps, both with a series of micro cusps in fetal teeth of MPEG 22172 (Fig. 14 a). In both specimens the fetal teeth of the lower jaw are in a single row, different from fetal teeth on the dentary of *Caecilia gracilis* (MZUSP 57070), which are arranged in numerous rows.

Colour–In life, *M. taylori* is pink (Fig. 15), purple or light lavender, and this range of colours may occur in individuals of the same population (pers. obs.). Venter and lateral surfaces slightly lighter than dorsum along entire body; area surrounding the cloaca, mandible and part of head are lighter. Nussbaum & Hoogmoed (1979) provided a slightly different description but pattern here described was observed in paratype RMNH 15165B. Dark colour of dorsum extends laterally and ventrally in primary grooves of many specimens. Preserved specimens grayish or brownish, some with blotches resulting from lack of pigmentation. Nussbaum & Hoogmoed (1979) cited lighter spots in the posterior part of the body of the holotype.

Variation-Males have wider and longer heads than females, consequently all measures related to HW and HL are larger as well in males (Tab. 9). A similar dimorphism is found in *Brasilotyphlus guarantanus* (Maciel et al, in press). Since nothing is known about the ecology and natural history of this species, we can not make inferences about the cause of the dimorphism in head dimensions. Sexual dimorphism in head size was also reported for *Schistometopum thomense* (Bocage, 1873), in which males have greater head width and head length than females (Nussbaum & Pfrender, 1998). Delêtre & Measey (2004) tried to determine the cause of sexual dimorphism in *S. thomense*, rejecting an ecological hypothesis and postulating several hypothesis of sexual selection.

Geographic variation is not evident (Tab. 10). Two localities with the largest sample size showed practically the entire variation in number of primary and secondary annuli. The large differences in sample size among the populations prevent statistic analysis to tests for geographic differences.

Although the type specimens of *M. taylori* have no SA (Nussbaum & Hoogmoed, 1979), we found this character to be much more variable (0–21) than known until now. Because there are no other differences between specimens, and because the number of SA in other species is known to be variable, we have identified all specimens as *M. taylori* and have extended the known variation in SA.

Distribution: Brazil (state of Pará, south of the Amazon) and Surinam (area of Sipaliwini savanna) (Fig. 16).

Natural history-Nussbaum & Hoogmoed (1979) reported specimens of *M. taylori* from decayed logs on the forest floor, one specimen together with an individual of A*mphisbaena vanzolinii* Gans, 1962. Other collectors mentioned the same microhabitat in Caxiuanã (M.S. Hoogmoed; J. Gomes). Caldwell & Araújo (2005) at the Rio Xingu dug specimens of *Microcaecilia* sp. (which we suppose to be *M. taylori*) from rotted palm roots in a sandy-loamy soil and from mounds of soil at the base of an unidentified species of palm tree. At Curua-Una they collected a specimen from the stomach of *Micrurus lemniscatus* (L.), which was collected at night near pools in a road through forest.

Remarks–The lack of records of *Microcaecilia taylori* in Brazilian Guiana causes a disjunct distribution pattern, with most localities south of the Amazon and only the type locality at the border of Suriname and Brazil north of the Amazon (Fig. 16). However, as no morphological characters could be found that would separate these populations, we consider them all as *M. taylori*.

Caldwell & Araújo (2005) mention *Microcaecilia* sp. from two localities in Pará south of the Amazon. In a remark under “General comments” it is stated that this would be an undescribed species according to a pers. comm. of R. Nussbaum. Although we were not able to examine this material, we tentatively consider these specimens identical with *M. taylori* on the basis of the picture published and on the fact that from one locality (Belo Monte, Rio Xingu) we have examined several recently collected specimens of *M. taylori*.

A specimen (CHUNB 47937) from the municipality of Confresa, State of Mato Grosso, Brazil, has 138 PA, eight more than the highest number known for *Microcaecilia taylori*, but no other unique characters to distinguish it from *M. taylori*. CHUNB 47937 seems to be slightly more slender than *M. taylori*, but this may be related to the fact that the specimen is very dehydrated. We consider this specimen of uncertain identity and have not included it in our analyses.

***Microcaecilia unicolor* (Duméril, 1863)**

Rhinatrema unicolor Duméril, 1863: 321.

Microcaecilia unicolor: Taylor, 1968: 542; Frost, 1985: 623; Reynolds et al., 2004b; Frost, 2008.

Diagnosis–Maximum TL 235 mm. PA 106-117. SA 56-91. Eye not visible. PMT, PPT and DT monocuspid; maxillary teeth may extend posteriorly of level of choanae. Weak vertical keel may be present on terminal region of body. Small terminal shield. Dermal scales start between annulus 8 and 56.

Description- Based on literature (Taylor, 1968; Lescure & Marty, 2000) and MPEG 26476. Maximum TL 235 mm. TL 27–40 times BW. Head longer than wide, slightly narrower than body. Snout projecting distinctly beyond mouth. Nostrils subcircular, may be visible from above. Eyes not visible. Tentacle small, laterally positioned, near margin of mouth, closer to angle of mouth than to nostrils, they may be visible from above. TT larger than NN. Nuchal grooves distinct dorsally, laterally and ventrally, except the third which ventrally is incomplete; the second collar partially fused ventrally with the first primary body fold; a dorsal transverse groove is present on both collars, less pronounced on the first one. Body semi-cylindrical, slightly wider than deep. Width along the body may slightly vary. PA 106–117, completely encircling the body, except a few annuli that are ventrally incomplete at midbody and the annuli interrupted by the cloaca. SA 56–91, 40 complete in MPEG 26476. A small terminal shield; one annulus posterior to cloaca in MPEG 26476. Weak vertical keel may be present on the terminal shield. Opening of the cloaca transverse, sometimes slightly irregularly shaped. AD 12 in MPEG 26476; about as many on the anterior as on the posterior edge of the cloaca (six anterior and six posterior in MPEG 26476). SI on annulus 8 in MPEG 26476 and at most on annulus 56 (Taylor, 1968). Tongue anteriorly attached to floor of mouth, no narial plugs on tongue. Three series of teeth. PMT monocuspid, maximally 17, little variation in size, posterior maxillary teeth slightly smaller, PMT series may extend slightly posteriorly to level of choanae (e.g. in MPEG 26476). PPT monocuspid maximally 28, with no apparent variation in size; teeth smaller than PMT. Maximally 26 monocuspid DT, approximately of the same size as PMT.

Colour-The colour of body of MPEG 26476 in life is dark blue except for the jaw and gular region, and to the cloaca which are reddish white. Lescure & Marty (2000) mention bluish gray or dark blue to the colour of the body and whitish or whitish pink to the gular region.

Variation-For variation see description and for comparison with other species of *Microcaecilia* see Tab. 11.

Distribution-French Guiana and Brazil (state of Pará) (Fig. 16).

Remarks-Taylor (1968) designated a lectotype for *Microcaecilia unicolor* and described a specimen from Guyana. Taylor (1972) recognized that in his monograph of 1968 he referred the specimen of Guyana to *M. unicolor* with “some hesitancy” due to the lower number of annuli and higher number of PMT than in the other known specimens from French Guiana. Wilkinson et al. (in press 2009) state that the specimen studied by Taylor (1968) from Guyana and the specimens from Suriname cited as *M. unicolor* by Nussbaum & Hoogmoed (1979), are possibly undescribed species, or in the case of the Suriname specimens that they could represent juveniles of *Microcaecilia grandis* Wilkinson et al (in press).

Wilkinson et al. (in press) divide *Microcaecilia* into two groups of species based on dentition characters. According to them, *M. unicolor* is grouped with the species that have monocuspid PPT and PMT not reaching posteriorly to level of choanae. The single Brazilian specimen studied here, only differs from *M. unicolor* as understood by Wilkinson et al. (in press), in having the maxillary teeth reaching posteriorly of choanae and a slightly higher count of secondaries than the highest value known (Duméril, 1863; Taylor, 1968; Wilkinson et al. in press).

Microcaecilia sp. nov.

Holotype–MPEG 14596 (Fig. 17), from Reserva Pacanari (00º38’ S 52º34’ W), District of Monte Dourado, municipality of Almeirim, State of Pará, Brazil, 4-XII-2001, leg. A. L. Prudente and R. R. Silva.

Paratypes-MPEG 14597 same data as the holotype. IEPA/TQ 233 from the Parque Nacional Montanhas do Tumucumaque, Igarapé Mapaoni, Municipality of Laranjal do Jari, State of Amapá, Brazil (N 2° 11’ W 54° 35’), January 2005 and IEPA/TQ 721 from the Parque Nacional Montanhas do Tumucumaque, Igarapé Mutum, Municipality of Pracuúba, State of Amapá, Brazil (N 1° 23’ W 51° 53’), between October and November 2005, both leg. Jucivaldo Lima.

Diagnosis-Maximum TL 227 mm. PA 122–129. SA 42-51. Eye not visible. PMT and DT monocuspid; PPT bicuspid; maxillary teeth extending posteriorly of the level of the choanae. A small terminal shield is present. A weak vertical keel may be present in the terminal region of the body. Scales starting between annulus 23 and 56.

Comparison with other species-*Microcaecilia* sp. nov. differs from *M. unicolor*, *M. albiceps,* and *M. rabei* in having a higher number of PA and from *M. supernumeraria* in having a lower number of SA; it has a higher number of SA than *M. taylori*.

Microcaecilia sp. nov. differs from *M. grandis* Wilkinson, Nussbaum & Hoogmoed (in press) by its smaller size, in not having the top of the head slightly convex, and not having concave upper jaw margins.

Microcaecilia sp. nov. is distinct from all other species in having a small terminal shield (an intermediate condition between absence of terminal shield in *M. supernumeraria* and well defined terminal shield in other species like in *M. taylori*). For further comparisons see Tab. 11.

Description–Maximum TL 227 mm. TL 35.7-48.3 times (41.1 ± 4.6; n = 4) BW. Head longer than wide, slightly narrower than the body. Snout projecting distinctly beyond the mouth. Nostrils subcircular. Eyes not visible, not even in the smallest juvenile specimens. Tentacle small, laterally positioned, near the margin of the mouth, closer to angle of the mouth than to nostril, may be visible from above. TT larger than NN. Nuchal grooves may be distinct dorsally, laterally and ventrally, except the third groove which ventrally is incomplete; two nuchal collars, second nuchal collar ventrally partially fused with the first primary body fold; a dorsal transverse groove on the collars, less pronounced on the first one. Body semi-cylindrical, slightly wider than deep. Width along the body may vary slightly. PA 122-129; completely encircling the body, except the first and/or second anterior annuli, that are ventrally incomplete, some annuli ventrally incomplete at midbody and the annulus interrupted by the cloaca. SA 42-51; at most 11 complete. Opening of cloaca transverse, sometimes slightly irregularly shaped. AD 10-13; generally about as many on anterior as on posterior edge of cloaca (e.g. five anterior and five posterior in MPEG 14597). Paired anal glands may be present. Small terminal shield on the posteriormost part of body; at most one annulus posterior to level of cloaca. Dermal scales start between annulus 23 and 56; at most six rows of dermal scales per fold. Tongue anteriorly attached to floor of mouth, no narial plugs on tongue. Three series of teeth. PMT monocuspid, maximally 31, with little variation in size, but posterior maxillary teeth slightly smaller, extending to level of posterior border of choanae or posteriorly of them. Maximally 22 bicuspid PPT with no apparent variation in size; smaller than PMT. DT monocuspid, maximally 22, approximately same size as PMT.

Colour-In preservative grayish or brownish with the lateral and ventral surfaces of the body slightly lighter than the dorsum. Grooves on sides of body may be slightly darker than general body colour.

Variation–Insufficient data for statistical tests for sexual dimorphism, intra-, and interpopulational variation. For variation see description and Tab. 11.

Distribution–Only known from the localities where holo- and paratypes were collected in northeastern Pará and adjacent western Amapá, Brazil. (Fig. 16).

Nectocaecilia Taylor 1968 (Monospecific genus).

***Nectocaecilia petersii* (Boulenger, 1882)**

Nectocaecilia petersii: Taylor 1968: 279; Frost, 1985: 640; Mijares et al., 2004; Frost, 2008.

Typhlonectes sp. 2 Bannerman, 2001: 164.

Diagnosis- TL 590 mm (holotype, Taylor, 1968). Tentacles closer to nostrils than to the eyes. Nostrils subtriangular, may be visible from above. Choanae open. No dorsal keel or fin present. Body semi-cylindrical. PA 131–145. Fetal gills dorsolaterally attached in the nuchal region.

Description–Species reaching 590 mm TL; TL/BW 33.8-37 times (35.6 ± 1.1; n = 4). Head longer than wide, HL/HW 1.4-1.5 (1.4 ± 0.04; n = 5). Head slightly narrower than body. Snout projecting distinctly beyond mouth (1.6 mm in MPEG 7555). Nostrils subtriangular and may be visible from above. Eyes visible, in an open orbit. Small tentacles anteriorly in head, slightly behind and below nostrils, near margin of mouth, much closer to nostrils than to angle of mouth, and not visible from above. EE slightly larger than TT and much larger than NN. Nuchal grooves may be totally indistinct dorsally and ventrally but distinct laterally; no dorsal transverse groove present on either of the collars. Body semi-cylindrical, slightly wider than deep. PA 131-145; narrowly interrupted dorsally and ventrally along the greater part of the body, the most posterior ones may be complete. Unsegmented terminal shield; annuli ending anteriorly of the cloaca. No SA. Dermal scales absent. Region posteriorly of cloaca may be slightly compressed. Cloacal disk subcircular. AD nine (n = 5), four anterior and five posterior of the cloaca. Paired anal glands were only observed in one male of a total of five specimens studied. Tongue not completely attached anteriorly to floor of mouth; two narial plugs. Four series of teeth, all monocuspid. PMT maximally 38 (Taylor, 1968), varying in size, posterior ones slightly smaller, they may extend posteriorly of level of choanae, like PPT. PPT maximally 34 (Taylor, 1968), posterior teeth smaller. No diastema between PVT and PPT; teeth approximately same size as PMT. DT maximally 30, approximately same size as PMT; posterior teeth smaller. ST at most six, slightly smaller than DT.

Fetuses have gills attached dorsolaterally in the nuchal region (Wilkinson, 1989).

Colour–In preservative the colour is dark brown, grooves along body darker. Skin above the eyes lighter than the colour of the body.

Variation-Insufficient data for statistical tests for sexual dimorphism, intra-, and interpopulational variation. For variation see description.

Distribution–Venezuela and Brazil (State of Amazonas) (Fig. 18). Mijares et al. (2004) stated that the only known locality for this species was the general area of Cerro Yapacana in Venezuela, but they assumed the species would also be present in Brazil and Colombia. We here provide distributional data for Brazil, which considerably extend the known distribution with approximately 440 km to the south. Up till now *Nectocaecilia petersii* was collected only in few localities in Brazil (Reserva de Desenvolvimento Sustentável Mamirauá and Rio Tea).

Natural history-Gorzula & Celsa Señaris (1998) found 23 specimens in Venezuela, 20 of them in a plot of two square meters, in burrows of the fish *Synbranchus* near a creek; one specimen was found crawling on the bank of a creek at night. A similar microhabitat was recorded for *Typhlonectes compressicauda* (Moodie, 1978). MPEG 7555 from Mamirauá was collected between the roots of floating vegetation (field data MSH).

Remarks–Taylor (1968, 1970a) described *Nectocaecilia fasciata*, *N. ladigesi*, *N. cooperi*, and *N. haydee*, that were later synonimized with respectively, *Chthonerpeton indistinctum*, *Typhlonectes compressicauda* and *T. natans* (*N. cooperi* and *N. haydee* (Wilkinson, 1988, 1989, 1991, 1996).

Potomotyphlus Taylor 1968 (Monospecific genus)

***Potomotyphlus kaupii* Berthold, 1859**

Caecilia kaupii Berthold, 1859: 181**.**

Chthonerpeton microcephalum: Miranda-Ribeiro, 1937: 66; Miranda Ribeiro 1955: 407

Typhlonectes kaupii: Dunn 1942: 537

Potomotyphlus kaupii: Taylor, 1968: 257; Frost, 1985: 640; Lescure & Marty, 2000: 306; Caramaschi, U., & Pombal Jr., 2000: 49; Wilkinson et al., 2004; Marty et al., 2007a 35; Marty et al., 2007b: 38; Galatti et al 2007: 93; Frost, 2008.

Diagnosis–TL 695 mm (Taylor, 1968). PA 83–102. SA absent. Head slightly depressed ventrally, narrower than most of the body. Small tentacles closer to nostrils than to eyes. Nostrils subtriangular, may be visible from above. Body compressed. A dorsal keel or fin, at least on posterior half of body. Marked sexual dimorphism in terminal region, females having terminal tip narrower and more pointed than in males. Cloacal disk elongate anteriorly, rounded posteriorly. Cloacal disk may be sunken in relation to surrounding surface and surrounded by fleshy folds of skin.

Description– Species reaching 695 mm TL. TL/BW 28.8–68.1 times (41 ± 8.7; n = 41). Head small, narrower than body and slightly depressed. Head longer than wide, HL 1.1–1.9 times HW (1.5 ± 0.1; n = 59). Snout projecting distinctly beyond mouth. Nostrils subtriangular, and may be visible from above. Eye in open orbit, visible in most specimens, indistinct in some, independently of size. Small tentacles positioned anteriorly in head, below nostrils, near margin of mouth, much closer to nostrils than to angle of mouth, not visible from above. EE slightly less than TT and more than NN. Nuchal grooves may be indistinct or distinct laterally and ventrally. Body compressed, deeper than wide. PA 83–102; interrupted dorsally. The last 3–6 annuli only distinct laterally. SA absent. No annuli from approximately level of cloaca to terminal tip of body. Cloacal disk extended anteriorly; some anterior denticulations are elongate (two in MPEG 9672). AD 7–11 (9 ± 0.7; n = 50); generally an approximately similar number in posterior and anterior edge of cloaca (e.g. four anterior and five posterior ones in MPEG 2888). Cloacal disk may be sunken in relation to surrounding surface and be surrounded by fleshy folds of skin in both males and large females. Paired anal glands only observed in two male specimens of a total of 57 specimens studied. Dermal scales absent. Tongue completely attached anteriorly to floor of mouth; two large narial plugs. Four series of teeth, all monocuspid. PMT maximally 60, with no distinct variation in size; extending posteriorly of level of choanae like PPT. PPT maximally 53. No diastema between PVT and PT; smaller than PMT. DT maximally 64, approximately same size as PMT; posterior teeth smaller. ST at most 12, approximately same size as PPT.

Colour–In life grayish or brownish. Grooves along body may be darker than body. Marty et al. (2007a) describe the colour of a freshly dead female as: body blue-grey, lighter on head. Underside white-blue. Grooves of primary annuli darker than rest of body. Colour of second specimen (not collected) in life is described as dorsally grey, changing to blue on head and a whitish ventral colouration. Colour photograph of live specimen published in Marty et al. (2007b) agrees completely with that description.

Variation-Sexual dimorphism in cloacal region: males have cloaca more sunken than large females, and small females do not have cloaca sunken at all. For variation see description and Tab. 12.

Distribution–Amazon and Orinoco drainage systems in northern South America: Brazil (states of Acre, Amapá, Amazonas, Goiás, Pará and Roraima), Colombia, Ecuador, French Guiana, Peru and Venezuela (Fig. 19). Lescure & Marty (2000: 306) doubted the locality “Cayenne” of a specimen in the museum in Brussels, but recently (Marty et al., 2007a; Marty et al., 2007b) they had to correct that opinion when they reported on recently collected, respectively photographed, specimens from Saut Maripa in the Oyapock river, south of Saint-Georges-de-l´Oyapock, French Guiana (this is in the border river between French Guiana and Amapá, Brazil).

Natural history- Marty et al. (2007a) report on a specimen that was collected at night in shallow water at the edge of a river in a cataract area. The specimen was slowly swimming and now and then approached the substrate. Marty et al. (2007a) concluded that the species thus could live in running water. Marty et al. (2007b) reported on a second specimen, observed at the same locality as the one reported upon by Marty et al. (2007a), also active at night, that moved around in crevices in rocks at the edge of the Oyapock river.

In the region of Belém, Brazil, specimens are regularly found in native shrimp traps called “matapi” by local people (Personal observation).

Siphonops Wagler 1828

Diagnosis-Maximum TL 450 mm. Eye visible. Dentition in three series. ST absent. Dermal scales absent. Tentacles closer to eyes than to nostrils. Terminal shield big, unsegmented; annuli ending before the cloaca. Primary annuli completely encircling the body, except for a few near the cloaca. Secondary annuli absent.

Siphonops annulatus (Mikan 1820)

Caecilia annulata: Mikan, 1820: pl. II.

Siphonops annulatus: Goeldi, 1899: 170; Spengel, 1915: 220; Dunn, 1942: 480; Taylor, 1968: 555; Hoogmoed, 1979: 273; Frost, 1985: 631; Lescure & Marty, 2000: 297; Lavilla et al., 2004; Frost, 2008.

Diagnosis–Maximum TL 450 mm. Annuli 78-98 (Taylor, 1973). Primary annuli completely encircling the body except for the three or four posteriormost ones. Secondary annuli absent. Eyes visible. Dentition in three series. Splenials absent. Scales absent. Tentacles closer to the eyes than to the nostrils.

Description–Maximum TL 450 mm (Taylor 1973). TL 17-26 times BW (Taylor 1968). Head slightly longer than wide and narrower than body. Snout projecting distinctly beyond mouth. Nostrils subcircular, may be visible from above. Eyes visible in open socket slightly elevated above the surface of the head. Tentacles small, laterally positioned, near margin of mouth, closer to eye than to nostril or angle of mouth; may be visible from above. TT larger than NN. Nuchal grooves distinct dorsally and ventrally, second collar partially fused below with first primary fold; dorsal transverse groove on each of both collars, less pronounced on the first one. Ventral transverse groove may be present on first collar. Body cylindrical, slightly wider than deep. Width along body may slightly vary. PA 78–98 (Taylor, 1973), completely encircling body, except for anterior body annulus that is ventrally fused with collar and some incomplete annuli in region near cloaca (e.g. four in MPEG 9193). SA absent. Dermal scales absent. Large unsegmented terminal shield extending from anteriorly of cloaca to posterior tip of body. Opening of cloaca subcircular, T-shaped, or I-shaped (Taylor, 1968). AD 9–10; generally about as many on the anterior as on the posterior edge of the cloaca (i.e. five anterior and four posterior in MPEG 9193). No dermal scales. Tongue anteriorly attached to floor of mouth, no narial plugs on tongue. Three series of teeth. PMT monocuspid, maximally 43 (Taylor, 1968) with little variation in size, posterior maxillary teeth slightly smaller, extending posteriorly of level of choanae. Maximally 47 monocuspid PPT (Taylor 1968) with no apparent variation in size; teeth smaller than PMT. DT monocuspid, at most 32 (Taylor, 1968), slightly larger than PMT. Fetal teeth in neonates in three rows in the lower jaw (Wilkinson & Nussbaum, 1998; Wilkinson et al., 2009).

Colour–Blackish or bluish with white grooves. Wilkinson et al (2009) reported a variation in color of females during parental care due to histological changes in the skin; attending females being much paler than the other adults.

Distribution–Cis-Andean South America (Argentina, Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Paraguay, Peru, Suriname, Venezuela) (Fig. 20), except in Chile and Uruguay (Dunn, 1942, Taylor, 1968, Lynch, 1999, Lavilla et al., 2004; Frost, 2008).

Natural History-Goeldi (1899) mentioned the encounter of a female with eggs under a moved tree trunk during ploughing of a pasture, and thus was the first to report oviparity in *Siphonops annulatus*. Taylor (1968) linked the wide distribution of *S. annulatus* to the fact that its moisture requirements are less than those in many other caecilians. Lynch (2006) also mentioned the tolerance of *S. annulatus* to dry conditions and reported finding specimens "under decomposing trunks of African oils palms, even in grazed pastures". Wilkinson et al. (2008) described dermatophagy in juveniles, which fed on their mother´s skin.

Remarks–Presumed to be the Gymnophionan with the largest known geographic distribution. Surprisingly, within its large distribution *S. annulatus* presents low variation, at least in external morphological characters (Dunn, 1942; Taylor, 1968; Lynch, 1999).

Although the species was reported from Suriname by Dunn (1942), Nussbaum & Hoogmoed (1979) clearly state that "Its occurrence in Surinam could not be confirmed by recent collections." Despite continued collecting this situation has not changed since (Hoogmoed, in press).

Taylor (1973) discussed geographic variation in number of annuli, and noted that specimens from Ecuador, Perú and Bolivia had higher counts (90-98) than specimens from the eastern part of the distribution of the species (80-90) Lynch (1999), however, found a range of 81–97 annuli for specimens from Colombia, with lower and higher limits close to the known extremes of variation. Our limited data on three Brazilian specimens show a range of 84–94. Two specimens from Guajará-Mirim and Espigão D'Oeste, State of Rondônia, have respectively 84 and 94 annuli and the other one from Juruá, State of Amazonas, has 84 annuli. Thus, the difference between eastern and western populations signalized by Taylor (1973) is not real and probably was due to lack of material.

In Brazil this species was recorded from Caatinga (Freitas & Silva, 2007), Atlantic forest (Taylor, 1968; Hoogmoed pers. obs.), Cerrado, and from Amazonia (our data). Although it is a species considered common in scientific collections (Taylor, 1968) the number of specimens from Brazilian Amazonia we could locate is very low. We did not analyze specimens from outside Amazonia.

Typhlonectes Peters, 1880

Diagnosis–TL up to 800 mm. Head slightly depressed. Tentacles closer to nostrils than to eyes. Nostrils subtriangular, visible from above. Dorsal keel or fin present in posterior part of body. Marked sexual dimorphism in terminal region, females having terminal tip narrower and more pointed than in males. Fetal gills dorsally attached to the nuchal region. Cloacal disk subcircular, may be in depression and be surrounded by fleshy folds of skin.

***Typhlonectes compressicauda* Duméril & Bibron, 1841**

Caecilia compressicauda Duméril & Bibron, 1841: 278.

Typhlonectes obesus: Taylor 1968: 253; Wilkinson, 1991: 307.

Typhlonectes compressicauda: Taylor, 1968; Moodie, 1978: 1005; Hoogmoed, 1979: 273; Frost, 1985: 640; Wilkinson, 1991:304; LaMarca et al., 2004; Neckel-Oliveira &

Gordo, 2004: 165, 171; Wilkinson & Nussbaum 2006: 71; Galatti et al 2007: 93; Frost, 2008.

Nectocaecilia ladigesi Taylor 1968: 273; Taylor, 1970b: 859; Wilkinson, 1991: 307; Glaw & Franzen, 2006: 156.

Typhlonectes cunhai Cascon, Lima-Verde & Benevides Marques, 1991: 96.

Typhlonectes sp. 1 Bannermann, 2001: 164.

Diagnosis–Maximum TL 800 mm. PA 75-88**.** Head slightly depressed. Nostril subtriangular. AD 9-11. SA absent. Fetal gills attached to the dorsal nuchal region. The cloacal disk may be in a depression and surrounded by fleshy folds of skin. Cloacal disk subcircular. Terminal part of the body triangular in cross-section with a flat ventral base and a ridge on the dorsum.

Description–TL 800 mm (Moodie, 1978); TL/BW 16-36.8 times (23.3 ± 4; n = 67). The head may be slightly narrower than the body and slightly depressed Head longer than wide, HL 1.1-1.7 times HW (1.4 ± 0.1; n = 107). Snout projecting distinctly beyond mouth (e.g. 2.3 mm in MPEG 22566). Nostrils subtriangular, and may be visible from above. Eyes visible, in open orbit. Small tentacles anteriorly in head, slightly behind and below nostrils, near margin of mouth, much closer to nostrils than to angle of mouth, and generally not visible from above. EE larger than TT and NN. Nuchal grooves may be totally indistinct dorsally and ventrally but distinct laterally; no dorsal transverse groove on either of the collars. Body compressed, deeper than wide. PA difficult to count, especially in the posterior part of the body of most of specimens, because of the occurrence of folds in the loose skin that are not annuli. PA 75-88; interrupted dorsally along most of the body. PA ending anterior of cloaca. SA absent. Unsegmented terminal shield posteriorly of cloaca; may be slightly compressed. Terminal part of body triangular in cross-section with a flat ventral base and a ridge on dorsum, with difference in shape between males and females. Cloacal disk subcircular; AD 9-11 (10 ± 2.1; n = 103); generally an approximately similar number in posterior and anterior edge of cloaca (e.g. five anterior and five posterior ones in MPEG 8006). Cloacal disk may be located in a depression and be surrounded by fleshy folds of skin in both large males and females. Paired anal glands only present in four males of 98 specimens analyzed. Diminutive dermal scales may be present in the dermis of some specimens in the posterior quarter of the body (Wake, 1975). The tongue is not completely attached anteriorly to floor of mouth; two large narial plugs. Four series of teeth, all monocuspid, but strong variation in shape of teeth may occur, with a tendency to have a much dilated tooth crown in juveniles (Wilkinson, 1991). PMT maximally 52 (Taylor, 1968) with no distinct variation in size, they may extend posteriorly of level of choanae like PPT. PPT maximally 48, smaller than other teeth. No diastema between PVT and PPT. DT maximally 60 (Taylor, 1968), larger than PMT. ST at most 14, approximately same size as PPT.

Colour–In preservative different tonalities of brown or blue. The colour is homogeneously distributed along body, except around the eyes and the cloacae region, which are lighter.

Variation-A distinct sexual dimorphism in terminal region, females having narrower and more pointed terminal tip than males.

A single specimen (MPEG 4616) has nine anal denticulations, which is an uncommon condition in *Typhlonectes compressicauda*. This number of anal denticulations was considered by Taylor (1968) to be characteristic for *T. natans*.

Geographic variation is not evident (Tab. 13).

Distribution-Brazil, Colombia, French Guiana, Guyana, and Peru (Fig. 21) (Taylor, 1968; Nussbaum & Hoogmoed, 1979; Duellman & Trueb, 1994; Lynch, 1999.

Natural history-This species is viviparous and gives birth to aquatic juveniles. Some authors (Wake 1970; Moodie, 1978; Exbrayat, 1983; Exbrayat & Delsol, 1985; suggested a markedly seasonal reproductive cycle for *Typhlonectes compressicauda*. Murphy et al (1977) provided observations on breeding behavior of *T. compressicauda* comparing it with that of another Typhlonectinae, *Chthonerpeton indistinctum*.

Moodie (1978) found specimens in tunnels at water level about 30-60 cm deep in a bank of a river in Brazilian Amazonia with the tunnels about 3–4 m separated, which suggests a high population density. Animals spent the day in tunnels and at night left the tunnels to search for food in the Solimões river, preferably in shallow water. Moodie (1978) analyzed the gut contents of 50 individuals and found shrimps and other arthropods. Moodie (1978) came to the conclusion that the reproductive cycle is influenced by the seasonal variation in water level. Verdade et al (2000) found insects, annelids, anuran eggs and vegetal matter in the guts of 18 juvenile *T. compressicauda*. MPEG 7549 was encountered at 23:00 h in shallow water (10 cm deep) between grass, at the margin of a river with dead, fallen trees and grassland.

Apparently this species is relatively abundant, being well known to local fishermen. In the region of Belém, Brazil, it is not difficult to find specimens in native shrimp traps called “matapi” by local people (Personal observation).

This species generally is considered aquatic, but Himstedt (1996; 1998), basing himself on the observations of Moodie (1978) in Brazilian Amazonia and on observations of *Chthonerpeton indistinctum* (Reinhardt & Lütken, 1862) in an aquaterrarium, comes to the conclusion that Typhlonectins probably are not purely aquatic, but rather show an amphibious way of life, spending part of the time (daytime) in burrows on land, and spending the night in the water, searching for prey. The observations of Gorzula & Señaris (1998) on *Nectocaecilia petersi* in Venezuela do not seem to completely support

Himstedts supposition. They found *N. petersi* in tunnels of the fish *Synbranchus*, apparently partly under water (time of day not stated), and they found an active specimen crawling on the bank of a creek at night.

T. compressicauda in captivity was observed to swallow the skin after shedding (Carvalho-Filho, pers. obs.).

Remarks-Wilkinson (1991) synonimized *Typhlonectes cunhai*, *T. obesus* and *Nectocaecilia ladigesi* with *T. compressicauda*. We have no reason to doubt these synonimizations.

RHINATREMATIDAE Nussbaum 1977

Rhinatrema Duméril & Bibron 1841

Diagnosis–Specimens with maximum TL 263 mm. Tentacles opening in a longitudinal, semicircular slit in skin, projecting anteriorly from above anterior part of eye. Cloaca longitudinal, transversal or t-shaped. A true tail present, with maximally 11 annuli. In males ventral tail tubercles present or not. Mouth terminal; snout not projecting beyond the mouth. Tongue may have longitudinal grooves. No narial plugs. Four teeth series; PMT, PPT, DT, ST. One row of scales per body fold. Boldly patterned brown with yellow longitudinal lateral bands.

Rhinatrema bivittatum **(Guérin-Méneville, 1838)**

Caecilia bivittatum Guérin-Méneville1838:16.

Rhinatrema bivittatum: Duméril & Bibron, 1841: 288; Taylor, 1968: 159; Hoogmoed, 1979: 273; Frost, 1985: 637; Lescure & Marty, 2000: 294; Gaucher et al., 2004; Frost, 2008; Stuart et al., 2008: 95.

Diagnosis–*Rhinatrema* with large yellow cephalic spot; total body annuli, 315-384. Males with granules on ventral surface of tail, posterior of cloaca. Posterior of cloaca only in females some tail annuli complete. Longitudinal grooves may be present on the tongue. First and second nuchal grooves distinct.

Description–Maximum TL 246 mm (MPEG 23548). TL/BW 22.2–31.4 times (26.6 ± 2.6; n = 10). Head longer than wide, HL 1.5–1.7 times LC (1.6 ± 0.07; n = 10). Mouth terminal; indistinct snout. Nostrils visible from above, near tip of snout; NTS always equal or larger than NNM, and equivalent to approximately half NN (e.g. NTS = 0.8 mm; NMM = 0.7 mm; NN = 1.6 mm in MPEG 23548). Tentacles opening in semicircular slit in skin, projecting anteriorly from above anterior part of eye.. Eyes visible in open orbit; medially positioned between nostrils and angle of mouth, slightly closer to nostrils than to angle of mouth in most specimens (e.g. EJA = 3.2 mm, EN = 2.7 mm MPEG 23548). Eyes positioned at same level as or slightly above nostrils EMM = 0.7 mm; NMM = 0.7 mm in MPEG 23548); EE larger than NN (e.g. EE = 4.1 mm; NN = 1.6 mm in MPEG 23548). First nuchal groove distinct dorsally; the second complete dorsally and ventrally; third groove indistinct; no dorsal transverse groove on first collar. Body semi-cylindrical, slightly wider than deep, (e.g. BW = 6.2 mm; BH = 5.7 mm in MPEG 23549). Total body annuli 315–384; most annuli complete, except some anterior annuli which are ventrally fused to the collar (e.g. six in MPEG 23548), and the annuli interrupted by the cloaca (e.g. five in MPEG 23549). Small unsegmented terminal shield. Tail small and slender, reaching at most 3.5 mm (RMNH 17667, Nussbaum & Hoogmoed, 1979). Sexual dimorphism in structure of tail: all tail annuli incomplete in males, due to presence of tubercles on ventral region of the tail; females without ventral tubercles but with complete and some (e.g. four in MPEG 23548) incomplete annuli. Dermal scales from first body annulus to last annulus on the tail; one row of dermal scales per body fold, the rows of dermal scales completely encircling the body, except in the first incomplete body annuli and in the incomplete tail annuli. The cloaca may be transversal or T-shaped (Fig. 22); AD 10–12 (11 ± 5; n = 7). Paired anal glands may be present. Tongue anteriorly completely attached to floor of mouth; no narial plugs. According to Taylor (1968) tongue strongly marked by grooves but in specimens studied here longitudinal grooves are absent or only slightly distinct on surface of tongue . Four series of teeth, all monocuspid. PMT maximally 33 (Nussbaum & Hoogmoed, 1979) with little variation in size, maxillary teeth slightly larger, they may extend posteriorly of level of choanae like PPT. PPT maximally 37 (Nussbaum & Hoogmoed, 1979), with hardly any variation in size; teeth smaller than the maxillary teeth. No diastema between PVT and PPT. DT maximally 28 (Nussbaum & Hoogmoed, 1979), approximately same size as PMT. ST at most 31 (Nussbaum & Hoogmoed, 1979), approximately same size as PPT.

Colour–Tip of snout yellow; irregular, large yellow spot on anterior region of head, generally not reaching tip of snout, posteriorly surpassing level of eyes, but not reaching occipital region. Irregular yellow stripe connecting eyes and nostrils. Upper and lower border of mouth yellow like cephalic spot, and those two stripes may form one stripe on side of head behind corner of mouth. Gular region of same colour as venter; yellow stripe with irregular upper and lower border on sides of body from level of collars to level of cloaca. It may be fused to the mouth stripes. Dorsum of body brown with small yellow spots randomly distributed; underside slightly lighter than dorsum and with more dispersed yellow spots. Dorsal part of tail may have yellow spot (e.g. MPEG/AP348 and IEPA/TQ287). Females with small lighter region close to tip of tail. Tongue dark.

Variation–Males with group of tubercles on ventral region of tail (Fig 22); absent in females. No apparent sexual difference in number of annuli as suggested by Nussbaum & Hoogmoed (1979). Insufficient data for statistic analyses. Further data on variation in description and in Table 14.

Distribution–Guyana, French Guiana, Suriname and Brazil (states of Amapá and Pará north of the Amazon) (Fig. 23).

Remarks-Nussbaum & Hoogmoed (1979) only had four specimens of *R. bivittatum* available: the holotype from Cayenne, French Guiana, and three specimens collected in Brazil, Guyana and Suriname. Recent collections in Brazil and in French Guiana showed that this species is relatively common (specimens here treated, Lescure & Marty, 2000; Wilkinson & Nussbaum, 2006).

Taylor (1968) noted that second collar is distinct and larger than first, but did not mention the third nuchal groove. He considered the first few ventrally incomplete body annuli as the posterior limit of the second collar in both *Rhinatrema bivittatum* and *Epicrionops* spp. (Taylor 1968). Here we regard the third nuchal groove as indistinct and consequently also the posterior delimitation of the second collar. According to Taylor (1968) dermal scales start on the collars, a condition present only in Ichthyophidae (at that time including *Rhinatrema*), but in our opinion in *Rhinatrema* dermal scales only start at the first PA.

***Rhinatrema* sp. nov.**

Rhinatrema cf. *bivittatum*: Kok & Kalamadeen, 2008: 246.

Holotype–MPEG 19967 (Fig. 24), Brazil, state of Pará, municipality of Oriximiná, Porto Trombetas, Plateau Almeidas (S 1°40’ W 56°27’); collected by U. Galatti, J. A. R. Bernardi, and F. Sarmento, on 4 February 2006.

Paratypes–33 specimens. MPEG 19966, same data as holotype; MPEG 20167–20177, Porto Trombetas, collected by R. Carvalho Jr., 10–21 May 2006; MPEG 17435, Porto Trombetas, Plateau Almeidas (S 1°40’ W 56°27’) collected by R.A.T. Rocha, J.A.R.

Bernardi and G.L.F. Silva, 14 June 2004; MPEG 21912, Porto Trombetas, Plateau Bacaba collected by G.F. Maschio and equipe, 8 November 2007; MPEG 16975, Porto Trombetas, Plateau Almeidas (S 1°40’ W 56°27’) collected by R.A.T. Rocha, J.A.R. Bernardi and G.L.F. Silva, 29 September 2003. MPEG 26478, Porto Trombetas collected by J.A.R. Bernardi and F. Sarmento, 1 February 2009; MPEG 26477, Brazil, state of Pará, municipality of Oriximiná, Serra do Acaraí, 01°17,1’N; 58°41,7’W; collected by T.C.S. Avila-Pires, W. Rocha., and M.A. Ribeiro-Junior, 30 August 2008. MPEG 26945, Brazil, State of Amazonas, municipality of Urucará, 2°24’54’’S; 57°38’22”W, collected by E. G. Pereira, and equipe, 10 February 2009. MNRJ 47921, 48248 from Porto Trombetas collected by E.G. Pereira and equipe, 16 December 2006 and 30 January 2007; MNRJ 52982–52987; PUCMG 10114, 10115, 10134, 10178, Porto Trombetas, collected by D. Baêta and equipe between 4 March 2008 and 28 June 2008.

Diagnosis–A *Rhinatrema* without large cephalic spot on anterior part of head, TBA 276–338. No tail tubercles in males and females. Cloaca may be transversal or longitudinal. Only first nuchal groove distinct. Tongue with distinct longitudinal grooves.

Comparison with *R. bivitattum*-*Rhinatrema* sp. nov. differs from *R. bivittatum* mainly in having lower number of TBA (276-338 instead of 315-384 in *R. bivittatum*); in lacking large yellow spot on the anterior region of head; in absence of tail tubercles in males and in having only first nuchal groove distinct.

Description–Maximum TL 263 mm (MNRJ 52982). TL/BW 19.6-27.7 (24.3 ± 4.7; n = 33). Head longer than wide; slightly narrower than the body. Mouth terminal; snout hardly projecting beyond the mouth. Nostrils subcircular, visible from above, near the tip of the snout. NTS always equal or larger than NMM, and equivalent to approximately half NN. Tentacles opening in a semicircular slit in the skin, projecting anteriorly from above anterior part of eye extending in front of it. Eyes visible in open orbit; medially positioned between nostrils and angle of mouth, slightly closer to nostrils than to angle of mouth in most specimens. Eyes at same level or slightly above that of nostrils in relation to margin of mouth. EE larger than NN. First nuchal groove distinct dorsally and ventrally, no dorsal transverse groove; second and third nuchal grooves indistinct. Body nearly cylindrical, slightly wider than deep. TBA 276-338; most annuli complete, except few anterior annuli which are ventrally continuous with collar (e.g. four in MPEG 19966), and annulus interrupted by the cloaca. Small, unsegmented terminal shield on tip of tail. Tail small and slender with a maximum length of 3.5 mm (MPEG 26477). All tail annuli complete in males and females; no tubercles on the ventral region of the tail in either sex.. Dermal scales from first body annulus to last tail annulus; one row of dermal scales per body annulus, completely encircling the body, except in first few incomplete body annuli. Cloaca may be transverse or longitudinal (Fig. 22); AD 13-20 (15.4 ± 5.4; n = 29). Paired anal glands may be present; more frequent in males (in 14 males and in two females of 32 specimens verified). Tongue completely attached to floor of mouth anteriorly; with distinct longitudinal grooves; no narial plugs. Four series of teeth, all monocuspid. PMT maximally 29 with slight variation in size, maxillary teeth slightly larger, they may extend posteriorly of level of choanae, like PPT. PPT maximally 34, with indistinct variation in size. No diastema between PVT and PT; teeth smaller than those in maxillary series DT maximally 24, approximately same size as PMT. ST maximally 28, approximately same size as PPT.

Colour–Two colour patterns for the dorsum of the body can be discerned. In the first, the dorsal region is predominantly dark brown with sparse yellow spots. The other pattern is characterized by more and closer spaced yellow spots than in the first pattern. Border of lower jaw, as dorsal and lateral surface of head above commissure of mouth differs from dorsal body colour pattern in having yellow spots of larger size. A specimen from municipality of Urucará, state of Amazonas, Brazil has a more yellowish head than specimens of Oriximiná. Yellow stripe with dorsal and ventral border not well defined on sides of body from nuchal region to level of vent; may extend anteriorly to angle of mouth. Ventral surface of the body is lighter than the dorsum, and the yellow spots are present fewer than in the dorsum. In preservative, the yellowish body parts become whitish or clear yellow, and the brownish become bluish in some specimens.

See photos of live specimens in (Fig. 25)

Variation-There is no sexual variation in colour. Females presented higher means in most of the morphometric characters studied. Since we have a low number of specimens we did not apply ANOVA to test sexual dimorphism and only visualized the differences in Table 14.

Distribution–In the southern and northern parts of the municipality of Oriximiná, state of Pará, Brazil and in the municipality of Urucará, state of Amazonas, Brazil (Fig. 23). Based on the description and figure in Kok & Kalamandeen (2008) the species also occurs in Kaieteur National Park, Guyana.

A Rhinatrematid larva from Parque Nacional Montanhas do Tumucumaque, Amapá state, Brazil is present in the material of IEPA (IEPA/TQ634). The specimen has a longitudinal cloaca and because of this might belong to this species, but as hardly anything is known about the ontogeny of the species of *Rhinatrema*, we prefer not to include this specimen in the type series, neither do we include it in the distribution map. This specimen has no annuli in the anteriormost part of the body, which might be a larval character. The specimen is from an area (Tumuc Humac) from which only *R.*

bivittatum is known, but because of the longitudinal cloaca we prefer to mention with the specimen here.

Natural History–According to field notes of Délio Baêta and of Emiliane G. Pereira, most specimens were collected in pitfall traps. MPEG 26477 was collected at 22.55 h on the ground (Ribeiro-Junior, Personal observation). These data may suggest nocturnal foraging on the surface of the soil.

Remarks-Kok & Kalamandeen (2008) published an account and pictures of *Rhinatrema* cf. *bivittatum*, which seems to represent the species here described. We base our conclusion on the pictures, which clearly show the absence of a large yellow spot on the head, and by the number of total body annuli they present (315-384). The lowest number of TAB clearly falls in the variation of *Rhinatrema* sp. nov. and the highest number apparently has been taken from the literature and is a number that corresponds with *R. bivittatum*. Under "Taxonomic comments" Kok & Kalamandeen (2008) state that "The Kaieteur specimens substantially differ from specimens [of *R. bivittatum*] from the type locality (Cayenne, French Guiana) and most likely belong to an undescribed species (M. Wilkinson, D. Gower, P. Kok, pers. obs.)."

Etymology–Will be presented in the accepted manuscript.

KEY TO THE KNOWN SPECIES OF GYMNOPHIONA IN AMAZONIAN BRAZIL AND THE BRAZILIAN PART OF GUIANA.

1. Cloaca at the end of body, no tail; snout projecting beyond the mouth ... (Caeciliidae) ... **3**

- A short tail after the cloaca, mouth terminal … (Rhinatrematidae) **2**

2. Large yellow spot on top of head, total body annuli 315–384 ... ***Rhinatrema bivittatum***

- No yellow spot on top of head; total body annuli 276–338 … ***Rhinatrema* sp. nov.**

3. Dermal scales present … **4**

- Dermal scales absent ... **12**

4. Tentacles below nostrils (*Caecilia*) ... **5**

- Tentacles closer to eyes or to angle of jaw than to nostrils … **7**

5. PA 177–208 ... ***Caecilia gracilis***

- PA less than 177 ... **6**

6. PA 139–157 … ***Caecilia mertensi***

- PA 112–131 … ***Caecilia tentaculata***

7. No diastema between PT and PVT … (*Microcaecilia*) **9**

- Diastema between PT and PVT … (*Brasilotyphlus*) **11**

9. PA 113–130; SA 0–21; PPT bicuspid ... ***Microcaecilia taylori***

- SA higher than 21 ... **10**

10. PA 106–117; AS 56–91; PPT monocuspid ... ***Microcaecilia unicolor***

- PA 122–129; SA 42–51; PPT bicuspid ... ***Microcaecilia* sp. nov.**

11. PA 142–147; SA 23–36 ... ***Brasilotyphlus braziliensis***

- PA 151–170; SA 0–2 ... ***Brasilotyphlus guarantanus***

12. Tentacles closer to eyes than nostrils; body with white rings ... ***Siphonops annulatus***

- Tentacles closer to nostrils than to eyes; body without white rings ... **13**

13. Dorsal and ventral fins absent; body cylindrical, not compressed ... ***Nectocaecilia petersi***

- Dorsal and ventral fins present; body compressed...**13**

14. Cloacal disk elongate anteriorly; PA 83–102............................***Potomotyphlus kaupii***

- Cloacal disk subcircular; PA 75–88.................................***Typhlonectes compressicauda***

DISCUSSION

SPECIMENS OF QUESTIONABLE IDENTIFICATION

Some specimens studied could not be assigned unequivocally to one of the 14 species mentioned above or to any other species, and they have not be included in the key to the species.

Eleven specimens of *Microcaecilia* sp.(MPEG 630, 631; MZUSP 57073-57079; IEPA/TQ968, 1089) from Serra do Navio, State of Amapá, Brazil, may be inserted in the diagnosis of *M. taylori*, only differing from the other populations of this species in having a higher mean of secondary annuli (21.7 instead of 2.2 in *M. taylori* n = 124); a photo of a fetal tooth of IEPA/TQ968 (Fig. 14B) reveals a different shape in relation to a fetal tooth of *M. taylori* (Fig. 14A) in not having micro cusps on the internal cusp. Wake (2003) suggested that fetal dentition is species-specific in shape, but our sample did not allow us to use this character for taxonomic decisions, as the variation in this character is unknown. An analysis of a great series of specimens from Serra do Navio and the use of additional characters possibly could provide information to decide whether these specimens belong to *M. taylori*, or whether they form a distinct taxon. For the time being we refrain from making any decision on this.

SPECIES POSSIBLY OCCURRING IN BRAZILIAN AMAZONIA

Dunn (1942) described *Caecilia armata* from a single specimen, probably from “Brazil”, and until now no other specimens have been collected. Thus, its status and distribution remain uncertain, and because of this we did not include this taxon in this overview of Gymnophiona of Amazonian Brazil.

Atretochoana eiselti Taylor (1968), the largest known lungless tetrapod, is known of only two specimens (Nussbaum & Wilkinson, 1995, Wilkinson & Nussbaum, 1999, Wilkinson et al., 1998), both with unknown locality (the type from “South America”, the second specimen from “Brazil”), but with a strong supposition that it may be from central Brazil. Its presence in Brazilian Amazonia has not been documented, but it possibly could occur there.

GEOGRAPHIC VARIATION

Species with a (supposedly) wide distribution like *Caecilia tentaculata*, *C. gracilis*, *Siphonops annulatus*, *Typhlonectes compressicauda*, *Potomotyphlus kaupii*, with low geographic variation (at least in external morphometric characters) may be important taxa for phylogeographic studies also based on molecular data. Such studies could provide better insight into the relationships of different populations over the entire distribution area of these species and may indicate the need for taxonomic decisions. Gower & Wilkinson (2007) used molecular data (mitochondrial rRNA 12S and 16S sequences) to study four *Ichthyophis* spp. along a 1500 km transect in India and concluded that these four *Ichthyophis* belong to a single taxon demonstrating low geographic variation even across a geographic barrier.

Some studies of other vertebrate groups tested the influence of rivers on geographic variation and on the pattern of speciation for a series of groups of animals in the Amazon basin (e.g. Ayres & Clutton-Brock, 1992; Gascon et al, 1996; Hayes & Sewlal, 2004). Despite our assembling of many new data, distribution data for Gymnophiona in Brazilian Amazonia are still insufficient for serious zoogeographical analysis and we have to refrain from any speculations about possible speciation mechanisms that might have acted in the area.

Although most species here studied are distributed throughout the entire region some species are restricted to relatively small areas: *Brasilotyphlus braziliensis*, *Microcaecilia unicolor*, *Microcaecilia* sp. nov., *Rhinatrema bivittatum*, *Rhinatrema* sp. nov., all restricted to the Guiana Shield; *Caecilia mertensi* restricted to south of the Amazon (Amazonian Bolivia and western Amazonian Brazil); *B guarantanus*, restricted to southern Pará and northern Mato Grosso.

CONSERVATION

Generally Gymnophiona are assumed to be rare, and this idea seems to be re-enforced by collections of preserved material and the fact that for many species only one or a few specimens are known, often accompanied by scarce or no data at all. However, some species in Brazilian Amazonia have been collected in (relatively) large numbers: *Microcaecilia taylori*, *Caecilia gracilis*, *Typhlonectes compressicauda*, *Potomotyphlus kaupii*, e *Rhinatrema* sp. nov. and they formed the basis for the present study. Moodie (1978) reported that burrows of *T. compressicauda* in the area around Manaus were at a distance of 2-3 meters, thus suggesting a high population density. Péfaur et al. (1987) reported on a sample of 818 specimens of *Caecilia subnigricans* Dunn, 1942, collected during the flooding phase of an artificial lake. Cascon & Lima Verde (1994), described *Chthonerpeton arii* on the basis of 60 specimens, collected during migration over a road in a swampy area. Gorzula & Señaris (1998) collected 20 specimens of *Nectocaecilia petersi* in a plot of two square meters. During flooding of dams in Brazil large numbers of Gymnophiona (e.g. *Siphonops paulensis, Brasilotyphlus guarantanus* and *Caecilia mertensi*) have been collected (material in MPEG, respectively in CHUNB, UFMT and MZUSP).

Apparently Gymnophiona are much more numerous than generally assumed, but they need special (though not very sophisticated) techniques for collecting them: digging in suitable habitat (generally near creeks and rivers) or large scale flooding of areas. Based on these data we conclude that probably most species are not rare, but are only rarely collected, due to unsuitable collection techniques by most herpetologists.

The poor state of our knowledge about the population status and the threats to Gymnophiona also is shown by the fact that Young et al. (2004) report 89 species of Gymnophiona from South America, none of them threatened, 33 considered Least Concern, and 56 as Data Deficient. Since then these data have slightly changed, but still the DD category predominates. Of the species dealt with in this study 10 are considered Least Concern, one Data Deficient and three were not yet evaluated because they had not been described at the time of evaluation. However, this does not mean that the data for all species which are considered Least Concern are sufficient, far from that. Many of the categorizations have been based on very deficient information, but on the basis of general knowledge of the group, areas of occurrence and habitat, a categorization was made. Taking into account that Gymnophiona seem to be much more numerous than generally assumed, we think that none of the species dealt with here would fall in any threatened category when more data become available.

Thus, fortunately, for this group of Amphibians, the general conservation situation seems to be good, in contrast to that of Anurans and Caudata. However, this does not mean we can consider them as immune to environmental threats. They need clean (not polluted) water and terrestrial areas near creeks and rivers that have (preferably) original vegetation, although they also can be numerous, at least some species, in some places (Péfaur et al, 1987) in areas with degraded vegetation.

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Appendix 1

Specimens analyzed (number of specimens of each species in parenthesis)

Brasilotyphlus braziliensis (1) BRAZIL: AMAZONAS: Reserva do Gavião INPA/WWF (MZUSP 63097).

Brasilotyphlus guarantanus (48) BRAZIL: PARÁ: Canaã dos Carajás (MPEG 22170). MATO GROSSO: Guarantã do Norte (CHUNB 30703–30707; MPEG 16767, 16768, 22383-22387; UFMT 5008, 5012, 5013, 5015–5017, 5571–5578, 5581–5593, 6648-6655).

***Brasilotyphlus* sp.** (1) BRAZIL: RORAIMA: 7 km a oeste do rio Ajarani (MPEG 7779).

Caecilia gracilis (106) BRAZIL: AMAPÁ: Serra do Navio (MPEG 7349). AMAZONAS: Benjamin Constant (MNRJ 18664), Coari (MPEG 21113). MARANHÃO: Urbano Santos (HUFMA 620–691). PARÁ: Belém (MPEG 8368, 9848, 15857, 21112), Bragança (MPEG 1433, 7343), Capanema (MPEG 7354), Castanhal (MPEG 1358), Marabá (MZUSP 57068-57070) Maracanã (MPEG 1361), Melgaço (MPEG 15741, 16002), Santarém (MPEG 741, 742), Santo Antônio do Tauá (MPEG 1429), Tomé-Açú (MZUSP 12161), Viseu (MPEG 1428). TOCANTINS: Palmas (MZUSP/LAJ 450, MZUSP/LEM 86, 87; MZUSP/MRT 6756, 6757, 6975 - 6978, 8509; 906, 907).

Caecilia tentaculata (70) BRAZIL: ACRE: Resex Riozinho da Liberdade (UFACF 680, 688, 692, 697). AMAPÁ: Rio Maracá (MZUSP A100276). AMAZONAS: Manaus (INPA 1482, 1744; MZUSP 36668) Reserva INPA/WWF (MZUSP 69284). MARANHÃO: Nova Vida, BR316 (MPEG 7340–7342). MATO GROSSO: Apiacás (MZUSP 80926), Campo Novo dos Parecis (CHUNB 30691–30702; MPEG 16756–16766), Juruena (MZUSP 86335). PARÁ: Almeirim (MPEG 18159, 18160, 23542 –

23547), Marajó (MPEG/MJH55), Óbidos (MPEG 26468-26475), Oriximiná (MNRJ 48246, 48247; MPEG 20165, 20166), Paragominas (MPEG 26467), Parauapebas (MPEG 22068–22073, 22811), Portel (MPEG 22700), Viseu (MPEG 1359, 1362, 7344)

Caecilia mertensi (32) BOLIVIA: COCHABAMBA: Villa Tunari (ZSM 82/1982). BRAZIL: ACRE: Resex Riozinho da Liberdade (UFACF 701). MATO GROSSO: Araputanga (UFMT 4743, 6290, 6293, 6300, 6301, 6309, 6311, 6323, 6326); Vale de São Domingos (MZUSP 138446-138455; UFMT 6793); Jauru (UFMT 6310, 6322, 6325, 6288, 6298, 6331, 6788, 6790, 6791) RONDÔNIA: Espigão D'Oeste (MPEG 25178).

***Microcaecilia* sp.** (13) BRAZIL: AMAPÁ: Serra do Navio (MPEG 630, 631; MZUSP 57073-57079; IEPA/TQ968, 1089). RORAIMA: Colônia Apiaú (MZUSP 64829) PARÁ: Serra do Kukoinhokren (MZUSP 69347).

Microcaecilia taylori (128) SURINAME: SIPALIWINI: (RMNH 15165B) BRAZIL: PARÁ: Tucuruí (MPEG 3761), Melgaço (MPEG 5746-5748, 6660, 6670, 23360-23366, 26947, RMNH 40187), Portel (MPEG 22779-22783), Vitória do Xingu (MPEG 10106), Parauapebas (MPEG/PSH007, 014; MPEG 7350-7353, 16230, 22074-22169, 22171, 22172). Identification uncertain: MATO GROSSO: Confresa (CHUNB 47937)

Microcaecilia unicolor (1) BRAZIL: PARÁ: Óbidos (MPEG 26476).

Nectocaecilia petersii (4) BRAZIL: AMAZONAS: Rio Tea (INPA 12026, 12027, 12028) Uarini: Mamirauá (MPEG 7555).

Potomotyphlus kaupii (60) BRAZIL: ACRE: Rio Branco (MZUSP 58318). AMAPÁ: Macapá (MNRJ 18652). AMAZONAS: Iranduba, Ilha da Marchantaria (MZUSP A69843, A69844) Presidente Figueiredo, UHE Balbina (MPEG 3910) Rio Negro, between Tarumã and Tarumã-Mirim Rivers (MNRJ 18649). GOIÁS: UHE Serra da Mesa (MNRJ 18650, 18651). PARÁ: Abaetetuba (MPEG 22565) Acará (MPEG 9672)

Tucuruí (INPA 578, 1062, 1063, 1123-1125, 1127, 1147-1159, 5832, 7759; MZUSP 63083-63085; MNRJ 18654-18663), Baixo Rio Xingú, Baía de Souzel (MPEG 2888) Melgaço (MPEG 9627) Belém, Cotijuba (MPEG 1431) Belém, Mosqueiro (MPEG 9631) Belém, Utinga (MPEG 7345; MZUSP 22538) Jacundá (MZUSP 36733) Oriximiná, Cachoeira da Porteira (INPA 582) Santarém (MPEG 6342; MZUSP 36730, 129405, 129081) Serra dos Carajás, Cachoeira da Carreira Comprida (MPEG 7346) RORAIMA: Cachoeira do Bem Querer, médio rio branco (MPEG 7347, 7348).

Rhinatrema bivittatum (10) BRAZIL: AMAPÁ: Ferreira Gomes: Flona Amapá (IEPA/FL519) Laranjal do Jari: BR 156 (MPEG 26941), Reserva de Desenvolvimento Sustentável do Rio Iratapuru (IEPA/RS215), Parque Nacional Montanhas do Tumucumaque, Igarapé Mapaoni (IEPA/TQ272, TQ287, TQ306, TQ347, TQ348), PARÁ: Almeirim, Monte Dourado (MPEG 23548, 23549)

Siphonops annulatus (3) BRAZIL: AMAZONAS: Juruá (INPA 4401). RONDÔNIA: Guajará-Mirim (MPEG 9193), Espigão D’ Oeste (MPEG 25177)

Typhlonectes compressicauda (108) BRAZIL: AMAPÁ: Macapá (MNRJ 18653). AMAZONAS: Beruri (INPA 14594, 14596) Careiro: Paraná do Araçá (MZUSP 95860-95877) Manaus (INPA 12636, 14830, 14831, 14836, 14837, 14839, 14840, 14594, 14832, 14835, 14841, 15058; MPEG 4584 holotype of *T. cunhai*) Pitinga (INPA 6338, 6340, 6341) Rio Purus (INPA 12307), Tapauá (MZUSP 49892-49896) Uarini: Mamirauá (INPA 11131; MPEG 7549). PARÁ: Tomé-Açú (MPEG 19462, 19463; MZUSP 12160) Genipapo, Marajó (MZUSP 72634) Chaves, Marajó (MPEG 4616) Cachoeira do Arari, Marajó (MPEG 8006-8010, 8206-8209) Castanhal (MPEG 1346, 1357, 1360) Capitão Poço (MPEG 1430) Faro (MPEG 4546) Abaetetuba (MPEG 22566) Almeirim (MPEG 9537), Barcarena (MPEG 19287) Belém (MPEG 7337-7339, 7355-7361, 7363-7374; MZUSP 57679, 59522-59537, 72633).

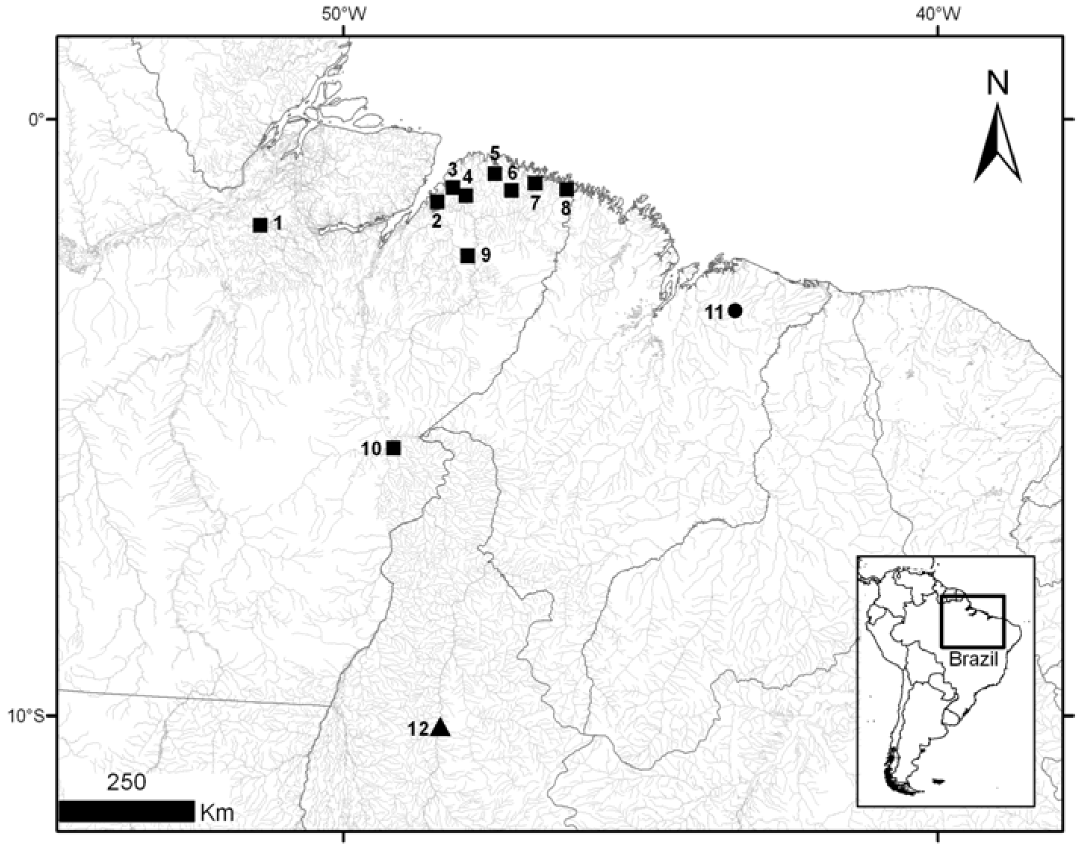


Fig. 1. *Caecilia gracilis* OTUs analyzed in the Stepwise Discriminant Function Analysis. PA (Squares): 1. Melgaço; 2. Belém; 3. Santo Antônio do Tauá; 4. Castanhal; 5-Maracanã; 6-Capanema; 7. Bragança; 8. Viseu; 9. Tomé-Açú; 10. Marabá. MA (Circle): 11. Urbano Santos, state of Maranhão. TO (Triangle): 12. Palmas, state of Tocantins.

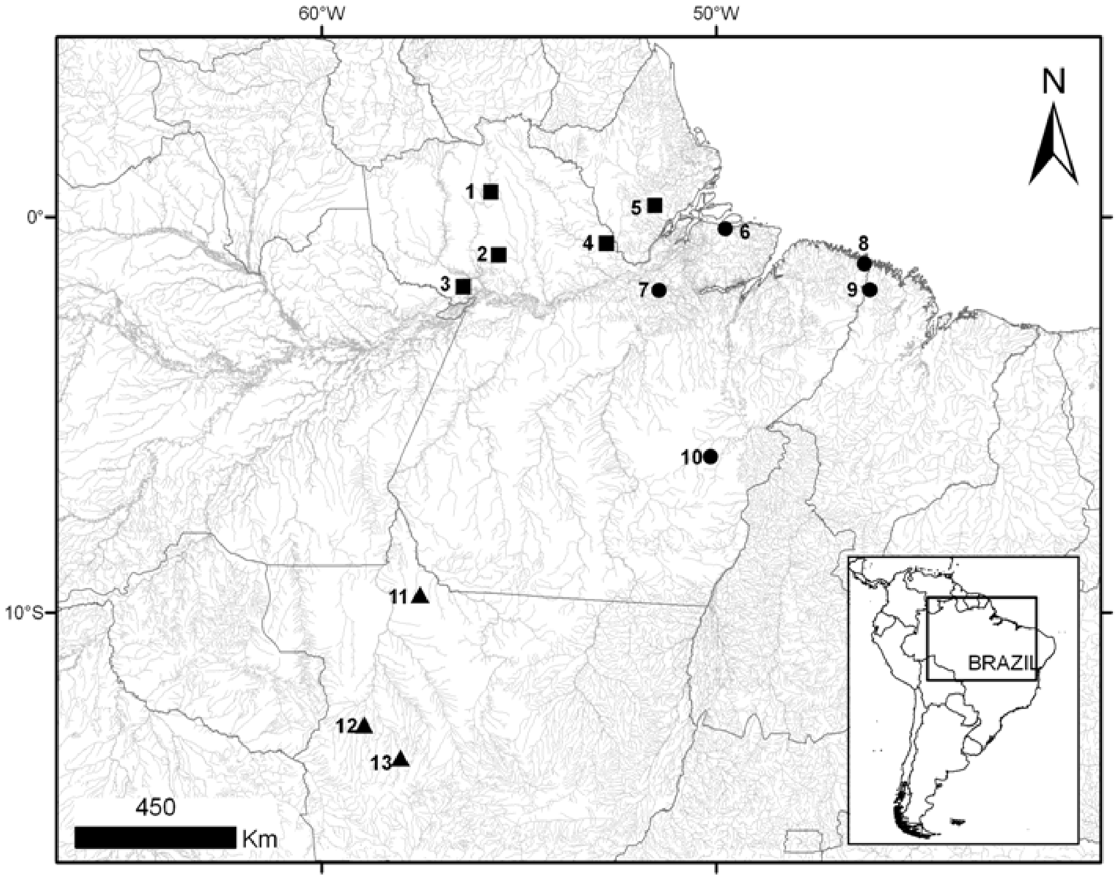


Fig. 2. *Caecilia tentaculata* OTUs analyzed in the Stepwise Discriminant Function Analysis. PAGS (Squares): 1. Estação Ecológica Grão Pará Centro, Óbidos, Pará; 2. Floresta Estadual Trombetas, Óbidos; 3. Porto Trombetas, Oriximiná, Pará; 4. Jari, Almeirim, Pará; 5. Rio Maracá, Amapá. PAB (Circles): 6. Chaves, Marajó Island, Pará; 7. Portel, Pará; 8. Viseu, Pará; 9. Nova Vida, Maranhão; 10. Carajás, Pará. MT (Triangles): 11. Apiacás, Mato Grosso; 12. Juruena, Mato Grosso; 13. Campo Novo dos Parecis, Mato Grosso.

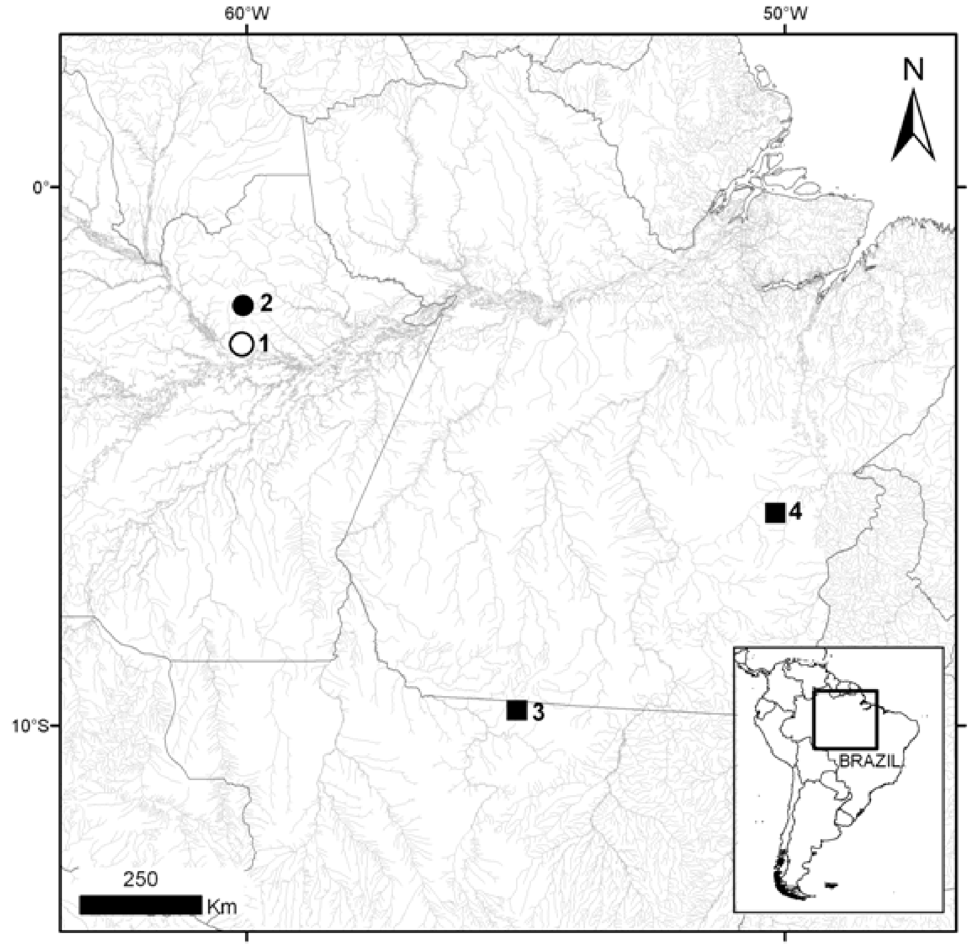
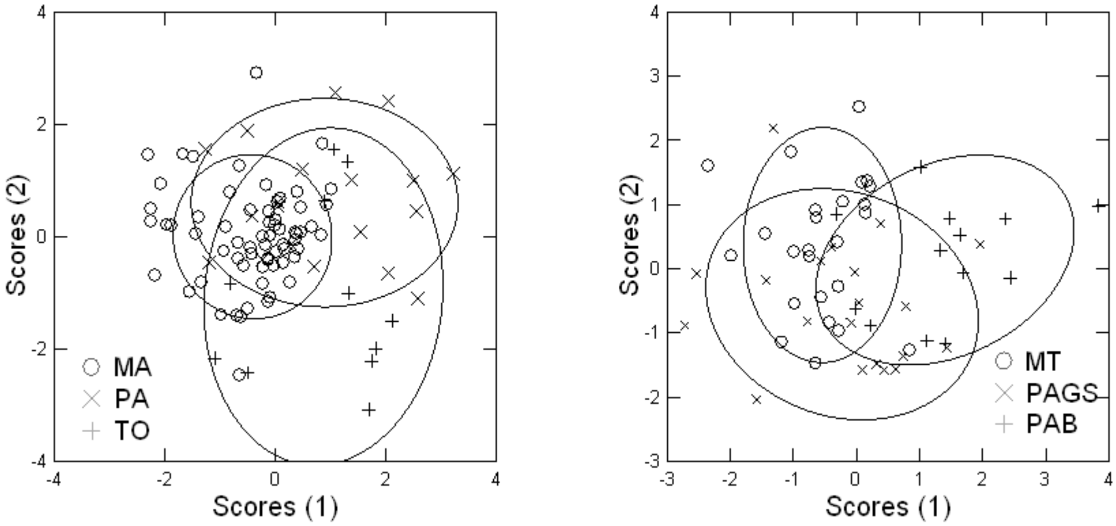


Fig. 3. Distribution of *Brasilotyphlus*. Circles represent *B. braziliensis* and squares are *B. guarantanus*. Open symbols correspond to data from literature. 1. Manaus, Amazonas, Brazil (Type Locality of *B. braziliensis*); 2 Reserva do Gavião INPA/WWF, Amazonas, Brazil; 3 Guarantã do Norte, Mato Grosso, Brazil (Type Locality of *B. guarantanus*); 4 Parauapebas, Pará, Brazil.



Caecilia gracilis *Caecilia tentaculata*

Fig. 4. Scatterplot graphs of scores of the first two axes of the Stepwise Discriminant Function Analysis employed for morphometric data of OTUs of *Caecilia gracilis* and *C. tentaculata*.

Fig. 5. A juvenile of *Caecilia gracilis* (MZUSP 57070), showing fetal teeth in the lower jaw.

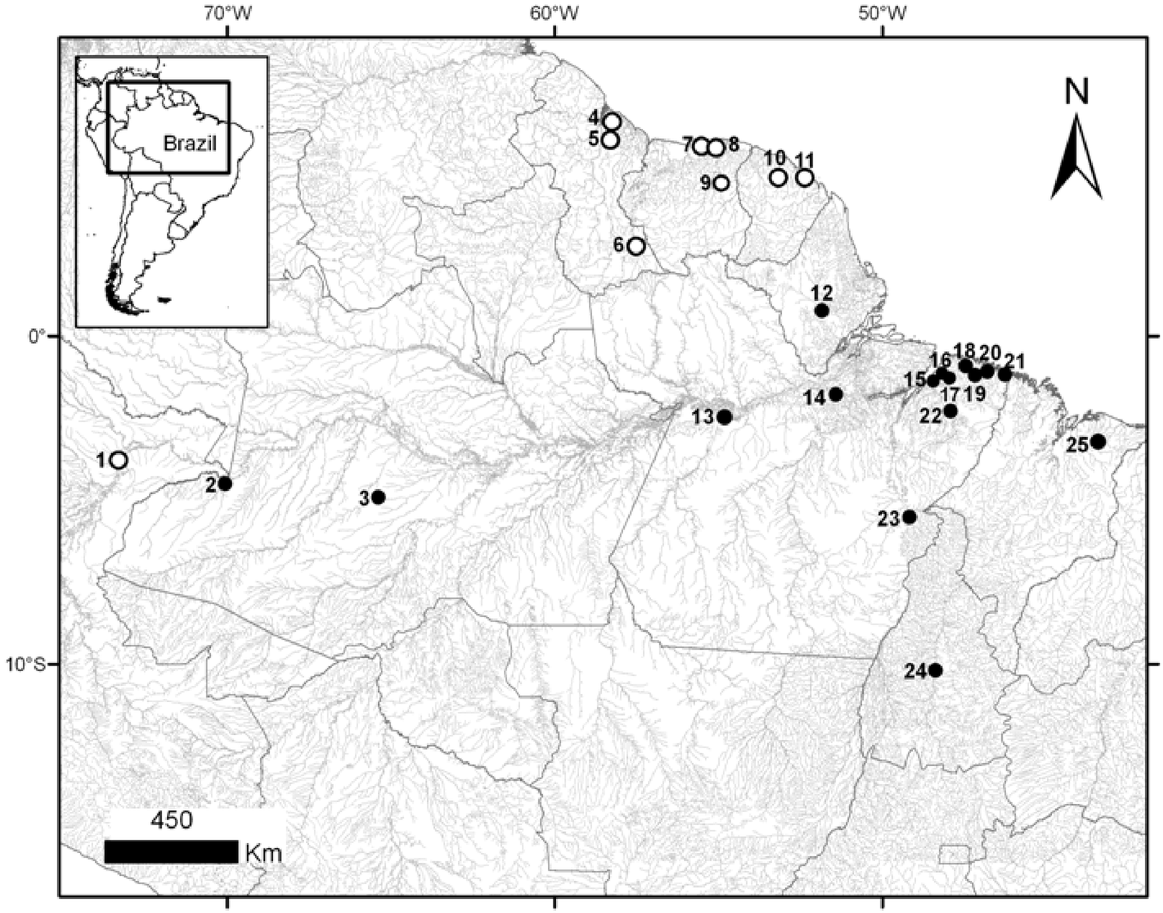


Fig. 6. Distribution of *Caecilia gracilis*. Open symbols represents data from literature and the close symbols specimens analyzed in this study. 1. Iquitos, Peru (Taylor, 1968); 2. Benjamin Constant, Amazonas, Brazil; 3. Urucú, Coari, Amazonas, Brazil; 4. Dunoon, Guyana (Taylor, 1968); 5. Wismar, Guyana (Taylor, 1968); 6. Orenoque Creek, Guyana (Nussbaum & Hoogmoed, 1979); 7. 30 km west of Paramaribo, Suriname (Nussbaum & Hoogmoed, 1979); 8. Onverwacht, Suriname (Nussbaum & Hoogmoed, 1979); 9. Sara Creek, Suriname (Nussbaum & Hoogmoed, 1979); 10-11. Localities in French Guiana based on the map on page 291 of Lescure & Marty (2000); 12. Igarapé Timbó, Rio Cupixi, Estrada para Serra do Navio, Amapá, Brazil; 13. Santarém, Pará, Brazil; 14. Melgaço, Pará, Brazil; 15. Belém, Pará, Brazil; 16. Santo Antônio do Tauá, Pará, Brazil; 17. Castanhal, Pará, Brazil; 18. Maracanã, Pará, Brazil; 19. Capanema, Pará, Brazil; 20. Bragança, Pará, Brazil; 21. Viseu, Pará, Brazil; 22.

Tomé-Açú, Pará, Brazil; 23. Marabá, Pará, Brazil; 24. Palmas, Tocantins, Brazil; 25. Urbano Santos, Maranhão, Brazil.

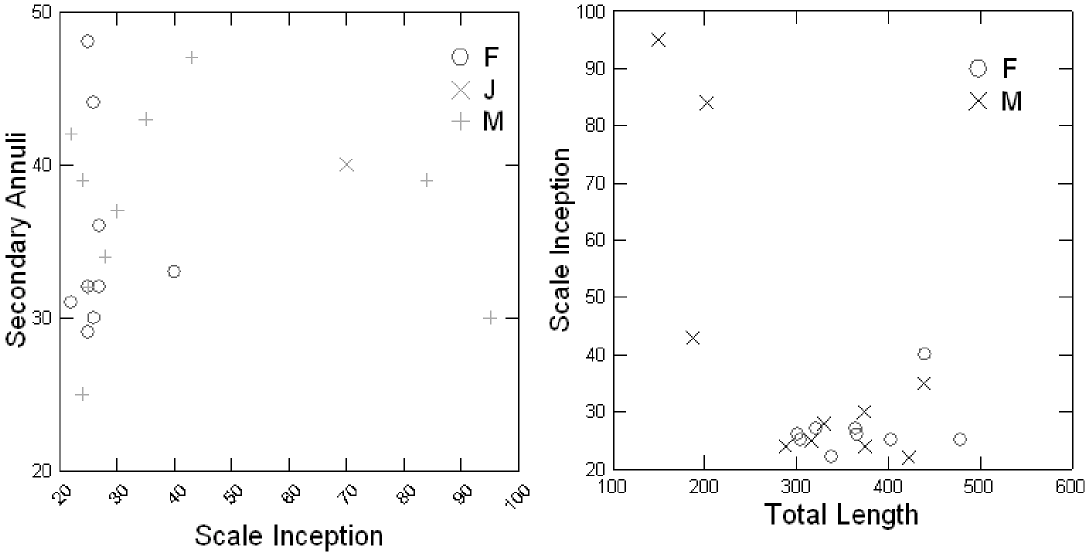


Fig. 7. Scatterplot graphs showing the relation of SI and SA and between TL and SI in *Caecilia mertensi*.

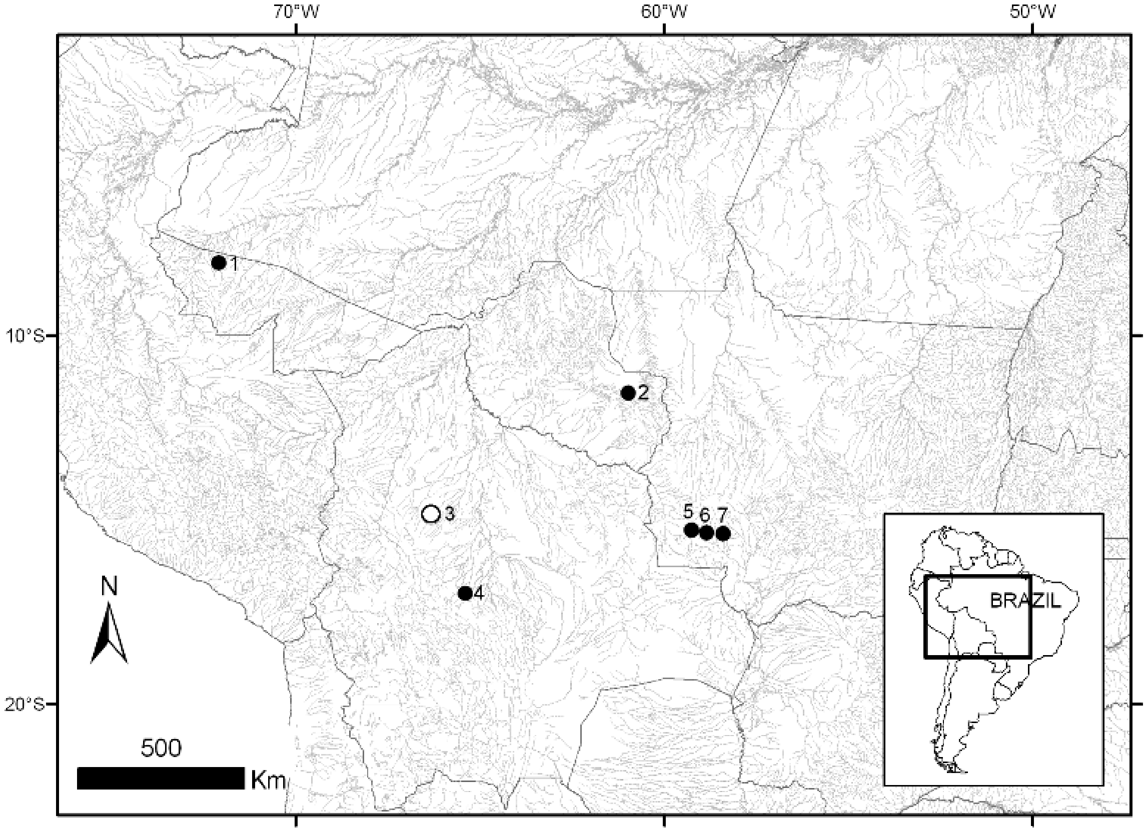


Fig. 8. *Caecilia mertensi*: 1. Resex Riozinho da Liberdade, Acre, Brazil; 2. Espigão D'Oeste, Rondônia, Brazil; 3. Yacuma, Beni, Bolívia (Reichle & Köhler, 1996); 4. Villa Tunari, Cochabamba, Bolivia (Type Locality of *Caecilia marcusi* Wake, 1985); 5. Vale de São Domingos, Mato Grosso, Brazil; 6. Jauru, Mato Grosso, Brazil; 7. Araputanga, Mato Grosso, Brazil.

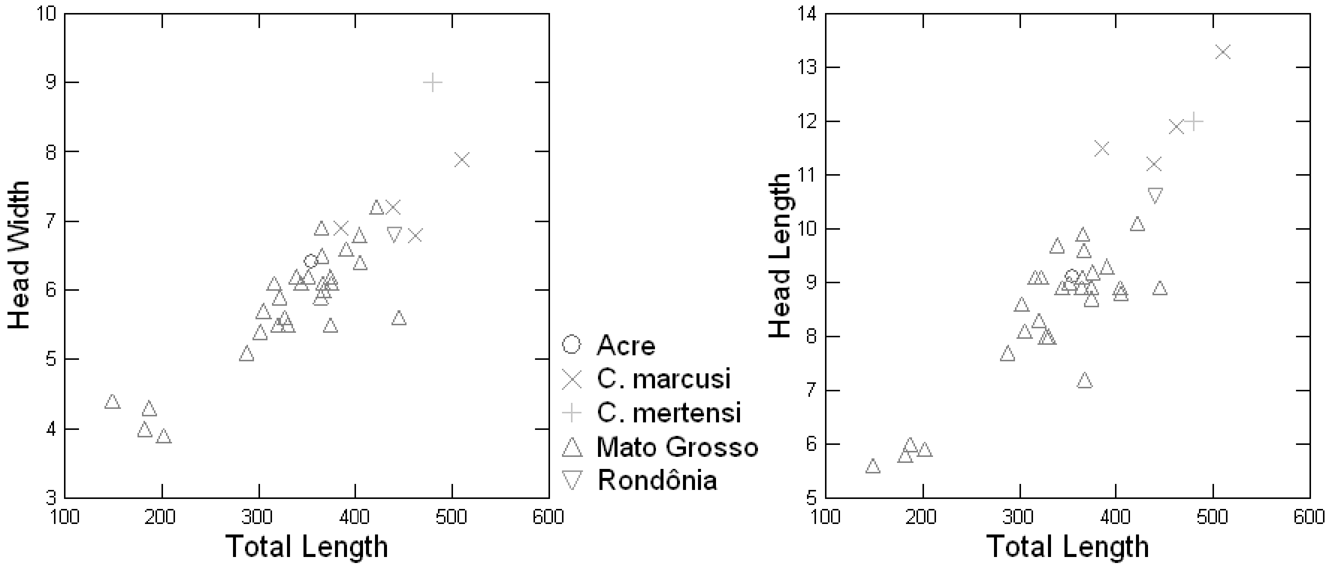


Fig. 9. Scatterplot of Total length versus Head width and Head Length for five populations (OTUs) of *Caecilia mertensi*, considering *C. marcusi* as a synonym.

Fig. 10. Ventral color patterns of *Caecilia tentaculata* from Brazilian Amazonia; all specimens are from the same locality, municipality of Almeirim, state of Pará. Upper row from left to right: MPEG 23542, 23543, 23544. Lower row from left to right: MPEG 23545, 23546, 23547.

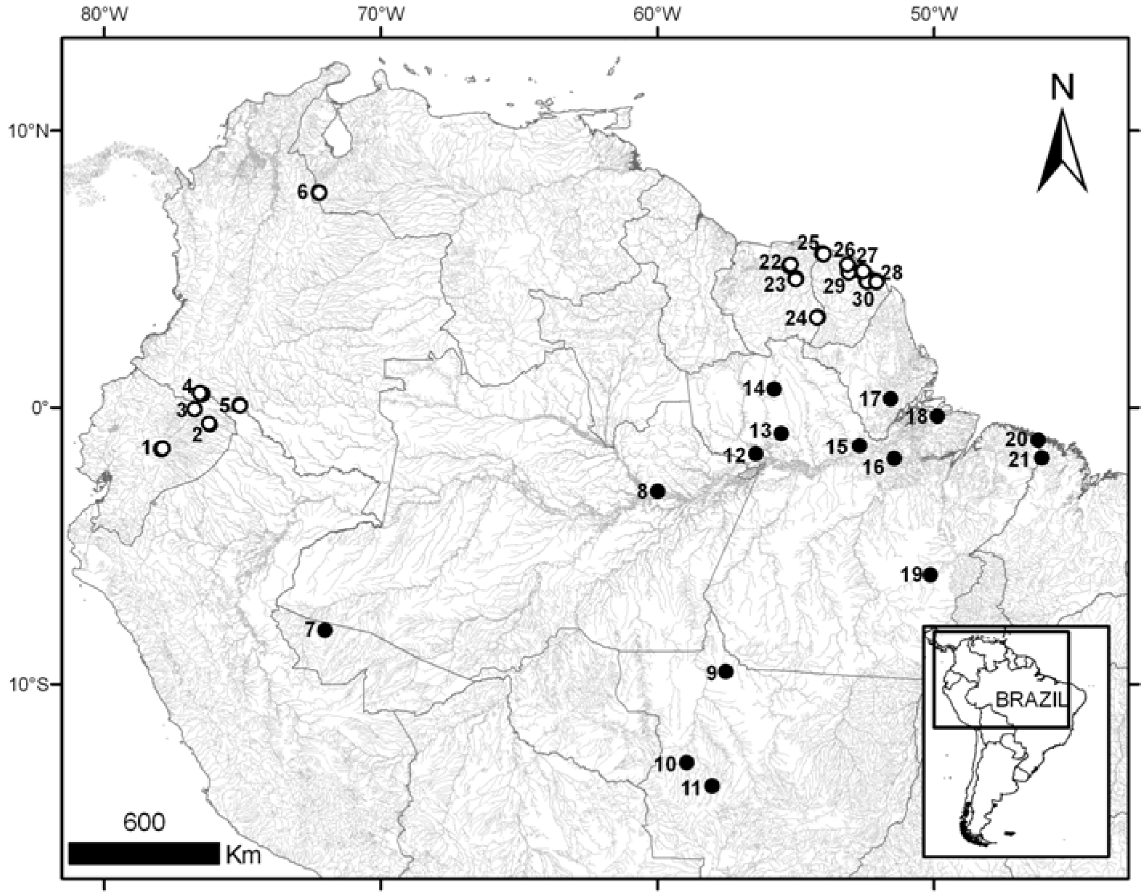


Fig. 11. Distribution of *Caecilia tentaculata*. 1. Vera Cruz, Pastaza, Ecuador (Taylor & Peters, 1974); 2. Estación de Biodiversidad Tiputini, Orellana, Ecuador (Cisneros-Heredia, 2006); 3. Santa Cecilia, Napo, Ecuador (Taylor, 1973); 4-5. Localities based on Figure 7 of Lynch (1999); 6. San Cristóbal, Táchira, Venezuela (Roze & Solano, 1963); 7. Reserva Extrativista Riozinho da Liberdade, Acre, Brazil; 8. Manaus Region, Amazonas, Brazil; 9. Apiacás, Mato Grosso, Brazil; 10. Juruena, Mato Grosso, Brazil; 11. Campo Novo dos Parecis, Mato Grosso, Brazil; 12. Trombetas, Oriximiná, Pará, Brazil; 13. Floresta Estadual Trombetas, Óbidos, Pará, Brazil; 14. Estação Ecológica Grão Pará Centro, Óbidos, Pará, Brazil; 15. Almeirim, Pará, Brazil; 16. Portel, Pará, Brazil; 17. Rio Maracá, Amapá, Brazil; 18. Chaves, Marajó, Pará, Brazil; 19. Parauapebas, Pará, Brazil; 20. Viseu, Pará, Brazil; 21. Nova Vida, BR316, Maranhão,

Brazil; 22. Railway km 121, Suriname (Nussbaum & Hoogmoed, 1979); 23. Sara Creek, Placer van Hemert, Suriname; 24. Camp Koemaroe, Suriname (Nussbaum & Hoogmoed, 1979); 25-30. Localities based on the map on page 293 (Lescure & Marty, 2000).

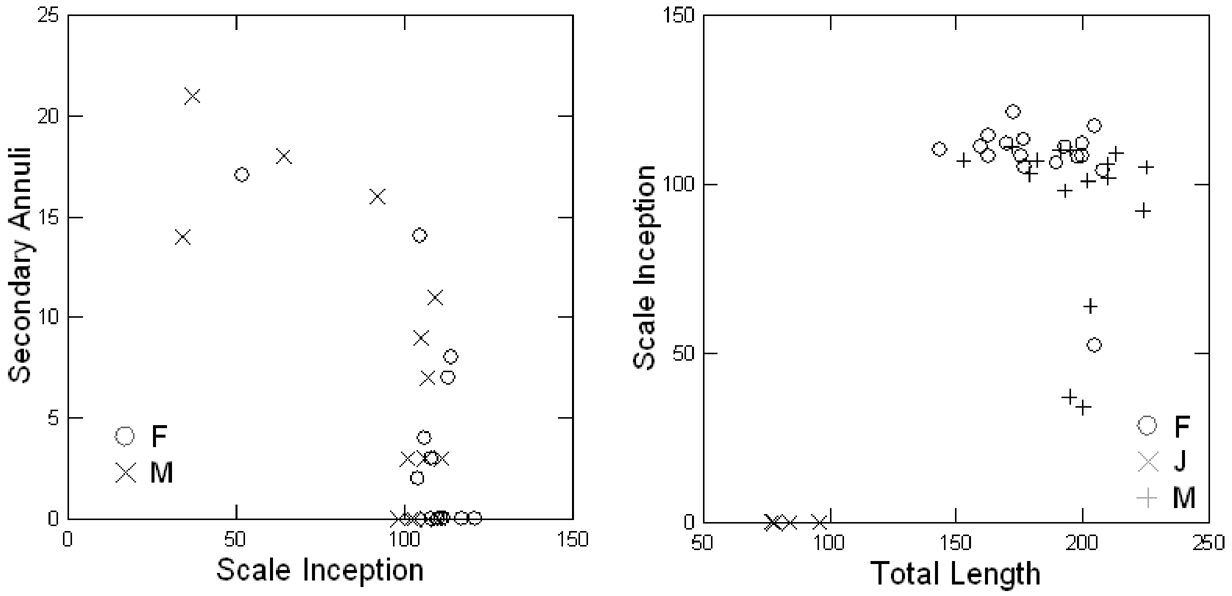


Fig. 12. Scatterplot graphs showing variation in Scale inception in *M. t*aylori.

Fig. 13. A bicuspid prevomerine tooth extracted from a specimen of *Microcaecilia taylori* (MPEG 22121).

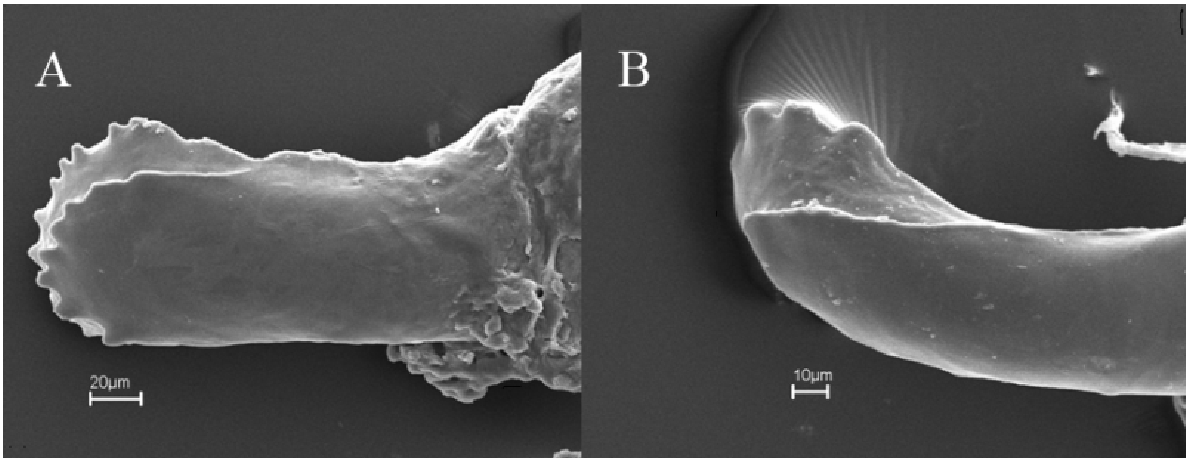


Fig. 14. A–Fetal tooth of *Microcaecilia taylori* (MPEG 22172) and B-*Microcaecilia* sp. (IEPA/TQ 968).

Fig. 15. A live specimen of *M. taylori* (MPEG 25936) from Belo Monte, state of Pará, Brazil. Photos by P.L. Peloso.

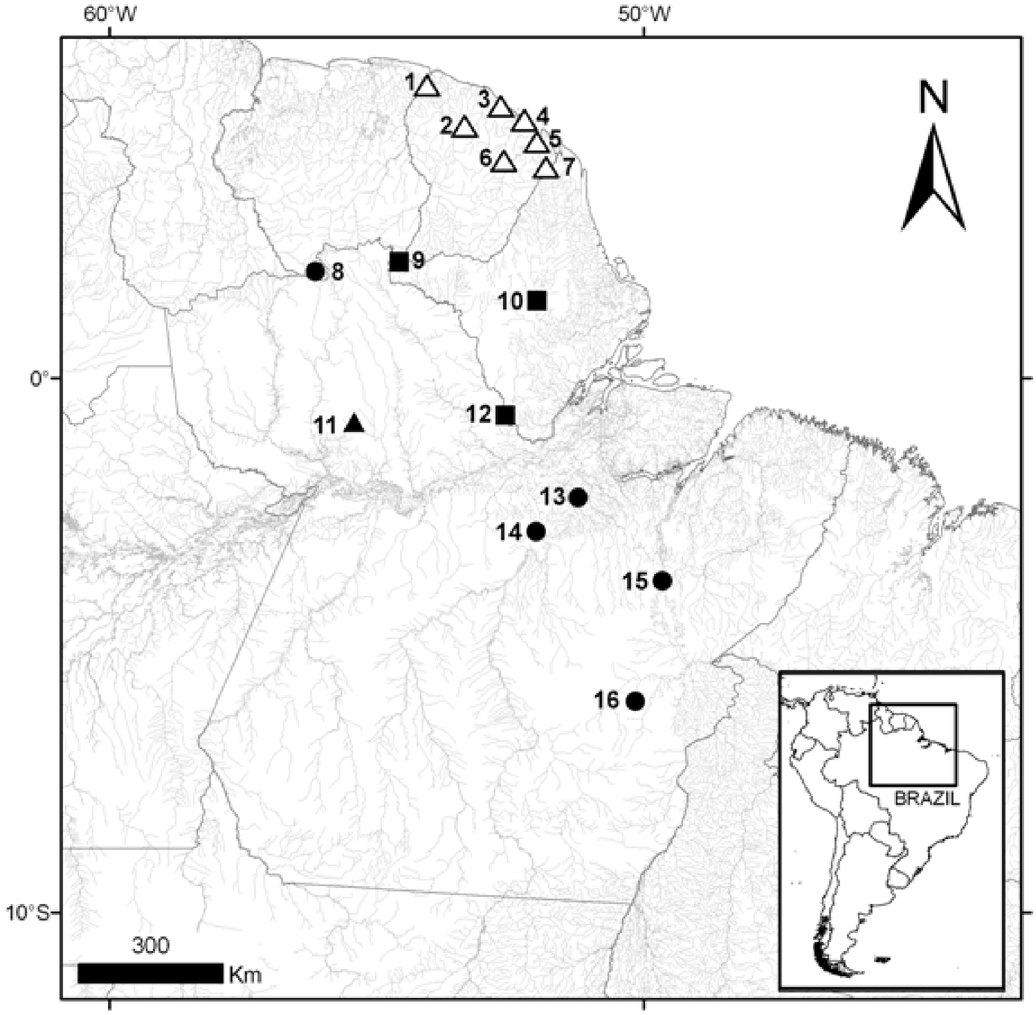


Fig. 16. Distribution of *Microcaecilia* spp. Triangles represent *M. unicolor*. Circles are *M. taylori*. Squares are *Microcaecilia* sp. nov. 1-7. Localities in French Guiana based on map on page 299 of Lescure & Marty (2001); 8. Type Locality of *Microcaecilia taylori*, Sipaliwini, Suriname; 9. Parque Nacional Montanhas do Tumucumaque, Igarapé Mapaoni, Laranjal do Jari, Amapá, Brazil; 10. Parque Nacional Montanhas do Tumucumaque, Pracuúba, Amapá, Brazil; 11. Flota Trombetas, Óbidos, Pará, Brazil; 12. Reserva Pacanari, Almeirim, Pará, Brazil; 13. Caxiuanã, Melgaço + Portel, Pará, Brazil; 14. Vitória do Xingú, Pará, Brazil; 15. Tucuruí, Pará, Brazil; 16. Parauapebas, Pará, Brazil.

Fig. 17. Holotype of *Microcaecilia* sp. nov. (MPEG 14596).

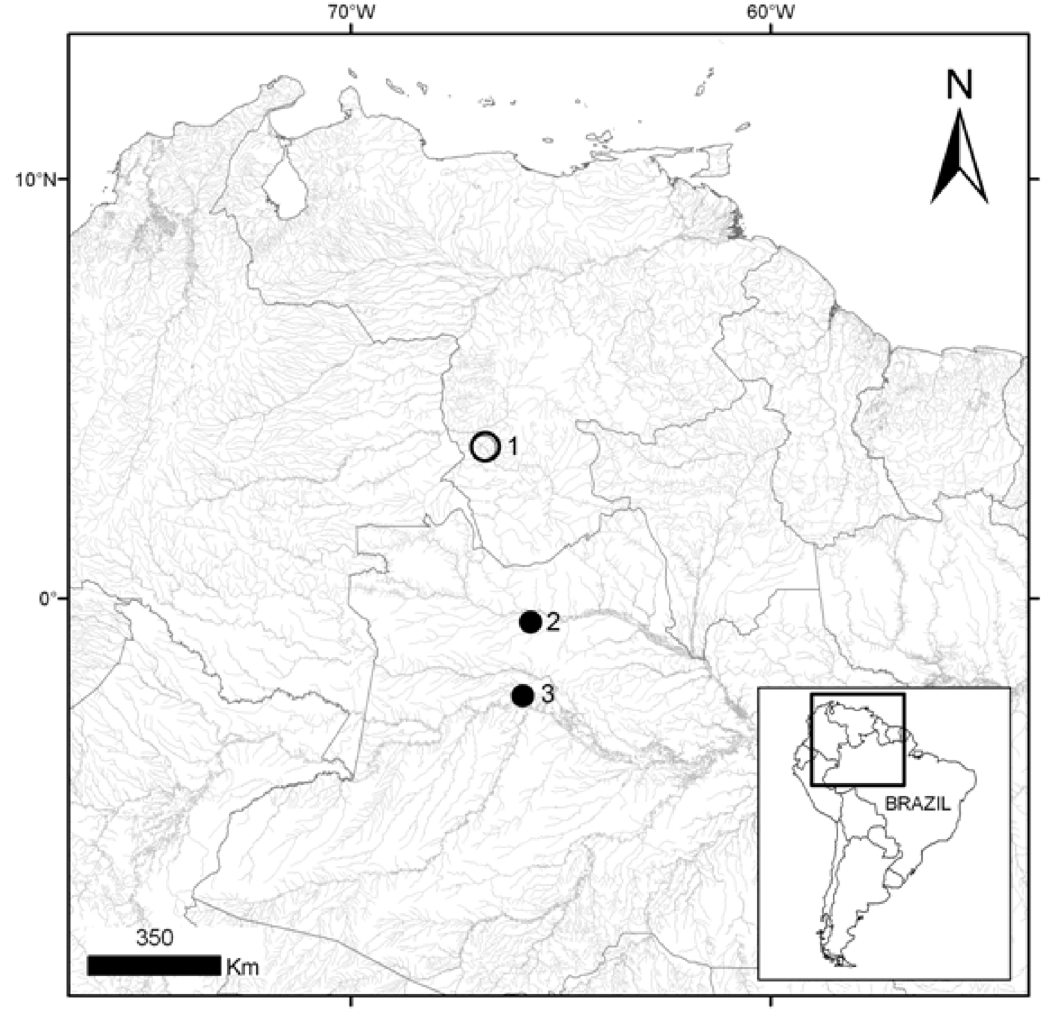


Fig. 18. *Nectocaecilia petersi*: 1. Cerro Yapacana, Amazonas, Venezuela (Gorzula & Señaris, 1998); 2. Rio Tea, Amazonas, Brazil; 3. Mamirauá, Uarini, Amazonas, Brazil.

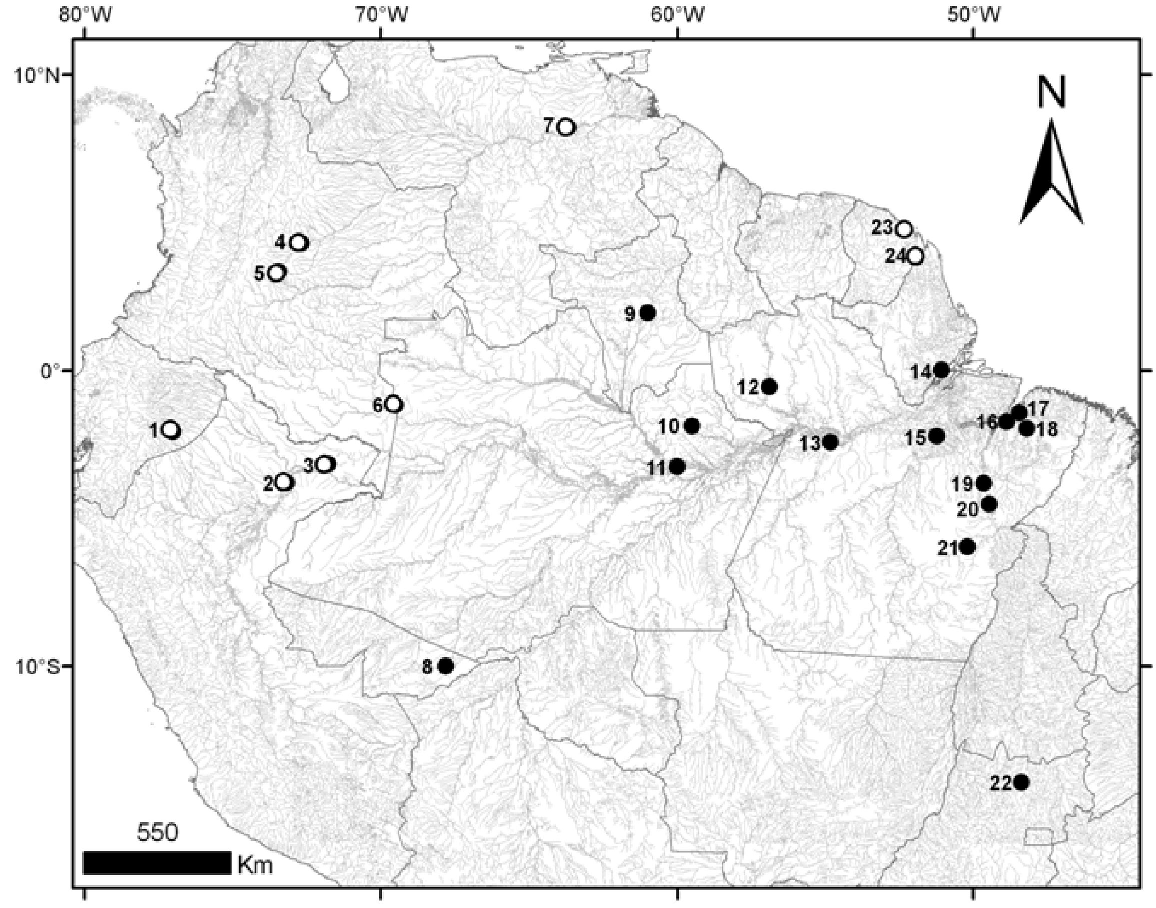


Fig. 19. *Potomotyphlus kaupii*: 1 Pucayacú, Pastaza, Ecuador (Taylor & Peters, 1974); 2 Río Itaya, San Antonio, Iquitos, Peru (Taylor, 1968); 3 Río Ampiyacú, near Pebas, Iquitos, Peru (Taylor, 1968); 4 Río Meta, Puerto López, Colombia (Lynch, 1999); 5 La Macarena, Meta, Colombia (Lynch, 1999); 6 Río Caquetá, La Pedrera, Amazonas, Colombia (Lynch, 1999); 7 Type Locality, Angostura, Ciudad Bolívar, Venezuela (Taylor, 1968); 8 Rio Branco, Acre, Brazil; 9 Cachoeira do Bem Querer, Roraima, Brazil; 10 UHE Balbina, Presidente Figueiredo, Amazonas, Brazil; 11 Ilha Marchantaria, Amazonas, Brazil; 12 Cachoeira Porteira, Oriximiná, Pará, Brazil; 13 Santarém, Pará, Brazil; 14 Macapá, Amapá, Brazil; 15 Melgaço, Pará, Brazil; 16 Abaetetuba, Pará, Brazil; 17 Belém, Pará, Brazil; 18 Acará, Pará, Brazil; 19 Tucuruí, Pará, Brazil; 20 Jacundá, Pará, Brazil; 21 Serra dos Carajás, Pará, Brazil; 22 Usina

Hidroeletrica Serra da Mesa, Goiás, Brazil; 23 Cayenne, French Guiana; 24 Oyapock river, Georges-de-l`Oyapock, French Guiana (Marty et al, 2007a).

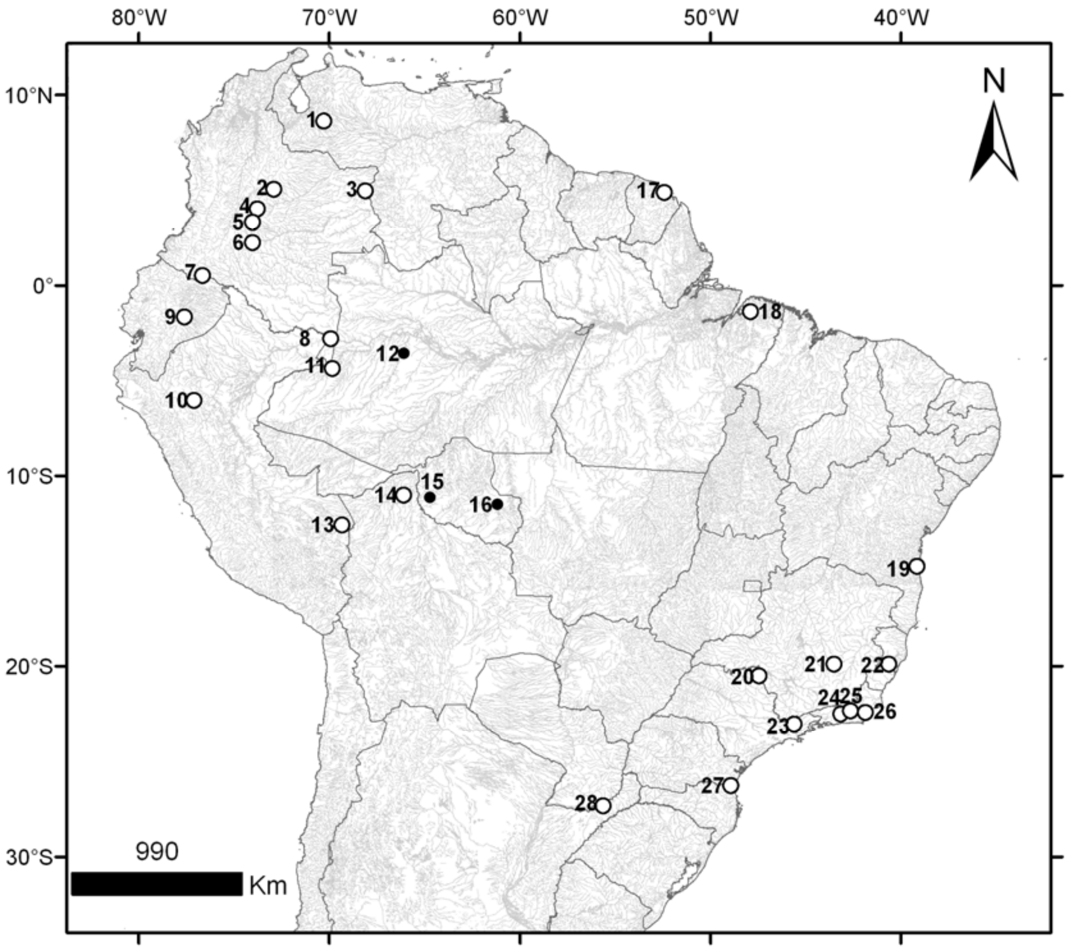


Fig. 20. *Siphonops annulatus*: 1 Barinas, Venezuela (Dunn, 1942); 2-8 Localities in Colombia based on map on page 330 of Lynch (1999); 9 Sarayacu, Ecuador (Dunn, 1942); 10 Moyabamba, Peru (Dunn, 1942); 11 Tabatinga, Amazonas, Brazil (Dunn, 1942); 12 Juruá, Amazonas, Brazil; 13 Puerto Maldonado, Peru (De La Riva, et al, 2000); 14 Riberalta, Bolivia (Dunn, 1942); 15 Guajará Mirim, Rondônia, Brazil; 16 Espigão D'Oeste, Rondônia, Brazil; 17 Cayenne, French Guiana (Dunn, 1942); 18. Belém, Pará, Brazil (Spengel, 1915); 19. Ilhéus, Bahia, Brazil (Wilkinson et al, 2008); 20. Franca, São Paulo, Brazil (Dunn, 1942); 21. Estação Ambiental de Peti, Minas Gerais, Brazil (Bertoluci et al, 2009); 22. Santa Teresa, Espírito Santo, Brazil (Dunn, 1942); 23. Taubaté, São Paulo, Brazil (Dunn, 1942); 24. Teresópolis + Petrópolis, Rio

de Janeiro, Brazil (Dunn, 1942); 25. Nova Friburgo, Rio de Janeiro, Brazil (Dunn, 1942); 26. Serra de Macaé, Rio de Janeiro, Brazil (Dunn, 1942); 27. Joinville, Santa Catarina, Brazil (Dunn, 1942); 28. San Ignácio, Misiones, Argentina (Taylor, 1968).

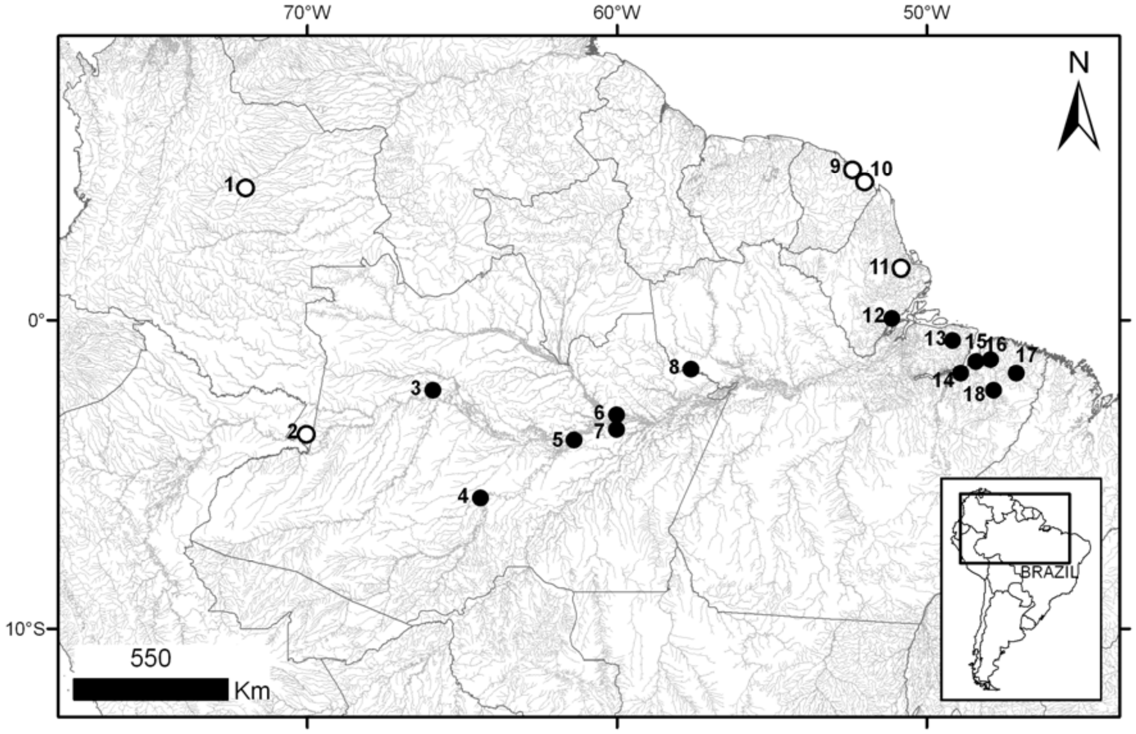


Fig. 21. *Typhlonectes compressicauda*: 1. Puerto Gaitán, Meta, Colombia (Lynch, 2006); 2. Leticia, Colombia (Duellman & Trueb, 1994); 3. Estação Ecológica de Mamirauá, Uarini, Amazonas; 4. Tapauá, Amazonas, Brazil; 5. Beruri, Amazonas, Brazil; 6. Manaus, Amazonas, Brazil; 7. Careiro, Amazonas, Brazil; 8. Rio Nhamundá, Faro, Pará, Brazil; 9. Type Locality, Cayenne, French Guiana; 10. Kaw and surroundings, French Guiana based on map of Lescure & Marty (2000) 11. Região dos lagos, Amapá, Brazil (Caramaschi & Pombal Jr., 2000); 12. Macapá, Amapá, Brazil; 13. Ilha de Marajó, Pará, Brazil; 14. Abaetetuba, Pará, Brazil; 15. Belém, Pará, Brazil; 16. Castanhal, Pará, Brazil; 17. Capitão Poço, Pará, Brazil; 18. Tomé-Açú, Pará, Brazil.

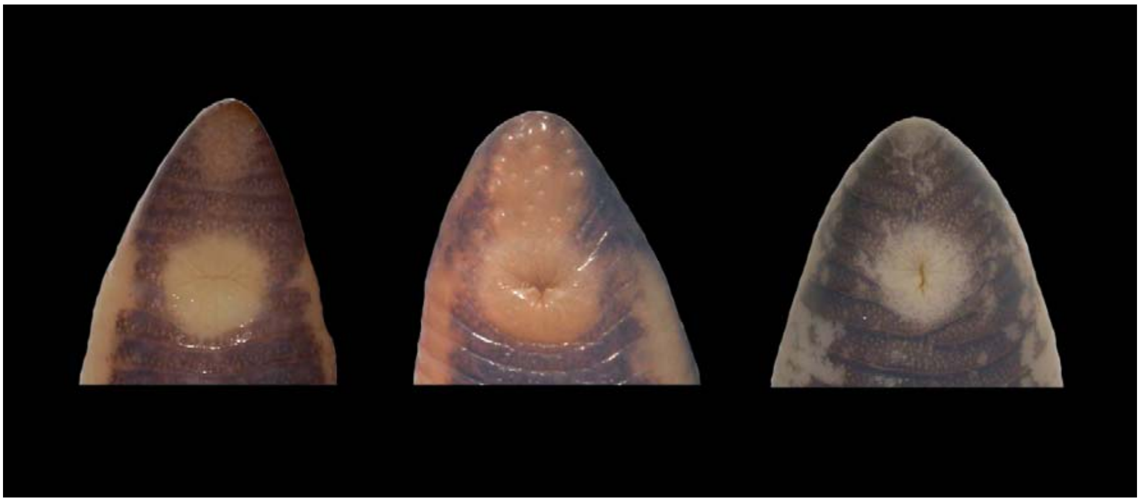


Fig. 22. Cloacal view of *Rhinatrema*. From left to right: Female of *R. bivittatum* IEPA TQ347; male of *R. bivittatum* IEPA/TQ287; female of *Rhinatrema* sp. nov. MPEG20177.

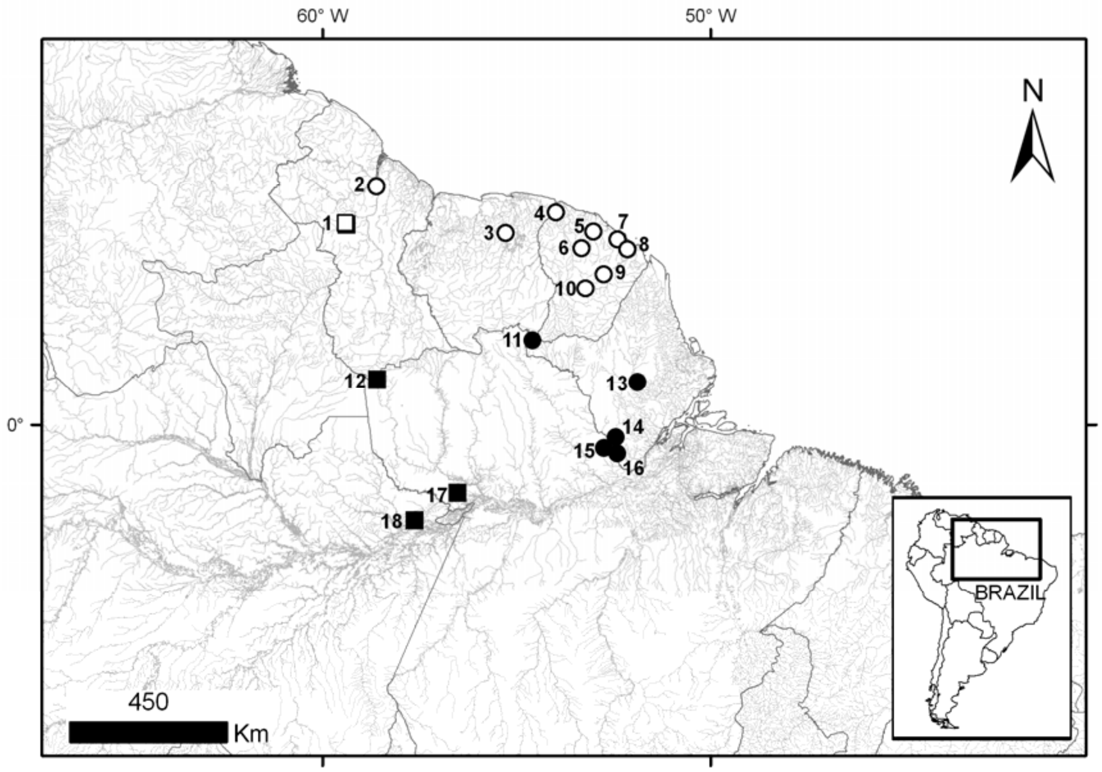


Fig. 23. Distribution of the genus *Rhinatrema*. Circles represent *Rhinatrema bivittatum* and squares *Rhinatrema* sp. nov. 1. Kaieteur National Park, Guyana (Kok & Kalamandeen, 2008); 2. Winiperu, Guyana (Nussbaum & Hoogmoed, 1979); 3. Brownsberg Natural Reserve, Suriname (Nussbaum & Hoogmoed, 1979); 4-10. Localities in French Guiana plotted in an adaptation of the map of page 295 (Lescure & Marty, 2000); 11. Parna Montanhas do Tumucumaque, Laranjal do Jari, Amapá, Brazil; 12. Serra do Acaraí, Oriximiná, Pará, Brazil;13. Floresta Nacional Amapá, Ferreira Gomes, Amapá, Brazil; 14. Reserva de Desenvolvimento Sustentável do rio Iratapuru, Laranjal do Jari, Amapá, Brazil; 15. Almeirim, Pará, Brazil; 16. Laranjal do Jari, BR156, Amapá, Brazil; 17. Porto Trombetas, Oriximiná, Pará, Brazil; 18. Urucará, Amazonas, Brazil.

Fig. 24. Holotype of *Rhinatrema* sp. nov. MPEG 19967.

Fig. 25. Live specimens of *Rhinatrema* sp. nov. Upper left MPEG 21912; photo by G.F. Maschio. Other pictures MPEG 26478; photo by J.F. Sarmento.

Tab. 1. Morphometric (in mm) and meristic data (range, mean ±standard deviation and sample size in parenthesis) of *B. braziliensis* and *B. guarantanus*.

	B. braziliensis	*B. guarantanus*
TL	147-260 204.2 ± 37.1 (5)	164-305 235.9 ± 42.3 (48)
HW	2.7-5.1 3.9 ± 0.7 (5)	2.5-4.2 3.5 ± 0.3 (48)
HL	4.5 (1)	3.8-6.2 4.9 ± 0.8 (48)
HH	2 (1)	1.5-3.4 2.5 ± 0.9 (42)
BW	3-6 4.4 ± 1 (5)	3.3-4.9 4.1 ± 1.6 (41)
BH	2.8 (1)	2.7-4.3 3.5 ± 1.6 (36)
WNC	2.9 (1)	2.7-4.5 3.7 ± 0.9 (47)
WTR	3.1 (1)	2.9-4.7 3.9 ± 1.2 (45)
WV	1.6 (1)	1.6-2.9 2.3 ± 0.7 (45)
TT	2.6 (1)	2.2-3.4 2.9 ± 0.6 (47)
TN	1.5-2.6 1.9 ± 0.3 (5)	1.3-2.4 1.8 ± 0.3 (48)
TJA	0.8 (1)	0.8-1.6 1.1 ± 0.2 (48)
TMM	0.2 (1)	0.2-0.5 0.3 ± 0.1 (46)
NN	1.2 (1)	0.9-1.5 1.3 ± 0.2 (48)
NMM	0.7 (1)	0.6-1.2 0.9 ± 0.2 (46)
SP	1.2 (1)	0.8-1.5 1.1 ± 0.2 (47)
PA	142-147 145 ± 1.7 (5)	151-170 160.3 ± 22.9 (49)
SA	23-36 27.4 ± 4.5 (5)	0-2 0.1± 0.4 (49)
CSA	4 -7 5.8 ± 1.1 (5)	0
AD	11 (1)	10-13 11.3 ± 3.7 (8)
AIV	2 (1)	0-3 1.8 ± 0.7 (46)
PMT	15-25 20.5 ± 8.7 (4)	17-24 21 ± 10.5 (27)
PVT	8-12 10.6 ± 1.7 (5)	8-13 9.9 ± 5 (25)
PT	10-14 12.2 ± 5 (4)	8-14 10.7 ± (25)
DT	13-18 15.8 ± 1.7 (5)	13-21 17.2 ± 8.7 (27)
TL/BW	43-48.7 46.1 ± 2.2 (5)	47.2-76.1 56.9 ± 6.1 (41)

Tab. 2. Morphometric (in mm) and meristic data (range, mean ±standard deviation and sample size in parenthesis) of *Caecilia gracilis*.

	AM	TO	AP	MA	PA
TL	323-405 (2)	139-510 326.5 ± 147.3 (11)	265 (1)	112-453 281.2 ± 80.7 (66)	150-735 417 ± 136.1 (17)
HW	4.3-4.8 (2)	2.8-5.6 4.2 ± 0.8 (12)	3.7 (1)	2.8-5.3 3.9 ± 0.8 (65)	3.5-7 5 ± 1 (17)
HL	6.5-6.9 (2)	4.4-8.6 6.6 ± 1.2 (12)	5.8 (1)	4.3-8.8 6.2 ± 1.4 (65)	5.7-11.5 7.9 ± 1.6 (17)
HH	3.2-3.4 (2)	1.9-4.8 3.1 ± 1.1 (11)	2.3 (1)	2-4.5 3 ± 1.5 (37)	2.5-5.9 3.7 ± 0.9 (17)
BW	4.3-5 (2)	4.6-5.7 5.2 ± 2.2 (3)	4 (1)	2.6-6.7 4.4 ± 1.2 (51)	4.2-10.7 6.5 ± 1.9 (13)
BH	3.9-4.4 (2)	5.1 (1)	3.1 (1)	2.3-5.9 3.6 ± 0.9 (64)	3.6-9.2 5.5 ± 1.6 (13)
WNC	4.3-4.8 (2)	2.8-6.2 4.5 ± 2.1 (9)	3.8 (1)	2.7-5.9 4.3 ± 1.6 (47)	3.8-10 5.9 ± 1.8 (13)
WTR	3.9-5.3 (2)	2.7-5.5 4.4 ± 1.8 (10)	3.9 (1)	2.5-6.3 4.2 ± 1.1 (62)	4-9.8 6.1 ± 1.7 (15)
WV	2.8-4 (2)	1.6-3.9 3.2 ± 1.3 (10)	2.5 (1)	2.4-5 3.2 ± 0.9 (31)	2.8-7.2 4 ± 1 (16)
EE	2.9 (2)	1.9-3.5 2.8 ± 0.9 (11)	2.2 (1)	1.9-5.2 2.5 ± 0.6 (65)	2.3-5 3.2 ± 0.7 (16)
EN	1.9 (1)	1.1-2.6 2 ± 0.7 (11)	1.7 (1)	1.2-2.4 1.7 ± 0.4 (65)	1.7-3 2.2 ± 0.4 (16)
ET	1.8-1.9 (2)	1.2-2.2 1.8 ± 0.6 (11)	1.6 (1)	1.2-2.4 1.7 ± 0.4 (65)	1.6-3.2 2.2 ± 0.4 (16)
EMM	0.8-0.9 (2)	0.5-1.1 0.8 ± 0.2 (11)	0.6 (1)	0.4-1.1 0.7 ± 0.2 (65)	0.5-1.4 0.9 ± 0.2 (16)
SP	1.1-1.6 (2)	0.9-1.9 1.5 ± 0.5 (11)	1.2 (1)	0.9-2.2 1.5 ± 0.3 (65)	1.4-2.8 1.8 ± 0.3 (17)
TT	1.9 (1)	1.1-2.4 1.9 ± 0.6 (11)	1.6 (1)	1.3-2.6 1.8 ± 0.4 (65)	1.6-3.4 2.2 ± 0.5 (17)

Tab. 2. Continued. Morphometric (in mm) and meristic data (range, mean ±standard deviation and sample size in parenthesis) of *Caecilia gracilis*.

	AM	TO	AP	MA	PA
TN	0.6 (2)	0.4-0.9 0.7 ± 0.2 (11)	0.6 (1)	0.4-0.9 0.6 ± 0.1 (65)	0.6-1.3 0.8 ± 0.2 (17)
TJA	4.1 (1)	2.7-5.4 3.9 ± 1.8 (9)	3.6 (1)	2.3-5.3 3.6 ± 0.8 (65)	3.1-6.7 4.4 ± 1 (17)
TMM	0.6-0.7 (2)	0.3-0.9 0.7 ± 0.2 (11)	0.6 (1)	0.4-1.1 0.7 ± 0.1 (65)	0.6-1.8 0.9 ± 0.2 (17)
NN	1.5 (1)	0.9-2 1.5 ± 0.5 (11)	1.3 (1)	1-1.9 1.4 ± 0.3 (65)	1.1-2.9 1.7 ± 0.4 (17)
NMM	1.1-1.3 (2)	0.7-1.7 1.3 ± 0.4 (11)	1.2 (1)	0.8-3.5 1.3 ± 0.4 (65)	0.9-2.4 1.5 ± 0.4 (17)
PA	182-193 (2)	191-206 199 ± 74.3 (10)	208 (1)	177-197 187.3 ± 23.1 (66)	180-205 192.7 ± 7.4 (17)
SA	16-26 (2)	18-28 22.8 ± 9.1 (10)	29 (1)	11-29 19.6 ± 4.5 (66)	12-52 32.4 ± 10.5 (17)
CSA	6 (1)	5-8 6.5 ± 2.5 (10)	6 (1)	0-8 5.2 ± 1.7 (58)	2-9 5.4 ± 2.2 (17)
AD	13 (1)	10-13 11.7 ± 5.5 (4)	10 (1)	10-14 12.3 ± 4.4 (53)	9-16 11.7 ± 1.5 (14)
AIV	2 (1)	2-4 2.8 ± 1.1 (10)	2 (1)	1-3 2.3 ± 0.5 (63)	1-3 2.1 ± 0.6 (17)
PMT	15-17 (2)	14-18 15.4 ± 4.3 (11)	16 (1)	9-19 14.3 ± 3.3 (52)	12-18 15.3 ± 1.4 (13)
PPT	13 (1)	14-18 15.8 ± 6.9 (9)	16 (1)	10-19 14 ± 4.3 (50)	12-14 13.3 ± 1.1 (3)
DT	14 (1)	10-18 13.9 ± 4.5 (11)	14 (1)	10-18 14.2 ± 3.3 (52)	8-17 13.2 ± 2.5 (9)
ST	4 (1)	0-5 3.1 ± 1.8 (8)	4 (1)	1-6 3.2 ± 1.1 (52)	3-4 3.8 ± 0.4 (5)
TL/BW	75.1-81 (2)	84.7-89.4 87 ± 1.9 (3)	66.2 (1)	37.3-90.6 61.8 ± 10.3 (50)	35.7-74.2 62.5 ± 10 (13)
SI				61-141 (2)	41-115 (2)

Tab. 3. Canonical Discriminant Functions: Standardized By Within Variances of the Stepwise Discriminant Analysis of *C. gracilis* OTUs from east Brazilian Amazonia.

	Axis 1	Axis 2
BW	0.192	0.757
BH	0.521	0.329
EN	1.012	- 0.225
ET	- 0.419	0.660
SP	- 0.374	0.370

Tab. 4. Classification Matrix from the Stepwise Discriminant Analysis of *C. gracilis* OTUs from east Brazilian Amazonia.

	MA	PA	TO	% correct	Jackknifed % correct
MA	63	2	0	97	95
PA	10	7	2	37	37
TO	4	2	5	45	36
Total	80	8	5	79	77

Tab. 5. Morphometric (in mm) and meristic data (range, mean ±standard deviation and sample size in parenthesis) of *Caecilia mertensi*.

	C. mertensi type	*C. marcusi* types	Acre	Mato Grosso	Rondônia
TL	480 (1)	385-510 449 ± 44.9 (4)	355 (1)	149-445 331.4 ± 71.7 (28)	440 (1)
HW	9 (1)	6.8-7.9 7.2 ± 0.4 (4)	6.4 (1)	3.9-7.2 5.7 ± 0.8 (28)	6.8 (1)
HL	12 (1)	11.2-13.3 11.9 ± 0.8 (4)	9.1 (1)	5.6-10.1 8.4 ± 1.2 (28)	10.6 (1)
HH		4.3	4.6 (1)	2.6-5.6 4.2 ± 1.9 (21)	5.4 (1)
BW		8.6-10.4 9.4 ± 0.7 (4)	7.5 (1)	4.7-10.6 7.9 ± 2.8 (25)	9.3 (1)
BH		7.3 (1)	7 (1)	4 -10.4 6.9 ± 2.8 (24)	8.4 (1)
WNC		8.2 (1)	6.6 (1)	4.4-8 6.6 ± 1.9 (26)	7.9 (1)
WTR		8.6 (1)	6.7 (1)	4.1-9.8 6.9 ± 1.9 (27)	8.3 (1)
WV		7.2 (1)	5 (1)	2.8-7.3 4.9 ± 1.4 (27)	5.6 (1)
EE	5.7 (1)	5.2-6.2 5.5 ± 0.3 (4)	4.4 (1)	2.6-4.9 3.9 ± 0.9 (27)	4.5 (1)
EN		3.5 (1)	2.6 (1)	1.7-3.2 2.6 ± 0.6 (27)	3.5 (1)
ET	4 (1)	3.5-3.9 3.6 ± 0.1 (4)	2.8 (1)	1.8-3.2 2.6 ± 0.6 (27)	3.6 (1)
EJA		4.3 (1)	3 (1)	1.6-3.7 2.6 ± 0.6 (27)	3.4 (1)
EMM		1.6 (1)	1.3 (1)	0.8-1.4 1.1 ± 0.2 (27)	1.5 (1)
SP	1.6 (1)	1.9-2.4 2.1 ± 0.1 (4)	2 (1)	1.2-2.5 1.9 ± 0.2 (28)	2.5 (1)
TT		3.4 (1)	3.1 (1)	2.1-3.7 2.9-0.4 (28)	3 (1)

Tab. 5. continued. Morphometric (in mm) and meristic data (range, mean ±standard deviation and sample size in parenthesis) of *Caecilia mertensi*.

	C. mertensi type	*C. marcusi* types	Acre	Mato Grosso	Rondônia
TN	1.9 (1)	1.3-2 1.7 ± 0.2 (4)	1.2 (1)	0.7-1.4 1 ± 0.2 (28)	1.3 (1)
TJA		6.9 (1)	5.7 (1)	3.4-6.5 5.1 ± 0.7 (28)	6.2 (1)
TMM		1.2 (1)	0.7 (1)	0.5-1.2 0.9 ± 0.1 (28)	1.3 (1)
NN	3.5 (1)	2.7-3.6 2.1 ± 0.3 (4)	2.3 (1)	1.4-2.6 2.1 ± 0.3 (28)	2.3 (1)
NJA		7.7 (1)	6 (1)	3.6-7.1 5.4 ± 0.8 (28)	6.4 (1)
NMM		2.3 (1)	1.9 (1)	1.2-2.3 1.7 ± 0.2 (28)	2.1 (1)
PA	142 (1)	139-143 141 ± 1.5 (4)	143 (1)	141-157 150.1 ± 4.1 (28)	143 (1)
SA	48 (1)	43-47 45 ± 1.4 (4)	39 (1)	25-47 36.1 ± 5.5 (28)	33 (1)
CSA		2 (1)	2 (1)	0-3 0.3 ± 0.7 (28)	2 (1)
AD		9-12 (2)	17 (1)	9-16 12.5 ± 5.6 (21)	13 (1)
AIV		3 (1)	4 (1)		
PMT	21 (1)	13-18 15 ± 1.8 (4)	15 (1)	8-17 13.5 ± 3.1 (27)	19 (1)
PPT	23 (1)	15-18 16.5 ± (4)	15 (1)	10-20 13.6 ± 5.6 (23)	14 (1)
DT	24 (1)	10-16 12.7 ± 2.1 (4)	16 (1)	6-17 13.1 ± 4.6 (25)	15 (1)
ST	4 (1)	1-3 2 ± 0.7 (4)		0-4 2.3 ± 1.2 (22)	4 (1)
TL/BW	38.4 (1)	37-53.7 47.7 ± 6.4 (4)	46.7 (1)	31.7-49.6 40.7 ± 4.5 (25)	47.3 (1)
SI	25 (1)	29-35 32.5 ± 2.2 (4)		22-95 36.6 ± 23.9 (17)	27 (1)

Tab. 6. Morphometric (in mm) and meristic data (range, mean ±standard deviation and sample size in parenthesis) of *Caecilia tentaculata*.

	Acre	Mato Grosso	PAGS	PAB	Manaus region
TL	485-783 677 ± 114.6 (4)	177.5-500.5 365.6 ± 98.9 (25)	340-720 513.6 ± 98.9 (20)	345-566 460.7 ± 65 (15)	202-820 605.5 ± 238.7 (4)
HW	11.3-17.8 15.1 ± 2.3 (4)	5.5-9.5 7.7 ± 1 (25)	8.9-16.1 11.7 ± 2.3 (20)	7.7-11 9.8 ± 3.4 (13)	5.7-17.1 12.4 ± 6.8 (3)
HL	15.8-22.4 19 ± 2.3 (4)	6.5-13 9.9 ± 1.5 (25)	11-21.9 15.7 ± 2.7 (20)	12.6-16.9 14 ± 5.6 (13)	7.9-21.6 16.3 ± 8.8 (3)
HH	8.7-13 10.6 ± 1.5 (4)	3.7-6.2 5.3 ± 2.4 (7)	6.1-13.5 9 ± 2.2 (20)	6.3-9.6 7.4 ± 3 (13)	3.9-13.7 9.7 ± 5.5 (3)
BW	17.6-25.9 22 ± 3 (4)	5.5-12.5 9.6 ± 3.1 (23)	10.5-29.9 17.2 ± 4.6 (20)	11.6-18.8 13.7 ± 7 (8)	7.1-25.4 18.7 ± 10.8 (3)
BH	16.2-22.6 19.8 ± 2.4 (4)	5.1-10.1 7.9 ± 3.2 (21)	9-26.5 15.3 ± 4.2 (20)	10.4-15.5 12.4 ± 6.3 (8)	5.6-23 17.1 ± 10.2 (3)
WNC	13.9-18.9 16.9 ± 1.8 (4)	5.6-10.5 8.3 ± 2.6 (23)	9.9-20.5 13.7 ± 2.9 (20)	10.2-12.8 11.1 ± 5.5 (8)	6.3-22.1 14.2 ± 9 (2)
WTR	13.8-22.3 18.5 ± 3 (4)	4.3-11.6 8.6 ± 2.6 (24)	9.6-23.8 15 ± 3.9 (20)	9.3-16.7 11.9 ± 6 (9)	5.8-25.1 17.5 ± 10.5 (3)
WV	10-17.1 13.7 ± 2.5 (4)	2.7-7.9 5.6 ± 2.3 (23)	6.3-14.2 9.6 ± 2.3 (20)	5.1-9.5 7.2 ± 3.7 (8)	3.2-15.1 9.1 ± 6.2 (2)
EE	7.8-11.9 9.9 ± 1.5 (4)	3.4-6.5 5.2 ± 0.8 (25)	5.2-9.5 7.3 ± 1.3 (20)	5.7-6.2 6.2 ± 1.6 (14)	3.8-11.1 8.4 ± 4.6 (3)
EN	5.1-7.9 6.3 ± 1 (4)	1.9-4.1 3.2 ± 0.5 (25)	3.4-6.5 4.8 ± 0.9 (20)	3.6-4.7 4.2 ± 1.4 (13)	2.6-7.3 5.3 ± 2.9 (3)
ET	5.8-8.2 6.8 ± 1 (4)	2.2-4.6 3.5 ± 0.6 (25)	3.7-7.6 5.5 ± 1.1 (20)	4.2-5.2 4.7 ± 1.6 (12)	3-8.2 5.8 ± 3.1 (3)
EJA	6.2-9.7 8.1 ± 1.5 (4)	2.6-5.6 3.9 ± 0.7 (25)	4.2-8.7 6.1 ± 1.3 (20)	4.5-6.1 5.1 ± 2.3 (11)	2.9-8.8 6.7 ± 3.7 (3)
EMM	2.4-3.8 3.2 ± 0.5 (4)	0.9-2.3 1.4 ± 0.2 (25)	1.9-3.5 2.5 ± 0.5 (20)	1.9-2.6 2 ± 0.8 (12)	1.4-3.8 2.9 ± 1.6 (3)
SP	3.8-5.5 4.8 ± 0.6 (4)	1.4-3.3 2.4 ± 0.4 (25)	3-5.4 3.8 ± 0.7 (20)	2.8-3.4 3.1 ± 1.2 (12)	1.9-5.2 4.1 ± 2.2 (3)
TT	4.9-7.9 6.9 ± 1.2 (4)	2.1-4.3 3.5 ± 0.6 (25)	3.9-7.2 5.2 ± 0.9 (20)	3.8-5.1 4.4 ± 1.8 (12)	2-8.6 6 ± 3.5 (3)
TN	2.3-3.4 2.9 ± 0.3 (4)	0.7-2 1.4 ± 0.3 (25)	1.4-3.2 2.3 ± 0.5 (20)	1.5-2.1 1.8 ± 0.6 (13)	1.2-4 2.6 ± 1.5 (3)

Tab. 6. continued. Morphometric (in mm) and meristic data (range, mean ±standard deviation and sample size in parenthesis) of *Caecilia tentaculata*.

	Acre	Mato Grosso	PAGS	PAB	Manaus region
TJA	11.5-16.4 14.1 ± 1.7 (4)	4.5-9.6 7 ± 1.2 (25)	7.1-15 10.4 ± 2.2 (20)	5.4-10.8 8.9 ± 4.1 (11)	6.1-15.1 11.7 ± 6.1 (3)
TMM	2-2.3 2.1 ± 0.1 (4)	0.8-1.8 1.2 ± 0.2 (25)	1-3 1.8 ± 0.6 (20)	1-1.7 1.4 ± 0.5 (13)	0.9-2.6 2 ± 1.1 (3)
NN	4.3-7.6 5.8 ± 1.1 (4)	1.7-3.7 3 ± 0.5 (25)	3.2-5.6 4.1 ± 0.6 (20)	3-4 3.5 ± 1.2 (13)	1.9-6.7 4.6 ± 2.6 (3)
NJA	12-17.2 14.7 ± 1.8 (4)	4.5-9.7 7.4 ± 1.4 (25)	7.7-15.5 10.9 ± 2.1 (20)	8.4-11 9.6 ± 4.3 (11)	5.9-17 12.6 ± 6.8 (3)
NMM	2.3-5.6 3.8 ± 1.2 (4)	1.1-3 2.1 ± 0.5 (25)	1.6-5.3 3.6 ± 1 (20)	2.6-3.2 2.9 ± 1 (13)	2-5.5 4.3 ± 2.3 (3)
PA	117-125 120.7 ± 2.8 (4)	119-129 124.6 ± 2.4 (25)	114-131 119.7 ± 3.7 (21)	118-129 122.4 ± 2.7 (15)	121-129 126.2 ± 3.1 (4)
CPA	4-7 4.7 ± 1.2 (4)	3-8 5.6 ± 1.4 (12)	2-8 4.8 ± 1.8 (20)	2-6 4.1 ± 1.3 (12)	3-7 5 ± 2 (2)
SA	32-37 34 ± 1.8 (4)	27-44 35.6 ± 4.6 (25)	23-43 36.1 ± 4.9 (20)	24-38 28.5 ± 7.9 (14)	31-41 38 ± 4.1 (4)
CSA	2-5 3.2 ± 1 (4)	0-4 1.7 ± 1.3 (25)	1-4 2.8 ± 0.9 (20)	0-5 2.5 ± 1.4 (14)	2-4 3.2 ± 0.8 (4)
AD	11-13 12 ± 0.7 (4)	10-15 13.1 ± 6.6 (14)	12-17 13.5 ± 1.7 (19)	11-16 13.3 ± 6.7 (8)	12-14 13 ± 0.8 (3)
AIV	2-3 2.2 ± 0.4 (4)	1-3 2.2 ± 0.6 (25)	2-3 2.6 ± 0.4 (19)	2-3 2.4 ± 0.7 (14)	2-3 2.5 ± 0.5 (4)
PMT	14-19 17.2 ± 1.9 (4)	9-22 16.1 ± 3.1 (25)	14 -21 17 ± 2 (16)	14-18 15.3 ± 7.7 (8)	14-16 15.3 ± 6.6 (3)
PPT	13-15 14.3 ± 6.2 (3)	12-20 16.5 ± 4.8 (23)	12-20 16 ± 2.7 (6)	16-19 17 ± 7.5 (4)	
DT	9-11 10 ± 4.3 (3)	10-20 15.4 ± 3.8 (24)	12-17 14.4 ± 1.5 (12)	10-15 13.6 ± 6.4 (5)	17 (1)
ST	0-4 (2)	2-4 3 ± 1.1 (23)	1-3 2.5 ± 1 (4)	3-4 3.4 ± 1.6 (5)	
TL/BW	27.5-33.1 30.6 ± 2 (4)	27.5-46.8 38.1 ± 4.1 (23)	22.2-43.8 30.5 ± 4.8 (20)	30.1-38.8 33.9 ± 2.8 (8)	26.5-30.4 28.4 ± 1.5 (3)
SI	23-28 25.7 ± 2.2 (4)	20-47 30 ± 8.5 (7)	6-29 17.2 ± 8.4 (8)	34-35 34.3 ± 14.8 (3)	28-31 (2)

Tab. 7. Classification Matrix from the Stepwise Discriminant Analysis of *C. tentaculata* OTUs from east Brazilian Amazonia.

	Axis 1	Axis 2
TL	0.411	1.029
HL	0.681	0.184
TMM	- 0.364	0.646
NN	- 0.590	0.043

Tab. 8. Classification Matrix from the Stepwise Discriminant Analysis of *C. tentaculata* OTUs from east Brazilian Amazonia.

	MT	PA1	PA2	% correct	Jackknifed % correct
MT	18	7	0	72	68
PA1	8	10	2	50	40
PA2	3	3	7	54	54
Total	29	20	9	60	55

Tab. 9. Statistic results from analysis of sexual dimorphism of *Microcaecilia taylori*.

	Males	Females	
Variables	Range mean ± SD and (N)	Range Mean ± SD and (N)	ANCOVA
HW	2.8-4.7 3.9 ± 0.5 (46)	2.9-4.7 3.7 ± 0.4 (54)	F = 15.385 P = 0.000
HL	4.3-7 5.6 ± 0.6 (45)	4.2-6.7 5.3 ± 0.5 (54)	F = 18.419 P = 0.000
TN	1.4-2.6 1.9 ± 0.3 (45)	1.4-2.6 1.7 ± 0.2 (54)	F = 18.728 P = 0.000
TJA	0.8-2 1.3 ± 0.3 (45)	0.8-1.6 1.2 ± 0.2 (53)	F = 12.243 P = 0.001
NN	1-1.7 1.3 ± 0.2 (45)	0.9-1.6 1.2 ± 0.1 (53)	F = 10.021 P = 0.002

Tab. 10. Morphometric (in mm) and meristic data (range, mean ± standard deviation and sample size in parenthesis) among populations of *Microcaecilia taylori*.

	Type locality	Parauapebas	Caxiuanã	Tucuruí	Belo Monte
TL	122-172 148.3 ± 20.4 (3)	77-225 168.7 ± 45.5 (100)	84-213 168.6 ± 52.3 (16)	177.3 (1)	173-200.2 (2)
HW	3.3-4.5 3.7 ± 0.5 (3)	2.6-4.7 3.7 ± 0.8 (101)	2.7-4.7 3.8 ± 1 (17)	3.5 (1)	3.5-4.3 (2)
HL	4.5-6.3 5.6 ± 0.7 (3)	3.7-7 5.3 ± 1.1 (101)	4.1-6.4 5.3 ± 1.3 (17)	4.8 (1)	5.1-5.8 (2)
HH	2.5 (1)	1.8-4.2 2.8 ± 0.7 (100)	1.8-3.6 2.7 ± 0.8 (17)	2.9 (1)	2.3-3.4 (2)
BW	3.6-5 4.2 ± 0.5 (3)	2.3-5.9 4.2 ± 2.1 (69)	2.2-5.3 4.2 ± 1.5 (16)	4 (1)	3.3-5 (2)
BH	3.3 (1)	2.1-5.1 3.4 ± 1.7 (69)	1.8-4.9 3.6 ± 1.3 (16)	3.4 (1)	2.6-3.7 (2)
WNC	3.5 (1)	2.8-5 3.8 ± 1.7 (79)	2.4-5.2 4 ± 1.4 (16)	3.7 (1)	3.7-4.4 (2)
WTR	3.7 (1)	2.4-5.4 3.9 ± 1.8 (76)	2.2-4.9 4 ± 1.1 (17)	4.1 (1)	3.2-3.6 (2)
WV	2.1 (1)	1.2-3.1 2.2 ± 0.8 (87)	1-3.6 2.4 ± 0.8 (17)	2.6 (1)	1.5-2.5 (2)
TT	2.7 (1)	2.1-4 3 ± 0.6 (101)	2.2-3.9 3.2 ± 1.1 (16)	2.9 (1)	2.9-3.5 (2)
TN	1.7-2.5 1.9 ± 0.3 (3)	1-2.6 1.7 ± 0.4 (99)	1.3-2.6 1.9 ± 0.5 (17)	1.7 (1)	1.6-2.1 (2)
TJA	1.4 (1)	0.6-1.9 1.2 ± 0.3 (99)	0.8-2 1.4 ± 0.4 (17)		1.5 (2)
TMM	0.3 (1)	0.2-0.5 0.3 ± 0.1 (98)	0.2-0.6 0.4 ± 0.1 (17)	0.3 (1)	0.3 (2)

Tab. 10 continued. Morphometric (in mm) and meristic data (range, mean ± standard deviation and sample size in parenthesis) among populations of *Microcaecilia taylori*.

	Type locality	Parauapebas	Caxiuanã	Tucuruí	Belo Monte
NN	1.2-1.7 1.4 ± 0.7 (3)	0.8-1.7 1.2 ± 0.3 (100)	0.9-1.6 1.3 ± 0.4 (16)	1.1 (1)	1.2-1.3 (2)
NMM	0.8 (1)	0.5-1.2 0.9 ± 0.2 (100)	0.7-1.2 0.9 ± 0.2 (17)	0.9 (1)	1 (2)
SP	0.9 (1)	0.8-1.6 1.2 ± 0.2 (100)	0.8-1.5 1.2 ± 0.3 (17)	1.1 (1)	1-1.1 (2)
PA	114-117 115.3 ± 1.2 (3)	115-130 123.2 ± 20.7 (102)	113-130 121.1 ± 28 (17)	121 (1)	125-130 (2)
SA	0 (3)	0-21 1.9 ± 4.5 (102)	0-11 2.4 ± 3.1 (17)	14 (1)	0-14 (2)
CSA	0 (3)	0-6 0.2 ± 1 (102)	0 (17)	0 (1)	0-3 (2)
AD	13 (1)	9-16 12.3 ± 5.4 (79)	11-16 13.1 ± 5.6 (14)		12-14 (2)
AIV	2-3 2.3 ± 0.4 (3)	1-3 1.9 ± 0.7 (93)	1-3 2.1 ± 0.7 (17)	1 (1)	2 (2)
PMT	24-30 27 ± 2.4 (3)	19-29 24 ± 12.1 (50)	19-29 23.6 ± 9 (15)	22 (1)	25 (2)
PPT	20-30 26 ± 4.3 (3)	18-28 23 ± 9.7 (23)	20-28 24 ± 12.1 (9)	22 (1)	25 (1)
DT	18-20 18.6 ± 0.9 (3)	13-23 18.5 ± 9.3 (50)	15-22 18 ± 8.6 (12)	13 (1)	15 (2)
TL/BW	33.8-37.7 35.3 ± 1.7 (3)	25.7-51.6 39.8 ± 4.9 (69)	31.6-51.9 39.2 ± 4.4 (16)	44.1 (1)	39.7-52.4 (2)
SI	106 (1)	37-117 100 ± 45.3 (26)	98-109 104 ± 51.5 (6)	105 (1)	34-121 (2)

Tab. 11. Morphometric (in mm) and meristic data (range, mean ± standard deviation and sample size in parenthesis) of *Microcaecilia* spp. from Brazilian Amazonia.

	M. sp. nov.	*M. taylori*	*M. unicolor*
NN	1-1.4 1.2 ± 0.1 (4)	0.8-1.7 1.2 ± 0.3 (119)	1.3 (1)
NMM	0.7-1.1 0.9 ± 0.1 (4)	0.5-1.2 0.9 ± 0.2 (121)	1.2 (1)
SP	0.9-1.2 1.1 ± 0.1 (4)	0.8-1.6 1.2 ± 0.2 (121)	1.2 (1)
PA	122-129 125.5 ± 2.5 (4)	113-130 123 ± 21.7 (123)	116 (1)
SA	42-51 42.8 ± 3.6 (4)	0-21 2.2 ± 4.5 (123)	91 (1)
CSA	6-11 8.5 ± 2 (4)	0-6 0.2 ± 1 (123)	40 (1)
AD	10-13 11.5 ± 1.1 (4)	9-16 12.5 ± 5.4	
AIV	2-4 2.7 ± 0.8 (4)	1-3 1.9 ± 0.7 (114)	2 (1)
PMT	16-31 24 ± 6.5 (4)	19-29 24 ± 12 (69)	15 (1)
PPT	21-22 21.5 ± 10.7 (2)	18-28 23.6 ± 10.5 (35)	18 (1)
DT	12-22 17.5 ± 4.1 (4)	13-23 18.4 ± 9.2 (64)	16 (1)
TL/BW	35.7-48.2 41.1 ± 4.6 (4)	25.7-52.4 39.8 ± 4.9 (89)	34.2 (1)
SI	23-56 41.3 ± 13.7 (3)	34-121 99.6 ± 47.2 (35)	8 (1)

Tab. 11. continued. Morphometric in (mm) and meristic data (range, mean ± standard deviation and sample size in parenthesis) of *Microcaecilia* spp. from Brazilian Amazonia.

	M. sp. nov.	*M. taylori*	*M. unicolor*
NN	1-1.4 1.2 ± 0.1 (4)	0.8-1.7 1.2 ± 0.3 (119)	1.3 (1)
NMM	0.7-1.1 0.9 ± 0.1 (4)	0.5-1.2 0.9 ± 0.2 (121)	1.2 (1)
SP	0.9-1.2 1.1 ± 0.1 (4)	0.8-1.6 1.2 ± 0.2 (121)	1.2 (1)
PA	122-129 125.5 ± 2.5 (4)	113-130 123 ± 21.7 (123)	116 (1)
SA	42-51 42.8 ± 3.6 (4)	0-21 2.2 ± 4.5 (123)	91 (1)
CSA	6-11 8.5 ± 2 (4)	0-6 0.2 ± 1 (123)	40 (1)
AD	10-13 11.5 ± 1.1 (4)	9-16 12.5 ± 5.4	
AIV	2-4 2.7 ± 0.8 (4)	1-3 1.9 ± 0.7 (114)	2 (1)
PMT	16-31 24 ± 6.5 (4)	19-29 24 ± 12 (69)	15 (1)
PPT	21-22 21.5 ± 10.7 (2)	18-28 23.6 ± 10.5 (35)	18 (1)
DT	12-22 17.5 ± 4.1 (4)	13-23 18.4 ± 9.2 (64)	16 (1)
TL/BW	35.7-48.2 41.1 ± 4.6 (4)	25.7-52.4 39.8 ± 4.9 (89)	34.2 (1)
SI	23-56 41.3 ± 13.7 (3)	34-121 99.6 ± 47.2 (35)	8 (1)

Tab. 12. Morphometric (in mm) and meristic data (range, mean ± standard deviation and sample size in parenthesis) of *Potomotyphlus kaupii* from Brazilian Amazonia.

	Tucuruí region	Macapá	R. Negro	R. Branco AC	Roraima	Santarém	Marchantaria AM	Serra dos Carajás PA	Trombetas	UHE Balbina	Melgaço + Xingu	Serra da Mesa
TL	169-370 247.2 ± 52.1 (35)	555 (1)	453.8 (1)	455 (1)	325-450 (2)	36-460 403.2 ± 41.8 (4)	460-490 (2)	255 (1)	332 (1)	242 (1)	173-395 (2)	183-310 (2)
HW	3.7-6.9 5.2 ± 0.7 (36)	9.2 (1)	6 (1)	8.1 (1)	5.9 (2)	5.5-6.4 5.9 ± 0.4 (3)	6.7-6.9 (2)	5 (1)	5.2 (1)	5.2 (1)	4.5-6 (2)	4.5-5.3 (2)
HL	5.3-9.7 7.5 ± 1 (36)	13.3 (1)	10.4 (1)	11.4 (1)	9.4 (2)	9.1-10.3 9.7 ± 0.5 (3)	10-10.2 (2)	8.2 (1)	8.3 (1)	8 (1)	7-9.3 (2)	7.5-9.9 (2)
HH	2.1-4 3 ± 0.4 (36)	5.4 (1)	3.6 (1)	4.8 (1)	3.6-3.7 (2)	3-4.3 3.7 ± 0.6 (3)	4.4-4.7 (2)	2.9 (1)	3.7 (1)	2.7 (1)	3.1-4 (2)	2.7-3.5 (2)
BW	4.3-11.3 6.6 ± 1.9 (24)	10.7 (1)	6.7 (1)	15.8 (1)	7.9-9.1 (2)		10.4-11.8 (2)	5.7 (1)	8.6 (1)	6.2 (1)	4.6 (1)	3.7-8.6 (2)
BH	4.8-15.7 9.1 ± 3 (25)	24.2 (1)	12.2 (1)	18.4 (1)	13.1-14.2 (2)		16-17 (2)	10 (1)	9.2 (1)	10 (1)	6.8 (1)	6.3-12.2 (2)
WNC	3.6-6.9 5.7 ± 0.8 (23)			9.2 (1)	6.5-6.7 (2)	6.1-7 6.4 ± 0.4 (3)	7.2-7.5 (2)	5.4 (1)	6.7 (1)	5.8 (1)		4.8-6.8 (2)
WTR	2.1-7 4.1 ± 1.3 (26)	4.9 (1)	3.9 (1)	10.4 (1)	5.7-5.8 (2)	4-6 5.1 ± 1 (3)	7.8-8.2 (2)	3.2 (1)	5.7 (1)	5.1 (1)	3 (1)	2.8-4.7 (2)
WV	2-7.2 3.7 ± 1.3 (31)	5.7 (1)	3.9 (1)	11 (1)	4.2-4.7 (2)	3.5-3.8 (2)	8.5-8.9 (2)	2.5 (1)	4.3 (1)	5.9 (1)	2.3-3.5 (2)	2.2-2.8 (2)
EE	2.9-4.5 3.6 ± 0.4 (19)		3.8 (1)	4.7 (1)		3.6-3.9 3.7 ± 0.1 (3)	3.9-4.1 (2)	3.5 (1)	4.2 (1)	3.5 (1)	2.9-3.9 (2)	3-3.8 (2)
EN	1.7-3 2.3 ± 0.3 (18)		3.1 (1)	3.3 (1)		2.9-3 2.9 ± 0.05 (3)	3.5-3.6 (2)	2.4 (1)	2.3 (1)	2.2 (1)	1.9-3.1 (2)	2.1-2.6 (2)
ET	1-2.3 1.6 ± 0.3 (18)		2.1 (1)	2.6 (1)		1.8-2.1 2 ± 0.1 (3)	2.3 (1)	1.7 (1)	1.6 (1)	1.5 (1)	1.2-2.2 (2)	1.6-1.8 (2)
EMM	0.9-1.5 1.1 ± 0.1 (20)	1.8 (1)	1.2 (1)	1.7 (1)		1.3-1.5 1.38 ± 0.1 (3)	1.6-1.7 (2)	1.1 (1)	1.2 (1)	1.1 (1)	1.1-1.6 (2)	1-1.3 (2)
SP	1.2-2.7 1.8 ± 0.2 (36)	3.2 (1)	2.5 (1)	2.6 (1)	2.2-2.4 (2)	2.5-2.6 2.56 ± 0.05 (3)	2.6-2.7 (2)	2 (1)	2 (1)	2 (1)	1.6-2.4 (2)	1.7-2.1 (2)

Tab. 12. continued. Morphometric (in mm) and meristic data (range, mean ± standard deviation and sample size in parenthesis) of *Potomotyphlus kaupii* from Brazilian Amazonia.

	Tucuruí region	Macapá	R. Negro	R. Branco AC	Roraima	Santarém	Marchantaria AM	Serra dos Carajás PA	Trombetas	UHE Balbina	Melgaço + Xingu	Serra da Mesa
TT	2.1-4 3.2 ± 0.4 (36)	5.5 (1)	3.5 (1)	4.4 (1)	3.7-3.8 (2)	3.5-3.7 3.6 ± 0.1 (3)	3.7-4.1 (2)	3.1 (1)	3.5 (1)	3.4 (1)	2.8-3.8 (2)	2.8-3.3 (2)
TN	0.4-1.8 0.6 ± 0.2 (36)	1.6 (1)	0.9 (1)	1.1 (1)	0.7-0.8 (2)	0.6-1.1 0.9 ± 0.2 (3)	0.7-1.3 (2)	0.7 (1)	0.5 (1)	0.6 (1)	0.5-0.7 (2)	0.4-0.8 (2)
TJA	2.1-4.2 2.8 ± 0.5 (36)	5.4 (1)	4.3 (1)	5.7 (1)	3.7 (2)	3.6-4.5 4.1 ± 0.4 (3)	4.2-4.8 (2)	3.3 (1)	3.5 (1)	3 (1)	2.6-4.2 (2)	3.2-3.3 (2)
TMM	0.7-1.2 0.9 ± 0.1 (36)	1.8 (1)	1.1 (1)	1.5 (1)	1.2 (2)	1.1-1.4 1.2 ± 0.1 (3)	1.4-1.5 (2)	0.9 (1)	0.8 (1)	1 (1)	0.8-1.2 (2)	0.8-1.2 (2)
NN	1.3-2.7 2 ± 0.2 (36)	3.3 (1)	2.2 (1)	2.9 (1)	2.4-2.5 (2)	2.5 (3)	2.3-2.7 (2)	2 (1)	2.3 (1)	2.1 (1)	1.6-2.3 (2)	1.7-2.2 (2)
NMM	0.9-1.6 1.1 ± 0.1 (36)	2.1 (1)	1.4 (1)	1.9 (1)	1.5 (2)	1.4-1.7 1.5 ± 0.1 (3)	1.8-2.1 (2)	1.2 (1)	1 (1)	1 (1)	1.2-1.4 (2)	1.2-1.5 (2)
PA	83-97 89.5 ± 3 (36)	93 (1)	100 (1)	87 (1)	93-98 (2)	92-102 97.2 ± 4.1 (4)	100-101 (2)	86 (1)	90 (1)	83 (1)	91-96 (2)	88-91 (2)
AD	7-11 8.8 ± 0.8 (29)	9 (1)	9 (1)		9-10 (2)	9-10 9.6 ± 0.5 (3)	9 (2)	9 (1)	9 (1)	8 (1)	9 (2)	9-10 (2)
AIV	0-1 0.2 ± 0.4 (36)	0 (1)		0 (1)	0-1 (2)	0 (4)	0-1 (2)	0 (1)	0 (1)	0 (1)	0-2 (2)	0 (2)
PMT	29-45 35.9 ± 4 (28)	54 (1)	49 (1)		36-39 (2)	32-36 (2)	30 (1)	35 (1)	32 (1)	38 (1)	32-40 (2)	39-44 (2)
PPT	28-36 31.8 ± 3.8 (5)	44 (1)	48 (1)			25 (1)				28 (1)	30 (1)	40 (1)
DT	22-40 30 ± 5.2 (25)	50 (1)	48 (1)		34 (2)	38 (1)		36 (1)	26 (1)	36 (1)	28-35 (2)	37-42 (2)
ST	4-11 8 ± 1.9 (14)	7 (1)	11 (1)		7-8 (2)					9 (1)		10 (2)
TL/BW	29.8-56.1 38.9 ± 7.9 (23)	51.8 (1)	68.1 (1)	28.7 (1)	35.7-56.9 (2)		41.5-42.9 (2)	44.7 (1)	38.6 (1)	39 (1)	37.6 (1)	36-49.4 (2)

Tab. 13. Morphometric (in mm) and meristic data (range, mean ± standard deviation and sample size in parenthesis) of *Typhlonectes compressicauda* from Brazilian Amazonia.

	Belém region	Macapá AP	Tapauá AM	Manaus region	Mamirauá AM	Pitinga AM	Faro PA
TL	128-610 278.2 ± 137.6 (58)	210 (1)	140-159 148 ± 8.1 (4)	122-460 243.6 ± 109.9 (30)	205-330 250 ± 69.4 (3)	143-163 152.6 ± 10 (3)	330 (1)
HW	4.9-16.9 8.8 ± 3.1 (58)	7.8 (1)	6.2-7.2 6.6 ± 0.3 (5)	5.9-14.3 8.3 ± 2.1 (33)	8.2-10 8.9 ± 0.9 (3)	5.9-6.8 6.2 ± 0.4 (3)	9 (1)
HL	7.9-19 12.3 ± 3.5 (58)	11.2 (1)	9.1-10.4 9.3 ± 0.5 (5)	8.5-19.7 11.5 ± 2.8 (31)	10.9-14.7 12.2 ± 2.1 (3)	8.7-9.8 9.1 ± 0.6 (3)	13.4 (1)
HH	3.4-10.8 5.4 ± 1.8 (58)	4.6 (1)		3.6-8.6 5.2 ± 1.3 (31)	5.2-5.7 5.4 ± 0.2 (3)	3.5-4.7 3.9 ± 0.6 (3)	5.5 (1)
BW	5.5-28.4 10.6 ± 6.2 (41)	10.3 (1)	9.9 (1)	5.4-21.9 21.1 ± 4.7 (20)	9.6 (1)	6.2-7.6 (2)	15.6 (1)
BH	6.3-28.5 11.6 ± 6 (42)	13.3 (1)	14.4 (1)	7.1-25.6 14.4 ± 5.1 (20)	12.3 (1)	6.7-7.1 (2)	17 (1)
WNC	5.4-21.5 10.3 ± 4.4 (44)	8.4 (1)	7.1-8 (2)	7.1-15.1 10.9 ± 2.1 (16)	9-10.9 (2)	6.2 (1)	12.6 (1)
WTR	4.6-19.3 7.9 ± 4 (43)	8.8 (1)	7.9 (1)	4.8-15 9.5 ± 3 (18)	8.7 (1)	4.5-5.1 (2)	9 (1)
WV	2.9-12.1 5.4 ± 2.4 (49)	4.9 (1)	5.9 (1)	3.5-11.9 7.4 ± 2.3 (17)	5.3 (1)	3-3.5 (2)	10.6 (1)
EE	4.1-9.9 6.1 ± 1.6 (58)	5.1 (1)	5-5.8 5.2 ± 0.3 (5)	4-9.2 5.5 ± 1.3 (31)	5.7-6.8 6.1 ± 0.6 (3)	4.5-5.1 4.8 ± 0.3 (3)	6.9 (1)
EN	2.3-8.8 3.9 ± 1.3 (57)	3.2 (1)	2.7-3.6 2.9 ± 0.3 (5)	2.3-5.6 3.4 ± 0.9 (31)	3.4-4.2 3.7 ± 0.4 (3)	2.7-3.3 2.9 ± 0.3 (3)	4.3 (1)
ET	1.7-5.4 3.2 ± 1.1 (57)	2.6 (1)	2-2.9 2.3 ± 0.3 (5)	1.9-5 3 ± 0.8 (31)	2.9-3.7 3.1 ± 0.4 (3)	2.2-2.6 2.4 ± 0.2 (3)	3.4 (1)
EMM	1-2.6 1.7 ± 0.4 (57)	1.4 (1)	1-1.4 1.1 ± 0.1 (5)	1-2.2 1.4 ± 0.3 (31)	1.5-1.9 1.6 ± 0.2 (3)	1.1-1.2 1.1 ± 0.05 (3)	1.7 (1)
SP	1.9-5 3 ± 0.8 (58)	2.6 (1)	2.1-2.4 2.2 ± 0.1 (5)	1.9-4.3 2.8 ± 0.6 (31)	2.6-3.3 2.8 ± 0.4 (3)	2-2.6 2.2 ± 0.3 (3)	3 (1)
TT	3.7-8.6 5.3 ± 1.3 (56)	4.9 (1)	4.2-5.4 4.5 ± 0.4 (5)	3.5-8.7 5 ± 1.2 (31)	5.1-6.4 5.6 ± 0.7 (3)	3.7-4.5 4 ± 0.4 (3)	6.6 (1)

Tab. 13. continued. Morphometric (in mm) and meristic data (range, mean ± standard deviation and sample size in parenthesis) of *Typhlonectes compressicauda* from Brazilian Amazonia.

	Belém region	Macapá AP	Tapauá AM	Manaus region	Mamirauá AM	Pitinga AM	Faro PA
TN	0.3-1.2 0.5 ± 0.2 (57)	0.4 (1)	0.2-0.4 0.3 ± 0.08 (5)	0.1-1 0.4 ± 0.1 (31)	0.5 (3)	0.2-0.5 0.3 ± 0.1 (3)	0.8 (1)
TJA	3-10.5 6 ± 2 (57)	4.7 (1)	4.2-5.9 4.6 ± 0.6 (5)	3.7-9.9 5.3 ± 1.5 (31)	5.6-7 6.1 ± 0.7 (3)	3.6-4.3 3.9 ± 0.3 (3)	6.3 (1)
TMM	1.1-2.9 1.8 ± 0.4 (57)	1.6 (1)	1.4-1.9 1.5 ± 0.1 (5)	1.1-3.2 1.7 ± 0.4 (31)	1.5-2 1.7 ± 0.2 (3)	1.2-1.3 1.2 ± 0.05 (3)	2.4 (1)
NN	2-6 3.7 ± 1.2 (57)	3.7 (1)	3-3.7 3.2 ± 0.2 (5)	2.4-6.1 3.5 ± 0.9 (31)	3.3-4.4 3.7 ± 0.6 (3)	2.7-3.1 2.8 ± 0.2 (3)	4.6 (1)
NMM	1.2-3.5 2 ± 0.5 (57)	1.8 (1)	1.5-2 1.7 ± 0.1 (5)	1.1-3 1.9 ± 0.4 (31)	1.9-2.1 2 ± 0.1 (3)	1.3-1.8 1.5 ± 0.2 (3)	2.2 (1)
PA	82-88 84.2 ± 1.5 (57)		80-84 81.6 ± 1.7 (5)	78-87 82.6 ± 2.5 (28)	84-85 (2)	82-84 83 ± 1 (3)	83 (1)
AD	9-11 10 ± 0.2 (58)	11 (1)	10 (5)	10 (31)	10 (3)	10-11 10.3 ± 0.5 (3)	10 (1)
AIV	0 (59)	0 (1)	0 (5)	0 (33)	0 (3)	0 (3)	0 (1)
PMT	16-48 35 ± 7.2 (38)	38 (1)	28-40 34 ± 6.9 (3)	28-47 36 ± 5.1 (16)	38-40 39.3 ± 1.1 (3)	41 (1)	38 (1)
PPT	24-48 35.8 ± 6 (24)	33 (1)	32 (1)	24-42 35 ± 4.6 (11)	32-36 (2)		34 (1)
DT	10-36 27.1 ± 6.3 (30)	25 (1)	18-36 (2)	20-37 30.4 ± 4.7 (14)	30 (2)	28 (1)	26 (1)
ST	7-13 10 ± 1.7 (17)	9 (1)	9 (1)	9-12 10.7 ± 1.5 (4)	12 (1)		
TL/BW	16.7-36.7 23.4 ± 4.5 (41)	20.4 (1)		18.7-31.7 23.9 ± 3.3 (24)	22.3 (1)	21.4-23 (2)	21.1 (1)

Tab. 14. Morphometric (in mm) and meristic data (range, mean ± standard deviation and sample size in parenthesis) of *Rhinatrema* spp. from Brazilian Guiana.

	Rhinatrema sp. nov.		*Rhinatrema bivittatum*	
	Male	Female	Male	Female
TL	97-193 171.6 ± 18.6 (23)	167-263 209.8 ± 26.8 (10)	145-188 166.2 ± 16.8 (5)	138-246 199.4 ± 35.2 (5)
HW	3.7-6.1 5.3 ± 0.4 (23)	5.5-7.2 6.2 ± 0.5 (10)	4.7-5.5 5.1 ± 0.3 (5)	4.4-6.4 5.6 ± 0.7 (5)
HL	5-9.2 7.8 ± 0.8 (23)	8-10 9 ± 0.6 (10)	7.5-8.9 8.3 ± 0.6 (5)	7.5-9.4 8.6 ± 0.6 (5)
HH	2.4-4 3.5 ± 0.3 (23)	3.3-5.3 4.2 ± 0.6 (10)	2.9-3.6 3.4 ± 0.3 (5)	2.9-3.9 3.6 ± 0.3 (5)
BW	4.7-7.9 6.9 ± 0.6 (23)	7.1-12.2 8.8 ± 1.5 (10)	5.5-7.4 6.2 ± 0.8 (5)	6.2-8.7 7.6 ± 1 (5)
BH	3.9-7.4 6.1 ± 0.7 (23)	6-12.3 8.2 ± 2 (10)	3.6-5.9 4.9 ± 0.8 (5)	4.4 -7.5 6.4 ± 1.2 (5)
WNC	3.8- 6.6 5.5 ± 0.6 (23)	5.3-8.1 6.7 ± 0.8 (10)	4.5-5.7 5.1 ± 0.4 (5)	4.4 -7 5.8 ± 0.8 (5)
WTR	4-5.9 5.2 ± 0.4 (23)	5.4-9.5 7 ± 1.3 (10)	3.6-4.3 3.9 ± 0.3 (5)	4.2-6.3 4.9 ± 2.1 (5)
WV	2.8-4 3.5 ± 0.7 (22)	3.8-6.3 4.7 ± 0.8 (10)	2.3-3.1 2.7 ± 0.3 (5)	2.4-3.5 3 ± 1.3 (5)
EE	2.2-3.6 3.3 ± 0.3 (23)	3.1-4 3.5 ± 0.3 (10)	3.5-4.2 3.9 ± 0.2 (5)	2.9-4.1 3.7 ± 0.4 (5)
EN	1.9-2.8 2.5 ± 0.2 (23)	2.3-3.4 2.8 ± 0.3 (10)	2.4 -2.9 2.6 ± 0.2 (5)	2.2-2.8 2.6 ± 0.2 (5)
EJA	1.6-3 2.6 ± 0.6 (22)	3-4 3.3 ± 0.3 (10)	2.1-3.1 2.6 ± 0.4 (5)	2.3-3.3 2.9 ± 0.3 (5)
EMM	0.5-0.9 0.7 ± 0.08 (23)	0.7-1.1 0.9 ± 0.1 (10)	0.6-0.8 0.7 ± 0.07 (5)	0.4-0.9 0.6 ± 0.2 (5)
TN	1.9-2.7 2.4 ± 0.5 (22)	2.3-3.3 2.7 ± 0.2 (10)	2.5-2.9 2.7 ± 0.2 (5)	2.4-2.9 2.7 ± 0.2 (5)
NN	0.9-1.6 1.4 ± 0.2 (23)	1.3-1.8 1.5 ± 0.1 (10)	1.3-1.6 1.4 ± 0.1 (5)	1-1.6 1.4 ± 0.2 (5)

Tab. 14. continued. Morphometric (in mm) and meristic data (range, mean ± standard deviation and sample size in parenthesis) of *Rhinatrema* spp. from Brazilian Guiana.

	Rhinatrema sp. nov.		*Rhinatrema bivittatum*	
	Male	Female	Male	Female
NMM	0.3-0.6 0.5 ± 0.08 (23)	0.5-0.8 0.6 ± 0.06 (10)	0.5-0.6 0.5 ± 0.04 (5)	0.4-0.7 0.5 ± 0.1 (5)
NTS	0.4-0.9 0.7 ± 0.1 (23)	0.7-1 0.8 ± 0.1 (10)	0.6-0.8 0.7 ± 0.08 (5)	0.5-0.8 0.7 ± 0.1 (5)
TAW	2.3-3.2 2.7 ± 0.6 (22)	3-4.3 3.4 ± 1.4 (8)	1.9-2.5 2.2 ± 0.2 (5)	1.3-2.8 2.3 ± 1 (5)
TAL	1.4-3.5 2.1 ± 0.4 (23)	1.9-2.6 2.3 ± 0.7 (9)	1.5-2 1.7 ± 0.2 (5)	1.8-2.9 2.4 ± 0.4 (5)
TAA	3-8 4.2 ± 1.3 (22)	3-5 4 ± 0.4 (10)	3-5 4.2 ± 0.7 (5)	3-7 5.4 ± 1.3 (5)
TBA	276-338 298 ± 62 (22)	285-313 295.4 ± 10.2 (10)	329-358 341.2 ± 10.7 (5)	333-360 345.6 ± 9.9 (5)
AD	13-17 14.6 ± 5 (20)	15-20 17 ± 5.5 (9)	10-11 10.3 ± 5.1 (3)	11-12 11.2 ± 4.5 (5)
AIV	4-6; 5.4 ± 1.3; (22)	4 -7 5.2 ± 1 (10)	4 4 ± 0 (5)	5 5 ± 0 (5)
PMT	19-28 24.6 ± 5.5 (22)	22-29 25 ± 7.9 (9)	19-24 21.8 ± 1.7 (5)	19-28 23.2 ± 3 (5)
PPT	23-33 26.4 ± 13 (14)	20-34 25.8 ± 12.5 (7)	24-28 25.5 ± 10.3 (4)	19-28 24 ± 3.4 (4)
DT	14-24 18.8 ± 5.9 (21)	14-23 17.1 ± 8.2 (7)	19-25 22.3 ± 11.1 (3)	13-24 19.7 ± 4.1 (4)
ST	14-28 18.6 ± 9.5 (8)	16-25 21.3 ± 10 (3)	16 (1)	14-28 21 ± 11.6 (2)
TL/BW	20.6-27.4 24.6 ± 1.9 (23)	19.6-27.7 24 ± 2.4 (10)	24.7-29.6 26.8 ± 1.6 (5)	22.2-31.4 26.4 ± 3.3 (5)
TL/TAL	43.7-100.5 82.1 ± 11.8 (23)	64.2-121 90.8 ± 19 (9)	89.4-108.7 97 ± 6.4 (5)	69-109.4 84.8 ± 14 (5)