UNIVERSIDADE DE SÃO PAULO
FACULDADE DE FILOSOFIA, CIÊNCIAS E LETRAS DE RIBEIRÃO PRETO
PROGRAMA DE PÓS-GRADUAÇÃO EM BIOLOGIA COMPARADA

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Dissertação apresentada à Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto da Universidade de São Paulo, como parte das exigências para obtenção do título de Mestre em Ciências, no Programa de Pós-Graduação em Biologia Comparada.

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Orientador: Prof. Dr. Flávio Alicino Bockmann

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200 p.: 92 il. ; 30 cm

Dissertação de mestrado, apresentada à Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto USP. Área de concentração: Biologia Comparada.

Orientador: Bockmann, Flávio Alicino.

1. Taxonomy. 2. Phylogeny. 3. Morphology.

Dedico essa dissertação a todas as pessoas que conheci no meio acadêmico, que me fizeram crescer tanto como cientista como pessoa.

ACKNOWLEDGEMENTS

Ao Prof. Dr. **Flávio Alicino Bockmann**, que me orientou e me mostrou, através do exemplo, como é ser um cientista que também pensa nas pessoas e uma pessoa que também pensa com ciência.

Um agradecimento mais que especial ao Prof. Dr. **Dave Johnson** que me recebeu durante seis meses em um estágio no National Museum of Natural History, Smithsonian Institution (NMNH), Washington, D.C. e pelos preciosos comentários durante a realização dessa dissertação. Também gostaria de agradecer a todos os pesquisadores do **NMNH** em especial à Dra. **Ai Nonaka**, e Dr. **Roy Mc Diarmid**, pela valiosa ajuda enquanto eu frequentava a instituição.

Agradeço também a **Sandra Raredon**, **Kris Murphy** e **Jeff Cleyton** pela valiosa ajuda com fotografias, ajuda com a obtenção de espécimes e corantes. Também agradeço aos colegas Dr. **William B Ludt**, Dr. **Daniel Lumbantobing**, **Miguel Montalvo**, Dr. **Vinícius Espíndola** e Msc. **Paulo Presti** pelo companheirismo e pelas valiosas discussões durante a realização do estágio no **NMNH**. Esse estágio teve o precioso apoio da **Fundação de Amparo à Pesquisa do Estado de São Paulo – FAPESP** (No. Proc. 2018/14290-4), o qual eu agradeço imensamente.

À **Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto** e ao seu **Departamento de Biologia** por toda a formação acadêmica oferecida.

Ao Prof. Dr. **Ricardo Macedo Corrêa e Castro** e ao biologista Dr. **Hertz Figueiredo dos Santos,** pela ajuda preciosa para a realização desse trabalho.

Aos meus colegas do Laboratório de Ictiologia de Ribeirão Preto **André Esguícero**, **Bruno Almeida Botão**, **Davi lee Bang**, **Dahyes Felix Regasso**, **José Haroldo Braga**, **Malu Araújo Almeida**, **Mariana Bissoli de Morais**, **Pâmela Rodrigues Braga**, **Pedro Pereira Rizzato** e **Otávio Góes** pelo carinho, apoio e ajuda incondicional, em todos os momentos, durante a realização desse trabalho. À **Cláudia Romilda Ferreira Nunes**, que durante muito tempo ajudou a manter o LIRP sempre em ordem e por toda gentileza.

Aos antigos alunos Laboratório de Ictiologia de Ribeirão Preto Dr. **Fernando Apone**, Dra. **Renata Stopiglia**, Dr. **Osmar Santos**, Dr. **Thiago Pereira**, Dr. **William Gotto Ruiz**, que me acolheram de braços abertos desde a minha entrada no laboratório.

Aos colegas que me receberam tão bem durante a minha visita ao MZUSP Drª **Manoela Marinho Koh**, Drª. **Marina Loeb**, Ms. **Vinícius José**, Ms. **Vitor Pimenta Abrahão** e aos professores Prof. Dr. **Mario Cesar Cardoso de Pinna** e Prof. Dr. **Naércio Aquino Menezes**.

Um agradecimento especial ao Dr. **Murilo Nogueira de Lima Pastana** que além de me receber e me ajudar durante a visita ao museu me auxiliou com dicas valiosas acerca da realização do trabalho.

Ao Prof. Dr. **Peter Bartsch** (ZMB) e Prof. Dr. **Sven O. Kullander** (SMNH), por fornecer informações valiosas sobre o material atribuído a série-tipo de *Awaous tajasica*.

A Profa. Dra. **Mariana Françozo** (LUCL), pela disponibilidade em responder prontamente as perguntas acerca da história das primeiras ilustrações atribuídas a *Awaous tajasica*.

A **Dione Seripierre** (MZUSP), pela ajuda inestimável na obtenção de referências fundamentais para a realização desse trabalho.

Aos curadores das coleções fiéis depositárias brasileiras Prof. Dr. **Marcelo R. Britto** (MNRJ), Prof. Dr. **Luiz R. Malabarba** (UFRGS), Prof. Dr. **Paulo H. F. Lucinda** (UNT), Prof. Dr. **Ricardo S. Rosa** (UFPB), Prof. Dr. **Roberto E. Reis (**MCP) e Prof. Dr. **Wolmar B. Wosiacki** (MPEG) pelo empréstimo de material fundamental para a realização desse trabalho.

Aos curadores de coleções fiéis depositárias estrangeiras, Profa. Dra. **Ana Rosa Ramirez Coghi** (UCR), Prof. Dr. **John S. Sparks** (AMNH), Prof. Dr. **Mark H. Sabaj (**ANSP), Prof. Dr. **Masanori Nakae** (NMNS), Profª. Drª. **Lynne R. Parenti** (USNM), Prof. Dr. **Dave Catania** (CAS). Em especial a **Arturo Ângulo** (UCR), **Chloe Lewis** (AMNH) e **Mariangeles Arce** (ANSP) por intermediar e facilitar o empréstimo do material.

Também agradeço a **Jonathan Pfliger** (MNHN) e **Zora Gabsi** (MNHN) por me acolherem tão bem durante a minha visita ao Muséum national d'Histoire naturelle, em Paris, e ao Dr. **James McLaine** (NHM) e Dr. **Ralf Britz** (NHM) por me receberem no Natural History Museum, em Londres.

Um especial agradecimento aos curadores que, além de me receberem muito bem em suas instituições, também me concederam material via empréstimo: Prof. Dr. **Aléssio Datovo** (MZUSP), Prof. Dr. **Cristiano Moreira** (MNRJ) e Dr. **Philippe Keith** (MNHN).

Aos meus colegas da Quadragésima Nona turma do curso de Bacharelado em Biologia da Faculdade de Filosofia Ciências e Letras, que propiciaram uma graduação rica tanto no sentido acadêmico quanto pessoal.

Esse trabalho não teria sido possível sem o apoio financeiro e científico oferecido pela **Fundação de Amparo à Pesquisa do Estado de São Paulo – FAPESP** (No. Proc. 2017/24989-2), por meio de bolsa de mestrado concedida e da competente assessoria de seus assessores.

O autor agradece o apoio do Centro para Documentação da Biodiversidade, do Departamento de Biologia da FFCLRP, Universidade de São Paulo, Brasil. Esta dissertação faz parte do projeto "Core-Facility para conservação de documentação científica: coleções biológicas e pesquisa de alta tecnologia em morfologia comparada" (CT-INFRA 01/2013), financiado pela Financiadora de Estudos e Projetos (FINEP), Ministério da Ciência, Tecnologia, Inovações e Comunicação, Governo Federal do Brasil.

“I choose to see the beauty in this world.”
Dolores Abernatti, Westworld.

“I want a third pill […], a pill that would enable me to perceive, not the reality behind the illusion, but the reality in illusion itself.”
Slavoj Žižek, The pervert's guide to cinema.

RESUMO

SANTOS, João Pedro Trevisan dos. **Revisão taxonômica do subgênero *Awaous* (*Chonophorus*) (Lichtenstein, 1822) e relações filogenéticas dentro da "*Stenogobius* lineage" (Gobioidei: Gobiidae)**. 2020. Dissertação (Mestrado em Ciências) – Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, 2020.

Gobiidae atualmente é tida como uma das mais diversas famílias de peixes, por isso, apesar de amplamente estudada, ainda apresenta muitas lacunas de conhecimento. Nessa família encontra-se *Awaous* que é diagnosticado por apresentar papilas sobre grande parte da estrutura das brânquias. Esse gênero é atualmente dividido em três subgêneros, sendo eles *Awaous*, *Chonophorus* e *Euctenogobius*. O subgênero *Awaous* (*Chonophorus*) apresentaria três espécies nominais, *Awaous* (*Chonophorus*) *banana*, *Awaous* (*Chonophorus*) *lateristriga* e *Awaous* (*Chonophorus*) *tajasica*. Infelizmente as características diagnósticas apresentavam grande sobreposição o que dificultava o entendimento da real diversidade do subgênero. Assim um trabalho de revisão taxonômica foi empreendido. O trabalho de revisão contou com uma vasta análise de caracteres como contagem de raios e escamas, análise dos padrões de escamação em diferentes regiões do corpo, análise dos padrões dos poros do canal sensorial cefálico, das linhas de neuromastos superficiais cefálicas e, pela primeira vez, das papilas orais. Os resultados mostraram quatro espécies nominais, sendo uma delas *Awaous* (*Chonophorus*) *transandeanus*, considerada um sinônimo atualmente. Além disso a posição filogenética de *Awaous* sempre foi alvo de intenso debate. Inicialmente o gênero foi considerado proximamente relacionado à subfamília Sicydiinae, posteriormente membro de Gobionellinae e atualmente, com o advento de metodologia genética, *Awaous* foi novamente considerado próximo a Sicydiinae. Assim, uma análise filogenética baseada em morfologia externa, sistema sensorial, osteologia e musculatura foi implementada. Além de contar com uma nova proposta de homologia para as linhas de neuromastos superficiais, a presente dissertação é a primeira tentativa de incluir caracteres miológicos. Ficou demonstrado que *Awaous* seria grupo irmão de *Stenogobius*, proximamente relacionado a Sicydiinae. Assim a subfamília Sicydiinae é proposta abarcando o clado *Awaous* e *Stenogobius* e os demais gêneros atualmente alocados em Sicydiinae. O clado formado por Awaous e Stenogobius foi nomeado tribo Stenogobini e o clado formado pelos demais gêneros atualmente alocados em Sicydiinae foi chamado tribo Sicydiini. Além disso, o estudo das relações filogenéticas entre as espécies de *Awaous* mostrou que o suporte para a divisão desse gênero em subgêneros é muito fraco, sugerindo que a divisão de *Awaous* em três subgêneros pode não ser a mais adequada.

Palavras-chave: Taxonomia. Filogenia. Morfologia.

ABSTRACT

SANTOS, João Pedro Trevisan dos. **Taxonomic revision of subgenus *Awaous* (*Chonophorus*) (Lichtenstein, 1822) and phylogenetic placement within "*Stenogobius* lineage" (Gobioidei: Gobiidae).** 2020. Dissertação (Mestrado em Ciências) – Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, 2020.

Gobiidae is considered one of the most diverse families of fish, therefore, despite being widely studied, it still has many knowledge gaps. In this family is found *Awaous* which is diagnosed by the presence of papillae over much of the gill structure. This genus is currently divided into three subgenera, namely *Awaous*, *Chonophorus* and *Euctenogobius*. The subgenus *Awaous* (*Chonophorus*) would present three nominal species, *Awaous* (*Chonophorus*) *banana*, *Awaous* (*Chonophorus*) *lateristriga* and *Awaous* (*Chonophorus*) *tajasica*. Unfortunately, the diagnostic characteristics overlap extensively, which made it difficult to understand the real diversity of the subgenera. Thus, a taxonomic revision was implemented. The revision work was based on several characteristics such as ray and scale count, analysis of scale pattern in different regions of the body, analysis of pore patterns of the cephalic sensory canal, cephalic superficial neuromast lines and, for the first time, oral papillae. The results revealed four nominal species, one of them being *Awaous* (*Chonophorus*) *transandeanus,* currently considered a synonym. Moreover, the phylogenetic position of *Awaous* has always been the subject of intense debate. Initially the genus was considered closely related to the subfamily Sicydiinae, later a member of Gobionellinae and now, with the advent of genetic methodology, *Awaous* was once again considered close to Sicydiinae. Thus, a phylogenetic analysis based on external morphology, sensory system, osteology and musculature was implemented. Besides proposing new homology for the superficial neuromasts lines, this dissertation is the first attempt to include myological characters. It was demonstrated that *Awaous* is the sister group of *Stenogobius*, closely related to Sicydiinae. Thus, the Sicydiinae Subfamily is proposed encompassing *Awaous*, *Stenogobius* and the other genera currently allocated in Sicydiinae. The clade formed by *Awaous* and *Stenogobius* was named tribe Stenogobini and the clade formed by genera currently allocated in Sicydiinae was called tribe Sicydiini. In addition, the study of phylogenetic relationships among *Awaous* species revealed that the support for the division of this genus into subgenera is very weak, suggesting that the division of *Awaous* into three subgenera may not be the most appropriate.

Keywords: Taxonomy. Phylogeny. Morphology.

SUMMARY

1. TAXONOMY

1.1. INTRODUCTION

Currently the family Gobiidae comprises 258 genera and 1.873 species distributed throughout the tropical zone (ESCHMEYER *et al*., 2019. Diagnostic features for this family are five branchiostegal rays, expanded and medially-placed ventral processes on ceratobranchial 5 and a complex base on the dorsal hemitrich of pelvic-fin rays (GILL; MOOI, 2012).

Recently it was suggested that this family would be divided into two separate families, Gobiidae and Gobionellidae (THACKER, 2009). This division was adopted by some authors (NELSON *et al*., 2016; PEZOLD, 2011; THACKER, 2013; 2015), but the nomenclature may be inacurate. According to Gill and Mooi (2012), the names Oxudercidae, Amblyopina and Trypauchenina would predated Gobionellidae.

Herein the family Gobiidae is adopted *sensu* Gill and Mooi (2012) and, following (PEZOLD, 1993), divided into five subfamilies: Oxudercinae, Amblyopinae, Sicydiinae, Gobiinae and Gobionellinae.

The gobionelline genus *Awaous* Valenciennes, 1837, the main focus of this dissertation has pantropical distribution (PARENTI; THOMAS, 1998). It is distinguished by the presence of sensory papillae over much of the gill structure (**Figure 1**) (WATSON, 1992). *Awaous* comprises 21 presumably valid species of which *Awaous* (*Awaous*) *ocellaris* Broussonet, 1782 is the type species. According to Watson (1992), the junior synonyms for *Awaous* are *Platygobius* Bleeker, 1874; *Trichopharynx* Ogilby, 1898; *Suiboga* Pinto, 1960 and *Chiramenu* Rao, 1971. Watson (1992) also proposed that *Awaous* should be divided in three subgenera: *Awaous* Valenciennes, 1837; *Euctenogobius* Gill, 1859 and *Chonophorus* Poey, 1860.

WATSON (1992) brought together the species of *Awaous* (*Awaous*) in two groups. The *Awaous ocellaris* group has scales in the opercular and pre-opercular regions which are absent in the *Awaous nigripinnis* Valenciennes, 1837 group.

WATSON (1992) diagnosed the subgenus *Awaous* (*Chonophorus*) by the presence of a complete posterior oculoscapular canal between the pores “H” and “K” [*vs*. incomplete in *Awaous* (*Awaous*)], presence of well-developed sensory papillae over much of the lateral surface of the body [*vs*. poorly developed or absent in *Awaous* (*Awaous*)], caudal fin with two or three longitudinal rows of sensory papillae extending over the entire length of the fin [*vs*.

usually absent in *Awaous* (*Awaous*)], body shape slender [*vs*. usually robust in *Awaous* (*Awaous*)], absence of a dark spot over the posterior margin of the first dorsal fin [*vs*. conspicuous in most species of *Awaous* (*Awaous*)], sexual dichromatism absent [*vs*. usually present in *Awaous* (*Awaous*), male usually darker than the female] and color pattern usually cream or tan color with a series of irregular streaks or crescentic shaped markings and two to five brownish oblique bars [*vs*. color pattern varying between white, gray, green or tan with brown or black sports appearing on the lateral face of the body in *Awaous* (*Awaous*)].

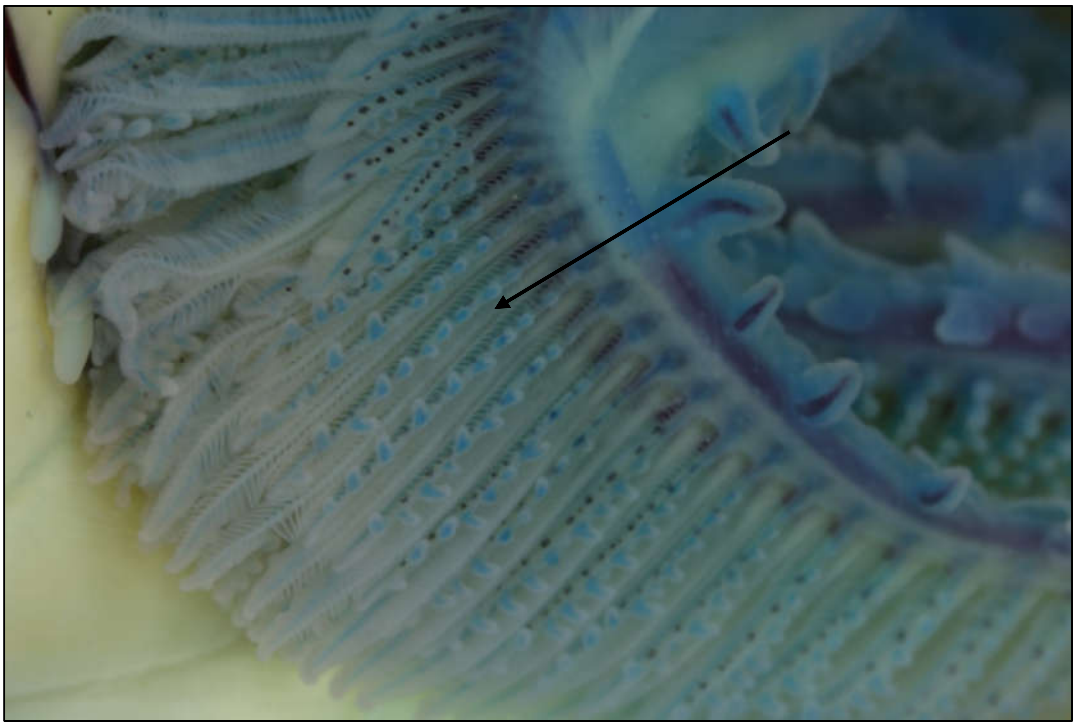

Figure 1 – Papillae over the gill structure of *Awaous* (*Chonophorus*) *tajasica* (Lichtenstein, 1822). Exemplar previously stained with alcian blue and alizarin red (**LIRP** 1074, 93.9 mm CP).

Watson (1992) also postulated that *Awaous* (*Chonophorus*) can be distinguished from *Awaous* (*Euctenogobius*) by the presence of a complete posterior oculoscapular canal between the pores "H" and "K" [*vs*. incomplete in *Awaous* (*Euctenogobius*)], presence of well-developed sensory papillae over much of the lateral surface of the body [*vs*. poorly developed or absent in *Awaous* (*Euctenogobius*)], absence of sexual dimorphism [*vs*. present in *Awaous* (*Euctenogobius*), males presenting longer jaws, longer and higher fins and a larger body size when compared to females], and papillae inside the mouth and interior surface of the gill more conspicuous [*vs*. poorly developed in *Awaous* (*Euctenogobius*)]. Furthermore, the color pattern in *Awaous* (*Euctenogobius*) is characterized by a series of six to eight vertical bars reaching from the base of the pectoral fin to the anterior margin of the caudal fin, and the first dorsal fin usually red or orange, very distinctive from the color pattern of *Awaous* (*Chonophorus*) (WATSON & HORSTHEMKE, 1995).

According to Watson (1996) *Awaous* (*Chonophorus*) comprises three valid species. (1) *Awaous* (*Chonophorus*) *Banana* (Valenciennes, 1837), occuring in the Atlantic coast from Florida to Trinidad and Tobago, occurring also on all Caribbean islands, and from Tamaulipas, Mexico until Caracas, Venezuela in the continental shelf. This species would also be distributed along the Pacific slope reaching from Baja California Sur and Sonora, Mexico to Tumbes in Peru. (2) *Awaous* (*Chonophorus*) *lateristriga* (Duméril, 1861) occurs on the African coast from Sierra Leone to the border between Angola and Namibia, also occurring in the Bioko island, Equatorial Guinea and (3) *Awaous* (*Chonophorus*) *tajasica* (Lichtenstein, 1822) distributed over the Brazilian coast from Piauí to Santa Catarina.

According to Watson (1996), *Awaous* (*Chonophorus*) *banana* (Valenciennes, 1837) has eight junior synonyms: *Gobius martinicus* Valenciennes, 1837, *Chonophorus bucculentus* Poey, 1860, *Gobius transandeanus* Günther, 1861, *Chonophorus contractus* Poey, 1861, *Gobius mexicanus* Günther, 1861, *Gobius dolichocephalus* Cope, 1867, *Awaous nelsoni* Evermann, 1898 and *Gobius (Awaous) guentheri* Regan, 1903. This species is distinguished by the presence of a duplicated pore "F" in the oculoscapular canal, scales in the longitudinal series ranging from 57 to 86 and scales in the pre-dorsal region ranging from 0 to 57.

Awaous (*Chonophorus*) *lateristriga* (Duméril, 1861) would present *Gobius* (*aeneofuscus*) *guineenses* var. Peters 1876 and *Gobius bustamantei* Greef, 1882 as junior synonyms. This species would be distinguished by the presence of a single pore "F" in the oculoscapular canal, scales in the longitudinal series reaching from 54 to 66 (usually 59 to 63), scales in the transversal series reaching from 13 to 20 (usually 17 to 18) and scales in the pre-dorsal region reaching from 0 to 35, always cycloid. Pre-dorsal region would never be entire scaled in this species (WATSON, 1996).

Awaous (*Chonophorus*) *tajasica* (Lichtenstein, 1822) would have as junior synonyms *Euctenogobius latus* O'Shaughnessy, 1875 and *Suiboga travassosi* Pinto, 1960. This species can be distinguished by the presence of a single pore "F" in the oculoscapular canal, scales in the longitudinal series reaching from 57 to 70 (usually 61 to 66), scales in the transversal series reaching from 14 to 21 (usually 16 to 18), pre dorsal scales reaching from 2 to 39. The pre-dorsal region would present naked spots but never entirely naked (WATSON, 1996).

Watson (1996) proposed *Gobius transandeanus* Günther, 1861 as junior synonym of *Awaous* (*Chonophorus*) *banana*. However, name *Awaous* (*Chonophorus*) *transandeanus* is currently considered as valid by some authors (BUSSING, 2002; ESCHMEYER *et al.*, 2018). The distribution of *Awaous* (*Chonophorus*) *transandeanus* (Günther 1861) would reach from Costa Rica to Peru in the pacific slope (BUSSING, 2002). This species would be distinguished by the presence of larger scales, scales in the transversal series reaching from 16 to 19 and scales in the longitudinal series reaching from 56 to 61.

In spite of Watson (1996) efforts the taxonomy of the subgenus remains uncertain, some of the diagnostic features are still not entirely sufficient to precisely identify the species within *Awaous* (*Chonophorus*). For example, the diagnostic scale counts for *Awaous* (*Chonophorus*) *tajasica* and *Awaous* (*Chonophorus*) *lateristriga* show a nearly complete overlap. Since both species present a single pore "F" in the oculoscapular canal, the difference between them would be the fact that the pre-dorsal region would be never completely naked in *Awaous* (*Chonophorus*) *tajasica* and never fully scaled in *Awaous* (*Chonophorus*) *lateristriga*. Such diagnostic features frequently lead to problems in the identification of exemplars.

Another interesting aspect of species within *Awaous* is the huge distribution area occupied by them, probably related to the amphidromous habit. According to Myers (1949) amphidromous species are "diadromous fishes whose migration from fresh water to the sea […] is not for the purpose of breeding". In *Awaous* this migration has trophic reasons. Adults lay their eggs in freshwater, and, after the eclosion, the larvae are carried to the sea where they remain as part of the plankton. After that the larvae return to freshwater, where they will reside during the adult phase (RADTKE *et al.*, 1988). There are four main factors influencing the dispersion of amphidromous species, the time spent in the sea, the capacity of active dispersal, geographic barriers and the influence of ocean currents (ROCHA *et al*., 2005).

Despite the amphidromous habit, some distribution areas assigned to some *Awaous* species extent beyond the limits of the ocean currents and geographical barriers proposed in the literature. As an example, it is very unlikely that *Awaous* (*Chonophorus*) *banana* would occur in both Atlantic and Pacific slopes of the American continent.

Another aspect of *Awaous* (*Chonophorus*) distribution remain in occurrence registers far away from the proposed distribution area for the species. *Awaous* (*Chonophorus*) *tajasica* was recently reported in North America (BERRA, 2002) and even in the Baja California, Mexico (RUIZ-CAMPOS, 2012; RUIZ-CAMPOS *et al.*, 1993; 2002), despite occurring originally in the Brazilian coast reaching from Maranhão to Rio Grande do Sul (TREVISAN, 2016).

In face of this scenario a taxonomic revision became extremely important, not only for stablishing diagnostic features and the occurrence areas for the species but also for help in the phylogenetic study of the group, explored in the second chapter of this dissertation.

1.2. OBJECTIVES

- Diagnose the species within *Awaous* (*Chonophorus*), comparing them with similar forms, assigning names to previously undescribed new species;
- Establish a complete list of synonyms for all recognized forms among *Awaous* (*Chonophorus*);
- Delimit the occurrence areas for the species within *Awaous* (*Chonophorus*).

1.3. MATERIAL AND METHODS

The species concept adopted in this dissertation follow Nelson and Platnick (1981), which define species as "the smallest detected samples of self-perpetuating organisms that have unique sets of characters".

1.3.1. Material examined

The examined material was obtained in scientific collections. The main criteria adopted for choosing the material was the geographic one. Specimens were selected through specialized browsers such as SpeciesLink (http://splink.cria.org.br/) for the Brazilian collections and Fishnet2 (http://fishnet2.net) for the international ones.

List of examined material:

Awaous (*Chonophorus*) *banana* (Atlantic slope):

NHM 1856.4.17: 41-42: 2 alc: 131.5 – 143.6 mm SL. Mexico. **Syntypes** of *Gobius mexicanus* designated by Günther (1861): 61. No information about Atlantic or Pacific slope. **SU** 47636:

1 alc. 145.8 mm SL. Mexico, San Luis Potossi, Tamazunchale, rio Moctezuma, Panuco river basin. 1952. **MCZ** 31220: 1 alc. 153.5 mm SL. **Holotype** of *Chonophorus contractus* designated by Poey (1861): 424. **MCZ** 13330: 1 alc. 241 mm SL. Cuba. **Syntype** of *Chonophorus bucculentus* designated by Poey (1860): 275. **MCZ** 13379: 1 alc. 219 mm SL. Cuba. **Syntype** of *Chonophorus bucculentus* designated by Poey (1860): 275. **MCZ** 13380: 1 alc. 234 mm SL. Cuba. **Syntype** of *Chonophorus bucculentus* designated by Poey (1860): 275. **MCZ** 13375: 1 alc. 165 mm SL. Cuba. **NMNH** 4772: 1 alc. 214 mm SL. Cuba. **NMNH** 4774: 1 alc. 210 mm SL. Cuba. **ANSP** 88598: 2 alc. 112.6 – 139 mm SL. Cuba, Santiago de Cuba, rio del aqueduto, San Boniato. 1938. **MCZ** 31220: 1 alc. 153.5 mm SL. Cuba. 1861. **ANSP** 64613: 1 alc. 147.3 mm SL. Guatemala, el Rancho, Motagua river. 1935. **NMNH** 134681: 23 alc. 145,8 – 72,3 mm SL. Guatemala, Zacapa, Chimalapa river in Cabanas, 23 miles west from Zacapa. 1946. **ANSP** 85774: 4 alc. 73.6 – 77.6 mm SL. Haiti, Port-au-Prince. 1936. **ANSP** 10819: 1 alc. 153.4 mm SL, Dominican Republic, Santo Domingo, West Indies. Year not informed. **MNHN** A- 1265: 1 alc. 98.6 mm SL. Dominican Republic, Santo Domingo. 1837. **Lectotype** designated by Watson (1996): 3. **MNHN** A- 1359: 1 alc. 71.8 mm SL. Dominican Republic, Santo Domingo. 1837. **Paralectotype** designated by Watson (1996): 3. **MNHN** A- 1266: 1 alc. 118.8 mm SL. Martinica. Year not informed. **Syntype** of *Gobius martinicus* designated by Valenciennes (1837): 105. **UCR** 1352-8: 10 alc. 61.8 – 94.9 mm SL. Costa Rica, Limón, Hone creek, 6 km west of Puerto Viejo. 1981. **UCR** 210-7: 7 alc. 64.9 – 93.1 mm SL. Costa Rica, Limón, río Suárez 1 km south of Cahuita at road crossing to Puerto Viejo. 1967. **UCR** 1144-6: 4 alc. 56.6 – 108.9 mm SL. Costa Rica, Limón, río Cocolis, 3.5 km southeast of Shiroles, on Bratsi-Shiroles road. 1977. **UCR** 1299-6: 7 alc. 129.6 – 61 mm SL. Costa Rica, río Cocolis, 3.5 km southeast of Shiroles, on Bratsi-Shiroles road. 1979. **UCR** 279-6: 7 alc. 108 – 50 mm SL. Costa Rica, Limón, inlet of río Sixaola, slightly upstream of Isla Grande. 1968. **ANSP** 163759: 1 alc. 42.2 mm SL. Costa Rica, Limon, Kelly creek at beach, Cauhita. 1988. **CAS** 219379: 2 alc. 135 – 125.4 mm SL. Trinidad and Tobago, river mouth in the Little Englishman bay. 2001. **AMNH** 264747: 1 alc. 51.3 mm SL. Panama. 2003. **AMNH** 243507: 1 alc. 51.3 mm SL. Venezuela, Falcon, mouth of La Pava River, below a road bridge, 30 meters from the sea. 2007.

Awaous (*Chonophorus*) *banana* (Pacific slope):

NMNH 48836: 1 alc. 66.5 mm SL. Mexico, Sinaloa, Rosario, Rosario river. 1897. **Holotype** of *Awaous nelsoni* designated by Evermann (1898): 2. **NMNH** 48837: 3 alc. 68.7 – 61.7 mm SL. Mexico, Sinaloa, Rosário, Rosário river. 1897. **Paratype (cotype)** of *Awaous nelsoni* designated by Evermann (1898): 2. **NMNH** 221109: 3 alc. 81.5 – 58.5 mm SL. Mexico, Sinaloa, Rosário, Rosário river. 1897. **Paratype** of *Awaous nelsoni* designado por Evermann (1898): 2. **CAS** 54365: 2 alc. 67.9 – 54.4 mm SL. Mexico, Sinaloa, vila Union, Presidio river, Presidio river basin, 14 miles south of Mazatlan on the road to Durango. 1952. **NMNH** 37172: 1 alc. 83.2 mm SL. Mexico, Presidio river, northwest Mexico. 1885. **NMNH** 102266: 1 alc. 83.8 mm SL. Mexico, Matias Romero, Oaxaca, Malotenga river, tributary of the Coatzalcoalcos four miles southeast of Matias Romero. **NMNH** 30741: 1 alc. 86.6 mm SL. Mexico, Baja California, Saint Lucas cape. 1882. **NMNH** 30931: 1 alc. 91.9 mm SL. Mexico, Baja California, Lapaz port, San José. **NMNH** 114395: 1 alc. 105.8 mm SL. Guatemala, Patulul, Coyolate river five miles southwest of Patulul. 1947. **UCR** 184-3: 7 alc. 97.8 – 52 mm SL. Nicaragua, León, rio 50 km west of Managua, Highway 12 Managua-León. 1967. **UCR** 121-3: 8 alc. 112 – 55.7 mm SL. Costa Rica, Puntarenas, rio Agujas, 3 Km from the coast on Tárcoles-Jacó road. 1967. **UCR** 101-14: 5 alc. 68.8 – 54.9 mm SL. Costa Rica, Puntarenas, rio Nuevo, 12 km east of the río Claro village at Interamerican Highway. 1967. **UCR** 69-3: 8 alc. 141.7 – 58.2 mm SL. Costa

Rica, Puntarenas, río Tamarindo, on road 12 to León. 1966. **AMNH** 264771: 1 alc. 53.2 mm SL. Panama, Chiriquí, canal close to Raya island. 2003. **Mzusp** 66632: 3 alc. 58.1 – 52.3. Panamá, Chepo, rio Mamoni, província de Panamá. 1965. **NMNH** 339912: 2 alc. 73.7 – 71.0 mm SL. Colombia, Choco, Creek of rio Parado, C. 10 Min. Helicopter Flight from Village of Parado. 1967. **NMNH** 120215: 1 alc. 57.1 mm SL. Colombia, rio D'agua, Buenaventura. 1943. **NMNH** 292679: 3 of 7 alc. 100.2 – 67.9 mm SL. Colombia, Choco, Creek into rio Jurado, C. 5 Min Heli-Flight Downstream Fr. Mountains. 1967. **NHM** 1860.6.16: 135-136: 2 alc. 84.8 – 86.3 mm SL. West Ecuador. **Syntypes** of *Gobius transandeanus* designated by Günther (1861): 62. **NHM** 1860.6: 16: 133-134: 2 alc. 102.4 – 108.5 mm SL. West Ecuador. **Syntypes** of *Gobius* (*Awaous*) *Guenteri* designated by Regan (1903): 629. **NMNH** 288040: 2 alc. 89.9 – 87.2 mm SL. Ecuador, Esmeraldas, Rio Bogota, Estero Sabalera a 600 m. Cerea Al Campamento La Chiquita Del Mag, Carretera a Ricaurte. 1987. **NMNH** 167717: 2 alc. 61.7 – 60 mm SL. Ecuador, waterfall close to Calima river. 1956.

Awaous (*Chonophorus*) *lateristriga*:

NMNH 292655: 3 alc. 72.5 – 68.7 mm SL. Sierra Leone, Foya Village, Tabe river, 16 mi. Southeast of Bo. 1962. **NMNH** 179697: 2 alc. 81.7 – 74.6 mm SL. Liberia, 2 miles east of Messurado river mouth. 1953. **SU** 63040: 3 alc. 60.9 – 51.1 mm SL. Gana, Amedica, volta R. 1963. **NMNM** 292667: 3 alc. 59 – 58,9 mm SL. Gana, Aimaso river. 1970. **NMNH** 295449: 3 alc. 93.4 – 88.7 mm SL. Togo, Mono river 36 km. Due E. of Ayengre. 1969. **SU** 15955: 2 alc. 95.8 – 82.1 mm SL. Cameroon, Biafra bay. 1940. **SU** 40391: 2 alc. 84,6 – 83,8 mm SL. Cameroon, brackish stream emptying into ocean, Mbode, 10 mi. south from Batangaon coast of Cameroon. 1940. **MNHN** 6228-1: 1 alc. 87.5 mm SL. Gabon. Year not informed. **Lectotype** designated by Watson (1996): 10. **MNHN** 1996-301: 1 alc. 73 mm SL. Gabon. Year not informed. **Paralectotype** designated by Watson (1996): 10. **AMNH** 238340: 4 alc. 63.5 – 53.2 mm SL. Democratic Republic of the Cong, main channel of Congo river, upstream of Boma. 2005. **AMNH** 263636: 2 alc. 52.2 – 50 mm SL. Democratic Republic of the Congo, Congo river, Boma region. 2014. **CAS** 214397: 1 alc. 50.2 mm SL. Sao Tome and Principe, Sao Tome, Agua Azeitona, below hwy. bridge. 2001.

Awaous (*Chonophorus*) *tajasica*:

MNRJ 44321: 3 alc. 91.4 – 73.9 mm SL. Ceará, Icó, Rio Salgado. 1945. **ANSP** 84176: 2 alc. 141.2 – 100.7 mm SL. Ceará, Fortaleza. 1937. **ANSP** 84174: 1 alc. 92.4 mm SL. Ceará, Choró river. 1937. **UFPB** 10028: 1 alc. 68.7 mm SL. Ceará, Itapipoca, riacho inominado, afluente do Rio Cruxati. 2014. **ANSP** 84175: 1 alc. 131.8 mm SL. Ceará, Russas, Rio Jaguaribe. 1936. **Neotype** designated by Watson (1996): 14. **MZUSP** 45041: 1 alc. 77.4 mm SL. Rio Grande do Norte, Tibau do Sul, Riacho do Galhardo. 1992. **UFPB** 4104: 1 alc. 73.4 mm SL. Paraíba, Itabaiana, Rio Paraíba do Norte. 1998. **UFPB** 4151: 1 alc. 118.8 mm SL. Paraíba, Rio Paraíba do Norte, PB - 408. 1998. **UFPB** 9359: 1 alc. 103 mm SL. Paraíba, Alhandra, rio Cupissura. 2013. **UFPB** 9360: 1 alc. 104.3 mm SL. Paraíba, Alhandra, rio Cupissura. 2013. **UFPB** 5737: 1 alc. 115.2 mm SL. Paraíba, Cacimba de dentro, jusante do Açude Cacimba da Várzea. 2003. **UFPB** 4525: 2 alc. 145.7 – 119.6 mm SL. Paraíba, Areia, Rio Angelim, bacia do Rio Mamanguape. 1999. **MCP** 30931: 1 alc. 95.7 mm SL. Alagoas, São Miguel dos Campos, Rio Barreiro na estrada BR 101 entre Pilar/São Miguel dos Campos, afluente do Rio Sumauma, Lagoa Mamguaba. 2002. **UFPB** 3430: 1 alc. 66.4 mm SL. Alagoas, Maceió, Complexo Estuarino Mundaú-Manguaba. 1988. **MZUSP** 66634: 1 alc. 62 mm SL. Alagoas, Maceió, Rio dos Remédios. 1988. **MZUSP** 66637: 7 alc. 123 – 99.5 mm SL. Alagoas, Maceió, Lagoa de Mundaú. 1985. **MZUSP** 51745: 1 alc. 112.4 mm SL. Alagoas, Penedo, Rio São Francisco no porto da balsa. 1997. **UFRGS** 17055: 1 alc. 122.6 mm SL. Sergipe, Muribeca, Rio Ladim, na BR-101 junto à ponte no km 28, afluente do baixo Rio Vaza Barris. 2012. **UFRGS** 17089: 2 alc. 98.3 – 97.3 mm SL. Sergipe, Itaporanga d'ajuda, Rio Banhado na estrada BR-101, junto à ponte. 2012.

NHM 1862.11.23: 42: 1 alc. 125 mm SL. South America; Brazil; Bahia. **Holotype** *Euctenogobius latus* designated by O'Shaughnessy (1875): 146. **MNRJ** 6196: 1 alc. 175.3 mm SL. Bahia, Salvador, Rio Pituaçu. Comissão do Museu Nacional e do Instituto de Saúde Pública do Estado da Bahia. 1951. **Holotype** *Suiboga tavassosi* designated by Pinto (1959) 218: 1. **MNRJ** 22941: 2 alc. 90.2 – 71.5 mm SL. Bahia, Itagimirim, Rio limoeiro, drenagem do Rio Jequitinhonha, BR 101 a montante do Rio Itagimirim. 2001. **MCP** 17853: 2 alc. 169 – 95.8 mm SL. Bahia, Teixeira de Freitas, rio Itanhém (costeiro), no corredor iniciando na estrada entre Teixeira Freitas e Medeiros Neto, a 17 km da BR-101. 1995. **ANSP** 174254: 1 alc. 107.4 mm SL. Brazil, Bahia, rio Caraiva, approx. 500 m W of highway BR 101 in Monte Pascoal. Year not informed. **UNT** 9498: 1 alc. 106.1 mm SL. Bahia, Gongogi, rio Gongogi. 2009. **UNT** 10418: 1 alc. 117 mm SL. Bahia, Ilhéus, Castelo novo, rio Almada. 2011. **UNT** 9259: 3 alc. 134.5 – 91.2. Bahia, Ilhéus, Castelo novo, rio Almada. 2009. **MZUSP** 111241: 1 alc. 127.3 mm SL. Bahia, Nilo Peçanha, Rio das Almas, dez quilômetros de Nilo Peçanha na estrada, corredeiras do Rio das Almas. Year not informed. **MZUSP** 66626: 2 alc. 97 – 58.4 mm SL. Espírito Santo, Linhares. Rio Doce. 2005. **MZUSP** 51710: 1 alc. 51.4 mm SL. Espírito Santo, Linhares, Rio Doce, margem direita da praia de areia abaixo da ponte da BR-101. 1997. **MCP** 42069: 1 alc. 110.1 mm SL. Espírito Santo, Linhares, rio Pequeno. 2002. **MZUSP** 66627: 2 alc. 92.3 – 68.1 mm SL. Espírito Santo, Santa Leopoldina, rio Santa Maria da Vitória. 1965. **MNRJ** 41842: 1 alc. 149.9 mm SL. Espírito Santo, Santa Teresa, rio Santa Maria do Rio Doce, bacia do rio Doce, na cachoeira do Rudio. 2013. **MNRJ** 8566: 3 alc. 90.8 – 58.1 mm SL. Espírito Santo, Santa Tereza. 1942. **MNRJ** 37630: 1 alc. 82.2 mm SL. Espírito Santo, Baixo Guandu, rio Mutum Preto no terço médio, entre o povoado de Alto Mutum. 2010. **MNRJ** 38982: 2 alc. 109.6 – 80.8 mm SL. Espírito Santo, Pau gigante, rio Taquarussú. 1940. **ANSP** 174255: 1 alc. 132.8 mm SL. Brazil, Espírito Santo, Itapemirim river at bridge on highway BR 101 approx. 12 km SW of Rio Novo do Sul. Year not informed. **MNRJ** 46587: 1 alc. 109.4 mm SL. Minas Gerais, Além Paraíba, Rio Paraíba do Sul, bacia do Rio Paraíba do Sul. 2015. **MNRJ** 17104: 1 alc. 58.1 mm SL. Minas Gerais, Além Paraíba, Rio Paraíba do Sul. 1990. **MNRJ** 17850: 3 alc. 153.6 – 116.7 mm SL. Minas Gerais, Cataguases, Rio Novo, afluente da margem direita do Rio Pomba, afluente da margem esquerda do Rio Paraíba do Sul. 1989. **MNRJ** 14771 1 alc. 136.6. Minas Gerais, Cataguases, Rio Novo, afluente da margem direita do Rio Pomba e afluente da margem esquerda do Rio Paraíba do Sul, até 8 Km a montante da foz. 1989. **MZUSP** 10319: 1 alc. 121.6 mm SL. Rio de Janeiro, São João da Barra. 1964. **MZUSP** 100849: 1 alc. 149.3 mm SL. Rio de Janeiro, Trajano de Morais. Margem esquerda do Rio grande na fazenda São Manuel, antes da desembocadura do Córrego do Macaco. 2008. **MZUSP** 66623: 1 alc. 92.5 mm SL. Rio de Janeiro, São Fidélis. Rio Paraíba do Sul. 1965. **MZUSP** 66635: 2 alc. 101.6 – 92.5 mm SL. Rio de Janeiro, São Fidélis, Córrego pedra d'água. 1965. **MZUSP** 121468: 1 alc. 60 mm SL. Rio de Janeiro, conceição de Macabu, Rio Aduelas, afluentes do rio São Pedro, na Fazenda Sossego. Bacia do Rio Macaé. Year not informed. **MZUSP** 26842: 2 alc. 90.9 – 87 mm SL. Rio de Janeiro. Cabeceira do Rio Guapiaçu, Cachoeira de Macacu. 1979. **MNRJ** 131580: 3 alc. 136.9 – 174.1 mm SL. Rio de Janeiro, Casemiro de Abreu, Rio Macaé, Figueira Branca, Casemiro de Abreu. 2017. **MNRJ** 48675: 6 alc. 126.6 – 156.4 mm SL. Rio de Janeiro, Macaé, Lagoa de Cabiúnas, Macaé. 1982. **LIRP** 6848: 1 alc. 116.8 mm SL. Rio de Janeiro, Bom Jesus do Itabapoana, Rio Itabapoana. 2008. **LIRP** 567: 3 alc. 50.4 – 39.6 mm SL. Rio de

Janeiro, Parati, Rio Muricana, faz. Muricana, Perequê-Açu. 1995. **MZUSP** 107461: 2 alc. 59.9 – 58.8 mm SL. São Paulo, Ubatuba, Riacho do Canto da Paciência, núcleo Picinguaba, Parque estadual da serra do mar. 2002. **LIRP** 1045: 4 alc. 63.5 – 37.4 mm SL. São Paulo, Ubatuba, Rio da Fazenda, núcleo Picinguaba. 1997. **LIRP** 1030: 1 alc. 57.5 mm SL. São Paulo, Ubatuba, Rio Picinguaba. 2000. **LIRP** 1022: 1 alc. 67.1 mm SL. São Paulo, Ubatuba, Rio da Fazenda, Parque Estadual da Serra do Mar - Núcleo Picinguaba. 1998. **MZUSP** 66628: 1 alc. 62.6 mm SL. São Paulo, Ubatuba, córrego do lado esquerdo da Praia do Perequê-Mirim. 1975. **MZUSP** 111188: 1 alc. 107.5 mm SL. São Paulo, Ubatuba, cachoeira do Rio Promirim. Km 30, BR-101. 2012. **MZUSP** 66629: 2 alc. 88.6 – 87.8 mm SL. São Paulo, Ubatuba Rio Indaiá, junto a estrada rio Santos. 1973. **LIRP** 1074: 14 alc. 94.7 – 51.5 mm SL. São Paulo, Ubatuba, Rio Indaiá. 1984. **LIRP** 543: 11 alc. 45.4 – 28.4 mm SL. São Paulo, Ubatuba, Rio Indaiá. 1988. **LIRP** 7687: 5 alc. 88.2 – 66.4 mm SL. São Paulo, Ubatuba, Rio Itamambuca, sob a ponte da BR-101. 2010. **LIRP**: 5745 3 alc: 100.5 – 74 mm SL. São Paulo, São Sebastiao, Rio Paúba. 2004. **UFRGS** 10192: 1 alc. 76.2 mm SL. São Paulo, Ilha Bela, Riacho indo para a praia do Castelhano, próximo ao centro. 2008. **MNRJ** 40907: 1 alc. 67.2 mm SL. Paraná, Paranaguá, rio Colônia Pereira (bacia do Garaguacu). 2012. **MNRJ** 40856: 3 alc. 101.7 – 80.4 mm SL. Paraná, Morretes, Rio Sagrado, bacia do Nhundiaquara, a montante do rio Pitanga, em estrada secundaria, continuação da BR-408. 2012. **MZUSP** 111193: 1 alc. 103 mm SL. Santa Catarina, Florianópolis, ponte Hiperbom. Agosto de 2010. **MNRJ** 41220: 1 alc. 145.7 mm SL. Santa Catarina, Jacinto Machado, Rio da Pedra, bacia do Araranguá, pontilhão de concreto, cerca de 10 Km do início da estrada dos cânions. 2012. **MNRJ** 40942: 1 alc. 121.1 mm SL. Santa Catarina, Joinville, Rio Pirabeiraba, bacia do Palmital, BR-101, entre Garuva e Joinville. Outubro de 2012. **LIRP** 480: 4 alc. 106.7 – 47.1 mm SL. Santa Catarina, Itapema, Rio Perequê. 1988. **UFRGS** 21377: 1 alc. 99 mm SL. Santa Catarina, Tubarão, Rio do Pouso, afluente direto do Rio Tubarão, na margem esquerda. 2016. **UFRGS** 21507: 1 alc. 81.1 mm SL. Santa Catarina, Luiz Alves, pequeno afluente do Rio Luiz Alves. 2016. **MCP** 15266: 1 alc. 129.7 mm SL. Rio Grande do Sul, Cidreira, Arroio desaguando diretamente no mar, Praia do Pinhal. 1991.

Awaous (*Euctenogobius*) *flavus* (Valenciennes, 1837):

MZUSP 66633: 1 alc. 84 mm SL. Brasil, Amapá, perto de Santana, Rio Amazonas. **MPEG** 1223: 2 alc. 55.4 – 59 mm SL. Brasil, Pará, Salvaterra, Praia de Jubim, mangue. 1982. **MPEG** 3775: 3 alc. 25 – 49.2 mm SL. Brasil, Pará, Icoroaci, bahia de Guajará. 1995. **MPEG** 3788: 2 alc. 24.3 – 27.3 mm SL. Brasil, Pará, Icoroaci, bahia de Guajará. Year not informed. **MPEG** 4029: 1 alc. 32.2 mm SL. Brasil, Pará, Rio Amazonas, furos-estuário. 1994. **MPEG** 4031: 1 alc. 33,1 mm SL. Brasil, Pará, Icoroaci, bahia de Guajará. 1995. **MPEG** 4034: 1 alc. 59.5 mm SL. Brasil, Pará, Rio Amazonas, furos-estuário. 1994. **MPEG** 4038: 2 alc. 55.1 – 56 mm SL. Brasil, Pará, Rio Amazonas, furos-estuário. 1994. **MZUSP** 116296: 2 alc. 60.1 – 59.3 mm SL. Brasil, Pará, Belém, Bahia de Marajó. Year not informed.

Awaous (*Awaous*) *commersonii* (Schneider *in* Bloch & Schneider, 1801):

NMNH 19983: 1 alc. 128.6 mm SL. Mautitius. Year not informed.

Awaous (*Awaous*) *ocellaris* (Broussonet, 1782):

ANSP 95521: 3 alc. 135.6 – 59,7 mm SL. Solomon Islands, British Solomon Islands, Guadalcanal Island, Poha River. 1953. **NMNS** 64842: 1 alc. 46.5 mm SL. Solomon Islands, Guadalcanal Island, Honiara. Year not informed.

1.3.2. Morphometrics

Morphometric data were acquired with a caliper with a 0,1 mm precision under a stereomicroscope LEICA MZ16-DFC295 available in Laboratório de Ictiologia de Ribeirão Preto (LIRP) and a Zeiss SteREO Discovery.V12 stereomicroscope with attached Zeiss Axio-Cam HRc digital camera and Z-stack software. Measurements details are expressed in the **Table 1** and **Figure 2**.

Twenty four measurements were taken on all 278 exemplars of *Awaous* (*Chonophorus*). All measurements were converted to a ratio of the Standard length, except for measurements of regions of the head which were converted to a ratio of the head length. Certain body regions of some exemplars were poorly preserved, thus the measurements were not taken in these regions.

The measurements of type specimens are presented separately in order to increase the comparative analysis. Measurements of individuals of the same species collected in different biogeographical regions (*sensu* SPALDING *et al*., 2007) were also compared separately in order to check the hypothesis of different species in different marine provinces.

The distribution of *Awaous* (*Chonophorus*) *banana* in the Atlantic slope encompasses only the biographical province of the "Tropical Northwestern Atlantic". On the Pacific slope the distribution encompasses the biogeographical regions of the "Warm Temperate Northeast Pacific" and "Tropical East Pacific", the distribution of *Awaous* (*Chonophorus*) *lateristriga* comprises the provinces of "West African Transition" and "Gulf of Guinea" and the distribution of *Awaous* (*Chonophorus*) *tajasica* encompasses the biogeographic regions of "Tropical Southwestern Atlantic" and "Warm Temperate Southwestern Atlantic". The boundaries of the provinces are presented in the map below (**Figure 3**).

Table 1 – Details of the measurements.

Measurement	Abbreviation	Description
Total length	TL	From anteromedial margin of the mesethmoid to tip of caudal fin
Standard length	SL	From anteromedial margin of the mesethmoid to base of caudal fin

Measurement	Abbreviation	Description
Head length	HL	From anteromedial margin of the mesethmoid to posterior margin of the opercle
Pre-dorsal distance	PD	From anteromedial margin of the mesethmoid to anterior margin of the first dorsal fin
Preopercular distance	POD	From anteromedial margin of the mesethmoid to posterior margin of the preopercular bone
Mandibular length	ML	From anteromedial margin of the dentary to posterior margin of the angular bone
Inter-opercular distance	ID	From posterior margin of each opercle
Interorbital distance	IOD	Horizontal distance between dorsal tip of each eye
Orbital diameter	OD	Horizontal distance between anterior and posterior margin of the eye
Distance between the nares	DN	Distance between the anterior nasal openings
Snout length	SNL	From anteromedial margin of the mesethmoid to anteromedial margin of the eye
Preanal distance	PA	From anteromedial margin of the dentary to urogenital opening
Body height	BH	On anterior margin of the second dorsal fin.
Caudal peduncle length	CPL	From anteroventral region of the ventral most anterior procurrent ray of the caudal fin to posterior region of the anal fin
Caudal peduncle height	CPH	From base of the procurrent rays of the caudal fin
First dorsal fin length	FDF	From anterior margin of the anterior fin ray to posterior margin of the posterior fin ray
Second dorsal fin length	SDF	From anterior margin of the anterior fin ray to posterior margin of the posterior fin ray
Anal fin length	AF	From anterior margin of the anterior fin ray to posterior margin of the posterior fin ray
caudal fin length	CF	From anterior margin of the caudal fin rays to posterior tip of the caudal fin
Pectoral fin length	PCF	From anterior margin of the pectoral fin rays to posterior tip of the pectoral fin

Measurement	Abbreviation	Description
Pelvic fin length	PLF	From anterior margin of the frenum to posterior margin of the connective pelvic fin membrane
Pelvic fin frenum length	PFFL	From anterior margin to posterior margin of the pelvic fin frenum
Distance between pelvic fin spines	DPFS	Distance between the spines of the pelvic fin

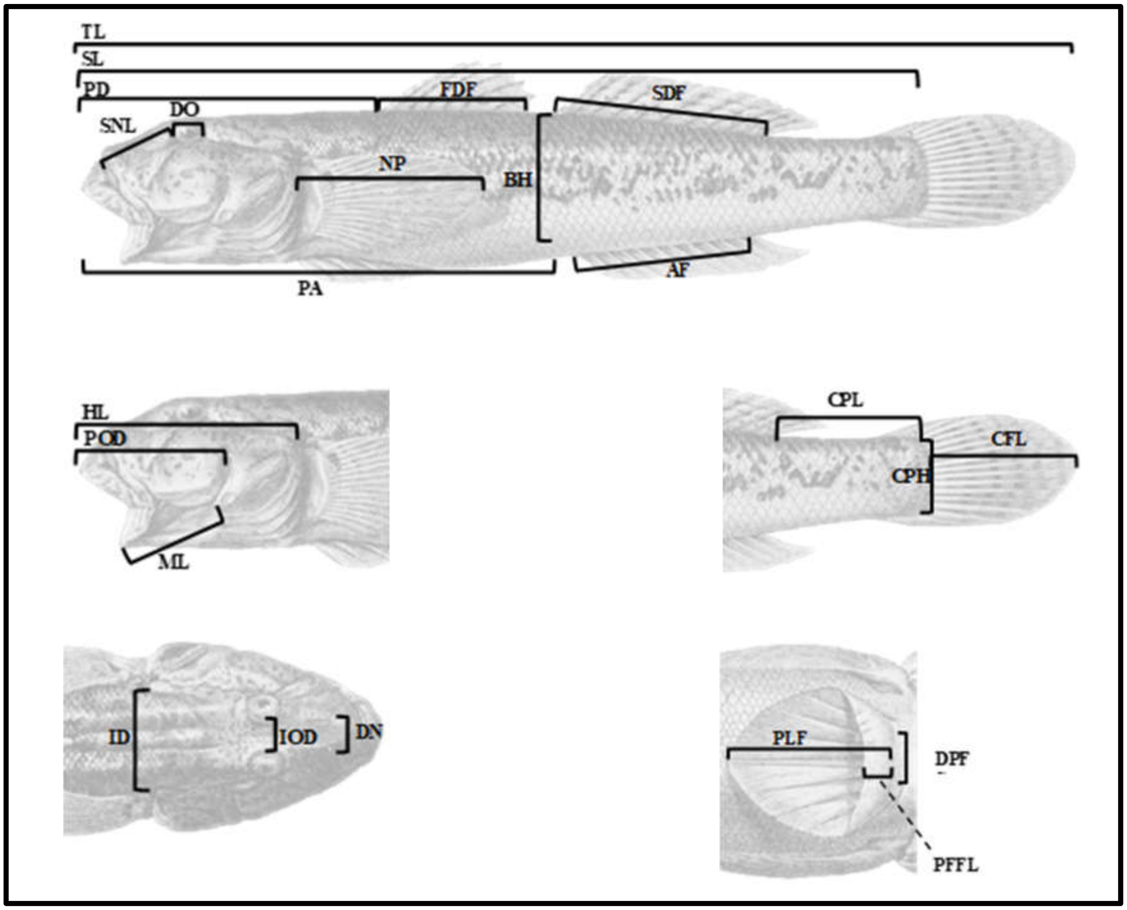

Figure 2 – Details of the measurements. Illustration extracted from Steindachner (1911). Abbreviations follow **Table 1**.

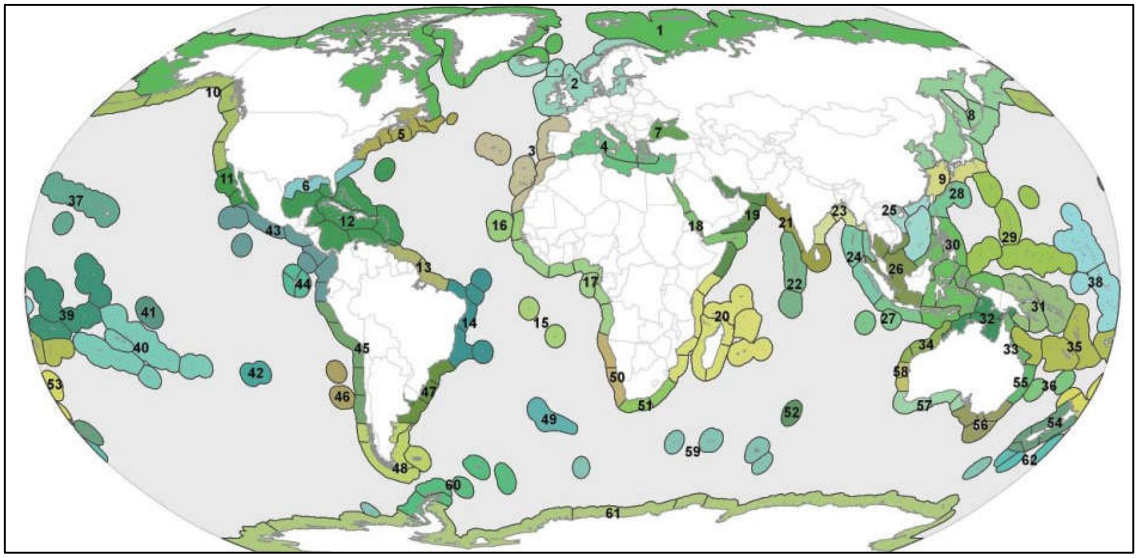

Figure 3 – Marine biogeographical regions according to Spalding *et al.* (2007). Number 11: "Warm Temperate Northeast Pacific", number 12: "Tropical Northwestern Atlantic", number 14: "Tropical Southwestern Atlantic", number 16: "West African Transition", number 17: "Gulf of Guinea", number 43: "Tropical East Pacific" and number 47: "Warm Temperate Southwestern Atlantic". Other regions were not mentioned in the text, thus were not detailed here.

1.3.3. Meristic

Fin rays were categorized on the basis of ossification and segmentation. Spines are represented in capital roman numbers, segmented but not branched rays are represented in lower case roman numbers, and branched rays are represented in arabic numerals following Akihito (1984). The most posterior ray of the second dorsal and anal fin is divided in two in a condition called *split to the base*. Akihito (1984) considered this condition representing only one ray, but, since they were completely split, in this dissertation, they were considered two independent rays.

Scale counts in transverse series follow Akihito (1984). Scale counts in dorsal margin, ventral margin and circum-peduncular series follow Caires (2012).

The pre-dorsal region of the species examined has an irregular disposition, thus scale counts were not taken in this region. A detailed study of the scale pattern was performed and is available in the next topic of this dissertation.

The scale count in the longitudinal series proposed by Akihito (1984) includes scales in pre-dorsal region, thus scale count in this series was here performed starting in the region of the vertical traced in the anterior margin of the first dorsal fin. Scale counts in the transversal and longitudinal series show an interesting variation, thus was stablished a comparative analysis of these counts in the different biogeographical provinces.

The scale counts of type specimens are presented separately in order to increase the comparative analysis. Some exemplars presented regions of the body poorly preserved, thus the counts were not taken in these regions.

1.3.4. Scale pattern

Previous studies with gobies demonstrate that some regions of the body of these fishes presents different scale patterns (DAWSON, 1967; CHEN; SHAO, 1996; HASTINGS; FINDLEY, 2015; WATSON, 1991), sometimes presenting different types of scales in distinct regions of the body. This information can be useful in a taxonomic context. Herein the scale pattern was analyzed in the chest region, pre-dorsal and anterior region of pectoral fin.

Scale pattern in the chest region was discriminated in three categories: chest region fully scaled, partially scaled and naked. Partially scaled pattern was stablished when the scales were absent in the region between the pelvic spines (**Figure 4 A, B** and **C**).

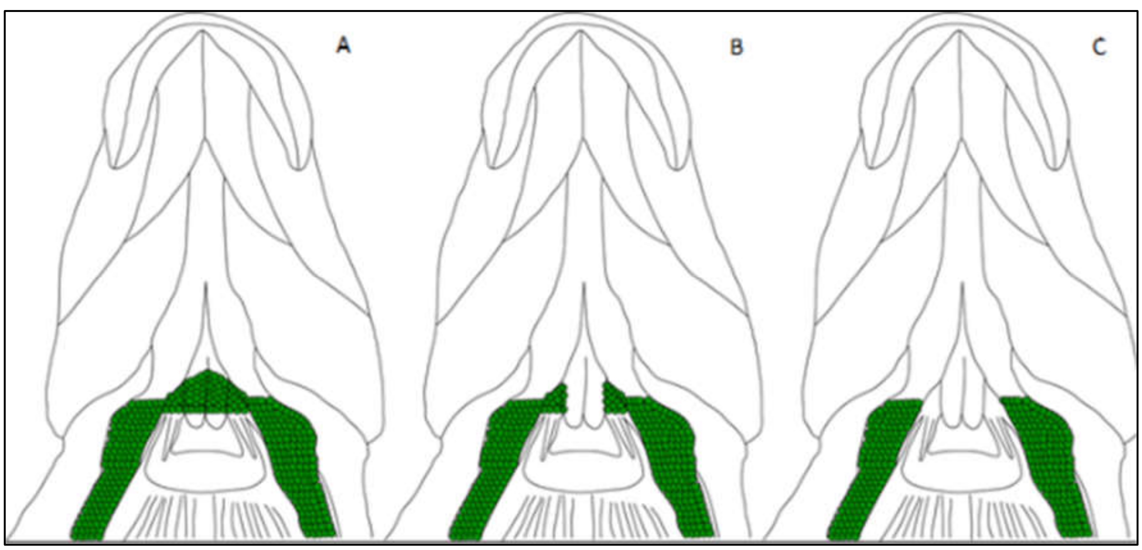

Figure 4 – Ventral view of *Awaous* (*Chonophorus*) illustrating the scale pattern in the chest region. A: fully scaled; B: partially scaled; C: naked.

Scale pattern in the pre-dorsal region also presented three distinctive arrangements: fully scaled, partially scaled and poorly scaled. The Partially scaled pattern was stablished when the scales were present only in half of the pre-dorsal region, poorly scaled pattern was considered when scales present a triangular arrangement not covering entirely the posterior half of pre-dorsal region (**Figure 5 A**, **B** and **C**). Some individuals present the scales in the median region of the pre-dorsal region absent, thus this pattern was also discriminated (**Figure 6 A B** and **C**).

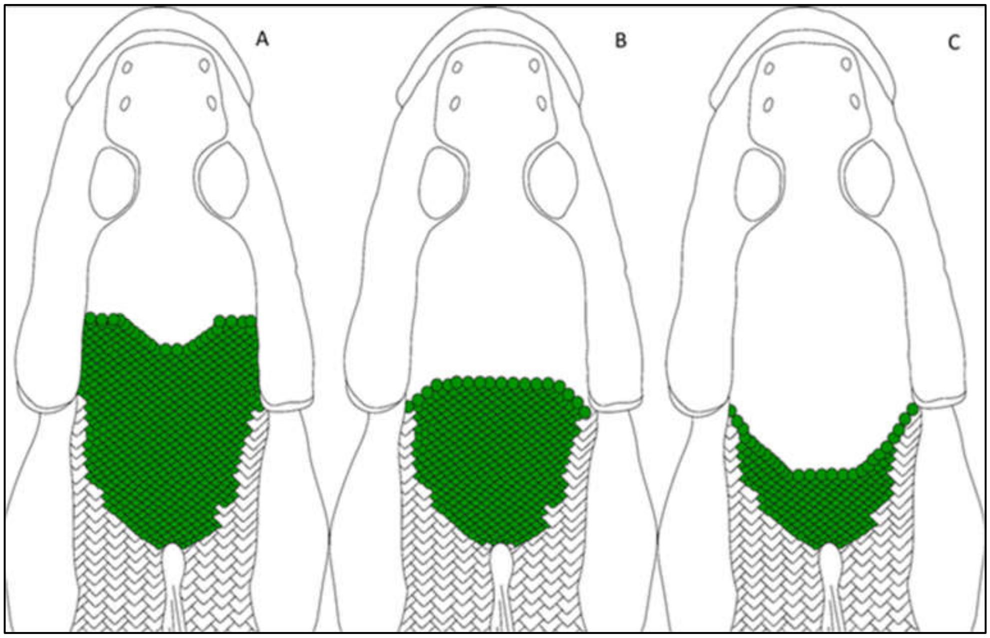

Figure 5 – Dorsal view of *Awaous* (*Chonophorus*) illustrating the pre-dorsal region scale pattern. **A**: fully scaled; **B**: partially scaled; **C**: poorly scaled.

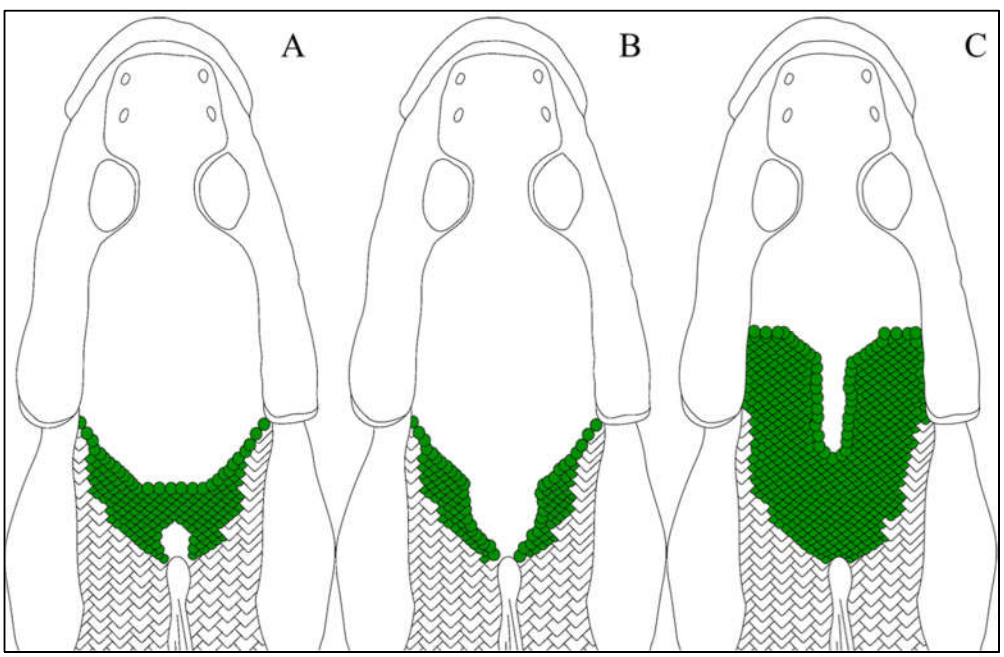

Figure 6 – Dorsal view of *Awaous* (*Chonophorus*) illustrating the scale pattern variation in the median region of the pre-dorsal region. **A**: poorly scaled with an interrupted median region; **B**: poorly scaled with a naked median region; **C**: fully scaled with an interrupted median region.

1.3.5. Oral papillae

An interesting feature of the species within *Awaous* (*Chonophorus*) is the presence of oral papillae. Initially the abundance of these papillae was measured in the region of post dental membrane, basihyal, vomer, presphenoid, cheeks, posterior region of the palate and gills. Subsequently a detailed study was implemented on the parasphenoid region and posterior region of the palate, the most informative ones. In the parasphenoid region the format was discriminated in conic or digitiform, conic ones being categorized as single or branched (**Figure 7 A**, **B** and **C**). The abundance and distribution of lines in this region were also examined. In the posterior region of the palate the papillae were always conical, thus were discriminated as single or branched, when branched could be abundant or sparse (**Figure 8 A**, **B** e **C**).

In some exemplars the papillae were poorly preserved, thus the papillae pattern was not considered in these specimens.

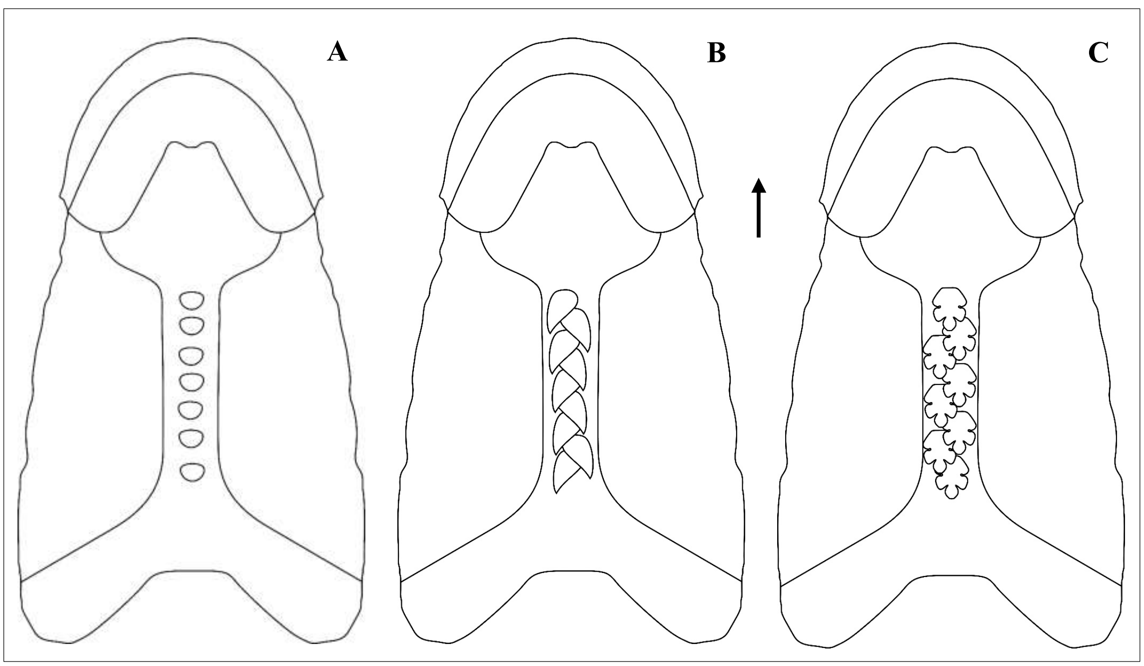

Figure 7 – Ventral view of the palate of *Awaous* (*Chonophorus*) illustrating the format observed in the papillae on the parasphenoid region. **A**: digitiform papillae; **B**: single conical papillae; **C**: branched conical papillae. Arrow points to anterior region.

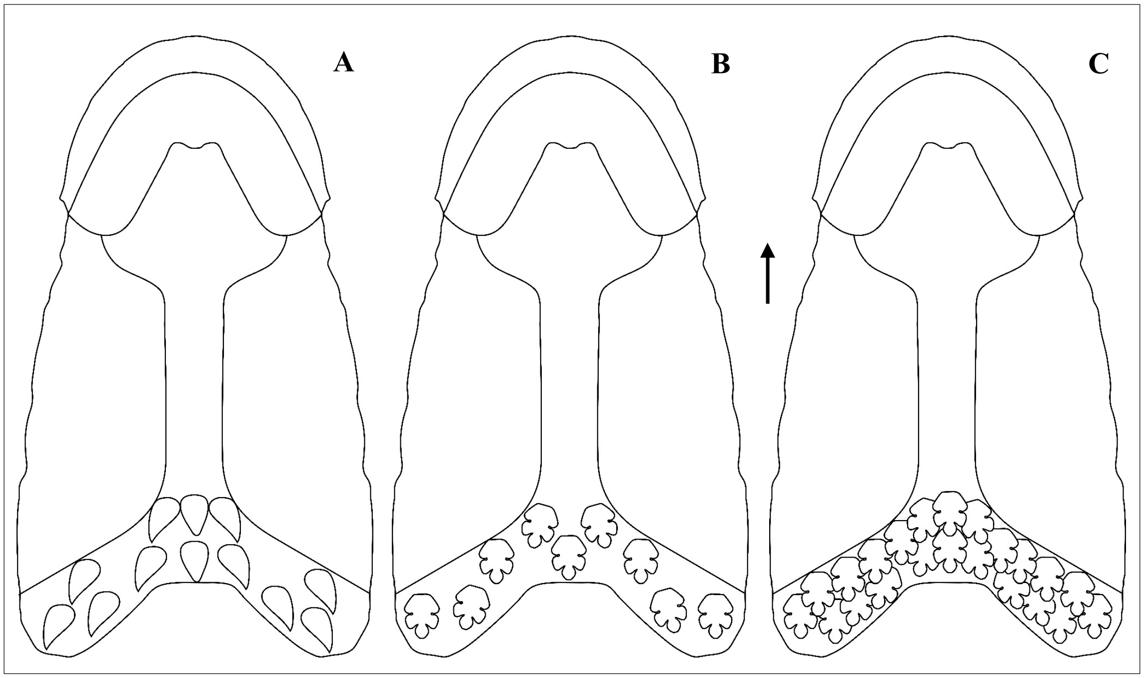

Figure 8 – Ventral view of the palate of *Awaous* (*Chonophorus*) illustrating the pattern observed on the posterior region of the palate. **A**: single sparse papillae; **B**: branched sparse papillae; **C**: branched abundant papillae. Arrow points to anterior region.

1.3.6. Cephalic sensory system pores

The nomenclature adopted for the cephalic sensory system pores and canals follow Akihito (1984) (**Figure 9**). The oculoscapular canal between pores "H" and "K" was examined in order to check if the species of *Awaous* (*Chonophorus*) have a complete oculoscapular canal or not. In addition, the state of the pore "F" of the oculoscapular canal was categorized throughout single or branched (WATSON, 1996).

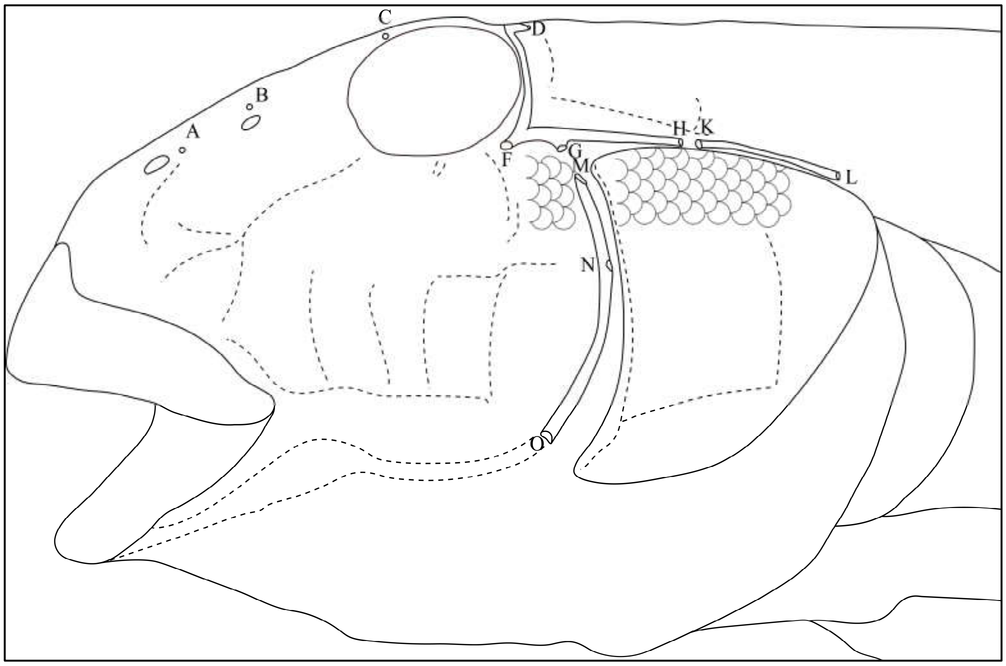

Figure 9 – Exemplar of *Awaous* (*Awaous*) *ocellaris* illustrating the nomenclature adopted for the pores of the oculoscapular canal (*sensu* AKIHITO, 1984) (**NMNS** 67320, 76.7 mm SL).

1.3.7. Superficial neuromast lines

The nomenclature adopted for the superficial neuromast lines in the opercular region follows Sanzo (1911). Sanzo (1911) adopted two different nomenclatures for the lines in the infra-orbital region. Letters were used to name lines in a longitudinal disposition (**Figure 10**), while numbers were adopted to name lines in a transversal orientation (**Figure 11**).

Sanzo's (1911) nomenclature presents some limitations, especially because it treats longitudinal and transversal lines distinctively. The author comments that his intention was to name lines based on innervation pattern and not only on position. Thus, herein, the nomenclature of Sanzo (1911) was adopted but with some adjustments based on the innervation pattern found in the literature and some examined exemplars. The reasons for adopting a new nomenclature and the new nomenclature proposal are detailed in the result section.

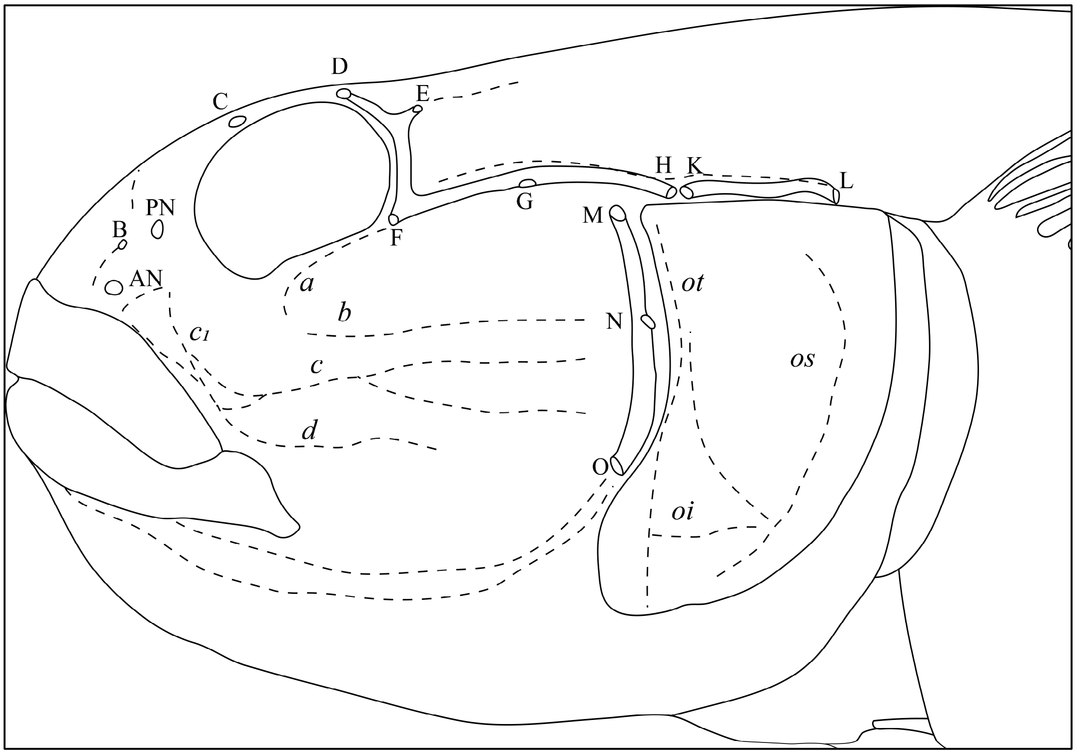

Figure 10 – *Bathygobius soporator*, illustrating the longitudinal pattern of superficial neuromast lines. Capital letters represent the pore nomenclature *sensu* Akihito (1984), small letters represent the nomenclature *sensu* Sanzo (1911), line *ot*: opercular transversal, line *os*: opercular superior, line *oi*: opercular inferior. AN: anterior nasal opening, PN: posterior nasal opening (**LIRP** 1414, 80.8 mm SL).

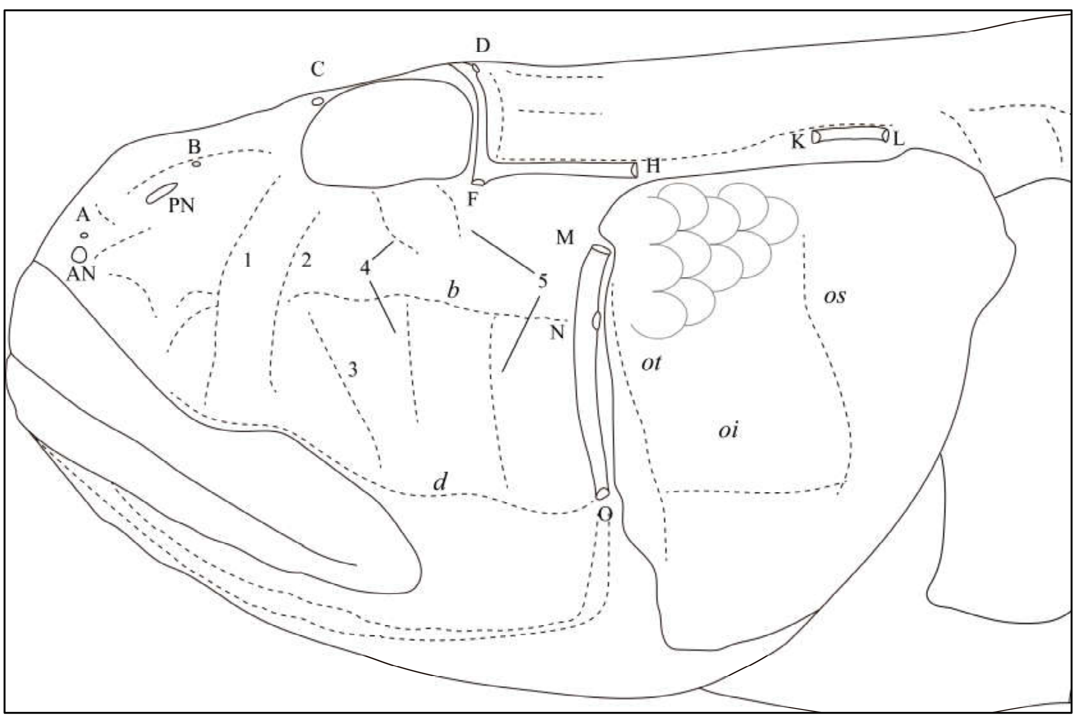

Figure 11 – *Gobionellus oceanicus*, illustrating the transversal pattern of superficial neuromast lines. Capital letters represent the pore nomenclature *sensu* Akihito (1984), numbers represent the nomenclature *sensu* Sanzo (1911), *ot*: opercular transversal line, *os*: opercular superior line, *oi*: opercular inferior line. AN: anterior nasal opening, PN: posterior nasal opening (**MZUSP** 66005, 132.5 mm SL).

1.4. RESULTS

1.4.1. Type specimens

Before presenting the results, it is necessary to introduce some important information about some type specimens.

Only one of the syntypes of *Gobius martinicus* Valenciennes, 1837, was found in the collection. Despite a clear mention of the lot **a-1327** in the catalog of type specimens of the **MNHN**, the specimen was not found.

The type specimens of *Chonophorus bucculentus* Poey, 1860 shows an interesting history. Presumably the lots containing type specimens are **MCZ** 13330, **MCZ** 13379, **MCZ** 13380. The lots **MCZ** 13375, **NMNH** 4772 e **NMNH** 4774 were collected by the same author in the same place and date but do not figure in the type series. These lots were also analyzed in order to check if they could be included in the type series.

The original description suggests that Poey looked at more than one individual of *Chonophorus bucculentus*, at least one male and one female '**Nous avons dans l'île une autre espèce qui diffère, dans les deux sexes, de celle que M. Valenciennes a décrite, par une tête très large et des joues renflées [...]**'.

Poey (1860) also identified some of the collected individuals as *Awaous banana*. The main difference between the species would be the volume of the cheeks, much broader in the proposed one.

Poey (1860) affirmed that he had one exemplar with 7 inches (178 mm) and one with 8 inches (203 mm) of *Awaous* (*Chonophorus*) *banana* "[...] **qui est d'un cinquième de la longueur de la tête dans un individu de cinq pouces, et d'un septième dans un de sept pouces. J'ai cru reconnaître cette espèce parmi nos poisons d'eau douce: mon individu de sept pouces a l'oeil d'un septième, et celui de huit pouces l'a d'un huitième** [...].

None of the exemplars has 178 mm of total length but the smallest individual is the **MCZ** 13375 (207 mm TL), and this exemplar was probably assigned to *Awaous banana* by the author. The exemplar in the jar **NMNH** 4774 has the smallest cheek size so it is probably the other exemplar identified as *Awaous* (*Chonophorus*) *banana*.

Poey (1860) provided a complete analysis of one individual with 265 mm "[…] **ce qu'il me reste a en diré est pris chez un individu de 265 millimètres** [...]." The individual with the total length closest to this value is **NMNH** 4772 (267 mm TL), currently not considered one of the syntypes. The author also mentioned that the largest examined individual would have 300 mm in total length "[...] **Les plus grands individus sont de 300 mili** [...]", the one closest to this measure is **MCZ** 13330 (305 mm TL). The lot **MCZ** 13380 (282 mm CT) is the only remaining jar with a female exemplar, so it is also probably part of the type series.

It was not possible to confirm if the lot **MCZ** 13379 belongs to the type series. In addition, the notes in the collection catalog are questionable. Despite the inscription of "type" in the label of the lot **MCZ** 13379, this information was not present in the collection catalog. Furthermore, the lot **MCZ** 13375 presents a "type" inscription in the catalog book, but this mark was not found in the label.

In face of this scenario, it was not possible to confirm if the lot **MCZ** 13379 belong to the type series, and accordingly it was not considered a type specimen here.

1.4.2. Morphometrics

The following tables demonstrate in details the measurements taken.

Table 2 – Measurements taken in exemplars of *Awaous* (*Chonophorus*) *banana* collected in the Atlantic slope.

Awaous (*Chonophorus*) *banana* (Atlantic)	Measurements	Maximum	Minimum	Mean	N
	SL	188.7	50.0	95.9	73
HL	PD	39.6	32.2	36.9	73
	POD	81.4	65.3	74.9	73
	ML	73.3	26.9	55.4	72
	ID	75.9	38.3	56.4	72
	IOD	19.5	6.4	11.1	73
	OD	24.8	13.9	19.1	72
	DN	21.3	11.8	15.5	70
	SNL	44.3	26.9	36.3	73
SL	HL	30.0	23.4	26.9	73
	TL	127.0	119.2	123.4	73
	PA	57.3	47.7	51.7	71
	BH	19.2	13.8	15.9	73
	CPL	20.7	12.2	15.5	68
	CPH	11.2	8.0	9.3	73
	FDF	14.8	10.7	12.5	67
	SDF	28.0	20.0	25.4	72
	AF	26.5	20.9	23.4	71
	CF	27.6	19.9	24.3	71
	PCF	26.7	19.7	23.4	70
	PLF	22.0	6.3	18.8	70
SL	PFFL	6.8	2.6	4.9	71
	DPFS	4.2	1.7	2.6	70

Table 3 – Measurements taken on the lectotype of *Gobius banana*. Measurements in bold diverge from **Table 2**.

Gobius banana (lectotype)	Measurements	Values
MNHN A- 1265	SL	98.6
HL	PD	37.3
	POD	70.9
	ML	64.2
	ID	36.6
	IOD	7.5
	OD	20.8
	DN	**11.3**
	SNL	31.3
SL	HL	26.9
	TL	
	PA	**58**
	BH	14.1
	CPL	14.8
	CPH	9.6
	FDF	10.2
	SDF	**29**
	AF	23.3
	CF	
	PCF	23.6
	PLF	17
	PFFL	3.3
	DPFS	

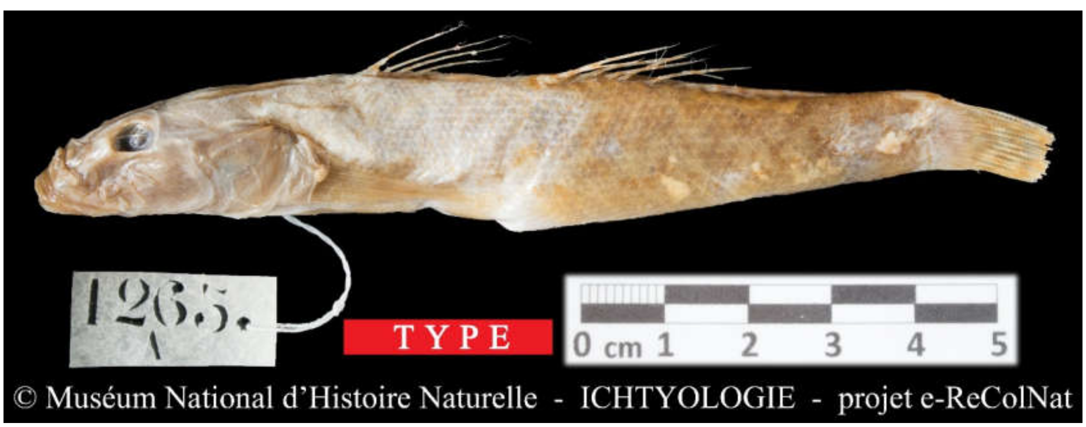

Figure 12 – Lateral view of the lectotype of *Gobius banana* (**MNHN** A- 1265, 98.6 mm SL), courtesy of **MNHN**.

Table 4 – Measurements taken on the paralectotype of *Gobius banana.* Measurements in bold diverge from **Table 2**.

Gobius banana (paralectotype)	Measurements	Values
MNHN A- 1359	SL	71.8
HL	PD	**40.9**
	POD	65.5
	ML	54.3
	ID	**32.5**
	IOD	
	OD	
	DN	
	SNL	36
SL	HL	27.4
	TL	123.1
	PA	55.4
	BH	**13.5**
	CPL	12.7
	CPH	**7.4**
	FDF	**9.5**
	SDF	22.4
	AF	18.7
	CF	21
	PCF	21
	PLF	20.3
	PFFL	3.9
	DPFS	1.9

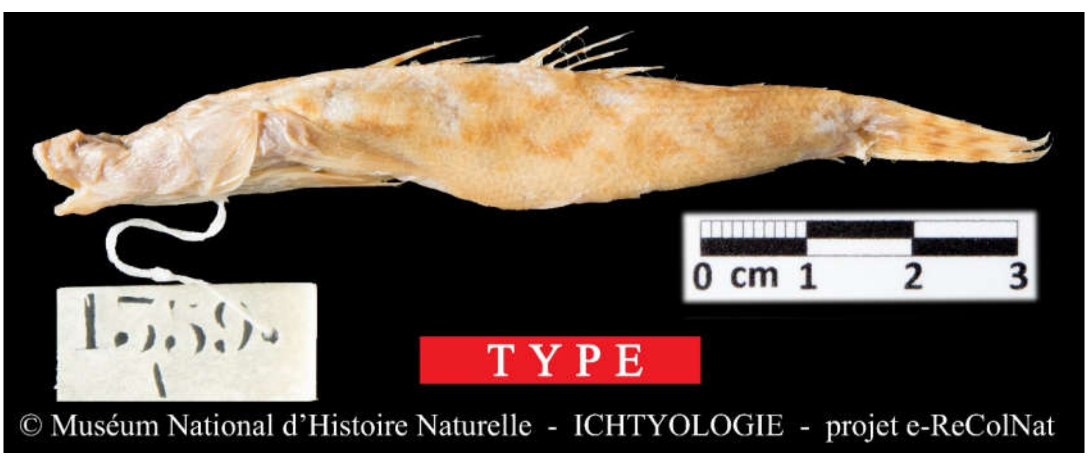

Figure 13 – Lateral view of the paralectotype of *Gobius banana* (**MNHN** A- 1359, 71.8 mm SL), courtesy of **MNHN**.

Table 5 – Measurements taken on the syntype of *Gobius martinicus*.

Gobius martinicus (syntype)	Measurements	Values
MNHN A-1266	SL	118.8
HL	PD	37.3
	POD	70.8
	ML	61.5
	ID	61.2
	IOD	12.4
	OD	15.8
	DN	15.2
	SNL	37.6
SL	HL	27.1
	TL	121
	PA	52.4
	BH	15.4
	CPL	13.2
	CPH	9.3
	FDF	12.7
	SDF	25.8
	AF	23.9
	CF	21.5
	PCF	22.3
	PLF	16.6
	PFFL	4.4
	DPFS	2.3

Figure 14 – Lateral view of the syntype of *Gobius martinicus* (**MNHN** A-1266, 118.8 mm SL), courtesy of **MNHN**.

Table 6 – Measurements taken on the holotype of *Chonophorus contractus*.

Chonophorus contractus (holotype) MCZ 31220	Measurements	Values
	SL	153.5
HL	PD	38.1
	POD	78.8
	ML	67.3
	ID	59.6
	IOD	17.5
	OD	21.2
	DN	15
	SNL	37.7
SL	HL	26.1
	TL	123.8
	PA	52.9
	BH	15.7
	CPL	13.9
	CPH	9.6
	FDF	11.3
	SDF	22.7
	AF	23.1
	CF	24.7
	PCF	23.3
	PLF	18.8
	PFFL	4.6
	DPFS	1.8

Figure 15 – Lateral view of the holotype of *Chonophorus contractus* (**MCZ** 31220, 153.5 mm SL), photo taken by Sandra Raredon at **NMNH**.

Table 7 – Measurements taken on one of the syntypes of *Chonophorus bucculentus.* Measurements in bold diverge from **Table 2**.

Chonophorus bucculentus (syntype)	Measurements	Values
MCZ 13330	SL	**241**
HL	PD	38.8
	POD	**81.5**
	ML	66.1
	ID	66.4
	IOD	**21.2**
	OD	12
	DN	19.9
	SNL	37.1
SL	HL	28.8
	TL	125.3
	PA	55.5
	BH	17.9
	CPL	12.7
	CPH	10.6
	FDF	11.9
	SDF	25.6
	AF	24.6
	CF	24.1
	PCF	24.9
	PLF	19.3
	PFFL	6.3
	DPFS	3.3

Figure 16 – Lateral view of one of the syntypes of *Chonophorus bucculentus* (**MCZ** 13330, 241 mm SL), photo taken by Sandra Raredon at **NMNH**.

Table 8 – Measurements taken on one of the syntypes of *Chonophorus bucculentus*. Measurements in bold diverge from **Table 2**.

Chonophorus bucculentus (syntype)	Measurements	Values
MCZ 13380	SL	**234**
HL	PD	36
	POD	75
	ML	58.1
	ID	67.3
	IOD	18.3
	OD	**12.5**
	DN	16.2
	SNL	40
SL	HL	26.6
	TL	**118.8**
	PA	55
	BH	17.3
	CPL	12.6
	CPH	9.9
	FDF	10.7
	SDF	24.3
	AF	21.6
	CF	21.6
	PCF	22
	PLF	16.1
	PFFL	4.8
	DPFS	3.3

Figure 17 – Lateral view of one of the syntypes of *Chonophorus bucculentus* (**MCZ** 13380, 234 mm SL), photo taken by Sandra Raredon at **NMNH**.

Table 9 – Measurements taken on one of the syntypes of *Chonophorus bucculentus.* Measurements in bold diverge from **Table 2**.

Chonophorus bucculentus (syntype)	Measurements	Values
NMNH 4772	SL	**214**
HL	PD	38.6
	POD	**83.7**
	ML	65.4
	ID	66.6
	IOD	17
	OD	15.2
	DN	**22.1**
	SNL	42.3
SL	HL	28.9
	TL	123.4
	PA	53.7
	BH	18.5
	CPL	12.3
	CPH	**11.5**
	FDF	11.7
	SDF	24.7
	AF	23.8
	CF	23
	PCF	21.8
	PLF	19.6
	PFFL	4.6
	DPFS	3

Table 10 – Measurements taken on one of the syntypes of *Gobius mexicanus*. Measurements in bold diverge from **Table 2**.

Gobius mexicanus (syntype)	Measurements	Values
NHM 1856.4.17.41	SL	143.6
HL	PD	36.6
	POD	73.7
	ML	54.8
	ID	54
	IOD	10.4
	OD	17.8
	DN	15.9
	SNL	37.5
SL	HL	25.4
	TL	**127.4**
	PA	53.5
	BH	16.8
	CPL	14.5
	CPH	9.5
	FDF	11.5
	SDF	25.1
	AF	23.2
	CF	21.7
	PCF	20.1
	PLF	15.1
	PFFL	3.5
	DPFS	2.8

Figure 18 – Lateral view of one of the syntypes of *Gobius mexicanus* (**NHM** 1856.4.17.41, 143.6 mm SL), courtesy of **NHM**.

Table 11 – Measurements taken on one of the syntypes of *Gobius mexicanus.* Measurements in bold diverge from **Table 2**. Blank spaces represent damaged regions.

Gobius mexicanus (syntype)	Measurements	Values
NHM 1856.4.17.42	SL	131.5
HL	PD	36
	POD	
	ML	68.8
	ID	58.7
	IOD	10.4
	OD	16.5
	DN	17.1
	SNL	32.1
SL	HL	24.9
	TL	122.4
	PA	53.3
	BH	18.5
	CPL	14.8
	CPH	10.2
	FDF	12.8
	SDF	27.1
	AF	23.3
	CF	22.7
	PCF	23.4
	PLF	16.3
	PFFL	4.5
	DPFS	2.3

Figure 19 - Lateral view of one of the syntypes of *Gobius mexicanus* (**NHM** 1856.4.17.42, 131.5 mm SL), courtesy of **NHM**.

Table 12 – Measurements taken in exemplars of *Awaous* (*Chonophorus*) *banana* collected in the pacific slope.

Awaous (*Chonophorus*) *banana* (Pacific)	Measurements	Maximum	Minimum	Mean	N
	SL	141.7	52	76.3	47
HL	PD	40	34	36.6	47
	POD	84.1	20.8	74.6	47
	ML	68.9	16.4	57.2	47
	ID	84.4	15.8	54.6	47
	IOD	17.5	3.7	10.6	47
	OD	25.2	5.7	20.5	47
	DN	20.4	4.4	15.4	47
	SNL	45.3	10.8	35.2	47
SL	HL	100	23	28.1	47
	TL	127.7	119.1	123.7	46
	PA	56.2	47.4	51.4	44
	BH	17.8	14.2	15.8	47
	CPL	18.7	13	15.1	40
	CPH	10	7.8	9.1	47
	FDF	16.1	11.1	12.6	44
	SDF	27.9	23.2	26	46
	AF	26.4	21.4	23.8	43
	CF	26.6	19.8	24	39
	PCF	25.8	19.2	23.5	46
	PLF	21.4	15.1	19	47
	PFFL	6.4	2.4	4.7	44
	DPFS	3.7	1.6	2.4	47

Table 13 – Measurements taken in exemplars of *Awaous* (*Chonophorus*) *banana* collected in the pacific slope occurring on the biogeographical province of "Warm Temperate Northeast Pacific" (*sensu* SPALDING *et al*. 2007).

Warm Temperate Northeast Pacific	Measurements	Maximum	Minimum	Mean	N
	SL	91.9	54.4	76.8	5
HL	PD	37.1	35.7	36.5	5
	POD	77.1	71.9	74.3	5
	ML	63.7	54	57	5
	ID	56.1	51.9	53.4	5
	IOD	13.1	8.6	10.7	5
	OD	21.5	17.1	19.2	5
	DN	17.8	11.5	15.3	5
	SNL	35.9	28.3	32.6	5
SL	HL	26.7	24.7	25.7	5
	TL	124.4	120.3	122.9	4
	PA	51.8	50.4	51.2	3
	BH	16.9	14.4	15.6	5
	CPL	14.4	13.2	13.9	4
	CPH	10	8.1	9	5
	FDF	16.1	12	13.4	5
	SDF	26.6	24.5	25.4	5
	AF	24.7	22.4	23.5	5
	CF	23.7	22.3	23	4
	PCF	24.4	19.2	21.7	5
	PLF	19.3	15.1	18	5
	PFFL	5.6	2.4	3.8	4
	DPFS	3.3	1.8	2.5	5

Table 14 – Measurements taken in exemplars of *Awaous* (*Chonophorus*) *banana* collected in the pacific slope occurring on the biogeographical province of "Tropical East Pacific" (*sensu* SPALDING *et al*. 2007).

Tropical East Pacific	Measurements	Maximum	Minimum	Mean	N
	SL	141.7	52	77.8	27
HL	PD	37.9	34.2	36.2	27
	POD	84.1	68.8	76.6	27
	ML	68.9	43.1	58.7	27
	ID	84.4	49.5	56.8	27
	IOD	17.5	6.7	10.9	27
	OD	24.6	14.9	20.7	27
	DN	18	11.9	15.5	27
	SNL	45.3	24.4	36	27
SL	HL	29	23	26.1	27
	TL	126.5	119.3	123.5	27
	PA	54.1	47.6	50.9	26
	BH	17.8	14.5	15.9	27
	CPL	17.4	14.1	15	21
	CPH	10	8	9.2	27
	FDF	13.8	11.1	12.4	24
	SDF	27.9	25.2	26.5	26
	AF	26.4	22.9	24.3	23
	CF	26.5	19.8	24	22
	PCF	24.9	20.9	23.5	26
	PLF	21.4	16.4	18.9	27
	PFFL	6.4	3.7	4.9	26
	DPFS	2.9	1.7	2.2	27

Table 15 – Measurements taken on one of the syntypes of *Gobius transandeanus*. Measurements in bold diverge from **Table 12** and values underlined in bold diverge from **Table 2** and **12**.

Gobius transandeanus (syntype)	Measurements	Values
NHM 1860.6.16.135	SL	86.3
HL	PD	35.9
	POD	73
	ML	62.8
	ID	46.5
	IOD	11.1
	OD	21.7
	DN	17.3
	SNL	33.6
SL	HL	26.2
	TL	121.2
	PA	53.5
	BH	<u>**13.6**</u>
	CPL	16.1
	CPH	**7.9**
	FDF	12.2
	SDF	25
	AF	22.4
	CF	21.3
	PCF	22.2
	PLF	18.1
	PFFL	3.2
	DPFS	1.7

Figure 20 – Lateral view of one of the syntypes of *Awaous transandeanus* (**NHM** 1860.6.16.135, 86.3 mm SL), courtesy of **NHM**.

Table 17 – Measurements taken on one of the syntypes of *Gobius transandeanus*. Values underlined in bold diverge from **Table 2** and **12**.

Awaous transandeanus (syntype)	Measurements	Values
NHM 1860.6.16.136	SL	84.8
HL	PD	36.1
	POD	72.2
	ML	54.2
	ID	43.6
	IOD	8.8
	OD	19.8
	DN	15.4
	SNL	37.9
SL	HL	26.8
	TL	**112.6**
	PA	**47.3**
	BH	14.3
	CPL	14.9
	CPH	8.4
	FDF	12.3
	SDF	25.8
	AF	22.5
	CF	**18.3**
	PCF	22.9
	PLF	20
	PFFL	5.8
	DPFS	1.7

Figure 21 – Lateral view of one of the syntypes of *Gobius transandeanus* (**NHM** 1860.6.16.136, 84.8 mm SL), courtesy of NHM.

Table 18 – Measurements taken on the holotype of *Awaous nelsoni.* Measurements in bold diverge from **Table 12**. Blank spaces represent damaged regions.

Awaous nelsoni (holotype) NMNH 48836	Measurements	Values
	SL	66
HL	PD	37.9
	POD	77.1
	ML	56
	ID	52
	IOD	11.4
	OD	24
	DN	14.9
	SNL	32
SL	HL	26.5
	TL	
	PA	**46.4**
	BH	15
	CPL	
	CPH	9.5
	FDF	12.4
	SDF	26.8
	AF	
	CF	
	PCF	19.1
	PLF	18.5
	PFFL	5.2
	DPFS	2.6

Figure 22 – Lateral view of the holotype of *Awaous nelsoni* (**NMNH** 48836, 66.0 mm SL), photo taken by Sandra Raredon at **NMNH**.

Table 19 – Measurements taken on one of the syntypes of *Gobius (Awaous) guentheri,* species currently considered a junior synonym of *Awaous* (*Chonophorus*) *banana*. Measurements in bold diverge from **Table 12** and values underlined in bold diverge from **Table 2** and **12**.

Gobius (Awaous) guentheri (syntype)	Measurements	Values
NHM 1860.6.16.133	SL	108.5
HL	PD	**33.5**
	POD	80.7
	ML	**69.1**
	ID	59.6
	IOD	11.6
	OD	18.6
	DN	17.5
	SNL	40
SL	HL	26.3
	TL	120.9
	PA	54.1
	BH	<u>**13.1**</u>
	CPL	13.6
	CPH	8.7
	FDF	11.7
	SDF	26.6
	AF	24
	CF	24.7
	PCF	23.4
	PLF	18.2
	PFFL	3.1
	DPFS	2.5

Figure 23 – Lateral view of one of the syntypes of *Gobius (Awaous) guentheri* (**NHM** 1860.6.16.133, 108.5 mm SL), courtesy of **NHM**.

Table 20 – Measurements taken on one of the syntypes of *Gobius (Awaous) guentheri*. Measurements in bold diverge from **Table 12**.

Gobius (Awaous) guentheri (syntype)	Measurements	Values
NHM 1860.6.16.134	SL	102.4
HL	PD	35.2
	POD	80.7
	ML	63.4
	ID	55.9
	IOD	14.5
	OD	20
	DN	18.3
	SNL	39
SL	HL	28.3
	TL	125
	PA	53
	BH	14.6
	CPL	14
	CPH	9.6
	FDF	11.5
	SDF	26.4
	AF	24.5
	CF	25.4
	PCF	20.2
	PLF	20.1
	PFFL	5.8
	DPFS	**1.3**

Figure 24 – Lateral view of one of the syntypes of *Gobius (Awaous) guentheri* (**NHM** 1860.6.16.134, 102.4 mm SL), courtesy of NHM.

Table 21 – Measurements taken in exemplars of *Awaous* (*Chonophorus*) *lateristriga*.

Awaous (*Chonophorus*) *lateristriga*	Measurements	Maximum	Minimum	Mean	N
	SL	95.8	50.2	69.9	27
HL	PD	39	34.1	36.4	27
	POD	81.7	71.2	76.2	27
	ML	65.4	43.1	57.3	25
	ID	76.7	48	57.1	27
	IOD	11.9	6.1	8.2	27
	OD	26.2	15.6	21.8	27
	DN	20.4	10.6	14.2	27
	SNL	43.7	27.3	33.2	26
SL	HL	29	24	26.3	27
	TL	123.5	116	120.8	23
	PA	56.8	48.6	53	25
	BH	16.6	13.8	15.3	27
	CPL	15.9	10.3	13.7	26
	CPH	10.1	7.4	8.8	27
	FDF	13.7	10.3	12.4	23
	SDF	27.6	23.9	25.4	23
	AF	26.5	20	23.3	24
	CF	24.5	17.1	21.5	23
	PCF	25.7	20.8	22.7	26
	PLF	22.2	15.7	19	25
	PFFL	6.3	3.5	4.8	27
	DPFS	3.1	1.5	2.2	27

Table 22 – Measurements taken in exemplars of *Awaous* (*Chonophorus*) *lateristriga* collected in the biogeographical province of "West African Transition" (*sensu* SPALDING *et al*., 2007).

West African Transition	Measurements	Maximum	Minimum	Mean	N
	SL	95.8	50.2	69.8	24
HL	PD	37.9	34.1	36.2	24
	POD	81.7	71.2	76.4	24
	ML	65.4	43.1	56.4	22
	ID	76.7	48	57.7	24
	IOD	11.9	6.1	8.2	24
	OD	26.2	18.1	22	24
	DN	20.4	10.6	14.3	24
	SNL	43.7	27.3	33.3	23
SL	HL	29	24	26.2	24
	TL	123.5	116	120.8	20
	PA	55.6	48.6	52.7	22
	BH	16.6	13.8	15.3	24
	CPL	15.9	10.3	13.7	23
	CPH	10.1	7.4	8.8	24
	FDF	13.7	10.3	12.3	20
	SDF	27.6	24.5	25.5	20
	AF	26.5	21	23.5	21
	CF	24.5	17.1	21.5	20
	PCF	24.7	20.8	22.5	23
	PLF	22.2	15.7	18.9	22
	PFFL	6.3	3.5	4.8	24
	DPFS	3.1	1.5	2.3	24

Table 23 – Measurements taken in exemplars of *Awaous* (*Chonophorus*) *lateristriga* collected in the biogeographical province of "Gulf of Guinea" (*sensu* SPALDING *et al*., 2007). Measurements in bold diverge from **Table 22**.

Gulf of Guinea	Measurements	Values	N
	SL	50.2	1
HL	PD	37.3	1
	POD	77.5	1
	ML	63.4	1
	ID	50	1
	IOD	9.9	1
	OD	21.8	1
	DN	13.4	1
	SNL	32.4	1
SL	HL	28.3	1
	TL	121.7	1
	PA	**56.8**	1
	BH	15.9	1
	CPL	15.1	1
	CPH	8.8	1
	FDF	12.5	1
	SDF	**24.1**	1
	AF	22.7	1
	CF	22.7	1
	PCF	25.7	1
	PLF	19.5	1
	PFFL	6.2	1
	DPFS	2.4	1

Table 24 – Measurements taken on the lectotype of *Gobius lateristriga.* Measurements in bold diverge from **Table 21**.

Gobius lateristriga (lectotype)	Measurements	Values
MNHN- 6228-1	SL	87.5
HL	PD	39
	POD	73.4
	ML	63.1
	ID	54.5
	IOD	9
	OD	15.6
	DN	13.1
	SNL	33.6
SL	HL	27.9
	TL	121
	PA	55.4
	BH	15.7
	CPL	12.8
	CPH	9.3
	FDF	13
	SDF	23.9
	AF	20
	CF	21.6
	PCF	24.7
	PLF	19.3
	PFFL	4.5
	DPFS	1.7

Figure 25 – Lateral view of the lectotype of *Gobius lateristriga* (**MNHN** 6228-1, 87.5 mm SL), courtesy of **MNHN**.

Table 25 – Measurements taken on the paralectotype of *Gobius lateristriga.* Measurements in bold diverge from **Table 21**.

Gobius lateristriga (paralectotype)	Measurements	Values
MNHN- 1996-301	SL	73
HL	PD	36.2
	POD	72.6
	ML	62.9
	ID	51.8
	IOD	6.6
	OD	21.3
	DN	12.7
	SNL	29.9
SL	HL	27
	TL	119.5
	PA	53.7
	BH	16.4
	CPL	12.6
	CPH	9
	FDF	13
	SDF	25.2
	AF	22.9
	CF	22.1
	PCF	22.3
	PLF	19.2
	PFFL	4.1
	DPFS	1.6

Figure 26 – Lateral view of the paralectotype of *Gobius lateristriga* (**MNHN** 1996-301, 73.0 mm SL), courtesy of **MNHN**.

Table 26 – Measurements taken in exemplars of *Awaous* (*Chonophorus*) *tajasica*.

Awaous (*Chonophorus*) *tajasica*	Measurements	Maximum	Minimum	Mean	N
	SL	169	51.4	91.5	101
HL	PD	39.7	32.8	36.2	101
	POD	86.5	71	78.6	98
	ML	85.3	48.8	61.6	77
	ID	81.3	43.4	59.6	101
	IOD	20.2	6	10.2	102
	OD	28.4	14.8	20.5	100
	DN	23.9	11.1	15.4	98
	SNL	44.3	29.9	37.1	97
SL	HL	30.1	21.9	25.6	102
	TL	126.3	115.4	121.8	86
	PA	72.9	37.2	51.3	66
	BH	21.3	11.5	14.7	96
	CPL	17.8	11.6	13.9	84
	CPH	13.3	7.5	9.3	98
	FDF	18.8	9.3	12.5	93
	SDF	36	23	25.8	100
	AF	31.2	20.8	23.9	100
	CF	28.9	18.5	22.8	92
	PCF	28	17.1	22.7	95
	PLF	22.1	10.1	18.1	86
	PFFL	5.9	2.5	4.3	69
	DPFS	4.2	1.4	2.3	90

Table 27 – Measurements taken in exemplars of *Awaous* (*Chonophorus*) *tajasica* collected in the biogeographical province of "Warm Temperate Southwestern Atlantic" (*sensu* SPALDING *et al*., 2007).

Warm Temperate Southwestern Atlantic	Measurements	Maximum	Minimum	Mean	N
	SL	145.7	51.5	78.8	47
HL	PD	37.9	33.7	35.8	46
	POD	85.9	71	78.4	45
	ML	85.3	48.8	61	37
	ID	70.7	43.4	55.4	46
	IOD	16.4	6	9.1	47
	OD	25.5	14.8	21.1	47
	DN	19.4	11.1	14.5	47
	SNL	42.9	30.7	36.7	46
SL	HL	28.9	21.9	25.3	47
	TL	126.3	118.8	122.1	43
	PA	55	37.2	50.7	29
	BH	16.3	11.9	13.9	44
	CPL	17.8	11.6	13.9	43
	CPH	10.3	7.5	8.7	44
	FDF	14.5	9.3	12.1	46
	SDF	28.4	23	25.4	47
	AF	25.7	20.8	23.6	46
	CF	26.4	19.6	22.9	45
	PCF	25.8	17.1	22.4	43
	PLF	22.1	15.1	18.8	35
	PFFL	5.8	2.5	4.4	33
	DPFS	4.2	1.4	2.2	37

Table 28 – Measurements taken in exemplars of *Awaous* (*Chonophorus*) *tajasica* collected in the biogeographical province of "Tropical Southwestern Atlantic" (*sensu* SPALDING *et al*., 2007).

Tropical Southwestern Atlantic	Measurements	Maximum	Minimum	Mean	N
	SL	169	51.4	102.2	55
HL	PD	39.7	32.8	36.6	56
	POD	86.5	72	78.6	54
	ML	75.9	53	62.1	41
	ID	81.3	47.3	63	56
	IOD	20.2	6.2	11	56
	OD	28.4	14.8	20	54
	DN	23.9	11.5	16.3	52
	SNL	44.3	29.9	37.5	52
SL	HL	30.1	22.4	25.8	56
	TL	125	115.4	121.6	44
	PA	72.9	48.6	51.8	38
	BH	21.3	11.5	15.3	53
	CPL	16.5	12	14	42
	CPH	13.3	7.8	9.7	55
	FDF	18.8	10.6	13	48
	SDF	36	24.1	26.2	54
	AF	31.2	21.1	24.2	55
	CF	28.9	18.5	22.7	48
	PCF	28	19.7	22.9	53
	PLF	21.9	10.1	17.6	52
	PFFL	5.9	3.1	4.2	37
	DPFS	3.9	1.4	2.3	54

Table 29 – Measurements taken on the neotype of *Gobius tajasica*.

Gobius tajasica (neotype)	Measurements	Values
ANSP 84175	SL	131.8
HL	PD	39
	POD	81.3
	ML	52.6
	ID	67.6
	IOD	11.9
	OD	16.1
	DN	18.5
	SNL	38.7
SL	HL	30.1
	TL	124.4
	PA	50.8
	BH	17.1
	CPL	12.5
	CPH	10.5
	FDF	13.5
	SDF	25.8
	AF	24.1
	CF	21.2
	PCF	25.3
	PLF	17.6
	PFFL	4.1
	DPFS	2.7

Figure 27 – lateral view of the neotype of *Gobius tajasica* (**ANSP** 84175: 1 alc. 131.8 mm SL), photo taken by Sandra Raredon.

Table 30 – Measurements taken on the holotype of *Euctenogobius latus*.

Euctenogobius latus (holotype)	Measurements	Values
NHM 1862.11.23.42	SL	125
HL	PD	38.2
	POD	85.3
	ML	68.6
	ID	55.1
	IOD	12.7
	OD	19.5
	DN	18.4
	SNL	39.5
SL	HL	28.3
	TL	119.2
	PA	50.7
	BH	13.8
	CPL	12.4
	CPH	9
	FDF	11.1
	SDF	24.8
	AF	23.2
	CF	23.2
	PCF	24.3
	PLF	17.8
	PFFL	3.2
	DPFS	2.3

Figure 28 – Lateral view of the holotype of *Euctenogobius latus* (**NHM** 1862.11.23.42, 125 mm SL), courtesy of **NHM**.

Table 31 – Measurements taken on the holotype of *Suiboga travassosi.* Measurements underlined in bold diverge from **Table 26**, Measurements underlined diverge from **Table 27** e Measurements in bold diverge from **Table 28**.

Suiboga travassosi (holotype)	Measurements	Values
MNRJ 6196	SL	<u>**175.3**</u>
HL	PD	37.3
	POD	84.9
	ML	65.3
	ID	58.7
	IOD	16.3
	OD	<u>**14.3**</u>
	DN	<u>20</u>
	SNL	40.7
SL	HL	28.3
	TL	<u>**129.8**</u>
	PA	**48.2**
	BH	14.3
	CPL	12.2
	CPH	<u>10.7</u>
	FDF	11.5
	SDF	**23.6**
	AF	22.5
	CF	22.2
	PCF	23.6
	PLF	17.2
	PFFL	5.7
	DPFS	2

Figure 29 – Pictures of the holotype of *Suiboga travassosi* (**MNRJ** 6196, 175.3 mm SL), extracted from the original article (PINTO, 1960). 1: dorsal view of the head; 2: ventral view of the head.

1.4.3. Fin ray counts

Almost all individuals of *Awaous* examined presented the same fin ray count, with rare exceptions (**Table 32**).

Table 32 – Fin ray counts in exemplars of *Awaous* (*Chonophorus*). Numbers in parenthesis represent the examined individuals.

Species	Fist dorsal	Second dorsal	Anal	Pectoral	Pelvic
A. (*Chonophorus*) *banana* (Atlantic)	VI (75)	I + 10 (2) I + 11 (72)	I + 10 (2) I + 11 (71)	14 + i (6) 15 + i (68) 16 + i (1)	II + 10 (75)
A. (*Chonophorus*) *banana* (Pacific)	VI (56)	I + 11 (53)	I + 11 (53)	14 +i (7) 15 + i (47) 16 + i (1)	II + 10 (56)
A. (*Chonophorus*) *lateristriga*	VI (30)	I + 11 (30)	I + 11 (25)	14 + i (3) 15 + i (25) 16 + i (1)	II + 10 (33)
A. (*Chonophorus*) *tajasica*	V (1) VI (117)	I + 10 (3) I + 11 (117)	I + 10 (4) I + 11 (109)	14 + i (16) 15 + i (112) 16 + i (2)	II + 10 (121)

Table 33 – Most common values of fin ray counts in *Awaous* (*Chonophorus*).

Fin ray count				
Fist dorsal	Second dorsal	Anal	Pectoral	Pelvic
VI	I + 11	I + 11	15 + i	II + 10

1.4.4. Scale counts

Scale count in dorsal margin, ventral margin and circum-peduncular region are presented in **Table 34**.

Table 34 – Scale count in dorsal margin, ventral margin and circum-peduncular region. Numbers in parenthesis represent the examined individuals.

Scale count			
Species	circum-peduncular	dorsal margin	ventral margin
A. (*Chonophorus*) *banana* (Atlantic)	19 – 30 (83)	10 –19 (83)	10 – 17 (83)
A. (*Chonophorus*) *banana* (Pacific)	19 – 25 (54)	10 – 15 (54)	9 – 15 (54)
A. (*Chonophorus*) *lateristriga*	17 – 21 (40)	9 – 14 (40)	9 – 13 (40)
A. (*Chonophorus*) *tajasica*	14 – 23 (121)	7 – 13 (121)	8 – 14 (121)

Table 35 – Scale count in dorsal margin, ventral margin and circum-peduncular region of the examined type specimens.

Scale count in type specimens			
Exemplar	circum-peduncular	dorsal margin	ventral margin
MNHN A- 1265 (lectotype) *Gobius banana*	25	12	14
MNHN A- 1359 (paralectotype) *Gobius banana*	21	17	14
MNHN A-1266 (syntype) *Gobius martinicus*	26	11	11
MCZ 31220 (holotype) *Chonophorus contractus*	26	14	13

Scale count in type specimens			
Exemplar	circum-peduncular	dorsal margin	ventral margin
MCZ 13330 (syntype) *Chonophorus bucculentus*	25	11	13
MCZ 13380 (syntype) *Chonophorus bucculentus*	25	14	13
NMNH 4772 (syntype) *Chonophorus bucculentus*	26	11	11
NHM 1856.4.17.41 (syntype) *Gobius mexicanus*	26	16	15
NHM 1856.4.17.42 (syntype) *Gobius mexicanus*	26	15	13
NHM 1860.6.16.135 (syntype) *Awaous transandeanus*	21	14	12
NHM 1860.6.16.136 (syntype) *Awaous transandeanus*	21	13	11
NMNH 48836 (holotype) *Awaous nelsoni*	23	13	
NHM 1860.6.16.133 (syntype) *Gobius* (*Awaous*) *guentheri*	22	12	13
NHM 1860.6.16.134 (syntype) *Gobius* (*Awaous*) *guentheri*	25	13	12
MNHN- 6228-1 (lectotype) *Gobius lateristriga*	19	12	12
MNHN- 1996-301 (paralectotype) *Gobius lateristriga*	18	10	10
ANSP 84175 (neotype) *Gobius tajasica*	20	10	10
NHM 1862.11.23.42 (holotype) *Euctenogobius latus*	20	11	12
MNRJ 6196 (holotype) *Suiboga travassosi*	21	9	12

1.4.5. Scale count in longitudinal series

Scale counts in longitudinal series are presented in **Table 36**. The scale counts in *Awaous* (*Chonophorus*) *tajasica* have two separated ranges of high frequency, thus an analysis in the different biogeographical regions was performed (**Figure 30**). An analysis of the scale counts in the longitudinal series in *Awaous* (*Chonophorus*) *banana* occurring on both slopes was also implemented (**Figure 31**).

Table 36 – Scale counts in longitudinal series. Numbers in parenthesis represent the examined individuals.

Scale counts in longitudinal series		
Species	Range	Mode
A. (*Chonophorus*) *banana* (Atlantic)	49 - 68 (83)	53 - 63 (76)
A. (*Chonophorus*) *banana* (Pacific)	50 - 60 (54)	50 - 55 (46)
A. (*Chonophorus*) *lateristriga*	46 - 55 (40)	50 - 53 (30)
A. (*Chonophorus*) *tajasica*	34 - 58 (121)	37 - 41 (39) and 48 - 55 (48)

Table 37 – Scale counts in longitudinal series of the examined type specimen.

Longitudinal series of the examined type specimen	
Exemplar	Longitudinal
MNHN A- 1265 (lectotype) *Gobius banana*	54
MNHN A- 1359 (paralectotype) *Gobius banana*	56
MNHN A-1266 (syntype) *Gobius martinicus*	56
MCZ 31220 (holotype) *Chonophorus contractus*	58
MCZ 13330 (syntype) *Chonophorus bucculentus*	55
MCZ 13380 (syntype) *Chonophorus bucculentus*	56
NMNH 4772 (syntype) *Chonophorus bucculentus*	54
NHM 1856.4.17.41 (syntype) *Gobius mexicanus*	64
NHM 1856.4.17.42 (syntype) *Gobius mexicanus*	66
NHM 1860.6.16.135 (syntype) *Awaous transandeanus*	54
NHM 1860.6.16.136 (syntype) *Awaous transandeanus*	52
NMNH 48836 (holotype) *Awaous nelsoni*	51
NHM 1860.6.16.133 (syntype) *Gobius* (*Awaous*) *guentheri*	53
NHM 1860.6.16.134 (syntype) *Gobius* (*Awaous*) *guentheri*	52

Longitudinal series of the examined type specimen	
Exemplar	Longitudinal
MNHN- 6228-1 (lectotype) *Gobius lateristriga*	53
MNHN- 1996-301 (paralectotype) *Gobius lateristriga*	50
ANSP 84175 (neotype) *Gobius tajasica*	49
NHM 1862.11.23.42 (holotype) *Euctenogobius latus*	45
MNRJ 6196 (holotype) *Suiboga travassosi*	49

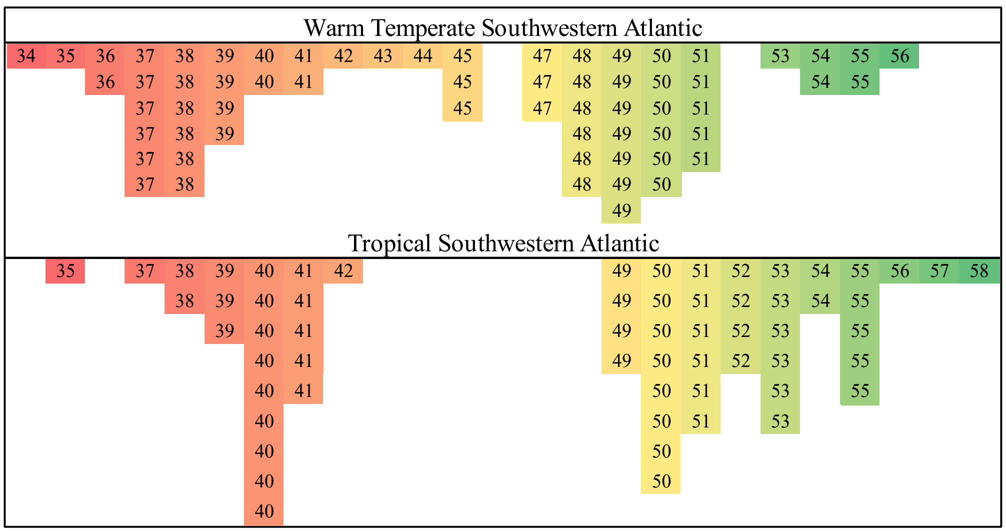

Figure 30 – Scale counts in the longitudinal series in *Awaous* (*Chonophorus*) *tajasica* comparing individuals collected in both biogeographical provinces (*sensu* SPALDING *et al*., 2007) cited before.

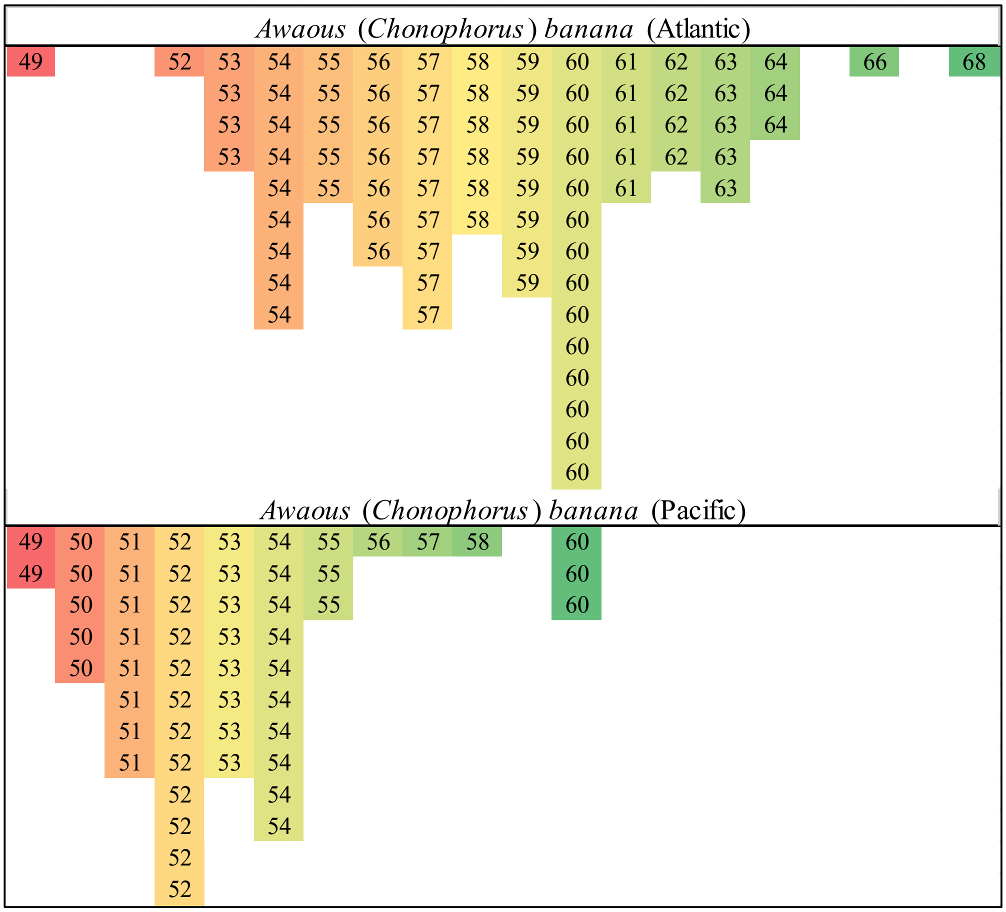

Figure 31 – Scale counts in the longitudinal series of *Awaous* (*Chonophorus*) *banana* collected in the Atlantic and Pacific slopes.

1.4.6. Scale count in transversal series

Scale counts in transverse series are presented in **Table 38**.

Table 38 – Scale counts in transversal series. Values in bold diverge from the range presented by other species. Numbers in parenthesis represent the examined individuals.

Scale counts in transversal series		
Species	Range	Mode
A. (*Chonophorus*) *banana* (Atlantic)	16-28 (80)	**20-24 (67)**
A. (*Chonophorus*) *banana* (Pacific)	16-23 (48)	17-20 (41)

Scale counts in transversal series		
Species	Range	Mode
A. (*Chonophorus*) *lateristriga*	15-22 (38)	17-19 (35)
A. (*Chonophorus*) *tajasica*	13-19 (129)	14-18 (122)

Table 39 – Scale count in transverse series of the examined type specimens. Values in bold diverge from other *Awaous* (*Chonophorus*) species.

Scale count in transversal series of type specimens	
Exemplar	Transversal
MNHN A- 1265 (lectotype) *Gobius banana*	23
MNHN A- 1359 (paralectotype) *Gobius banana*	20
MNHN A-1266 (syntype) *Gobius martinicus*	21
MCZ 31220 (holotype) *Chonophorus contractus*	22
MCZ 13330 (syntype) *Chonophorus bucculentus*	**24**
MCZ 13380 (syntype) *Chonophorus bucculentus*	20
NMNH 4772 (syntype) *Chonophorus bucculentus*	22
NHM 1856.4.17.41 (syntype) *Gobius mexicanus*	**26**
NHM 1856.4.17.42 (syntype) *Gobius mexicanus*	**26**
NHM 1860.6.16.135 (syntype) *Awaous transandeanus*	20
NHM 1860.6.16.136 (syntype) *Awaous transandeanus*	18
NMNH 48836 (holotype) *Awaous nelsoni*	20
NHM 1860.6.16.133 (syntype) *Gobius* (*Awaous*) *guentheri*	19
NHM 1860.6.16.134 (syntype) *Gobius* (*Awaous*) *guentheri*	19
MNHN- 6228-1 (lectotype) *Gobius lateristriga*	17
MNHN- 1996-301 (paralectotype) *Gobius lateristriga*	16
ANSP 84175 (neotype) *Gobius tajasica*	18
NHM 1862.11.23.42 (holotype) *Euctenogobius latus*	19
MNRJ 6196 (holotype) *Suiboga travassosi*	19

Awaous (*Chonophorus*) *banana* (Atlantic)

16	17	18		20	21	22	23	24	25	26		28
	17			20	21	22	23	24	25	26		
	17			20	21	22	23	24	25	26		
				20	21	22	23	24				
				20	21	22	23	24				
				20	21	22	23	24				
				20	21	22	23	24				
				20	21	22	23	24				
				20	21	22	23	24				
				20	21		23	24				
				20	21		23					
				20	21		23					
				20	21		23					
					21		23					
					21		23					
							23					
							23					
							23					
							23					
							23					
							23					

Awaous (*Chonophorus*) *banana* (Pacific)

16	17	18	19	20	21	22	23
16	17	18	19	20		22	23
	17	18	19	20			
	17	18	19	20			
	17	18	19	20			
	17	18	19				
	17	18	19				
	17	18					
	17	18					
	17	18					
	17	18					
	17	18					
		18					
		18					
		18					
		18					
		18					

Figure 32 – Comparative analysis of scale counts in transversal series of *Awaous* (*Chonophorus*) *banana* occurring in the Atlantic and Pacific slopes.

1.4.7. Chest region scales

The scale pattern in the chest region is presented in **Table 40**. Values in bold will be discussed in details.

Table 40 – Scale pattern in chest region. Numbers in parenthesis represent the examined individuals.

Scale pattern in chest region			
Species	Naked	Partially scaled	Fully scaled
Awaous (*Chonophorus*) *banana* (Atlantic)	24% (17)	9% (6)	**67%** (47)
Awaous (*Chonophorus*) *banana* (Pacific)	28% (9)		**72%** (23)
Awaous (*Chonophorus*) *lateristriga*	**77%** (30)		23% (9)
Awaous (*Chonophorus*) *tajasica*	**76%** (79)	14% (15)	10% (10)

Table 41 – Scale pattern in chest region of the type specimens examined.

Scale pattern in chest region in the type specimens	
Exemplar	chest
MNHN A- 1265 (lectotype) *Gobius banana*	Fully scaled
MNHN A- 1359 (paralectotype) *Gobius banana*	Fully scaled
MNHN A-1266 (syntype) *Gobius martinicus*	Fully scaled
MCZ 31220 (holotype) *Chonophorus contractus*	Fully scaled
MCZ 13330 (syntype) *Chonophorus bucculentus*	Fully scaled
MCZ 13380 (syntype) *Chonophorus bucculentus*	Fully scaled
NMNH 4772 (syntype) *Chonophorus bucculentus*	Fully scaled
NHM 1856.4.17.41 (syntype) *Gobius mexicanus*	Fully scaled
NHM 1856.4.17.42 (syntype) *Gobius mexicanus*	Fully scaled
NHM 1860.6.16.135 (syntype) *Awaous transandeanus*	Fully scaled
NHM 1860.6.16.136 (syntype) *Awaous transandeanus*	Fully scaled
NMNH 48836 (holotype) *Awaous nelsoni*	Fully scaled
NHM 1860.6.16.133 (syntype) *Gobius* (*Awaous*) *guentheri*	Fully scaled
NHM 1860.6.16.134 (syntype) *Gobius* (*Awaous*) *guentheri*	Fully scaled

Scale pattern in chest region in the type specimens	
Exemplar	chest
MNHN- 6228-1 (lectotype) *Gobius lateristriga*	Partially scaled
MNHN- 1996-301 (paralectotype) *Gobius lateristriga*	Naked
ANSP 84175 (neotype) *Gobius tajasica*	Naked
NHM 1862.11.23.42 (holotype) *Euctenogobius latus*	Partially scaled
MNRJ 6196 (holotype) *Suiboga travassosi*	Naked

1.4.8. Pre-dorsal region scales

The scale pattern in the pre-dorsal region presented a high variation in the examined individuals, the results are presented in **Table 42**.

Table 42 – Scale pattern in the pre-dorsal region of *Awaous* (*Chonophorus*). Numbers in parenthesis represent the examined individuals. C: complete median region; I: interrupted median region e N: naked median region.

Pre-dorsal region						
Species	Poorly scaled			Partially scaled	Fully scaled	
	Complete	I	N		C	I
A. (*Chonophorus*) *banana* (Atlantic)	6% (4)		2% (1)	2% (1)	71% (46)	20% (13)
A. (*Chonophorus*) *banana* (Pacific)	6% (3)				80% (41)	14% (7)
A. (*Chonophorus*) *lateristriga*	33% (12)				56% (20)	11% (4)
A. (*Chonophorus*) *tajasica*	17% (18)	11% (11)	13 % (13)	4% (4)	41% (42)	15 % (15)

Table 43 – Scale pattern in chest region of the type specimens examined.

Scale pattern in the pre-dorsal region of type specimens	
Exemplar	Pre-dorsal
MNHN A- 1265 (lectotype) *Gobius banana*	Fully scaled
MNHN A- 1359 (paralectotype) *Gobius banana*	Fully scaled
MNHN A-1266 (syntype) *Gobius martinicus*	Fully scaled
MCZ 31220 (holotype) *Chonophorus contractus*	Fully scaled

Scale pattern in the pre-dorsal region of type specimens	
Exemplar	Pre-dorsal
MCZ 13330 (syntype) *Chonophorus bucculentus*	Fully scaled
MCZ 13380 (syntype) *Chonophorus bucculentus*	Fully scaled
NMNH 4772 (syntype) *Chonophorus bucculentus*	Fully scaled
NHM 1856.4.17.41 (syntype) *Gobius mexicanus*	Fully scaled
NHM 1856.4.17.42 (syntype) *Gobius mexicanus*	Fully scaled
NHM 1860.6.16.135 (syntype) *Awaous transandeanus*	Fully scaled
NHM 1860.6.16.136 (syntype) *Awaous transandeanus*	Fully scaled
NMNH 48836 (holotype) *Awaous nelsoni*	Fully scaled
NHM 1860.6.16.133 (syntype) *Gobius* (*Awaous*) *guentheri*	Fully scaled
NHM 1860.6.16.134 (syntype) *Gobius* (*Awaous*) *guentheri*	Fully scaled
MNHN- 6228-1 (lectotype) *Gobius lateristriga*	Fully scaled
MNHN- 1996-301 (paralectotype) *Gobius lateristriga*	Fully scaled
ANSP 84175 (neotype) *Gobius tajasica*	Fully scaled
NHM 1862.11.23.42 (holotype) *Euctenogobius latus*	Fully scaled
MNRJ 6196 (holotype) *Suiboga travassosi*	Inconclusive

1.4.9. Pectoral fin base scales

Some of the analyzed type specimens have the base of the pectoral fin covered with scales. Thus, an investigation of the scale pattern in this region was performed. Results can be seen in **Table 44** and **45**.

Table 44 – Scales in the base of pectoral fin of *Awaous* (*Chonophorus*). Numbers in parenthesis represent the examined individuals.

Base of pectoral fin		
Species	Naked	Fully scaled
Awaous (*Chonophorus*) *banana* (Atlantic)	74% (52)	**26% (18)**
Awaous (*Chonophorus*) *banana* (Pacific)	97% (30)	3% (1)
Awaous (*Chonophorus*) *lateristriga*	100% (41)	
Awaous (*Chonophorus*) *tajasica*	98% (107)	2% (2)

Table 45 – Scale pattern in the base of pectoral fin of examined type specimens. Values in bold diverge from expected.

Base of pectoral fin of type specimens	
Exemplar	Scales
MNHN A- 1265 (lectotype) *Gobius banana*	Absent
MNHN A- 1359 (paralectotype) *Gobius banana*	Absent
MNHN A-1266 (syntype) *Gobius martinicus*	**Present**
MCZ 31220 (holotype) *Chonophorus contractus*	**Present**
MCZ 13330 (syntype) *Chonophorus bucculentus*	**Present**
MCZ 13380 (syntype) *Chonophorus bucculentus*	**Present**
NMNH 4772 (syntype) *Chonophorus bucculentus*	**Present**
NHM 1856.4.17.41 (syntype) *Gobius mexicanus*	**Present**
NHM 1856.4.17.42 (syntype) *Gobius mexicanus*	**Present**
NHM 1860.6.16.135 (syntype) *Awaous transandeanus*	**Present**
NHM 1860.6.16.136 (syntype) *Awaous transandeanus*	Absent
NMNH 48836 (holotype) *Awaous nelsoni*	**Present**
NHM 1860.6.16.133 (syntype) *Gobius* (*Awaous*) *guentheri*	Absent
NHM 1860.6.16.134 (syntype) *Gobius* (*Awaous*) *guentheri*	Absent
MNHN- 6228-1 (lectotype) *Gobius lateristriga*	Absent
MNHN- 1996-301 (paralectotype) *Gobius lateristriga*	Absent
ANSP 84175 (neotype) *Gobius tajasica*	Absent
NHM 1862.11.23.42 (holotype) *Euctenogobius latus*	Absent

Base of pectoral fin of type specimens	
Exemplar	Scales
MNRJ 6196 (holotype) *Suiboga travassosi*	Absent

1.4.10. Oral papillae

Papillae in the post-dental membrane, basihyal, vomer, cheeks and gills present the same abundance and morphology in all examined exemplars. On the other hand, papillae in the parasphenoid region presented a variation in the morphology, abundance and disposition in *Awaous* (*Chonophorus*), results are presented in **Table 46** and **47**. Papillae in the posterior region of the palate were always conic in all analyzed individuals, thus, in this region, only the abundance and presence of ramification were examined. Results are presented in **Table 48**. An analysis of the correlation between papillae in both regions were conducted (*e.g.* exemplars with branched papillae in the parasphenoid region presenting always branched papillae in the posterior region of the palate), but no correlation was found.

Table 46 – Abundance of the papillae in the parasphenoid region of *Awaous* (*Chonophorus*). Numbers in parenthesis represent the examined individuals.

Abundance of the papillae in the parasphenoid region			
Species	Abundant	Sparse	Absent
A. (*Chonophorus*) *banana* (Atlantic)	16% (10)	**76% (48)**	8% (5)
A. (*Chonophorus*) *banana* (Pacific)	21% (11)	**71% (37)**	8% (4)
A. (*Chonophorus*) *lateristriga*	36% (13)	**58% (21)**	7% (2)
A. (*Chonophorus*) *tajasica*	**56% (58)**	42% (43)	2% (2)

Table 47 – Abundance of the papillae in the parasphenoid region of examined type specimens. Values in bold diverge from expected.

Abundance of papillae in the parasphenoid region	
Exemplar	Papillae
MNHN A- 1265 (lectotype) *Gobius banana*	**Absent**
MNHN A- 1359 (paralectotype) *Gobius banana*	**Absent**
MNHN A-1266 (syntype) *Gobius martinicus*	**Abundant**
MCZ 31220 (holotype) *Chonophorus contractus*	Sparse
MCZ 13330 (syntype) *Chonophorus bucculentus*	**Abundant**
MCZ 13380 (syntype) *Chonophorus bucculentus*	Sparse
NMNH 4772 (syntype) *Chonophorus bucculentus*	Sparse
NHM 1856.4.17.41 (syntype) *Gobius mexicanus*	Sparse
NHM 1856.4.17.42 (syntype) *Gobius mexicanus*	Sparse
NHM 1860.6.16.135 (syntype) *Awaous transandeanus*	Sparse
NHM 1860.6.16.136 (syntype) *Awaous transandeanus*	Sparse
NMNH 48836 (holotype) *Awaous nelsoni*	**Absent**
NHM 1860.6.16.133 (syntype) *Gobius* (*Awaous*) *guentheri*	**Absent**
NHM 1860.6.16.134 (syntype) *Gobius* (*Awaous*) *guentheri*	Sparse
MNHN- 6228-1 (lectotype) *Gobius lateristriga*	**Abundant**
MNHN- 1996-301 (paralectotype) *Gobius lateristriga*	**Abundant**
ANSP 84175 (neotype) *Gobius tajasica*	Abundant
NHM 1862.11.23.42 (holotype) *Euctenogobius latus*	Sparse
MNRJ 6196 (holotype) *Suiboga travassosi*	Sparse

Table 48 – Disposition, morphology and ramification of papillae in the parasphenoid region of *Awaous* (*Chonophorus*). Numbers in parenthesis represent the examined individuals.

Papillae in parasphenoid region						
Species	lines		Morphology		Ramification	
	One	Several	Digitiform	Conical	Single	Branched
A. (*Chonophorus*) *banana* (Atlantic)	83% (45)	17% (9)	**32%** (18)	68% (38)	64% (36)	36% (20)
A. (*Chonophorus*) *banana* (Pacific)	91% (43)	9% (4)	**38%** (18)	62% (29)	68% (32)	32% (15)
A. (*Chonophorus*) *lateristriga*	100% (30)			100% (30)	63% (19)	37% (11)
A. (*Chonophorus*) *tajasica*	83% (85)	17% (17)	6% (6)	94% (90)	66% (64)	34% (33)

Table 49 – Disposition, morphology and ramification of papillae in the parasphenoid region of type specimens. Values in bold diverge from expected.

Papillae in parasphenoid region			
Exemplar	Lines	Morphology	Ramification
MNHN A- 1265 (lectotype) *Gobius banana*	**Absent**	Inapplicable	Inapplicable
MNHN A- 1359 (paralectotype) *Gobius banana*	**Absent**	Inapplicable	Inapplicable
MNHN A-1266 (syntype) *Gobius martinicus*	**Two lines**	Conic	Single
MCZ 31220 (holotype) *Chonophorus contractus*	One line	Conic	Single
MCZ 13330 (syntype) *Chonophorus bucculentus*	One line	Conic	Single
MCZ 13380 (syntype) *Chonophorus bucculentus*	One line	Conic	Single
NMNH 4772 (syntype) *Chonophorus bucculentus*	One line	Conic	Single
NHM 1856.4.17.41 (syntype) *Gobius mexicanus*	Inconclusive	Conic	Single
NHM 1856.4.17.42 (syntype) *Gobius mexicanus*	Inconclusive	Conic	Single
NHM 1860.6.16.135 (syntype) *Awaous transandeanus*	Inconclusive	Conic	Single
NHM 1860.6.16.136 (syntype) *Awaous transandeanus*	Inconclusive	Conic	Single
NMNH 48836 (holotype) *Awaous nelsoni*	**Absent**	Inapplicable	Inapplicable
NHM 1860.6.16.133 (syntype) *Gobius* (*Awaous*) *guentheri*	**Absent**	Inapplicable	Inapplicable
NHM 1860.6.16.134 (syntype) *Gobius* (*Awaous*) *guentheri*	One line	Conic	Single

Papillae in parasphenoid region			
Exemplar	Lines	Morphology	Ramification
MNHN- 6228-1 (lectotype) *Gobius lateristriga*	One line	Conic	**Branched**
MNHN- 1996-301 (paralectotype) *Gobius lateristriga*	One line	Conic	Single
ANSP 84175 (neotype) *Gobius tajasica*	One line	Conic	**Branched**
NHM 1862.11.23.42 (holotype) *Euctenogobius latus*	**Two lines**	Conic	**Branched**
MNRJ 6196 (holotype) *Suiboga travassosi*	One line	Conic	Single

Table 50 – Abundance and ramification of papillae in the posterior region of the palate in *Awaous* (*Chonophorus*). Numbers in parenthesis represent the examined individuals.

Papillae in the posterior region of the palate					
Species	Abundance		Ramification		Absent
	Abundant	Sparse	Branched	Single	
A. (*Chonophorus*) *banana* (Atlantic)	28% (10)	**72%** (26)	**86%** (31)	14% (5)	7% (3)
A. (*Chonophorus*) *banana* (Pacific)	17% (5)	**83% (24)**	**75% (21)**	25% (7)	7% (2)
A. (*Chonophorus*) *lateristriga*	32% (10)	**68%** (21)	25% (7)	**75%** (21)	7% (2)
A. (*Chonophorus*) *tajasica*	**89%** (85)	11% (10)	**92%** (71)	8% (6)	2% (2)

Table 51 – Abundance and ramification of papillae in the posterior region of the palate in examined type specimens.

Papillae in the posterior region of the palate		
Exemplar	Abundance	Ramification
MNHN A- 1265 (lectotype) *Gobius banana*	**Absent**	**Absent**
MNHN A- 1359 (paralectotype) *Gobius banana*	**Absent**	**Absent**
MNHN A-1266 (syntype) *Gobius martinicus*	Sparse	Branched
MCZ 31220 (holotype) *Chonophorus contractus*	Sparse	Branched
MCZ 13330 (syntype) *Chonophorus bucculentus*	Sparse	Branched
MCZ 13380 (syntype) *Chonophorus bucculentus*	Sparse	Branched
NMNH 4772 (syntype) *Chonophorus bucculentus*	Sparse	Branched
NHM 1856.4.17.41 (syntype) *Gobius mexicanus*	Sparse	Branched
NHM 1856.4.17.42 (syntype) *Gobius mexicanus*	Sparse	Branched
NHM 1860.6.16.135 (syntype) *Awaous transandeanus*	Sparse	Branched
NHM 1860.6.16.136 (syntype) *Awaous transandeanus*	Sparse	Branched
NMNH 48836 (holotype) *Awaous nelsoni*	**Absent**	**Absent**
NHM 1860.6.16.133 (syntype) *Gobius* (*Awaous*) *guentheri*	Sparse	Branched
NHM 1860.6.16.134 (syntype) *Gobius* (*Awaous*) *guentheri*	Sparse	Branched

Papillae in the posterior region of the palate		
Exemplar	Abundance	Ramification
MNHN- 6228-1 (lectotype) *Gobius lateristriga*	Sparse	Single
MNHN- 1996-301 (paralectotype) *Gobius lateristriga*	Sparse	Single
ANSP 84175 (neotype) *Gobius tajasica*	Abundant	Branched
NHM 1862.11.23.42 (holotype) *Euctenogobius latus*	Abundant	Branched
MNRJ 6196 (holotype) *Suiboga travassosi*	Sparse	Branched

1.4.11. Cephalic sensory system pores

The oculoscapular canal is considered complete between pores "H" and "K" in *Awaous* (*Chonophorus*) (WATSON, 1996). Despite some rare exceptions this condition is confirmed herein (**Table 52**) and (**Figure 33**).

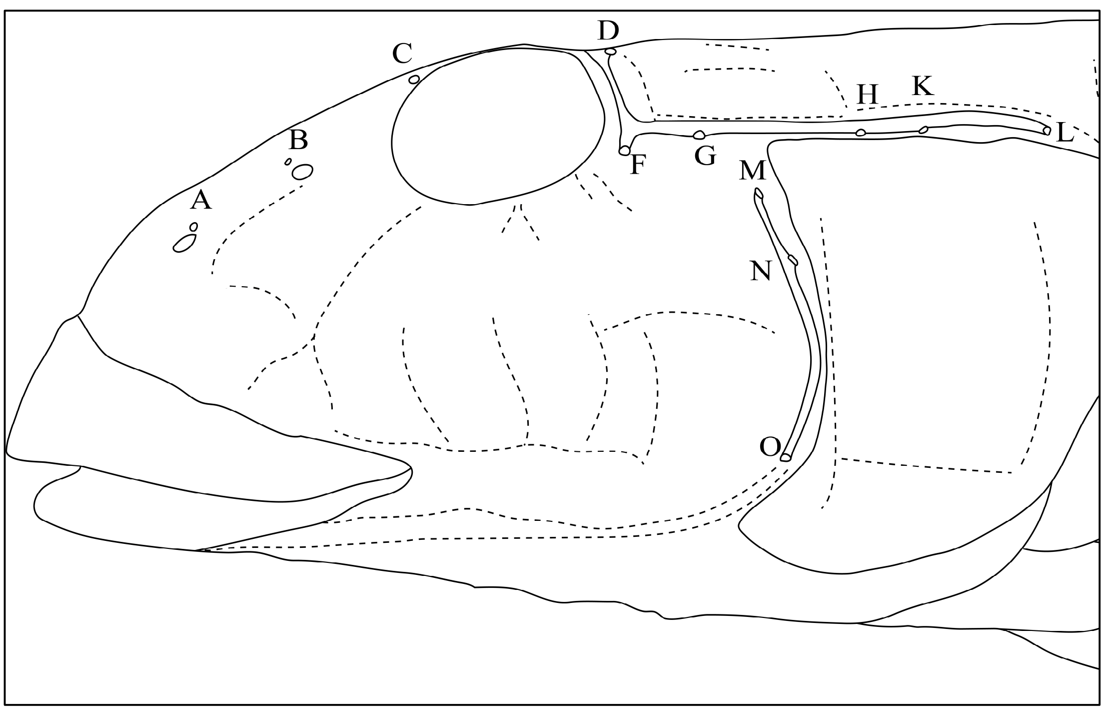

Figure 33 – *Awaous* (*Chonophorus*) *lateristriga* (**NMNH** 292655, 100.5 mm SL).

The presence of pore "J" was variable among *Awaous* (*Chonophorus*) species. The majority of individuals of *Awaous* (*Chonophorus*) *tajasica* and *A*. (*Chonophorus*) *lateristriga* presented this pore, having three pores in the posterior region of oculoscapular canal. In *Awaous* (*Chonophorus*) *banana* this pore was absent in half of the individuals collected in both slopes, resulting in two pores present in the posterior region of oculoscapular canal.

Table 52 – Pores in posterior region of the oculoscapular canal in *Awaous* (*Chonophorus*). Numbers in parenthesis represent the examined individuals.

Pores in posterior region of oculoscapular canal				
Species	Two pores	Three pores	Four pores	Interrupted canal
A. (*Chonophorus*) *banana* (Atlantic)	45% (30)	**50% (32)**	3% (2)	
A. (*Chonophorus*) *banana* (Pacific)	44% (22)	**52% (26)**	4% (2)	
A. (*Chonophorus*) *lateristriga*	**67 % (18)**	15% (4)		19% (5)
A. (*Chonophorus*) *tajasica*	**90% (46)**	10% (5)		

Table 53 – Pores in posterior region of the oculoscapular canal in examined type specimens.

Pores in posterior region of oculoscapular canal	
Exemplar	Observed state
MNHN A- 1265 (lectotype) *Gobius banana*	Two pores
MNHN A- 1359 (paralectotype) *Gobius banana*	Two pores
MNHN A-1266 (syntype) *Gobius martinicus*	Two pores
MCZ 31220 (holotype) *Chonophorus contractus*	Two pores
MCZ 13330 (syntype) *Chonophorus bucculentus*	Two pores
MCZ 13380 (syntype) *Chonophorus bucculentus*	Two pores

Pores in posterior region of oculoscapular canal	
Exemplar	Observed state
NMNH 4772 (syntype) *Chonophorus bucculentus*	Two pores
NHM 1856.4.17.41 (syntype) *Gobius mexicanus*	**Three pores**
NHM 1856.4.17.42 (syntype) *Gobius mexicanus*	**Three pores**
NHM 1860.6.16.135 (syntype) *Awaous transandeanus*	Two pores
NHM 1860.6.16.136 (syntype) *Awaous transandeanus*	Two pores
NMNH 48836 (holotype) *Awaous nelsoni*	Two pores
NHM 1860.6.16.133 (syntype) *Gobius* (*Awaous*) *guentheri*	**Three pores**
NHM 1860.6.16.134 (syntype) *Gobius* (*Awaous*) *guentheri*	Two pores
MNHN- 6228-1 (lectotype) *Gobius lateristriga*	Two pores
MNHN- 1996-301 (paralectotype) *Gobius lateristriga*	**Two pores**
ANSP 84175 (neotype) *Gobius tajasica*	**Two pores**
NHM 1862.11.23.42 (holotype) *Euctenogobius latus*	**Two pores**
MNRJ 6196 (holotype) *Suiboga travassosi*	**Inconclusive**

Awaous (*Chonophorus*) *lateristriga* and *Awaous* (*Chonophorus*) *tajasica* presented a single pore “F” of the oculoscapular canal, while in *Awaous* (*Chonophorus*) *banana* this pore is presented branched in individuals collected on both slopes (**Table 54**).

Table 54 – State of ramification of pore “F” in *Awaous* (*Chonophorus*). Numbers in parenthesis represent the examined individuals.

State of ramification of pore “F”		
Species	pore “F”	
	Single	Branched
Awaous (*Chonophorus*) *banana* (Atlantic)	7% (5)	**93%** (69)
Awaous (*Chonophorus*) *banana* (Pacific)	31% (17)	**69%** (37)
Awaous (*Chonophorus*) *lateristriga*	**90%** (27)	10% (3)
Awaous (*Chonophorus*) *tajasica*	**100%** (104)	

Table 55 – State of ramification of pore “F” in the examined type specimens. Values in bold diverge from expected.

State of ramification of pore “F”	
Exemplar	Pore “F”
MNHN A- 1265 (lectotype) *Gobius banana*	Branched
MNHN A- 1359 (paralectotype) *Gobius banana*	Branched
MNHN A-1266 (syntype) *Gobius martinicus*	**Single (right side)**
MCZ 31220 (holotype) *Chonophorus contractus*	Branched
MCZ 13330 (syntype) *Chonophorus bucculentus*	Branched
MCZ 13380 (syntype) *Chonophorus bucculentus*	Branched
NMNH 4772 (syntype) *Chonophorus bucculentus*	Branched
NHM 1856.4.17.41 (syntype) *Gobius mexicanus*	Branched
NHM 1856.4.17.42 (syntype) *Gobius mexicanus*	Branched
NHM 1860.6.16.135 (syntype) *Awaous transandeanus*	Branched

State of ramification of pore “F”	
Exemplar	Pore “F”
NHM 1860.6.16.136 (syntype) *Awaous transandeanus*	Branched
NMNH 48836 (holotype) *Awaous nelsoni*	Branched
NHM 1860.6.16.133 (syntype) *Gobius* (*Awaous*) *guentheri*	Branched
NHM 1860.6.16.134 (syntype) *Gobius* (*Awaous*) *guentheri*	Branched
MNHN- 6228-1 (lectotype) *Gobius lateristriga*	Single
MNHN- 1996-301 (paralectotype) *Gobius lateristriga*	Single
ANSP 84175 (neotype) *Gobius tajasica*	Single
NHM 1862.11.23.42 (holotype) *Euctenogobius latus*	Single
MNRJ 6196 (holotype) *Suiboga travassosi*	Single

1.4.12. Superficial neuromast lines

To understand the homology of the superficial neuromast lines it is necessary to clarify the relationships between the lines and the nerves associated with them. In addition, a comparative analysis encompassing the lines and nerves throughout the lineages of Gobioidei can support homology statements.

Currently Rhyacichthyidae is considered the basal family within Gobioidei (MILLER, 1973). A recent work demonstrated that *Rhyacichthys*, member of this family, presents only lines *b* and *d* (*sensu* SANZO, 1911) (ASAOKA *et. al*, 2014).

Wongrat and Miller (1991) performed a description of the innervation pattern in exemplars of Odontobutidae, Butidae and Eleotridae finding an interesting associated pattern between lines and nerves. However, they decided to keep the established Sanzo (1911) nomenclature. After that, Asaoka *et al*. (2011) described the innervation pattern in *Odontobutis obscurus* (Temminck & Schlegel, 1845), again without changing the nomenclature.

Both papers provide interesting information concerning the homology of the lines, particularly helping in the understanding of the homology between transverse and longitudinal lines, neglected in the currently nomenclature. The knowledge obtained by these anatomical works were used to better represent the homology of the lines. Thus, herein, the nomenclature of Sanzo (1911) was adopted, with some necessary small adjustments, explained below.

In the following text, the region closest to the origin of the nerve is treated as **branch**, the intermediary region is treated as **portion** and the most distal region is called **segment**. Since Odontobutidae also figures in the base of ramification of Gobioidei, *Odontobutis obscurus* was taken as a starting point to understand of the homology of the lines.

A closer look in the innervation pattern of *Odontobutis obscurus* reveals that the *line a* (*sensu* SANZO, 1911) is actually innervated by two different branches of the buccal ramus. The **anterior region** of the *line a* is innervated by the **anterior segment** of the **posterior portion** of the **second branch** of the buccal ramus of trigeminus nerve, while the **posterior region** is innervated by the **third branch** of the buccal ramus of trigeminus nerve. Thus, the **anterior region** of *line a* (*sensu* SANZO, 1911) will be treated as a_2, since *line a1* already figures in the current nomenclature.

In conclusion, the adopted nomenclature considers the *line a* as the one innervated by the **third branch** of the buccal ramus of trigeminus nerve, *line a1* innervated by **posterior segment** of the **posterior portion** of the **second branch** of the buccal ramus of trigeminus nerve and a_2 line innervated by the **anterior segment** of the **posterior portion** of the **second branch** of the buccal ramus of trigeminus nerve (**Figure 34** and **35**).

The *line c* is innervated by three different portions. The portions were called c_3, c_4 and c_5 following the antero-posterior orientation. Lines c_1 and c_2 already figure in the Sanzo (1911) nomenclature. *Line c3* is associated with the **anterior segment** of the **posterior portion** of the **first branch** of the buccal ramus of trigeminus nerve, *line c4* is associated with the **posterior segment** of the **posterior portion** of the **first branch** of the buccal ramus of trigeminus nerve and c_5 is associated to the **anterior portion** of the **second branch** of the buccal ramus of trigeminus nerve (**Figure 34** and **35**).

The pattern observed in *Odontobutis obscurus* was then compared to that observed in *Perccottus glenii* Dybowski, 1877, another representative of Odontobutidae (WONGRAT; MILLER, 1991). In this species the differentiation between a_1 and a_2 lines was not possible (**Figures 36** and **37**).

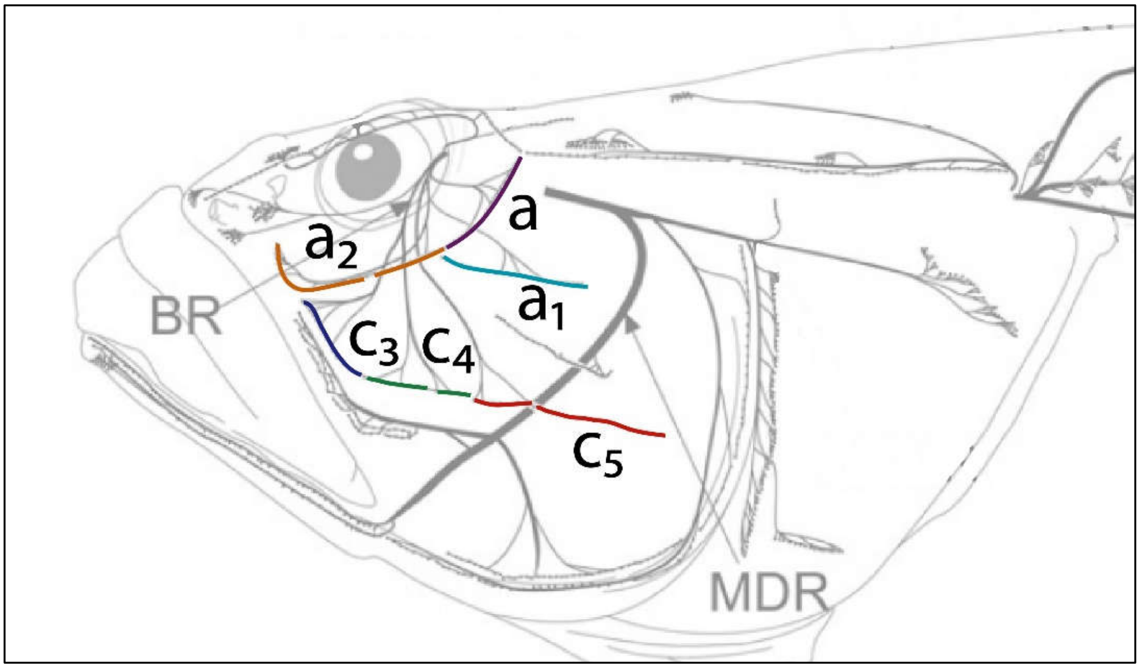

Figure 34 – Disposition of the superficial neuromast lines and the nerves in *Odontobutis obscurus* adapted from Asaoka *et al* (2011). Lines in purple: *line a*, lines in light blue: *line* a_1, lines in orange: a_2 line, lines in dark blue: c_3, lines in green: c_4, lines in red: c_5. BR: buccal ramus of trigeminus nerve, MR: mandibular ramus of trigeminus nerve.

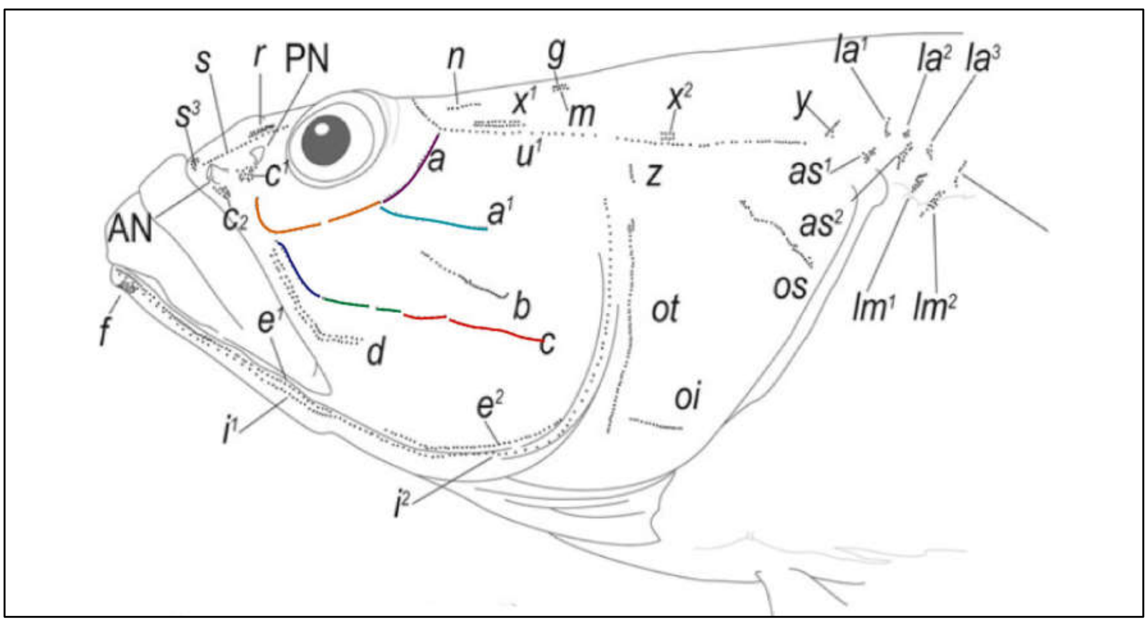

Figure 35 – Disposition of the superficial neuromast lines in *Odontobutis obscurus* adapted from Asaoka *et al* (2011). Lines in purple: *line a*, lines in light blue: *line* a_1, lines in orange: a_2 line, lines in dark blue: c_3, lines in green: c_4, lines in red: c_5. AN: anterior nasal opening, PN: posterior nasal opening. Other letters represent the nomenclature proposed by Sanzo (1911).

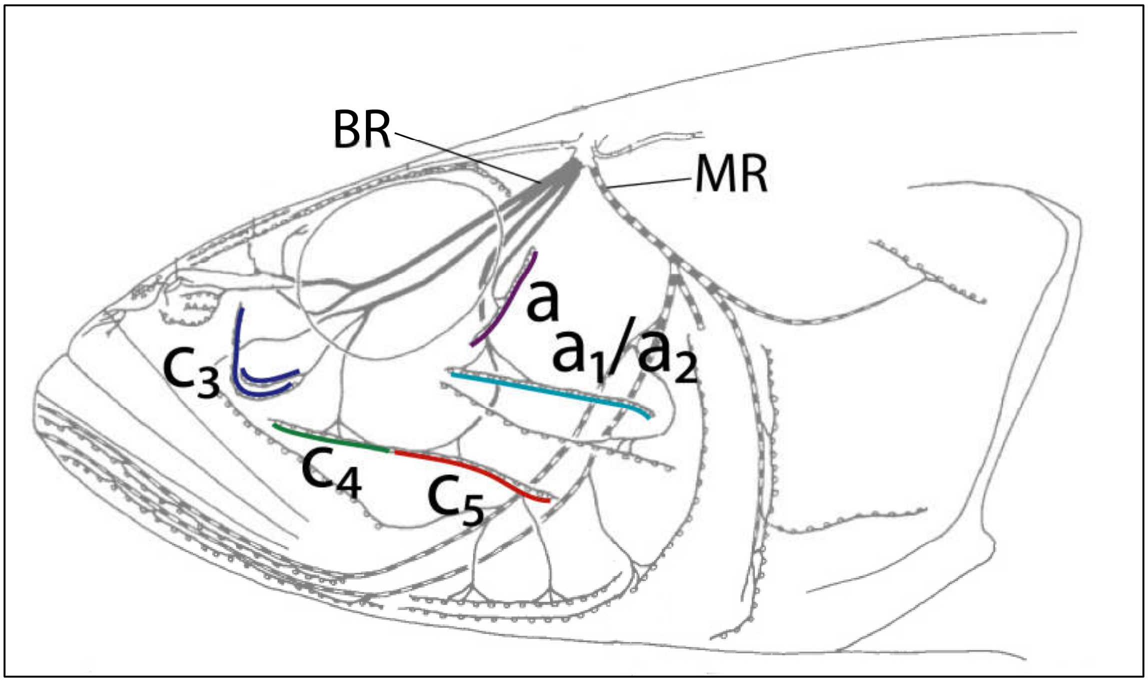

Figure 36 – Disposition of the superficial neuromast lines and the nerves in *Perccottus glenii* adapted from Wongrat and Miller (1991). Lines in purple: *line a*, lines in light blue: *line* a_1, lines in orange: a_2 line, lines in dark blue: c_3, lines in green: c_4, lines in red: c_5. BR: buccal ramus of trigeminus nerve, MR: mandibular ramus of trigeminus nerve.

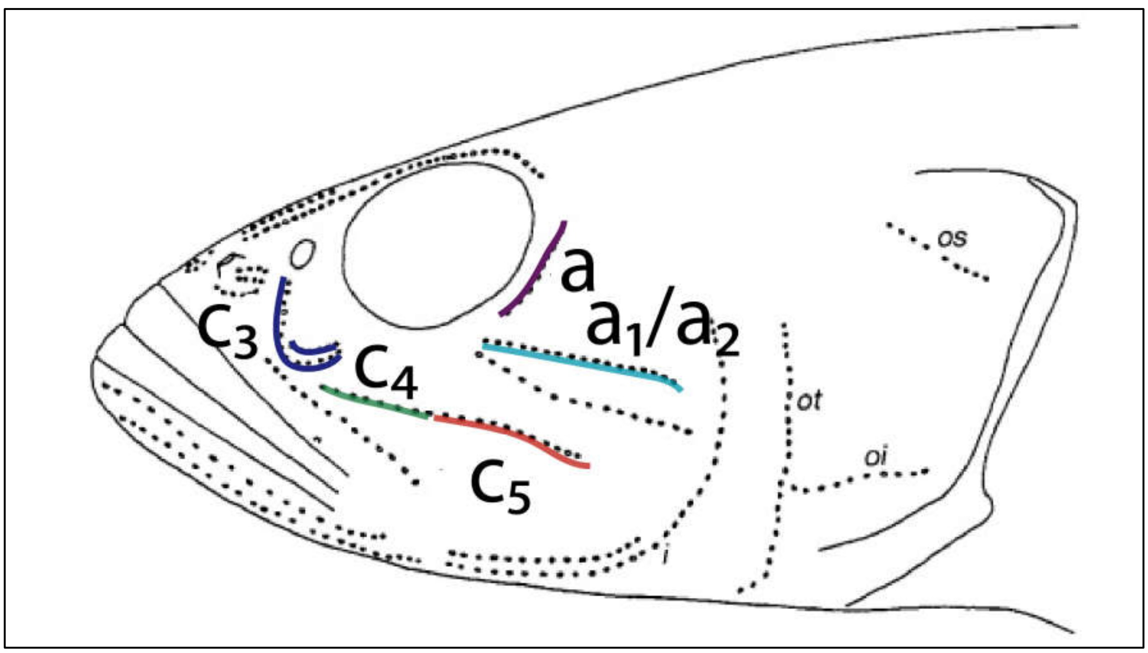

Figure 37 – Disposition of the superficial neuromast lines in *Perccottus glenii* adapted from Wongrat e Miller (1991). Lines in purple: *line a*, lines in light blue: *line* a_1, lines in orange: a_2 line, lines in dark blue: c_3, lines in green: c_4, lines in red: c_5. Other letters represent the nomenclature proposed by Sanzo (1911).

Lastly the pattern was applied to species of *Oxyeleotris* Bleeker, 1874 at in the base of diversification of Gobioidei (**Figures 38** and **39**).

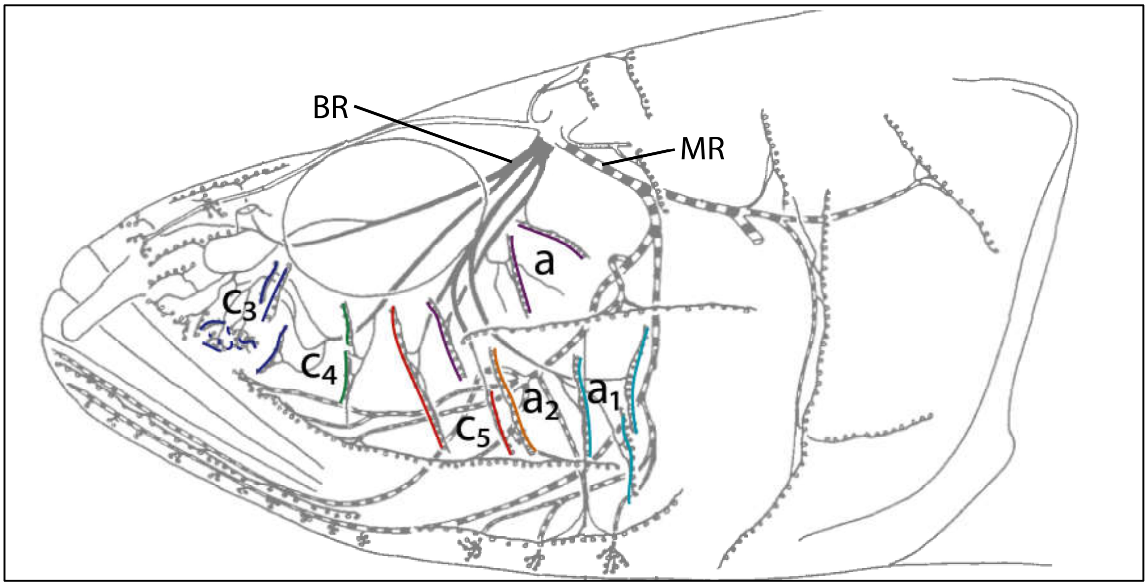

Figure 38 – Disposition of the superficial neuromast lines and the nerves in *Oxyeleotris marmorata* (Bleeker, 1852) adapted from Wongrat e Miller (1991). Lines in purple: *line a*, lines in light blue: *line* a_1, lines in orange: a_2 line, lines in dark blue: c_3, lines in green: c_4, lines in red: c_5. BR: buccal ramus of trigeminus nerve, MR: mandibular ramus of trigeminus nerve.

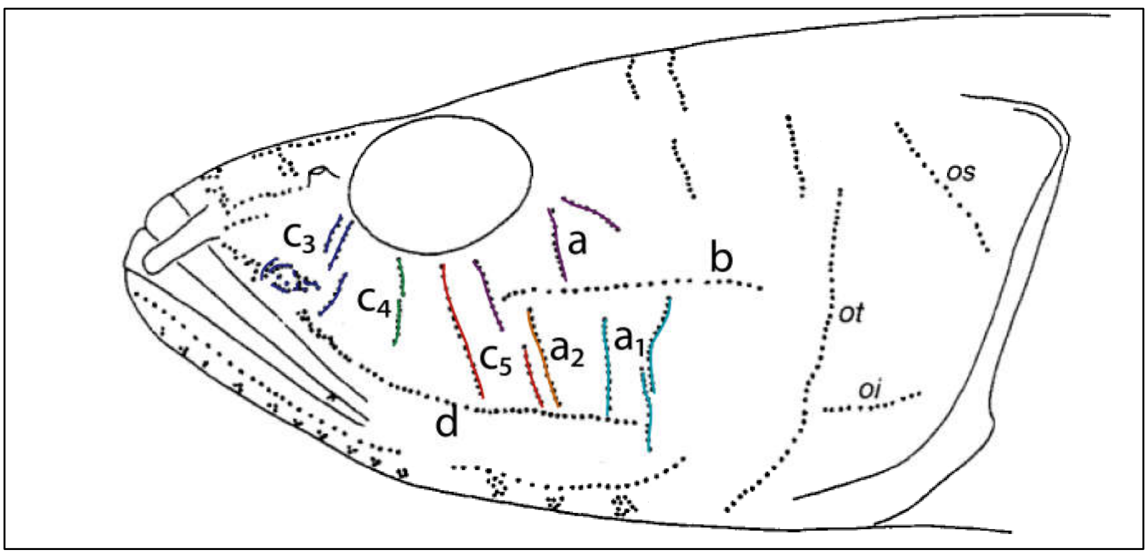

Figure 39 – Disposition of the superficial neuromast lines in *Oxyeleotris marmorata* (Bleeker, 1852) adapted from Wongrat e Miller (1991). Lines in purple: *line a*, lines in light blue: *line* a_1, lines in orange: a_2 line, lines in dark blue: c_3, lines in green: c_4, lines in red: c_5. Other letters represent the nomenclature proposed by Sanzo (1911).

An analysis of the correlation between lines and nerves in gobies and eleotrids is being prepared to determine if the pattern found here can be observed in these families. However, some exemplars of *Awaous* (*Chonophorus*) *tajasica* were prepared following the protocol for nerve staining developed by Esguícero and Bockmann (*in prep*.) and a preliminary analysis suggests that the pattern can be observed in gobiid species. The disposition of lines in *Awaous* (*Chonophorus*) *tajasica* can be observed above (**Figure 43**).

Exemplars of *Awaous* (*Chonophorus*) present a very conservative pattern in the disposition of superficial neuromasts lines, thus it was not possible to distinguish species based on the disposition of these lines.

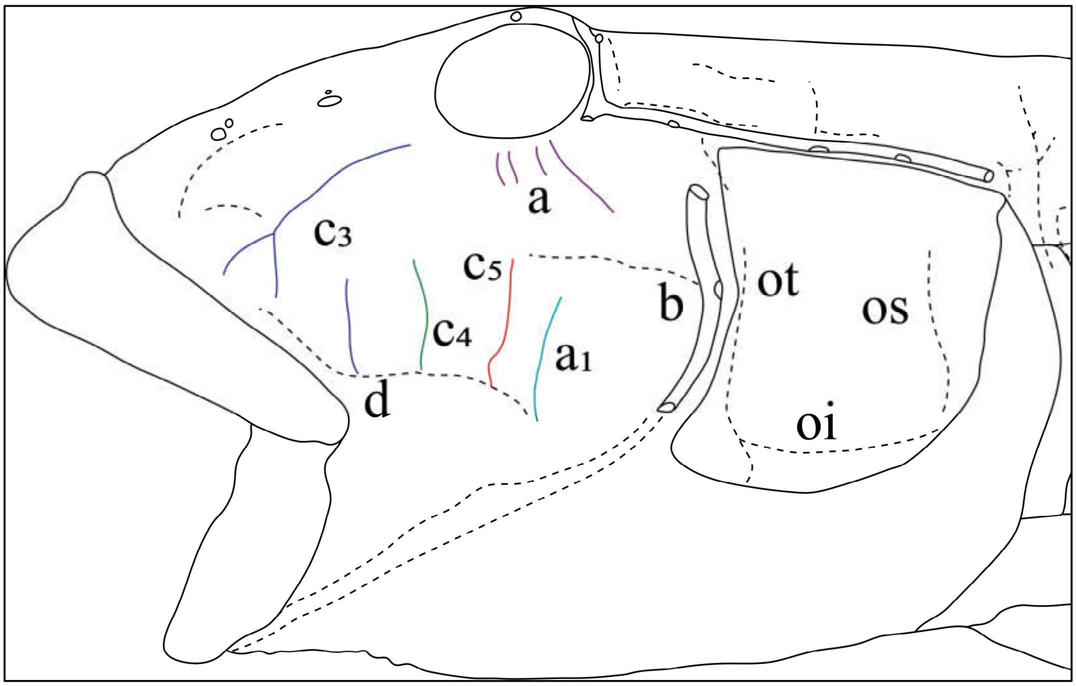

Figure 43 – Disposition of the superficial neuromast lines in *Awaous* (*Chonophorus*) *tajasica*, demonstrating the pattern observed in *Awaous* (*Chonophorus*) (**LIRP** 5745, 100.5 mm SL). Lines in purple: *line a*, lines in light blue: *line* a_1, lines in orange: a_2 line, lines in dark blue: c_3, lines in green: c_4, lines in red: c_5.

In spite of the extremely conservative pattern observed in *Awaous* (*Chonophorus*) there are some differences when compared to the pattern presented by Watson (1996: fig.7) (**Figure 44**).

In the illustration (**Figure 44**) the line *d* (*sensu* SANZO, 1991) is absent. The posterior portion of *line c3* is much more inclined anteriorly, *line c4* is segmented in several diagonal lines much more dorsally expanded, *line a1* is much more posterior. In addition, the *line a* has two anterior branches, not observed in the examined exemplars. Since the author did not identified the represented exemplar it is not possible to confront the image with the original specimen.

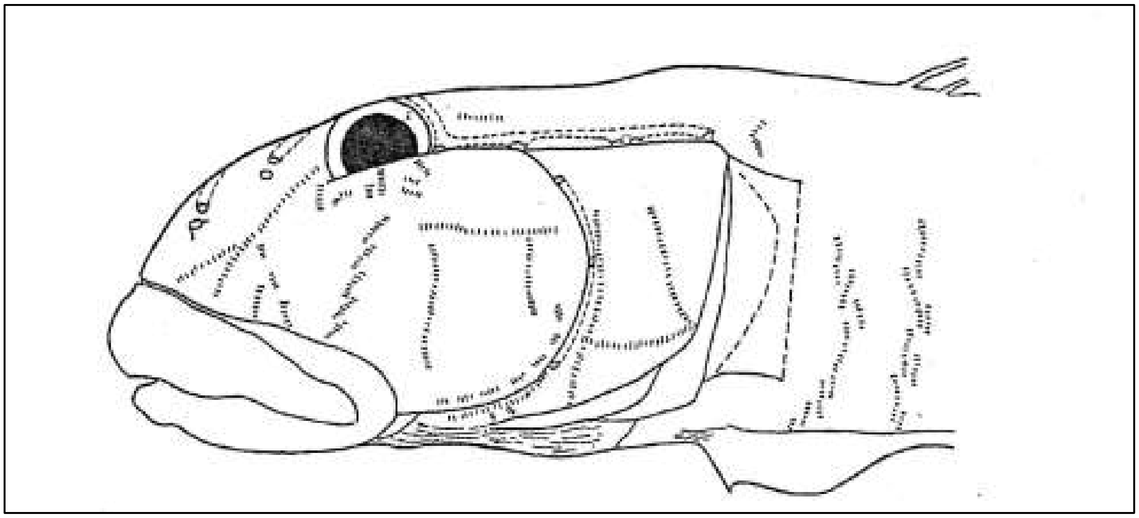

Figure 44 – Disposition of the superficial neuromast lines in *Awaous* (*Chonophorus*) *tajasica* (according to WATSON, 1996: p. 13, fig.7).

1.5. DISCUSSION

1.5.1. Morphometric data

An analysis of the morphometric data indicates that the body shape is extremely conservative in *Awaous* (*Chonophorus*). In spite of all additional measurements taken, the proportion of the measurements remain extremely similar in all examined species.

All exemplars of *Awaous* (*Chonophorus*) *banana* collected in the Atlantic slope belong to the same biogeographical province, thus a comparative analysis was not possible. Since exemplars collected in the Pacific slope belonged to different biogeographical provinces the comparative analysis was performed, however the measurements were extremely superposed making impossible to separate species. In addition, the measurements taken in exemplars occurring in the Atlantic and Pacific slope demonstrate a complete overlap, also making impossible the establishment of new species.

The comparative analysis between the biogeographical provinces in *Awaous* (*Chonophorus*) *tajasica* also revealed a complete overlap, not allowing differentiation of species. The preanal distance and second dorsal fin length in the examined *A*. (*Chonophorus*) *lateristriga* occurring in the biogeographical province of “Gulf of Guinea” diverge from other exemplars collected in the biogeographical province of “West African Transition”, however it is possible that this variation may be related to the poor sample allied with the small size of the analyzed exemplar collected in the “Gulf of Guinea” province.

The lectotype MNHN A- 1265 of *Gobius banana* presented the distance between the nares, preanal distance and second dorsal fin length diverging from the range observed in individuals of the same species. In addition, the paralectotype MNHN A- 1359 presented the pre-dorsal length, the inter-opercular distance, caudal peduncle height and first dorsal fin length also diverging from the expected. No other measurements diverged in those exemplars. It is relevant to say that both specimens are in a very poor state of conservation, the head shape was extremely affected by a degradation process throughout the years, especially in the paralectotype. As consequence, some measurements were not taken in the anterior region of both exemplars since it was impossible to establish reliable landmarks. Thus, the divergence in the measurements was considered an effect of the poor state of conservation of the exemplars.

Some measurement proportions of the exemplars of *Chonophorus bucculentus* diverge from the range found for *Awaous* (*Chonophorus*) *banana*, but the syntypes of this species present the largest standard length when compared to examined exemplars of *A*. (*Chonophorus*) *banana*, which it may explain the variation.

The syntype of *Gobius mexicanus* (NHM 1856.4.17.41) presented a larger ratio in total and standard length when compared to *Awaous* (*Chonophorus*) *banana*. However, all other morphological features of this specimen agreed with the species cited above. This difference was them considered a variation within *A*. (*Chonophorus*) *banana*.

Body and caudal peduncle depths diverge between the syntype NHM 1860.6.16.135 of *Awaous transandeanus* and the other specimens of *Awaous* (*Chonophorus*) *banana* analyzed. In addition, the total length, pre-anal distance, and caudal fin length varied between the syntype NHM 1860.6.16.136 of *Awaous transandeanus* and the other specimens of *Awaous* (*Chonophorus*) *banana* occurring in the Pacific slope. No measurements varied in both syntypes at the same time and other characteristics agreed with the pattern found in the specimens occurring in the Pacific Ocean. Thus, that divergence was considered a variation.

The syntype NHM 1860.6.16.133 of *Gobius guentheri* presented the pre-dorsal and mandibular lengths diverging from other specimens of *Awaous* (*Chonophorus*) *banana* collected in the pacific slope. Also, the body depth varied among specimens occurring in both slopes. In addition, proportions of the pre-dorsal distance and distance between pelvic fin spines varied between the syntype NHM 1860.6.16.134 of *Gobius guentheri* and the individuals of *Awaous* (*Chonophorus*) *banana* collected in the Pacific Ocean. No measurement proportions varied in both syntypes at the same time and the other characteristics agreed with the morphology found in other specimens of *Awaous* (*Chonophorus*) *banana* from the Pacific slope. Thus, such a divergence was also considered a variation.

The proportions of the orbital diameter and total length of the holotype of *Suiboga travassosi* MNRJ 6196 (**Table 29**) diverge from the range found for *A*. (*Chonophorus*) *tajasica* (**Table 24**). Furthermore, the proportions of the preanal distance and length of the second dorsal-fin of *Suiboga travassosi* diverge from the range found for *A*. (*Chonophorus*) *tajasica* occurring in the biogeographical province of "Tropical Southwestern Atlantic". In addition, the proportions of the distance between nares and the caudal peduncle depth of this specimen diverge from the range observed in the biogeographical province of the "Warm Temperate Southwestern Atlantic". This was the largest examined specimen. Besides, the eyes were found in a poor state of conservation, remaining almost completely sunken in the cranium. Furthermore, some body parts of this specimen were deformed during the fixation process, including the anterior portion of the head. Thus, the observed variation may be associated with the large size allied with the poor state of conservation of the holotype of *Suiboga travassosi*.

1.5.2. Meristic Data

Fin-ray counts were extremely conserved among *Awaous (Chonophorus)* species, showing almost complete overlapping so that no diagnostic character was extracted from these counts. Scale counts in dorsal margin, ventral margin and circum-peduncular region also presented a wide overlap in all examined specimens.

In spite of some overlap, the scale counts in longitudinal region was very informative. Specimens of *Awaous* (*Chonophorus*) *banana* collected in the Pacific slope presented less scales in the longitudinal region when compared to specimens collected in the Atlantic slope (**Table 35**).

The found range for *A*. (*Chonophorus*) *tajasica* presented two different curves (**Table 35**), which could indicate the presence of two distinct species. However, a comparative analysis of the scale counts in the different biogeographical provinces revealed two different ranges in both provinces, not indicating allopatric species. The morphology of all examined exemplars is extremely similar. In addition, the scale count in transversal series presented a huge overlap. Moreover, the scale count in the longitudinal series follow a different methodology, which could probably explain the results observed in *A*. (*Chonophorus*) *tajasica*. In face of this scenario the final decision was to consider the divergence in the scale count in the longitudinal region of *Awaous* (*Chonophorus*) *tajasica* as a variation of the species.

Scale count in the transversal region was also very informative. The range presented by *Awaous* (*Chonophorus*) *banana* collected in the Atlantic slope, in spite of a small overlap, diverge from all other examined specimens, including specimens of *Awaous* (*Chonophorus*) *banana* collected in the Pacific slope (**Table 37**). A closer look reveals that the overlap is caused only by a minority of specimens (**Figure 32**). Results found in this dissertation are very similar to the ones obtained by Bussing (2002), which reinforces the accuracy of the information presented herein.

Since specimens of *Awaous* (*Chonophorus*) *banana* occurring in the Pacific slope differ from the ones collected in the Atlantic slope by scale counts in transversal and longitudinal regions, the Pacific ones are here proposed as belonging to another species. The name *Awaous transandeanus* (Günther, 1861) had already been proposed and will be adopted here to refer to the forms occurring in the Pacific Ocean. In addition, the type specimens of the species *Awaous nelsoni* Evermann, 1898 and *Gobius (Awaous) guentheri* Regan, 1903 presented the scale count in transversal and longitudinal regions congruent with those ranges found for *Awaous* (*Chonophorus*) *transandeanus*. As a result, these names will be considered junior synonyms of *Awaous transandeanus* (Günther, 1861) which has the nomenclatural priority.

1.5.3. Chest region scales

Awaous (*Chonophorus*) *banana* and *A*. (*Chonophorus*) *transandeanus* presented the base of the pelvic fin covered with scales while in *A*. (*Chonophorus*) *tajasica* and *A*. (*Chonophorus*) *lateristriga* the scales in this region are frequently absent (**Table 39**). Scale pattern in this region permit to differ the Caribbean and Pacific species from the others. Also, it could indicate that the Brazilian species may be closer related to the African one. See chapter II for further discussion.

1.5.4. Pre-dorsal region scales

Despite there is a huge variation in the disposition of scales in the pre-dorsal region, it was not possible to segregate species based on this characteristic. All examined species presented the majority of individuals exhibiting the pre-dorsal region fully scaled or fully scaled with an interruption at the median region (**Table 41**).

1.5.5. Pectoral fin base scales

Scales in the base of pectoral region are frequently absent in *Awaous* (*Chonophorus*). However, one fourth of analyzed specimens of *Awaous* (*Chonophorus*) *banana* presented scales in this region (**Table 43**). Scales in this region were also observed in the syntype MNHN A-1266 of *Gobius Martinicus*, all syntypes of *Chonophorus bucculentus*, all syntypes of *Gobius mexicanus* and holotype NMNH 48836 of *Chonophorus contractus*. Furthermore, scales in this region are present in one of the syntypes of *Awaous* (*Chonophorus*) *transandeanus* (NHM 1860.6.16.135) and in the holotype NMNH 48836 of *Awaous nelsoni*.

The presence of scales in the base of pectoral fin was rare in all examined species, thus it was also considered a variation.

1.5.6. Oral papillae

The arrangement of the papillae in the post-dental membrane, palatine region, region between gills, vomer and tongue was extremely conserved in species belonging to *Awaous* (*Chonophorus*).

The papillae in parasphenoid region are usually sparse in the subgenus cited above. However, more than a half of specimens of *Awaous* (*Chonophorus*) *tajasica* presented abundant papillae in this region (**Table 45**). In addition, *Awaous* (*Chonophorus*) frequently present conic papillae in the parasphenoid region. However, one third of examined individuals assigned to *A*. (*Chonophorus*) *banana* and *Awaous* (*Chonophorus*) *transandeanus* presented digitiform papillae in the parasphenoid region (**Table 47**). Since the variation was only found in a fraction of the exemplars, they were not considered diagnostic features themselves, but this variation can be considered part of the set of diagnostic features for the species (*sensu* NELSON; PLATNICK, 1981).

In the lectotype MNHN A- 1265 and paralectotype MNHN A- 1359 of *Gobius banana*, the holotype NMNH 48836 of *Awaous nelsoni* and the syntype 1860.6.16.133 of *Gobius* (*Awaous*) *guentheri* the papillae were absent in the parasphenoid region, which may be explained by the poor state of conservation of these exemplars. Furthermore, the syntype

MNHN A-1266 of *Gobius martinicus*, the syntype MCZ 13330 of *Chonophorus bucculentus*, the lectotype MNHN- 6228-1 and the paralectotype MNHN- 1996-301 of *Gobius lateristriga* presented abundant papillae in this region, which considered a variation for the species.

Awaous (Chonophorus) tajasica presented abundant papillae in the posterior region of the palate diverging from all other examined species (**Table 49**). The sparse papillae in the posterior region of the palate in the holotype of *Suiboga travassosi* was considered a variation. Moreover, *A*. *(Chonophorus) lateristriga* presented single papillae in this region contrasting with the branched ones presented by other analyzed species. Variations cited above were present in the majority of individuals, thus they were considered diagnostic characters for *Awaous (Chonophorus) lateristriga* and *Awaous (Chonophorus) tajasica*.

1.5.7. Cephalic sensory system

Only a small sample of *A*. *(Chonophorus) lateristriga* and *A*. *(Chonophorus) tajasica* presented the pore "J" in the posterior oculoscapular canal while half of individuals of *A. (Chonophorus) banana* and *A*. (*Chonophorus*) *transandeanus* presented the cited pore (**Table 51**). This variation was also not considered diagnostic itself, but figure in the diagnostic set of characters as an auxiliary character.

In *A*. (*Chonophorus*) *lateristriga* and *A*. (*Chonophorus*) *tajasica* the pore "F" was single in almost all examined specimens while in *A*. (*Chonophorus*) *banana* and *A*. (*Chonophorus*) *transandeanus* this pore is usually branched. The state of pore "F" was also considered a diagnostic feature.

1.5.8. Species of *Awaous* (*Chonophorus*)

Characters cited above allowed to conclude that *Awaous* (*Chonophorus*) includes four valid species: *Awaous* (*Chonophorus*) *banana*, *Awaous* (*Chonophorus*) *lateristriga*, *Awaous* (*Chonophorus*) *tajasica*, and *Awaous* (*Chonophorus*) *transandeanus*. Since the morphology of these species is extremely conserved, a general description of the morphology of *Awaous* (*Chonophorus*) is presented below.

General description of morphology of *Awaous* (*Chonophorus*):

Species of *Awaous* (*Chonophorus*) present an elongated body with body height decreasing posteriorly, cylindric body in the pre-dorsal region, gradually tapering posteriorly. Lateral profile convex in the anterior region, gradually becoming almost vertical in the posterior region, caudal peduncle lower and more compressed than anterior region of the body. In dorsal view, the pre-dorsal region has a convex shape. They have an ellipsoid-shaped protuberance in the center of this region, extending from the anterior region of the first ray of the first dorsal fin to the median region of the supraoccipital bone. Pre-dorsal region usually fully scaled with cycloid scales, scales in this region smaller than scales in lateral surface of the body. Scales in chest region also cycloid, resembling scales in pre-dorsal region. Body covered with ctenoid scales with the same size along body length.

Head length greater than width, depressed, conical or round head depending on the degree of development of the *retromalaris* portion of the *adductor mandibulae* muscle, males presenting a round head shape and females presenting a conical one.

Lateral eyes, dorsal margin of orbits slightly exceeding the top of the head, ventral margin partially covered by cheeks. Anterior and posterior nostrils are next to each other, distance being minor than the distance between the two adjacent nostrils. Subterminal mouth. Lips fleshy and prominent. Interior of the mouth filled with oral papillae, mainly in the vomer region, post-dental membrane, parasphenoid, posterior region of the palate, cheeks, tongue, gill arches and gills.

Five branchiostegal rays, first, second, third and fourth branchiostegal rays associated with the anterior ceratohyal. Fifth ray associated with posterior ceratohyal. Branchiostegal membrane not attached to the posterior border of the operculum and isthmus region, adhering to the isthmus only in the posterior region of the inferior border of the operculum.

Pelvic fins are fused in an oval-shaped adhesive disc by a connective membrane. The two spines are associated with a frenum. Pelvic fins with five branched rays, the fifth ray being fused the connective membrane. Earlier branched rays are smaller in size and usually appear hidden by the frenum in ventral view, ray size gradually increases anteroposteriorly.

Triangular first dorsal fin, dorsally rounded, with 6 spines. Membrane between the spines not reaching the dorsal end of the spines resulting in a serrated conformation. It originates posteriorly to the pelvic fin, not reaching the second dorsal fin. Second dorsal fin in a rectangular shape, membrane between the rays reaching the dorsal end of them. Usually having one spine and eleven branched rays, the most posterior two fin rays have the same implantation base, being separated since the base. It originates in the same vertical as the anal fin, posterior region not reaching the base of the caudal fin rays.

Lanceolate Pectoral Fins. Presenting one segmented but not branched fin ray in the most ventral region and 14 to 16 branched fin rays.

Anal fin with the same shape as the second dorsal fin and the same fin ray count, two posterior most rays also divided from its base. Truncated caudal fin with symmetrical lobes. Consisting of six branched rays in the upper lobe and six to seven in the lower lobe.

Incomplete lateral line ending in the posterior margin of the head. Anterior oculoscapular canal presenting pores A, B, C, D, F, G, H, K and L, pore D being the only unpaired one. Preopercular canal presenting pores M, N and O.

Color pattern in ethanol: Background of the body Yellowish or olivaceous with brownish bars and spots. Presenting two conspicuous parallel bars in the lateral side of the snout region, between the eyes and the upper lip. Anterior bar originating in the anterior region of the eye and posterior bar in the ventral region of the eyes, both reaching the dorsal margin of the upper lip. Cheeks with two slightly descending horizontal stripes present in the operculum region. Trunk region with three semicircular stripes. Anterior bar with origin slightly posterior to pore "F" of the oculoscapular canal reaching the base of the pectoral fin. Intermediate bar originating from the dorsal midline of the body near the posterior margin of the operculum and reaching the anterior third of the pectoral fin, partially overlapped by pectoral fin rays in lateral view. Posterior bar originating from the dorsal region of the body slightly posterior to the beginning of the pectoral fin, reaching the posterior third of this fin, also partially covered by the pectoral fin in lateral view. Juvenile specimens presenting, in addition to the semicircle-shaped bars, three other vertical bars along the length of the body which shape gradually being posteriorly replaced by an irregular one. Dorsal region of the body with a series of small round spots that, due to their proximity, may form small irregular blotches. Circular blot in the base of the caudal fin rays extending posteriorly over the rays, covering one tenth of its length. Dorsal fin membrane colored by interrupted brownish horizontal bars and small spots, also brownish in color. Hyaline anal fin. Yellowish pelvic fin with. Caudal fin with a series of equidistant semicircular bars along its length, sometimes intertwining in the median region.

Ecology: Species within *Awaous* (*Chonophorus*) present a medium size, adult specimen reaching from 5 to 16 cm in standard length, usually found in river bottoms. They are considered omnivorous, but algae represent more than half of their gastric content (SABINO; CASTRO, 1991). Feeding strategies includes grazing, with separation of food items in the oral cavity

(SABINO; CASTRO, 1991). Species are usually found in rivers, but occasionally some specimens are collected in brackish water from intermittent streams during the dry season, being recorded in flooded fields and margin of rivers and streams (WATSON, 1996). They are considered amphidromous, habit characterized by migration between freshwater and saltwater for reasons other than reproductive (MYERS, 1949). In the case of *Awaous* (*Chonophorus*) species this migration would occur for trophic reasons: adults lay their eggs in the rivers and, after hatching, the larvae are passively carried to saltwater where they remain as part of the plankton before returning to freshwater, where they stay during the adult phase (RADTKE *et al*., 1988).

Awaous (*Chonophorus*) *banana* (Valenciennes, 1837)

Gobius martinicus Valenciennes, 1837

Chonophorus bucculentus Poey, 1860

Chonophorus contractus Poey, 1861

Gobius mexicanus Günther, 1861

Gobius dolichocephalus Cope, 1867

Figure 45 – *Awaous* (*Chonophorus*) *banana*. A: lateral view, B: dorsal view, C: ventral view (**UCR** 1352-8: 88.4 mm SL).

Diagnosis: *Awaous* (*Chonophorus*) *banana* differs from *Awaous* (*Chonophorus*) *lateristriga* and *Awaous* (*Chonophorus*) *tajasica* by presenting the chest region fully scaled and the pore "F" of the oculoscapular canal branched [*vs*. chest region naked and the pore "F" of the oculoscapular canal single in *Awaous* (*Chonophorus*) *lateristriga* and *Awaous* (*Chonophorus*) *tajasica*]. Also, it differs from *Awaous* (*Chonophorus*) *transandeanus* by presenting scale count in longitudinal series varying from 49 to 68 (mode from 53 to 63) [*vs*. 50 – 60 (mode from 50 to 55 in *Awaous* (*Chonophorus*) *transandeanus*] and scale count in transversal series varying from 16 – 28 (mode from 20 to 24) [*vs*. 16 – 23 (mode from 17 to 20) in *Awaous* (*Chonophorus*) *transandeanus*].

Distribution: from northern Florida occurring on all Caribbean islands including Trinidad and Tobago, in the continental shelf occurs from Tamaulipas, Mexico, to Caracas, in Venezuela.

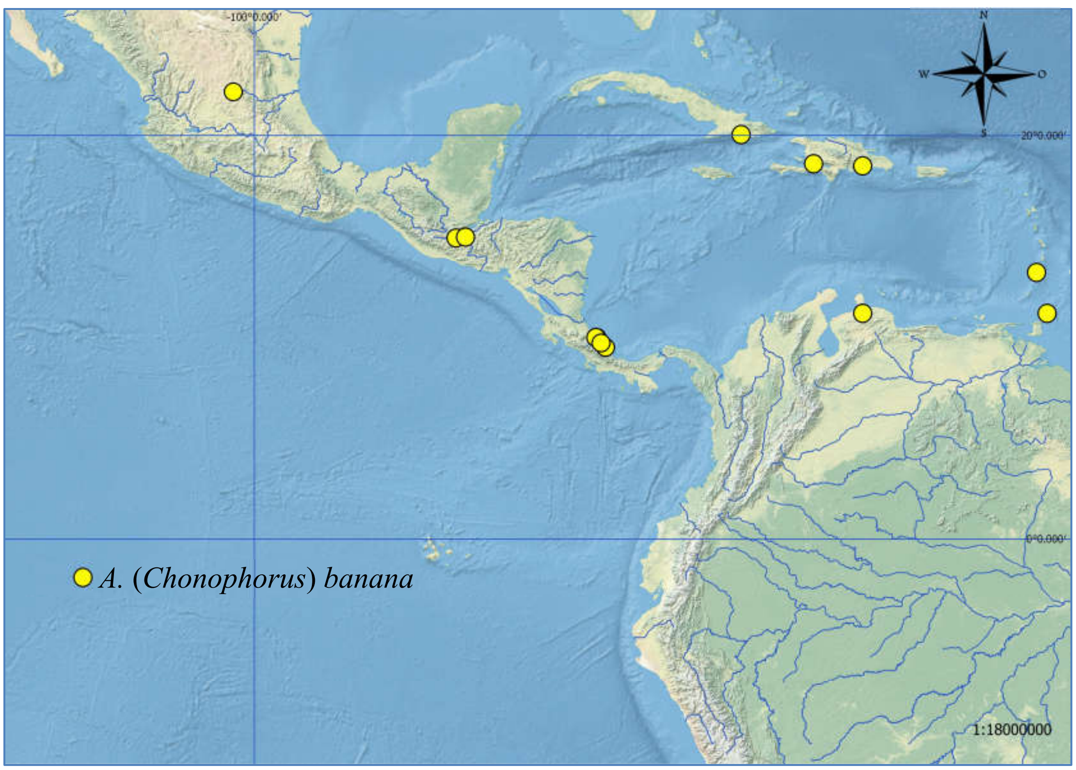

Figure 46 – Distribution map of *Awaous* (*Chonophorus*) *banana*.

Awaous (*Chonophorus*) *lateristriga* (Duméril, 1861)

Gobius (*aeneofuscus*) *guineenses* var. Peters, 1876 (WATSON, 1996).

Gobius bustamantei Greeff, 1882 (WATSON, 1996).

Figure 47 – *Awaous* (*Chonophorus*) *lateristriga*. A: lateral view, B: dorsal view, C: ventral view (**USNM** 292655: 72.5 mm SL).

Diagnosis: *Awaous* (*Chonophorus*) *lateristriga* differs from *Awaous* (*Chonophorus*) *banana* and *Awaous* (*Chonophorus*) *transandeanus* by presenting the chest region naked and the pore "F" of the oculoscapular canal single [*vs*. chest fully scaled and pore "F" of the oculoscapular canal branched in *Awaous* (*Chonophorus*) *banana* and *Awaous* (*Chonophorus*) *transandeanus*]. Also, it differs from *Awaous* (*Chonophorus*) *tajasica* by presenting single and sparse oral papillae in the posterior region of the palate [*vs*. oral papillae in the posterior region of the palate abundant and branched *Awaous* (*Chonophorus*) *tajasica*].

Distribution: *Awaous* (*Chonophorus*) *lateristriga* occurs from Sierra Leone to the border between Angola e Namibia, occurring also in Bioko Island, Equatorial Guinea.

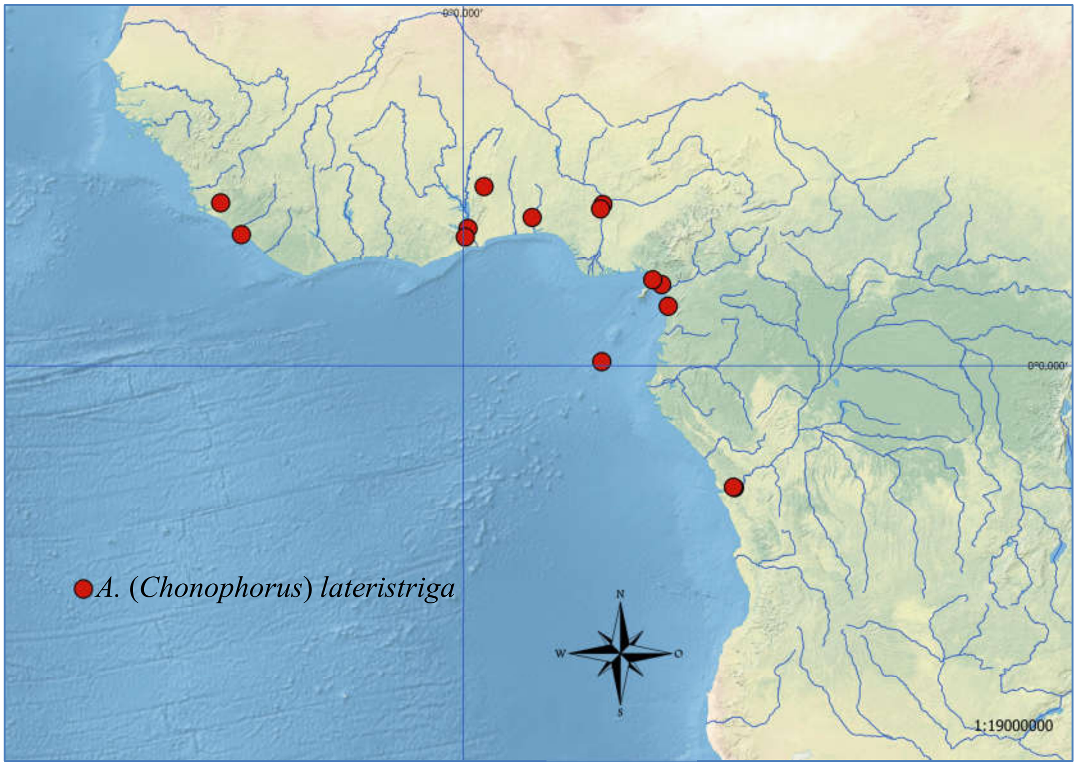

Figure 48 – Distribution map of *Awaous* (*Chonophorus*) *lateristriga*.

Awaous (*Chonophorus*) *tajasica* (Lichtenstein, 1822)

Suiboga travassosi Pinto, 1960

Euctenogobius latus O'Shaughnessy, 1875

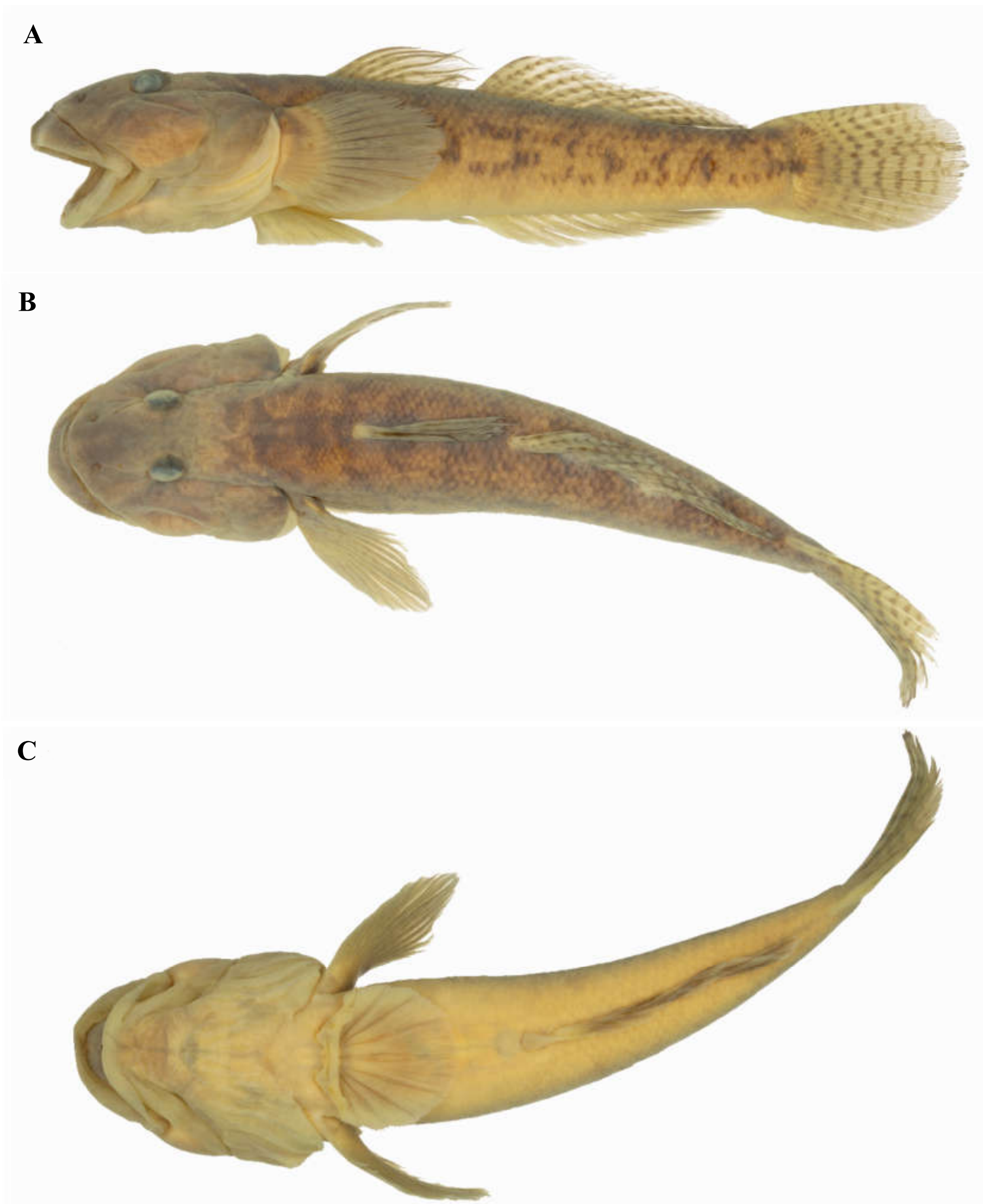

Figure 49 – *Awaous* (*Chonophorus*) *tajasica*. A: lateral view, B: dorsal view, C: ventral view (**UNT** 9259, 134.5 mm SL).

Diagnosis: *Awaous* (*Chonophorus*) *tajasica* differs from *Awaous* (*Chonophorus*) *banana* and *Awaous* (*Chonophorus*) *transandeanus* by presenting the chest region naked and a pore "F" of the oculoscapular canal single [*vs*. chest fully scaled and pore "F" of the oculoscapular canal branched in *Awaous* (*Chonophorus*) *banana* and *Awaous* (*Chonophorus*) *transandeanus*]. Also, it differs from *Awaous* (*Chonophorus*) *lateristriga* by presenting branched and abundant oral papillae in the posterior region of the palate (*vs*. oral papillae in the posterior region of the palate sparse and single in *Awaous* (*Chonophorus*) *lateristriga*).

Distribution: *Awaous* (*Chonophorus*) *tajasica* occurs from Rio Grande do Sul to Maranhão, Brazil.

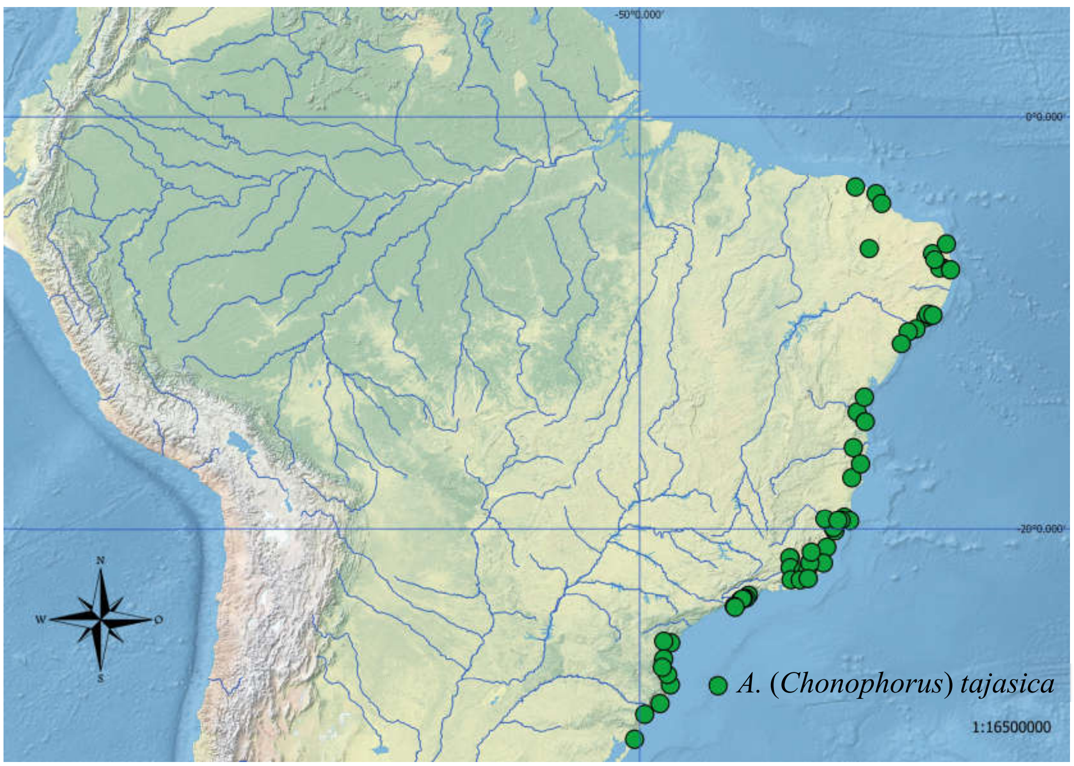

Figure 50 – Distribution map of *Awaous* (*Chonophorus*) *tajasica*.

Awaous (*Chonophorus*) *transandeanus*

Awaous nelsoni Evermann, 1898

Gobius (*Awaous*) *guentheri* Regan, 1903

Figure 51 – *Awaous* (*Chonophorus*) *transandeanus*. A: lateral view, B: dorsal view, C: ventral view (**UCR** 121-3, 72.3 mm SL).

Diagnosis: *Awaous* (*Chonophorus*) *transandeanus* differs from *Awaous* (*Chonophorus*) *lateristriga* and *Awaous* (*Chonophorus*) *tajasica* by presenting the chest region fully scaled and the pore of the oculoscapular canal branched [*vs*. chest region naked and the pore "F" of the oculoscapular canal single in *Awaous* (*Chonophorus*) *lateristriga* and *Awaous* (*Chonophorus*) *tajasica*]. Also, it differs from *Awaous* (*Chonophorus*) *banana* by presenting scale count in longitudinal series varying from 50 – 60 (mode from 50 to 55) [*vs*. 49 – 68 (mode from 53 to 63) in *Awaous* (*Chonophorus*) *banana*) and scale count in transversal series varying from 16 – 23 (mode from 17 to 20) [*vs*. 16 – 28 (mode from 20 to 24) in *Awaous* (*Chonophorus*) *banana*].

Distribution: Pacific coast of America occurring from Baja California Sur and Sonora in Mexico to Tumbes, Peru.

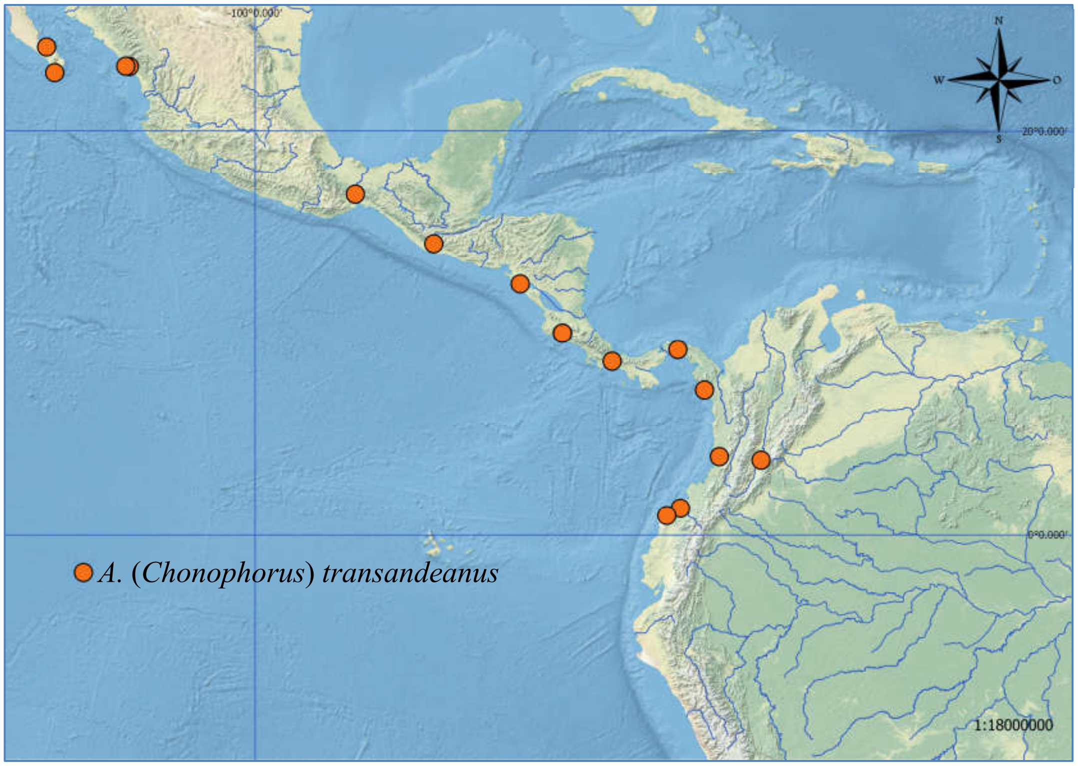

Figure 52 – Distribution map of *Awaous* (*Chonophorus*) *transandeanus*.

1.5.9. Distribution map

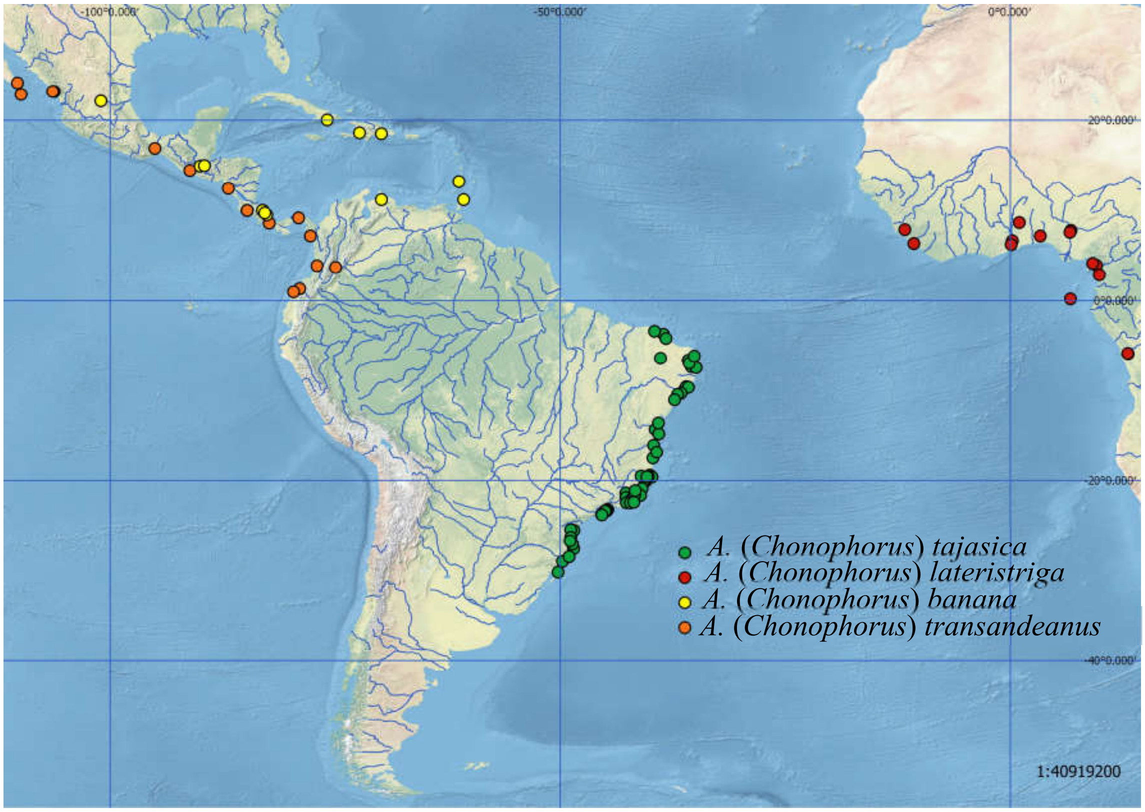

Figure 53 – Distribution map for the species within *Awaous* (*Chonophorus*).

2. PHYLOGENETIC PLACEMENT

2.1. INTRODUCTION

Initially the genus *Gobius* Linnaeus, 1758 was described having seven nominal species. The genus was characterized by the presence of two pores of the cephalic sensory canal between the eyes very close to each other and two anterior pores also very close, four branchiostegal rays and pelvic fins fused in an oval shape with 12 rays. The type species, by original designation is *Gobius niger* Linnaeus, 1758.

Valenciennes (1837) devoted chapter 14 of his work to describe the family of the "Goboids." The family would present 9 genera, namely: *Apocryptes* Valenciennes, 1837, *Trypauchen* Valenciennes, 1837, *Amblyopus* Valenciennes, 1837, *Periophthalmus* Bloch & Schneider, 1801, *Boleophthalmus* Valenciennes, 1837, *Eleotris* Bloch & Schneider, 1801, *Gobioides* Lacepède, 1800, *Gobius* and *Sicydium* Valenciennes, 1837. He also suggested some genera that would be similar to "Goboid" such as *Platyptera* Cuvier, 1829 synonym of *Rhyacichthys* Boulenger, 1901. Although *Platyptera* was described before *Rhyacichthys*, this name was predated by *Platyptera* Meigen, 1803 in Diptera. Gobioids would present only the species *Gobioides broussonnetii*. Other gobioid species, described by Lacepède and Linnaeus, were considered synonyms and were considered members of *Amblyopus*. *Sicydium* would present four species characterized by having a jaw with numerous thin and flexible teeth and a row of stronger teeth implanted directly into the bone (VALENCIENNES, 1837).

Vallenciennes (1837) also stablished that *Gobius* would present two divisions, the *Gobius* of the Seas of Europe, with 19 species, and the foreign *Gobius*, with 79 species divided into eleven categories. Among the foreign *Gobius* was the "Lancettes" division, which would include *Gobius lanceolatus* (Bloch, 1783), currently a junior synonym of *Gobionellus oceanicus* (Pallas, 1770) (ESCHMEYER *et al.,* 2018), *Gobius bacalaus* (Valenciennes, 1837), another junior synonym of *Gobionellus oceanicus* (ESCHMEYER *et al*., 2018), *Gobius brasiliensis* (Bloch & Schneider, 1801), a junior synonym of *Gobioides broussonnetii* Lacepède, 1800 (ESCHMEYER *et al*., 2018) and *Gobius smaragdus* Valenciennes, 1837, currently dealt as *Ctenogobius smaragdus* (ESCHMEYER *et al*., 2018). An "*Awaous* division" was also proposed, embracing *Gobius ocellaris* Broussonet, 1782, presently valid as *Awaous* (*Awaous*) *ocellaris* (ESCHMEYER *et al*., 2018), *Gobius nigripinnis* Valenciennes, 1837, a junior synonym of *Awaous* (*Awaous*) *commersoni* (Schneider, 1801) (ESCHMEYER *et al*., 2018), *Gobius pallidus* Valenciennes, 1837, valid as *Awaous* (*Awaous*) *pallidus* (ESCHMEYER *et al*., 2018), *Gobius guamensis* Valenciennes, 1837, valid as *Awaous* (*Awaous*) *guamensis* (ESCHMEYER *et al*., 2018), *Gobius banana* Valenciennes, 1837, valid as *Awaous* (*Chonophorus*) *banana* (ESCHMEYER *et al*., 2018) and *Gobius martinicus* Valenciennes, 1837, a junior synonym of *Awaous* (*Chonophorus*) *banana* (ESCHMEYER *et al*., 2018). This division was characterized by an elongated face due to the posterior position of the eyes.

Bleeker (1874) proposed a classification for the family gobioid (*sensu* VALENCIENNES, 1837), proposing several divisions for the subfamily Gobiiformes "Les groupes, dans la sous-famille des Gobiiformes, sont plus nombreux" (BLEEKER, 1874). The Latrunculini group which, among others, included *Evorthodus* Gill, 1859 and *Sicyopus* Gill, 1863. The Sicydiini group would be characterized by presenting "a mobile gum over the teeth", being dived in three divisions. The first division including only *Tridentiger* Gill, 1859, the second containing *Sicydium* Valenciennes, 1837, *Sicyopterus* Gill, 1860 and *Microsicydium* Bleeker, 1874, currently junior synonym of *Sicyopterus* (ESCHMEYER *et al*., 2018) and the third presenting only *Lentipes* Günther, 1861.

In addition, Bleeker (1874) proposed the Gobiini group with five subgroups. The Eugobii subgroup would have seven divisions named from "a" to "g" characterized by having "jaw teeth decreasing in size along the maxillary length". Within Eugobii *Awaous* Valenciennes, 1837 was grouped with *Rhinogobius* Gill, 1859 (division "d") both not grouped with *Stenogobius* Bleeker, 1874 since the last one had no teeth in the external series (division "a"). *Euctenogobius* Gill, 1859 was placed in the division "g" of the Eugobii subgroup along with *Oxyurichthys* Bleeker, 1857.

Furthermore, Bleeker (1874) proposed Gobionelli, another subgroup of Gobiini. This division have *Gobionellus* and *Synechogobius* Gill, 1859, currently a junior synonym of *Acanthogobius* Gill, 1859 (ESCHMEYER *et al*., 2018). This was the first mention to the subfamily Gobionellinae (LARSON, 2001).

Regan (1911) listed a number of characteristics for Gobiidae, then treated in familial rank, dividing it in two subfamilies. The subfamily Gobiinae would present two divisions. The first one containing *Awaous*, *Gobionellus*, *Oxyurichthys* and *Stenogobius*, among others, and the second one containing *Gobioides*, *Taenioides*, *Trypauchen* Valenciennes, 1837, and *Trypauchenichthys* Bleeker, 1860.

Koumans (1931) proposed the subfamily Sicydiaphine resulting from the union between the Sicydiini and Latrunculini subgroups proposed by Bleeker (1874). This subfamily would be characterized by its elongated body, not very wide gill openings, except in *Aphia* Risso, 1827, wide isthmus, second dorsal fin not elongated, united pelvic fins, labial teeth on the lower lip, a row of simple teeth on the jaw, posterior rows sometimes covered by the gum, elongated head and naked snout and cheeks. In addition to included in this subfamily *Aphia*, a current member of Gobiinae (PEZOLD, 1993), and *Gobiopterus* Bleeker, 1874and *Evorthodus*, the last two genera currently included in Gobionellinae (PEZOLD, 1993).

Miller (1973) described the osteology of *Rhyacichthys* and placed it in a separate family, Rhyacichthidae, a basal clade of the suborder Gobioidei. Miller (1973) also proposed to include more than 20 genera in the subfamily Gobionellinae, encompassing *Gobioides*, *Gobionellus*, *Oxyurichthys* and *Stenogobius*, among others. Unfortunately, *Awaous* was not treated in this publication. This subfamily would be characterized by the presence of "two epural bones; fan-hypurals separate; no endopterygoid; five branchiostegal rays; no upper postcleithrum, or supratemporals; scapula minute or absent; metapterygoid opposed to quadrate, not meeting ectopterygoid; preopercular not meeting symplectic (except in *Trypauchen*); anterior oculoscapular canal rarely extending across snout, and preopercular canal with three pores, when present."

Hoese (1984) recognized five sub-families within Gobiidae, including Sicydiinae, characterized by presenting "tongue fused to floor of mouth or free only at tip, highly modified jaw suspension; thickened and highly branched pelvic rays and fleshy pads at tips of pelvic spines". The author did not recognize Gobionellinae (*sensu* MILLER, 1973) as valid.

It was only later that the genus *Awaous* was treated as a member of the subfamily Sicydiinae, placed in the *Sicydium* group (BIRDSONG *et al*., 1988) (**Figure 54**). *Awaous* was included in Sicydiinae by presenting the first pterygiophore of the first dorsal fin associated with the third vertebra and the others associated with the other vertebrae following the formula (12210) (**Figure 55**); 10 thoracic and 16 abdominal vertebrae; one epural and the first two pterygiophores of the anal fin located anteriorly to the first hemal spine. However, there is a disagreement between the authors. Pezold in BIRSONG et al. (1988), argued that *Awaous* should be included in *Gobionellus* group of the subfamily Gobiinae due to characteristics associated with superficial neuromast lines (BIRDSONG *et al*., 1988).

Awaous was then postulated as the sister group of Sicydiinae and Gobionellinae (HARRISON, 1989), being excluded from the Sicydiinae due to the presence of a non-dorsally expanded premaxilla. In addition, the palatine in *Awaous*, although long, has a smaller ethmoidprocess, ectopterygoid and quadrate with a more generalized morphology and a preopercle that does not expand anteriorly in the same way as in the Sicydiinae (HARRISON, 1989). Since *Awaous* share several characteristics related to the external morphology and life-style with Sicydiinae, it was proposed as sister group of the sub-family.

	DF	(N)	V	(N)	EPU	(N)	AP	(N)
Awaous	3-12210	(18)	10+16=26	(18)	1	(18)	2	(18)
Evorthodus	3-12210	(15)	10+16=26	(15)	1	(16)	2	(16)
	3-13101	(1)	10+17=27	(1)				
Lentipes	3-12210	(4)	10+16=26	(4)	1	(4)	2	(4)
Sicydium	3-12210	(12)	10+16=26	(12)	1	(12)	2	(12)
Sicyopterus	3-12210	(14)	10+16=26	(14)	1	(14)	2	(14)
*Sicyopus**	3-12210		10+16=26					
Stiphodon	3-12210	(20)	10+16=26	(20)	1	(19)	3	(14)
					2	(1)	2	(4)

* Not examined; based on information in Sakai and Nakamura (1979) and Akihito et al. (1984).

Figure 54 – Table indicating members of the Sicydium group (*sensu* BIRDSONG *et al*., 1988). DF: first dorsal fin pterygophores insertion formula; V: total vertebrae, including thoracic + abdominal; EPU: number of epurals; AP: number of anal fin pterygophores located anteriorly to the first hemal spine.

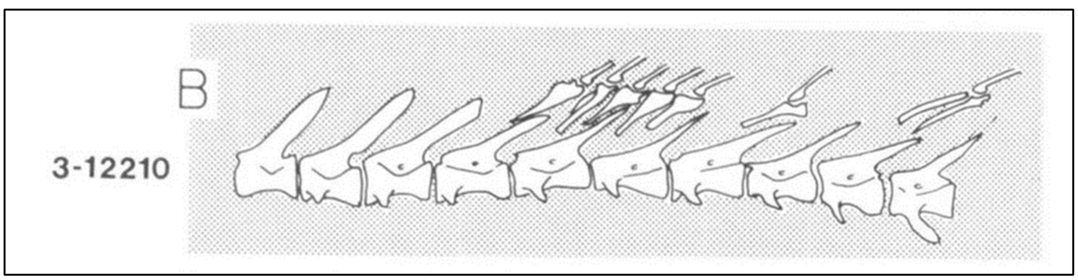

Figure 55 – Distribution pattern of the first dorsal fin pterygiophores (adapted from BIRDSONG *et al*., 1988).

Within Gobionellinae *Stenogobius* was proposed as the sister group of all remaining genera, and the sub-family was divided into two groups, the *Ctenogobius* lineage with *Evorthodus*, *Gobioides* and *Gobionellus*, among others and the *Oxyurichthys* lineage, including *Oxyurichthys* and members of Amblyopinae and Oxudercinae (*sensu* PEZOLD, 1993).

Subsequently, Parenti and Maciolek (1993) defined Sicydiinae based on six synapomorphies: (1) rounded pelvic disc with posteriorly rounded pelvic bones and thickened, highly branched pelvic-fin rays, and thickened pelvic-fin spine; (2) fleshy pads at posterior tips of pelvic-fin spines; (3) pelvic-fin spine and first ray close together at their proximal ends, and separated from remaining four pelvic-fin rays (**Figure 53**); (4) palatine bone with long dorsal process that articulates with lateral ethmoid; (5) dorsal expansion of premaxilla, no differentiation between ascending and articular processes, and reduction in rostral cartilage e (6) adnate tongue. Since *Awaous* lacks all of these characteristics it was not included in Sicydiinae.

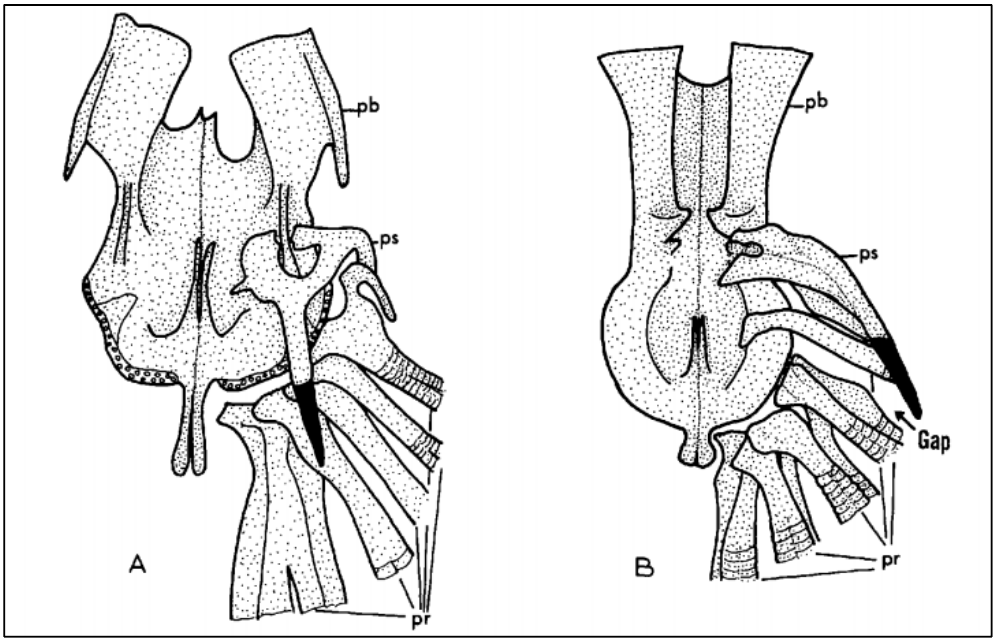

Figure 56 – Main differences in pelvic fins between A: *Awaous sp*. and B: *Sicyopus fehlmann*i (extracted from PARENTI; MACIOLEK, 1993). Pb: pelvic bone; ps: pelvic spine and pr: branched pelvic rays. The arrow indicates the separation between the first and second branched rays of the pelvic fin.

In 1993, Pezold defined the subfamily Gobiinae from inferred synapomorphies of cephalic sensory canal characteristics. The subfamily Gobionellinae, however, consisted only of a small assemblage of convenience, with no supporting synapomorphies.

Parenti and Thomas (1998) listed more synapomorphies for Sicydiinae including: (1) pelvic fin spine articulating directly with bone and in slightly perpendicular position and (2) basiyial in subretangular. *Awaous* was considered closely related to *Gnatholepis* and *Stenogobius* and Sicydiinae was considered sister group to a clade formed by *Rhinogobius* and *Tukugobius* (**Figure 57**).

Larson (2001) proposed *Awaous* within Gobionellinae in a clade called "*Stenogobius* group" (**Figure 58**) containing *Awaous*; *Stenogobius* Bleeker, 1874; *Evorthodus* Gill, 1859; *Ctenogobius* Gill, 1858; *Gnatholepis* Bleeker, 1874; *Oligolepis* Bleeker, 1874; *Oxyurichthys* Bleeker, 1857; *Gobionellus* Girard, 1858; *Gobioides* Lacepède, 1800 and *Rhinogobius* Gill, 1859. The group differs from the *Mugilogobius* group, another group within Gobionellinae, by the following characters: (A) anterior nasal opening present; (B) absence of villi in the head; (C) absence of infraorbital pores and (D) a modal pattern of transverse cephalic superficial neuromast lines. The *Stenogobius* group was reaffirmed by Pezold (2004). Larson (2001) and Pezold (2004) did not included representatives of Sicydiinae in their analyses.

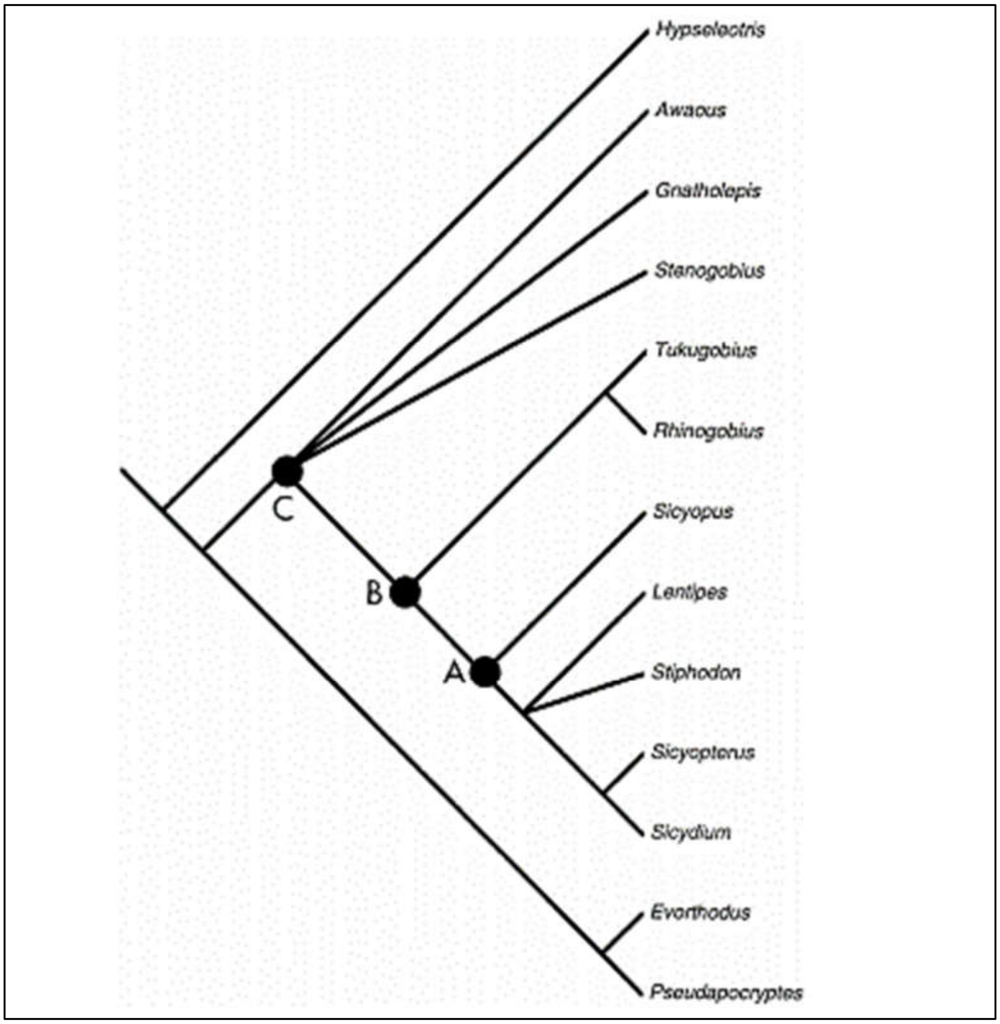

Figure 57 – Phylogenetic relations between Gobionellinae and Sicydiinae, (extracted from PARENTI; THOMAS, 1998).

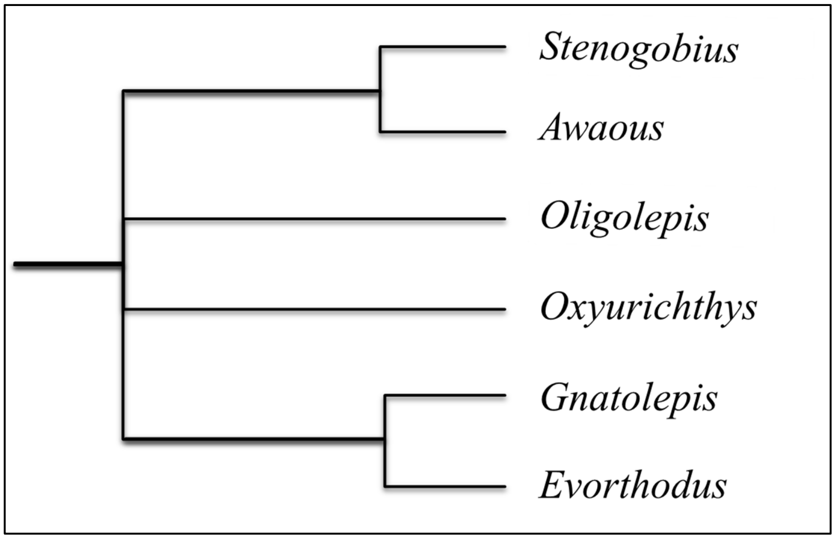

Figure 58 – Figure 58 – Phylogenetic relationships between some of the members of the *Stenogobius* group (*sensu* LARSON, 2001) (adapted from Larson, 2001).

Wang *et al*. (2001) using molecular data, considered *Stenogobius* a clade closely related to Sicydiinae and distantly related to other Gobionellinae taxa. They also considered a clade formed by *Stenogobius* plus Sicydiinae as sister group to *Oligolepis*, *Rhinogobius* and representatives of Oxudercinae and Amblyopinae. This big clade was called Gobionellinae. According to Gill and Mooi (2012) this decision was unwarranted since it predates Oxudercidae, Amblyopina and Trypauchenina.

Thacker (2003), also using molecular data, suggested the clade *Awaous* plus *Stenogobius* as sister to other Sicydiinae. It was also suggested that *Awaous* is more closely related to the subfamily Sicydiinae and that *Stenogobius* lies at the base of this clade, sister group to other Gobionellinae (*sensu* PEZOLD, 1993) (THACKER, 2009; 2013; 2015). This clade was then called "*Stenogobius* lineage" (**Figure 59**).

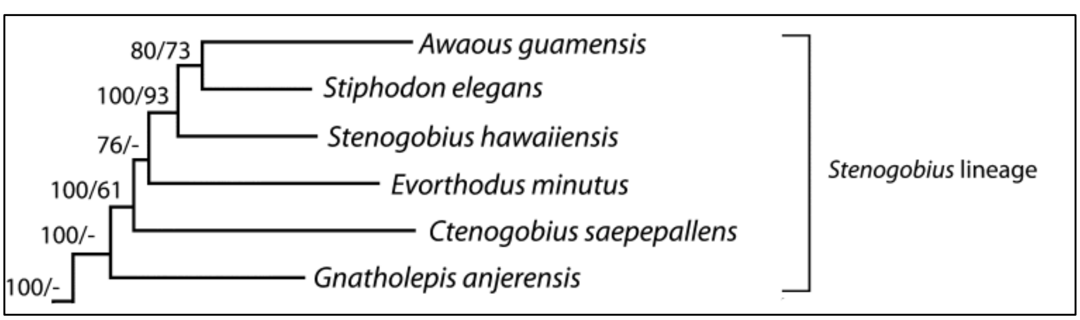

Figure 59 – *Stenogobius* lineage (*sensu* THACKER, 2013) (extracted from Thacker, 2013).

Keith *et al*. (2011), once again using molecular data, performed a phylogenetic analysis of the members of Sicydiinae. In this analysis, *Awaous* was considered the sister group of Sicydiinae (sensu THACKER, 2009). Such analysis placed *Cotylopus* Guichenot, 1863 at the base of the whole subfamily, named “Clade C”. *Sicydium* Valenciennes, 1837, and *Sicyopterus* Gill, 1860 formed a later derivative clade called “Clade D”. *Lentipes* Günther, 1861, *Akihito* Watson, Keith & Marquet, 2007 and one of the species of *Sicyopus* Gill, 1863 genera *Stiphodon* Weber, 1895, “Clade F” and some *Sicyopus* species “clade G” (KEITH *et al*., 2011) (**Figure 60**).Caires (2012) performed a phylogenetic reconstruction of *Microphilypnus* Myers, 1927, using Gobiidae as an external group. His phylogeny recovered *Awaous* closely related to *Gnatholepis* being this clade sister group to *Evorthodus*, *Gobionellus* and *Gobioides*. Unfortunately, *Stenogobius* and Sicydiinae were also not included in this analysis.

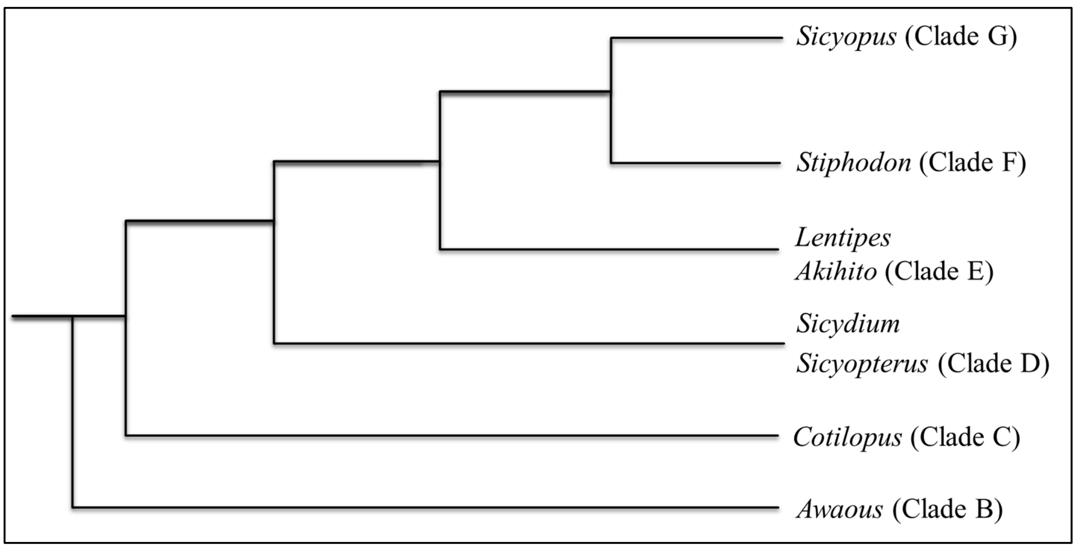

Figure 60 – Phylogenetic reconstruction of Sicydiinae (adapted from KEITH *et al*., 2011).

Subsequently Agorreta and Ruber (2012) again proposed *Awaous* as the sister group of *Stenogobius* forming a clade called “Gobionellinae *clade III*”, which was sister to the Sicydiinae clade. Together, these two formed the sister group of some other genera of Gobionellinae (*sensu* PEZOLD, 1993), placed in “Gobionellinae clade II” (**Figure 61**).

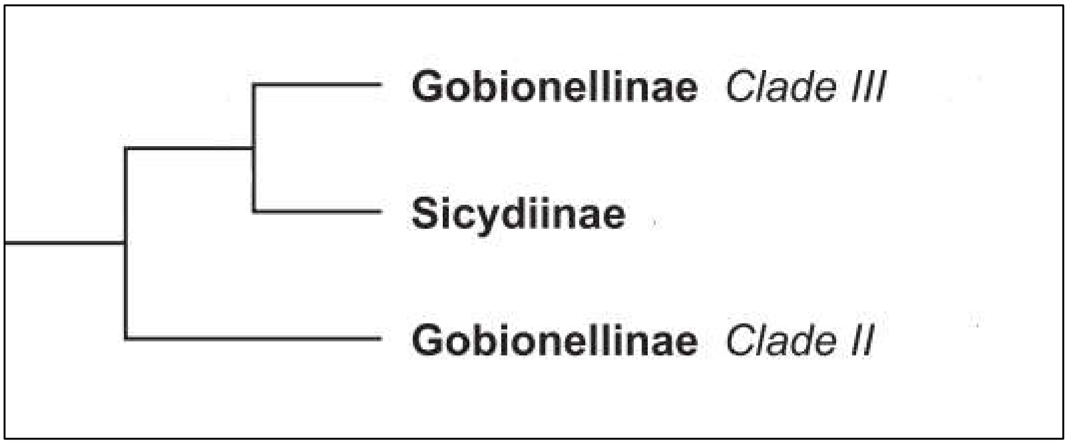

Figure 61 – Cladogram showing a hypothesis of division of the Gobionellinae. *Awaous* and *Stenogobius* form a clade called "Gobionellinae *clade III*" (extracted from AGORRETA; RÜBER, 2012).

Posteriorly, Agorreta (2013), again using molecular data, placed *Awaous* in the *Gobionellinae-like* division (*sensu* AGORRETA *et al*., 2013) (**Figure 62**). *Awaous* (*Chonophorus*) *banana* (Valenciennes 1837) was then considered sister group to *Stenogobius sp*. and this clade the sister clade of *Awaous* (*Euctenogobius*) *flavus* (Valenciennes 1837) both figuring as sister group to Sicydiinae. The whole clade was considered sister to a clade formed by genera currently placed in Gobionellinae (*sensu* PEZOLD, 1993) the junction of both clades would form the *Stenogobius* lineage (*sensu* AGORRETA *et al*., 2013) (**Figure 63**). Tornabene (2013) in his concatenated dataset of nuclear genes recovered the same previous results (AGORRETA; RÜBER, 2012). However, the tree generated using rhodopsin dataset recovered *Awaous* at the basis of the clade including *Stenogobius* and other Sicydiinae (**Figure 64**).

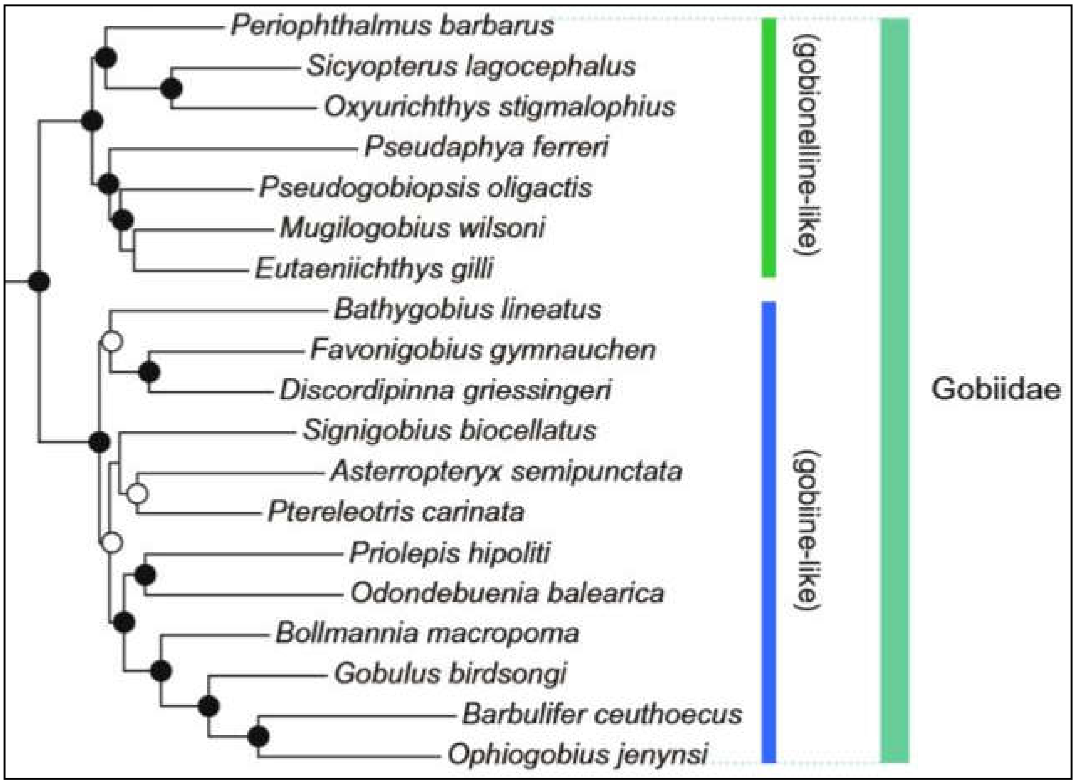

Figure 62 – Proposed relationships within Gobiidae, *Awaous* figures within Gobionellinae-like in a lineage represented by *Oxyurichthys stigmalophius* Mead & Böhlke, 1958 (extracted from AGORRETA *et al*., 2013).

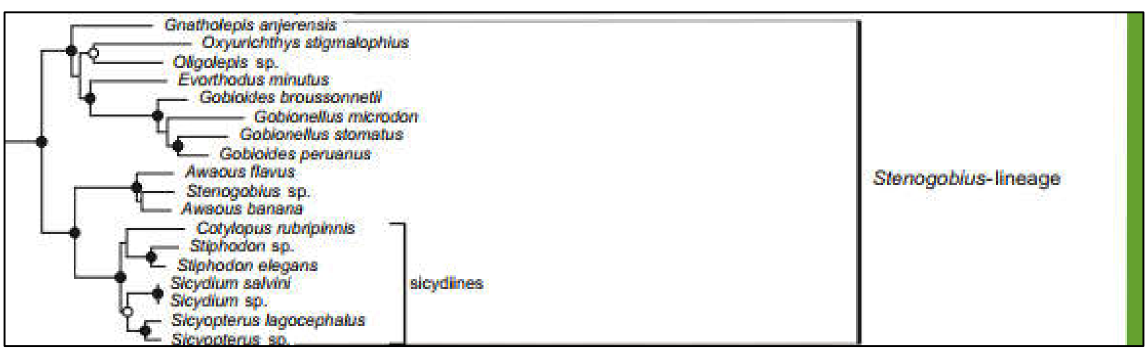

Figure 63 – Positioning of *Awaous* within "*Stenogobius* lineage" (*sensu* AGORRETA *et al.,* 2013) (extracted from AGORRETA *et al*., 2013).

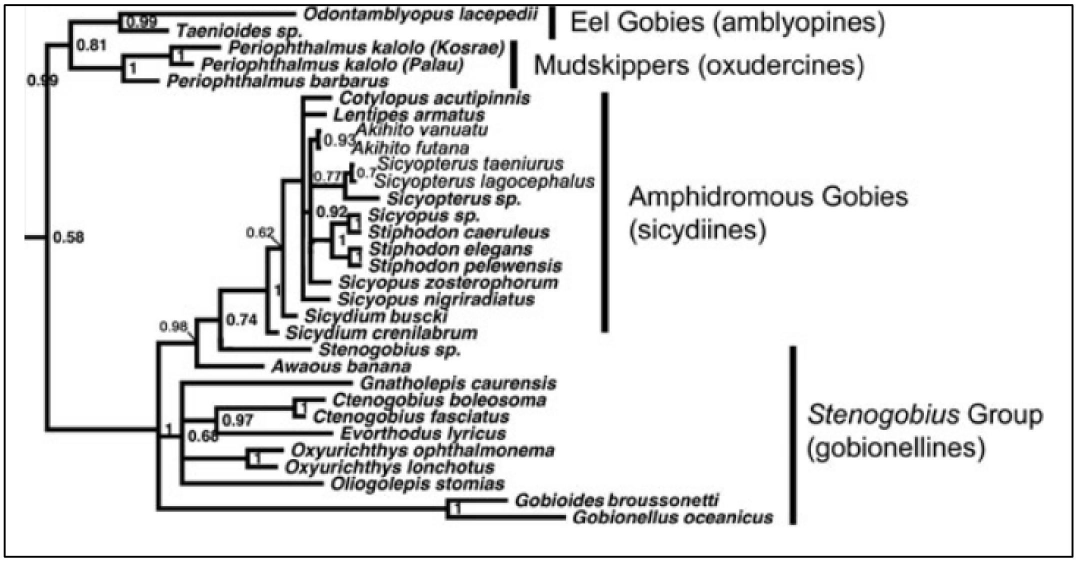

Figure 64 – Cladogram containing the phylogenetic relationships within part of the Gobiidae family using rhodopsin dataset (extracted from TORNABENE, 2013).

2.2. OBJECTIVE

- Understand the phylogenetic relationships of the subgenus *Awaous* (*Chonophorus*) by comparison with other species allocated at the *Stenogobius* lineage (*sensu* AGORRETA *et al*., 2013).

2.3. MATERIAL AND METHODS

2.3.1. Material examined

The original idea was to include the majority of representatives of *Awaous* and genera considered cloded related to this genus in the past. The intention was to include the type species of each genera, following the recommendation of Prendini (2001).

Rhyacichthys aspro (Valenciennes, 1837) was included in the analysys for being considered the type species of the Rhyacichthydae subfamily, considered the basal family within Gobioidei (MILLER, 1973). *Odontobutis obscurus* (Temminck & Schlegel, 1845) is considered the type species of Odontobutidae family, currently also considered a basal family within Gobioidei (GILL; MOOI, 2012). *Eleotris* is currently the type genus of the family Eleotridae considered a sister family to Gobiidae (MILLER, 1973), thus were also included in the analisys. Unforntunately the type species of *Eleotris* was not available, thus *Eleotris perniger* (Cope, 1871), were choosed representing the genus.

All exemplars of *Awaous* (*Chonophorus*) were included, *Awaous* (*Euctenogobius*) *flavus* was included representing the monotypic subgenus *Awaous* (*Euctenogobius*), *Awaous* (*Awaous*) *ocellaris* was included representing *Awaous* (*Awaous*) *ocellaris* group (sensu WATSON, 1992) and *Awous* (*Awaous*) *commersoni* was picked since it is the type species of the *Awaous* (*Awaous*) *nigripinnis* group (sensu WATSON, 1992).

Gobioides, *Gobionellus*, *Oxyurichthys* and *Stenegobius* were included as representatives of Gobionellinae "clade II" (*sensu* AGORRETA; RÜBER, 2012). The type species of *Stenogobius* were not available, thus *Stenogobius* (*Insularigobius*) *genivittatus* (Valenciennes, 1837) were examined representing the subgenus *Stenogobius* (*Insularigobius*) and *Stenogobius* (*Stenogobius*) *laterisquamatus* (Weber, 1907) were analyzed representing the *Stenogobius* (*Stenogobius*) subgenus. The type species of *Oxyurichthys* was not available, thus *Oxyurichthys cornutus* McCulloch & Waite, 1918 were choosed representing the genus.

Cotylopus Guichenot, 1863, *Lentipes* Günther, 1861, *Sicydium* Valenciennes, 1837 and *Sicyopterus* Gill, 1860 were picked representing the Sicydiinae subfamily (*sensu* PARENTI; MACIOLEK, 1993). The type species of *Sicyopterus* were also not available, thus *Sicyopterus longifilis* de Beaufort, 1912, was choosed representing this genus.

The Gobiinae subfamily was choosed as an external clade to Gobionellinae and Sicydiinae. *Gobius* Linnaeus, 1758 and *Bathygobius* Bleeker, 1878 were choosed representing the subfamily. The type species of *Bathygobius* were not available, thus *Bathygobius soporator* (Ginsburg, 1947) were choosed as a representative of the genus.

Awaous (*Awaous*) *commersonii* (Schneider *in* Bloch & Schneider, 1801):

MNHN 0558: 1 of 4 musc. 82.7 mm SL. Reunion island. 1998.

Awaous (*Awaous*) *ocellaris* (Broussonet 1782):

NMNH 52381: 1 of 5 musc. 90.3 mm SL. Samoa, Apia. Year not informed.

Awaous (*Chonophorus*) *banana*:

UCR 1352-8: 1 of 10 musc. 87 mm SL. Costa Rica, Limón, Hone Creek, 6 km W of Puerto Viejo. 1981. **UCR** 1352-8: 1 of 10 C&S. 61.2 mm SL. Costa Rica, Limón, Hone Creek, 6 km W of Puerto Viejo. 1981.

UCR 1144-6: 1 of 4 C&S. 58.8 mm SL. Costa Rica, Limón, Río Cocolis, 3.5 km SE of Shiroles, on Bratsi-Shiroles road. 1977.

Awaous (*Chonophorus*) *lateristriga*:

NMNH 292655: 1 of 3 musc. 68.8 mm SL. Sierra Leone, Foya Village, Tabe River, 16 mi. Southeast of Bo. 1962. **CAS** 214661: 2 of 2 C&S. 58.8 – 49.3 mm SL. Sao Tome and Principe, Sao Tome, Praia das conchas, near mouth, tidal mudflat area. 2001.

Awaous (*Chonophorus*) *tajasica*:

NMNH 272626: 4 of 16 musc. 182 – 152 mm SL. Brazil, Ceara, Reservoir at Pentecoste, Ceara. 1966. **LIRP** 1074: 2 of 21 musc. 90.4 – 88.6 mm SL. São Paulo, Ubatuba, rio Indaiá. 1984. **LIRP** 5745: 1 of 3 C&S. 74 mm SL. São Paulo, São Sebastiao, rio Paúba. 2004. **LIRP** 549: 1 C&S. 83.6 mm SL. Rio de Janeiro, Parati, rio Pedra Branca, faz. Muricana, Perequê-Açu. 1995.

Awaous (*Chonophorus*) *transandeanus*:

UCR 121-3: 1 of 8 musc. 76.6 mm SL. Costa Rica, Puntarenas, rio Agujas, 3 Km from the coast on Tárcoles-Jacó road. 1967. **UCR** 121-3: 1 of 8 C&S. 72.6 mm SL. Costa Rica, Puntarenas, rio Agujas, 3 Km from the coast on Tárcoles-Jacó road. 1967. **UCR** 101-14: 1 of 5 C&S. 64.1 mm SL. Costa Rica, Puntarenas, rio Nuevo, 12 km E of the río Claro village at Interamerican Highway. 1967.

Awaous (*Euctenogobius*) *flavus*:

CAS 78681: 2 of 2 C&S 34.5 – 33.6 mm SL. Colombia, puerto del rio cienega (marsh) on central rio Magdalena. Year not informed. **NMNH** 404258: 1 of 3 musc. 39.1 mm SL. French Guyana, Cayuni river. 2011.

Bathygobius soporator (Ginsburg, 1947):

LIRP 1414: 1 of 107 musc. 53.4 mm SL. Brasil, São Paulo, São Sebastião, entre a praia do Zimbro e a Praia Grande. 1996. **LIRP** 1414: 1 of 107 C&S. 60.6 mm SL. Brasil, São Paulo, São Sebastião, entre a praia do Zimbro e a Praia Grande. 1996.

Cotylopus acutipinnis Guichenot, 1863:

MNHN 1984-0809: 1 of 20 alc. 50.2 mm SL. Reunion. 1982. **MNHN** 1984-0809: 1 of 20 musc. 52.5 mm SL. Reunion. 1982.

Eleotris perniger (Cope, 1871):

NMNH 314440: 1 of 56 musc. 81.1 mm SL. Santo Domingo, Provincia San Pedro de Macoris, 5.5 km North Los Montones, headwater of creek feeding into rio Almirante. 1989. **NMNH** 314440: 1 of 56 C&S. 60.7 mm SL. Santo Domingo, Provincia San Pedro de Macoris, 5.5 km North Los Montones, headwater of creek feeding into rio Almirante. 1989.

Evorthodus lyricus (Girard, 1858):

MNHN 2016- 0618: 1 alc. 41.7 mm SL. French Guiana, Sinnamary, river mouth. 1982. **MZUSP** 66355: 1 de 2 musc. 54.6 mm SL. Brasil, Rio de Janeiro, Atafona, Ilha da convivência. 1964. **NMNH** 106630: 2 de 5 alc. 49 – 40.9 mm SL. Caribbean Sea, Virgin Island, St. Croix, Caledonia Stream. 1937. **NMNH** 147625: 2 alc. 60 – 50.2 mm SL. Puerto Rico, Guayanilla, Ojo de Agua, spring near central San Francisco. 1948. **NMNH** 192106: 1 of 2 C&S. 33.7 mm SL. Cuba, Havana, Province, rio de Almandarez, Marianao, 0.5 mile up rio from 23rd st. Bridge. 1953.

Gobioides broussonnetii Lacepède, 1800:

MZUSP 81124: 1 musc. 196 mm SL. Brasil, São Paulo, Iguape, exemplares coletados em Manguezal próximo à Itacapara. 2003.

Gobionellus oceanicus (Pallas, 1770):

MZUSP 66005: 1 alc. 132.5 mm CP. Brasil, São Paulo, Cananéia. 1985. **NMNH** 352117: 1 of 9 musc. 93.4 mm SL. Atlantic, Caribbean Sea, Jamaica, Kingston Harbor. 1934. **NMNH** 352117: 2 of 9 C&S. 72.4 4 – 69.3 mm SL. Atlantic, Caribbean Sea, Jamaica, Kingston Harbor. 1934.

Gobius niger Linnaeus, 1758:

NMNH 298489: 1 of 30 musc. 71.9 mm SL. Atlantic, Mediterranean Sea, St. George Bay, St. George Bay, R. of Lebanon. 1964.

Lentipes concolor (Gill, 1860):

NMNH 316119: 2 of 9 C&S. 46,1 – 48.6 mm SL. Hawai, Maui, Honolewa stream below wailua falls. 1991. **NMNH** 316119: 1 of 9 musc. 67.9 mm SL. Hawai, Maui, Honolewa stream below wailua falls. 1991.

Odontobutis obscurus (Temminck & Schlegel, 1845):

MZUSP 122849: 1 alc. 72.9 mm SL. Japan, Ehime-ken, Kamiekena Gun. 1979. **MZUSP** 122849: 1 musc. 77.6 mm SL. Japan, Ehime-ken, Kamiekena Gun. 1979

Oxyurichthys cornutus McCulloch & Waite, 1918:

NMNH 372811: 2 of 37 C&S. 62.3 – 59.5 mm SL. Republic of Philippines, Siquijor island., Tidal inlet at Sabanj. 1979. **NMNH** 372811: 4 of 37 musc. 79.2 mm SL. Filipinas, entrada de Maré em Sabanj, ilha de Siquijor. Maio de 1979.

Rhyacichthys aspro (Valenciennes, 1837):

NMNS 97135: 1 alc. 71.6 mm SL. Japan, Ryukyu island, Yaeyama group, Okynawa, Taketomi, Yutsun-gawa river. **NMNH** 371845: 1 musc. 59.9 mm SL. Taiwan. Date not informed.

Sicydium plumieri (Bloch, 1786):

MNHN 1998-0587: 1 alc. 91.3 mm SL. 1997. **ANSP** 144696: 1 of 2 musc. 63 mm SL. Puerto rico. Year not informed. **NMNH** 144033: 1 of 28. 73 mm SL. Caribbean Sea, Mameyes river, at the Y.M.C.A. Boys Camp, Palmer, Puerto Rico. **NMNH** 313724: 1 of 2 C&S. 73.3 mm SL. Atlantic, Caribbean Sea, Dominica, B.W.I., foot of Tra-Falgar falls and portion of trois pitons river behind hydro-electric station. 1964.

Sicyopterus longifilis de Beaufort, 1912:

MZB 24873: 1 of 5 alc. 79,5 mm CP. Island of Sulawesi, Province of Sulawesi Tengah, Kabupaten Tojo Una-una, Kecamatan Tojo, Tojo River. 2017.

Sicyopterus calliochromus Keith, Allen & Lord, 2012:

NMNH 313859: 1 of 6 musc. Indonesia, New Guinea, Irian Jaya, Northwest tip Waigeo Island between Tg. Manganeki and Tg. Boropen. 1979.

Stenogobius (*Insularigobius*) *genivittatus* (Valenciennes, 1837):

NMNH 278704: 1 of 18 alc. 63.9 mm SL. Pacific, Moorea Island, Society Islands, French Polynesia. 1986. **NMNH** 278704: 1 of 18 musc. 69.1 mm SL. Pacific, Moorea Island, Society Islands, French Polynesia. 1986. **NMNH** 278704: 2 of 18 C&S. 53.8 – 50,1 mm SL. Pacific, Moorea Island, Society Islands, French Polynesia. 1986.

Stenogobius (*Stenogobius*) *laterisquamatus* (Weber, 1907):

NMNH 298697: 1 of 10 alc. 72.8 mm SL. Papua New Guinea, Ramu river, approximately 4 km South of Bunapas Mission, Channel Between River Island + Eastern Bank. 1987. **NMNH** 298697: 1 of 10 alc. 83.9 mm SL. Papua New Guinea, Ramu river, approximately 4 km South of Bunapas Mission, Channel Between River Island + Eastern Bank. 1987. **NMNH** 298697: 2

of 10 alc. 58.1 – 58 mm SL. Papua New Guinea, Ramu river, approximately 4 km South of Bunapas Mission, Channel Between River Island + Eastern Bank. 1987.

2.3.2. Osteology

Specimens were cleared and stained following the protocol of TAYLOR AND VAN DYKE, 1985. Osteological nomenclature followed primarily Johnson and Patterson (1993) and Birdsong (1975).

Individuals of *Awaous* (*Chonophorus*) *banana, Awaous* (*Chonophorus*) *lateristriga*, *Awaous* (*Chonophorus*) *tajasica*, *Awaous* (*Chonophorus*) *transandeanus*), *Awaous* (*Euctenogobius*) *flavus*, *Bathygobius soporator* (Valenciennes 1837), *Eleotris perniger* (Cope, 1871)*, Gobionellus oceanicus, Oxyurichthys cornutus*, *Lentipes concolor*, *Sicyopterus longifilis*, *Stenogobius* (*Insularigobius*) *genivittatus* and *Stenogobius* (*Stenogobius*) *laterisquamatus* were cleared and stained. The internship in the **NMNH** allowed examination of previously cleared and stained individuals of *Evorthodus lyricus*, *Sicydium plumieri* and *Gobius niger*.

Some exemplars obtained on loan are rare in collection and, therefore, permission for clear and stain was not granted. Thus, 3D reconstructions were performed through microtomography which allow the analysis of bone elements without damaging the material. 3D reconstruction of computed micro/nano- tomography was performed by the V/tomex P equipment, part of the FFCLRP / USP Documentation Center for Biodiversity, Biology Department. The machine analyzes the density of various layers of animal tissue allowing the differentiation between them.

3D reconstruction was performed in individuals of *Awaous* (*Awaous*) *ocellaris, Awaous* (*Awaous*) *commersonii*, *Evorthodus lyricus*, *Sicydium plumieri*, *Cotylopus acutipinnis* and *Rhyacichthys aspro*.

2.3.3. Myology

The specimens were stained following the protocol proposed by Datovo & Vari (2013), dissected and photographed.

Photographs were taken using Canon EOS 5D camera with Canon EF 100 mm macro and Canon MP-E 65 mm super macro lens and Zeiss Stereo Discovery.V12 stereomicroscope with attached Zeiss Axio-Cam HRc digital camera. Photographs were then edited in Adobe

Photoshop CC and Adobe Illustrator CC. Illustrations were prepared using Wacom One digital pen tablet and Adobe Illustrator CC.

Nomenclature followed Datovo & Vari (2013) and Datovo & Rizzato (2018).

2.3.4. Phylogenetic Reconstruction

The morphological matrix of characters was made using Microsoft Excel 365 and notepad ++. Characters were ordinated from 0 to 75, respecting TNT default. Characters 0 to 5 were rescaled in a range from zero to one to avoid differences in the weighing. Characters: 19, 25, 41, 42, 62, 64 and 67 were ordinated to respect the parsimony in transformation series. Trees were generated using TNT software (GOLOBOFF *et al*., 2008). The most parsimonious trees were obtained using exhaustive search and indexes were obtained using the script *statsall* (designed by Peterson L. Lopes).

Root was set in *Rhyacichthys aspro*, a basal representative of Gobioidei (MILLER, 1973; GILL; MOOI, 2012).

2.4. RESULTS

2.4.1. Morphometric characters

Character 0. Snout, length, proportion in relation to head length (adapted from Valenciennes (1837)).

Character states: from 0 to 1 (Table 57).

Valenciennes (1837) reported that "a small group of gobies could be divided under the name of *Awaous* due to their longer faces and distant eye position". Thus, the snout length, as a proportion of the head length, was compared throughout the lineages to verify if it is in fact a synapomorphy for *Awaous*.

Character 1. Upper lip, thickness, proportion in relation to head length (adapted from Larson (2001), character: 25).

Character states: from 0 to 1 (Table 57).

Larson (2001) discriminated thick and thin lips. Herein, lip thickness is presented as a proportion of head length. The measure of lip thickness was taken from the tip of the lip to the anterior margin of the mesethmoid.

Character 2. First dorsal fin, length, proportion in relation to standard length.

Character states: from 0 to 1 (**Table 57**).

The length of the fins in the examined taxa was highly variable, thus the length of dorsal fins was analyzed. The length of first dorsal fin was considered as a proportion of the standard length, was included in the list of characters in order to help in the phylogenetic reconstruction.

Character 3. Second dorsal fin, length, proportion in relation to standard length.

Character states: from 0 to 1 (**Table 57**).

Second dorsal fin, as a proportion of the standard length, was also included.

Table 56 – Morphometric characters in examined taxa, characters 0 and 1 are presented as a ratio of the head length and characters 2 and 3 as a ratio of the standard length.

Terminal	Character			
	0	**1**	**2**	**3**
Rhyacichthys aspro	0.51	0.11	0.16	0.16
Odontobutis obscurus	0.22	0.04	0.12	0.15
Eleotris perniger	0.19	0.05	0.13	0.16
Bathygobius soporator	0.25	0.10	0.12	0.23
Gobius niger	0.23	0.10	0.14	0.31
Evorthodus lyricus	0.29	0.07	0.14	0.34
Gobioides broussonnetii	0.23	0.05	0.15	0.49
Gobionellus oceanicus	0.28	0.05	0.16	0.42
Oxyurichthys cornutus	0.29	0.07	0.14	0.38
Stenogobius (*Insularigobius*) *genivittatus*	0.32	0.05	0.14	0.31
Stenogobius (*Stenogobius*) *laterisquamatus*	0.28	0.03	0.15	0.29
Cotylopus acutipinnis	0.40	0.13	0.16	0.26
Lentipes concolor	0.42	0.10	0.13	0.26
Sicydium plumieri	0.37	0.18	0.15	0.26
Sicyopterus longifilis	0.43	0.12	0.17	0.28
Awaous (*Awaous*) *commersonii*	0.39	0.09	0.13	0.24
Awaous (*Awaous*) *ocellaris*	0.39	0.13	0.15	0.27
Awaous (*Chonophorus*) *banana*	0.36	0.18	0.12	0.26
Awaous (*Chonophorus*) *lateristriga*	0.34	0.17	0.10	0.25
Awaous (*Chonophorus*) *tajasica*	0.36	0.15	0.11	0.27
Awaous (*Chonophorus*) *transandeanus*	0.39	0.13	0.14	0.29
Awaous (*Euctenogobius*) *flavus*	0.38	0.16	0.05	0.13

Table 57 – Normalized data for morphometric characters in examined taxa.

Terminal	Character			
	0	**1**	**2**	**3**
Rhyacichthys aspro	1.00	0.53	0.93	0.08
Odontobutis obscurus	0.09	0.05	0.56	0.06
Eleotris perniger	0.00	0.14	0.65	0.07
Bathygobius soporator	0.17	0.44	0.58	0.28
Gobius niger	0.12	0.46	0.78	0.48
Evorthodus lyricus	0.32	0.26	0.76	0.57
Gobioides broussonnetii	0.12	0.13	0.80	1.00
Gobionellus oceanicus	0.29	0.13	0.92	0.80
Oxyurichthys cornutus	0.30	0.25	0.79	0.70
Stenogobius (*Insularigobius*) *genivittatus*	0.39	0.11	0.71	0.51
Stenogobius (*Stenogobius*) *laterisquamatus*	0.29	0.00	0.80	0.45
Cotylopus acutipinnis	0.67	0.65	0.93	0.34
Lentipes concolor	0.72	0.46	0.69	0.36
Sicydium plumieri	0.57	1.00	0.86	0.36
Sicyopterus longifilis	0.75	0.56	1.00	0.41
Awaous (*Awaous*) *commersonii*	0.63	0.40	0.68	0.29
Awaous (*Awaous*) *ocellaris*	0.62	0.64	0.82	0.38
Awaous (*Chonophorus*) *banana*	0.55	0.99	0.61	0.34
Awaous (*Chonophorus*) *lateristriga*	0.48	0.89	0.43	0.31
Awaous (*Chonophorus*) *tajasica*	0.52	0.75	0.46	0.37
Awaous (*Chonophorus*) *transandeanus*	0.64	0.66	0.71	0.42
Awaous (*Euctenogobius*) *flavus*	0.59	0.85	0.00	0.00

2.4.2. Meristic characters

Character 4. Second dorsal fin, number of rays (adapted from Larson (2001), character: 10).

Character states: from 0 to 1 (Table 58).

Larson (2001) correlated the fin ray counts for second dorsal fin and anal fin, treating them as a single character. Herein fin ray counts were analyzed separately to better represent the homology of the rays. The number of rays in the second dorsal fin varied from seven in *Rhyacichthys* and *Odontobutis* to 17 in *Gobioides*.

Character 5. Anal fin, number of rays: 6 – 16 (adapted from Larson (2001), character: 10).

Character states: from 0 to 1 (Table 58).

The number off rays was also examined, varying from 6 in *Rhyacichthys* to 16 in *Gobioides*.

Character 6. Branchiostegal ray, number (AKIHITO, 1969; SPRINGER, 1983; GILL; MOOI, 2012).

Character states: (0) 6 rays, (1) 5 rays.

Gill and Mooi (2012) suggested that the presence of five branchiostegal rays would be a synapomorphy for Gobiidae. In fact, only *Rhyacichthys*, *Odontobutis* and *Eleotris* presented six branchiostegal rays, while other taxa had only five.

Character 7. Spines in first dorsal fin, number (BÖHLKE; ROBINS, 1968).

Character states: (0) 7 spines, (1) 6 spines.

This characteristic was mentioned by Böhlke and Robins (1968) to refer to Atlantic gobies. *Rhyacichthys*, *Odontobutis* and *Eleotris* have seven spines in the first dorsal fin while other genera have six.

Table 58 – State of meristic characters in examined taxa. 4n: normalized data for character 4; 5n: normalized data for character 5.

Terminal	Character					
	4	**4n**	**5**	**5n**	**6**	**7**
Rhyacichthys aspro	7	0.00	6	0.00	0	0
Odontobutis obscurus	7	0.00	7	0.10	0	0
Eleotris perniger	9	0.20	9	0.30	0	0
Bathygobius soporator	10	0.30	9	0.30	1	1
Gobius niger	12	0.50	12	0.60	1	1
Evorthodus lyricus	11	0.40	12	0.60	1	1
Gobioides broussonnetii	17	1.00	16	1.00	1	1
Gobionellus oceanicus	14	0.70	15	0.90	1	1
Oxyurichthys cornutus	13	0.60	14	0.80	1	1
Stenogobius (*Insularigobius*) *genivittatus*	12	0.50	12	0.60	1	1
Stenogobius (*Stenogobius*) *laterisquamatus*	11	0.40	11	0.50	1	1
Cotylopus acutipinnis	11	0.40	11	0.50	1	1
Lentipes concolor	11	0.40	11	0.50	1	1
Sicydium plumieri	11	0.40	11	0.50	1	1
Sicyopterus longifilis	11	0.40	11	0.50	1	1
Awaous (*Awaous*) *commersonii*	11	0.40	11	0.50	1	1
Awaous (*Awaous*) *ocellaris*	11	0.40	11	0.50	1	1
Awaous (*Chonophorus*) *banana*	11	0.40	11	0.50	1	1
Awaous (*Chonophorus*) *lateristriga*	11	0.40	11	0.50	1	1
Awaous (*Chonophorus*) *tajasica*	11	0.40	11	0.50	1	1

Awaous (*Chonophorus*) *transandeanus*	11	0.40	11	0.50	1	1
Awaous (*Euctenogobius*) *flavus*	11	0.40	11	0.50	1	1

2.4.3. Oral papillae

Character 8. Post-dental membrane, oral papillae, presence.

Character states: (0) present, (1) absent.

All examined taxa except *Gobionellus*, *Cotylopus*, *Sicydium* and *Sicyopterus* have papillae in this region.

Character 9. Vomerine region, oral papillae, presence.

Character states: (0) present, (1) absent

Papillae in this region are present in the majority of analyzed taxa, except in *Cotylopus*, *Lentipes*, *Sicydium*, *Gobionellus* and *Stenogobius (Stenogobius) laterisquamatus*.

Character 10. Vomerine region, oral papillae, form.

Character states: (0) digitiform, (1) conical.

All species of *Awaous* except *A.* (*Euctenogobius*) *flavus* have conical papillae in the vomerine region. Other examined taxa have digitiform papillae in this region.

Inapplicability: This character does not apply to taxa lacking oral papillae in the vomerine region.

Character 11. Parasphenoid region, oral papillae, presence.

Character states: (0) present, (1) absent.

Among examined taxa only *Gobioides*, *Oxyurichthys*, *Evorthodus*, *Bathygobius*, *Gobius* and *Eleotris* lack papillae in the parasphenoid region.

Character 12. Parasphenoid region, oral papillae, form.

Character states: (0) digitiform, (1) conical.

Papillae in the parasphenoid region are conical in all species of *Awaous*, except *A.* (*Euctenogobius*) *flavus*. *Sicyopterus* also have conical papillae in this region, whereas they are digitiform in all other examined taxa.

Inapplicability: This character does not apply to taxa lacking oral papillae in the parasphenoid region.

Character 13. Posterior region of the palate, oral papillae, presence.

Character states: (0) present, (1) absent.

Oral papillae are absent in the posterior region of the palate only in *Evorthodus*, *Gobionellus*, *Stenogobius* (*Stenogobius*) *laterisquamatus* and *Sicydium*.

Character 14. Posterior region of the palate, oral papillae, form.

Character states: (0) digitiform, (1) conical.

Papillae at the posterior region of the palate are digitiform in *Rhyacichthys*, *Eleotris*, *Bathygobius*, *Gobius*, *Gobioides*, *Stenogobius* (*Insularigobius*) *genivittatus*, *Cotylopus*, *Lentipes* and *Sicyopterus*, being conical in *Awaous* except for *A.* (*Euctenogobius*) *flavus*.

Inapplicability: this character does not apply to taxa lacking papillae in the posterior region of the palate.

Character 15. Posterior region of the palate, conical oral papillae, form.

Character states: (0) single, (1) branched.

Conical papillae in the posterior region of the palate are single in *Awaous* (*Awaous*) *commersonii* and *A.* (*Chonophorus*) *lateristriga*, being branched in other representatives of *Awaous*. It was not possible to infer the States of this character in *Sicyopterus longifilis*, since the papillae were poorly preserved in the examined exemplar.

Inapplicability: this character does not apply to taxa lacking conical papillae in the posterior region of the palate.

Table 59 – State of oral papillae characters in examined taxa. Traces represent inapplicable characters (-). Question marks (?) represent missing data.

Terminal	Character							
	8	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Rhyacichthys aspro	0	0	0	0	0	0	0	-
Odontobutis obscurus	0	0	0	0	0	0	-	?
Eleotris perniger	0	0	0	1	-	0	0	-
Bathygobius soporator	0	0	0	1	-	0	0	-
Gobius niger	0	0	0	0	0	0	0	-
Evorthodus lyricus	0	0	0	1	-	1	-	-
Gobioides broussonnetii	0	0	0	1	-	0	0	-
Gobionellus oceanicus	1	1	-	0	0	1	-	-

Terminal	Character							
	8	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Oxyurichthys cornutus	0	0	0	1	-	1	-	-
Stenogobius (*Insularigobius*) *genivittatus*	0	0	0	0	0	0	0	-
Stenogobius (*Stenogobius*) *laterisquamatus*	0	1	-	0	0	1	-	-
Cotylopus acutipinnis	1	1	-	0	0	0	0	-
Lentipes concolor	0	1	-	0	0	0	0	-
Sicydium plumieri	1	1	-	0	0	1	-	-
Sicyopterus longifilis	1	0	0	0	1	0	0	?
Awaous (*Awaous*) *commersonii*	0	0	1	0	1	0	1	0
Awaous (*Awaous*) *ocellaris*	0	0	1	0	1	0	1	1
Awaous (*Chonophorus*) *banana*	0	0	1	0	1	0	1	1
Awaous (*Chonophorus*) *lateristriga*	0	0	1	0	1	0	1	0
Awaous (*Chonophorus*) *tajasica*	0	0	1	0	1	0	1	1
Awaous (*Chonophorus*) *transandeanus*	0	0	1	0	1	0	1	1
Awaous (*Euctenogobius*) *flavus*	0	0	0	0	0	0	0	-

2.4.4. Scale patterns

Character 16. Chest region, scales, presence (adapted from Caires (2012), character: 144).

Character states: (0) absent, (1) present.

Caires (2012) mentioned the importance of presence of scales in the ventral region. Herein only scales in the chest region were analyzed. *Rhyacichthys*, *Awaous* (*Chonophorus*) *tajasica*, *Awaous* (*Chonophorus*) *lateristriga*, *Awaous* (*Euctenogobius*) *flavus*, *Gobioides*, *Lentipes*, *Cotylopus*, *Sicydium* and *Sicyopterus* lack scales in the chest region. In other examined taxa this region is fully scaled.

Character 17. Region posterior to the first dorsal-fin spine, presence of cycloid scales (adapted from Caires (2012), character: 142).

Character states: (0) present, (1) absent.

The pre-dorsal region is usually covered with cycloid scales in examined taxa, gradually replaced by ctenoid scales posteriorly. In the most examined taxa cycloid scales are absent posterior to a vertical from the first dorsal-fin. However, in *Eleotris*, *Gobioides*, *Evorthodus*, *Gobionellus*, *Oxyurichthys*, *Cotylopus*, *Sicydium* and *Sicyopterus* cycloid scales are present posteriorly to this region.

Inapplicability: this character does not apply to *Lentipes*, it lacks scales. nor to *Rhyacichthys*, because it lacks cycloid scales in the dorsal region.

Character 18. Opercular and preopercular region, scales, presence.

Character states: (0) present, (1) absent.

Rhyacichthys, *Awaous* (*Awaous*) *ocellaris*, *Stenogobius* (*Stenogobius*) *laterisquamatus* and *Evorthodus lyricus* have scales on the opercle and preopercle. All other examined taxa lack then there.

Character 19. Base of pectoral fin, scales, presence.

Character states: (0) present, (1) absent.

Scales are present in the base of the pectoral fin in *Rhyacichthys*, *Awaous* (*Awaous*), *Stenogobius*, *Evorthodus*, *Bathygobius* and *Eleotris*. Other taxa lack scales in this region.

Table 60 – State of scale pattern characters in examined taxa. Traces represent inapplicable characters.

Terminal	Character			
	16	**17**	**18**	**19**
Rhyacichthys aspro	0	-	0	0
Odontobutis obscurus	0	1	0	1
Eleotris perniger	1	0	1	0
Bathygobius soporator	1	1	1	0
Gobius niger	1	1	1	1
Evorthodus lyricus	1	0	0	0
Gobioides broussonnetii	0	0	1	1
Gobionellus oceanicus	1	0	1	1
Oxyurichthys cornutus	1	0	1	1
Stenogobius (*Insularigobius*) *genivittatus*	0	1	1	0
Stenogobius (*Stenogobius*) *laterisquamatus*	1	1	0	0
Cotylopus acutipinnis	0	0	1	1
Lentipes concolor	0	-	1	1
Sicydium plumieri	0	0	1	1
Sicyopterus longifilis	0	0	1	1
Awaous (*Awaous*) *commersonii*	1	1	1	0
Awaous (*Awaous*) *ocellaris*	1	1	0	0
Awaous (*Chonophorus*) *banana*	1	1	1	1
Awaous (*Chonophorus*) *lateristriga*	0	1	1	1
Awaous (*Chonophorus*) *tajasica*	0	1	1	1
Awaous (*Chonophorus*) *transandeanus*	1	1	1	1
Awaous (*Euctenogobius*) *flavus*	0	1	1	1

2.4.5. Miscellaneous

Character 20. Mouth, position (LARSON, 2001, character: 11).

Character states: (0) inferior, (1) terminal, (2) superior.

Larson (2001) discriminated the mouth position as in inferior or terminal. Herein three categories are recognized: inferior, in *Rhyacichthys*, *Awaous*, *Stenogobius* (*Stenogobius*) *laterisquamatus*, *Lentipes*, *Cotylopus*, *Sicydium* and *Sicyopterus*; terminal, in *Stenogobius (Insularigobius) genivittatus*, *Evorthodus* and *Bathygobius;* and superior in *Eleotris*, *Gobius*, *Gobionellus* and *Oxyurichthys*.

Character 21. Floor of the mouth, tongue, fusion (HOESE, 1984; PARENTI; MACIOLEK, 1993, character: 6).

Character states: (0) tong not fused, (1) tong fused.

Hoese (1984) and Parenti and Maciolek (1993), suggested that the tong being fused to the floor of the mouth would be a synapomorphy presented by members of Sicydiinae. In addition to?? the members currently included in Sicydiinae, *Gobius*, *Evorthodus*, *Gobionellus*, *Oxyurichthys*, *Stenogobius* and *Awaous* also present the tong fused to the floor of the mouth.

Character 22. Tongue, shape (PEZOLD, 2004).

Character states: (0) triangular, (1) truncated, (2) round.

Pezold (2004) noted that tongue shape could be phylogenetic informative. *Rhyacichthys* has a triangular tongue, *Sicydium* and *Oxyurichthys* a round tongue and all other taxa a square (truncated) tongue shape.

Character 23. Inner edge of the pectoral girdle, fleshy lobes, presence (WATSON, 1992; LARSON, 2001, character: 4; PEZOLD 2004, character: 5).

Character states: (0) absent, (1) present.

Watson (1991), Larson (2001) and Pezold (2004) established that the presence of fleshy lobes on the inner edge of the pectoral girdle defines a clade formed by *Awaous* and *Stenogobius*. This is corroborated herein since among the examined genera only these two have it.

Character 24. Gills, papillae, presence (WATSON, 1992).

Character states: (0) absent, (1) present.

According to Watson (1992) the presence of sensory papillae over much of the gill structure is a unique synapomorphy of *Awaous* (**Figure 1**) corroborated herein.

Character 25. Caudal fin, format (VALENCIENNES, 1837).

Character states: (0) truncated, (1) oval, (1) lanceolate.

The group of "Lancettes" was initially proposed by Valenciennes (1837) based on the shape of the caudal fin. *Rhyacichthys*, *Bathygobius*, *Gobius*, *Awaous*, *Cotylopus*, *Lentipes*, *Sicydium* and *Sicyopterus* present a truncated caudal fin. In *Odontobutis*, *Eleotris* and *Stenogobius* the caudal fin has an oval aspect, while in *Gobioides*, *Gobionellus*, *Oxyurichthys* and *Evorthodus* this fin is lanceolate.

Character 26. Suction cup formed by the joint of the pelvic fins, format (PARENTI; MACIOLEK, 1993, character: 1).

Character states: (0) oval, (1) round.

The rounded shape of the suction cup formed by the joint of the pelvic fins was considered by Parenti and Maciolek (1993) a diagnostic character for Sicydiinae. In fact, among all analyzed taxa, it is round only *Cotylopus*, *Lentipes*, *Sicydium* and *Sicyopterus* being oval in all other examined taxa.

Inapplicability: this character does not apply to *Rhyacichthys*, *Odontobutis* and *Eleotris* because in these genera the pelvic fins are not fused.

Character 27. Membrane associated with the posterior most spine of the first dorsal fin, posterior attachment.

Character states: (0) not reaching the spine of the second dorsal fin, (1) reaching the spine of the second dorsal fin.

Posterior attachment of the membrane associated with the posterior most spine of the first dorsal fin never reaches the spine of the second dorsal fin in *Rhyacichthys*, *Odontobutis*, *Eleotris*, *Bathygobius, Awaous*, *Stenogobius* (*Stenogobius*) *laterisquamatus*, *Oxyurichthys*, *Cotylopus*, *Lentipes*, *Sicydium* and *Sicyopterus*. In *Gobius*, *Evorthodus*, *Gobioides*, *Gobionellus* and *Stenogobius* (*Insularigobius*) *genivittatus* this membrane attaches on the spine of the second dorsal fin.

Table 61 – State of external morphology characters in examined taxa. Traces represent inapplicable characters (-). Question marks (?) represent missing data.

Terminal	Character							
	20	**21**	**22**	**23**	**24**	**25**	**26**	**27**
Rhyacichthys aspro	0	0	0	0	0	0	-	0
Odontobutis obscurus	1	0	1	0	0	0	-	0
Eleotris perniger	2	0	1	0	0	1	-	0
Bathygobius soporator	1	0	1	0	0	0	0	0
Gobius niger	2	1	1	0	0	0	0	1
Evorthodus lyricus	1	1	1	0	0	2	0	1
Gobioides broussonnetii	2	1	1	0	0	2	0	1
Gobionellus oceanicus	2	1	1	0	0	2	0	1
Oxyurichthys cornutus	2	1	2	0	0	2	0	0
Stenogobius (*Insularigobius*) *genivittatus*	1	1	1	1	0	1	0	1
Stenogobius (*Stenogobius*) *laterisquamatus*	0	1	1	1	0	1	0	0
Cotylopus acutipinnis	0	1	2	0	0	0	1	0
Lentipes concolor	0	1	1	0	0	0	1	0
Sicydium plumieri	0	1	2	0	0	0	1	0
Sicyopterus longifilis	0	1	1	0	0	0	1	0
Awaous (*Awaous*) *commersonii*	0	1	1	1	1	0	0	0
Awaous (*Awaous*) *ocellaris*	0	1	1	1	1	0	0	0
Awaous (*Chonophorus*) *banana*	0	1	1	1	1	0	0	0
Awaous (*Chonophorus*) *lateristriga*	0	1	1	1	1	0	0	0
Awaous (*Chonophorus*) *tajasica*	0	1	1	1	1	0	0	0
Awaous (*Chonophorus*) *transandeanus*	0	1	1	1	1	0	0	0
Awaous (*Euctenogobius*) *flavus*	0	1	1	1	1	0	0	0

2.4.6. Cephalic sensory system

Character 28. Oculoscapular canal, presence of discontinuity (adapted from Pezold (2004), character: 7 and Caires (2012), character: 118).

Character states: (0) absent, (1) present.

Some taxa had the oculoscapular canal interrupted between pores "H" and "K" (**Figure 63**). The discontinuous canal is found in *Awaous* (*Awaous*), *Awaous* (*Euctenogobius*), *Stenogobius*, *Gobionellus*, *Evorthodus*, *Lentipes*, *Bathygobius* and *Gobius*. In *Rhyacichthys*, *Gobioides*, *Cotylopus*, *Sicydium*, *Sicyopterus* and *Awaous* (*Chonophorus*) the canal is complete (**Figure 65**).

Inapplicability: *Oxyurichthys* lacks the oculoscapular canal posteriorly to the pore "G", thus this character is inapplicable. *Odontobutis* and *Eleotris* have no oculoscapular canal, so this character is also inapplicable to these taxa.

Character 29. Pore "A", presence (CAIRES, 2012).

Character states: (0) present, (1) absent.

According to Caires (2012) the presence of pore "A" would be a condition shared by Gobionellinae and Sicydiinae. *Rhyacichthys* and the analyzed taxa belonging to these subfamilies presented pore "A". In *Bathygobius* and *Gobius* this pore is absent (**Figure 66).** According to Akihito (1964) the presence of pore "A" was observed only in members of Sicydiinae, Gobionellinae and in some Butidae and Odontobutidae.

Inapplicability: *Odontobutis* and *Eleotris* have no oculoscapular canal, so this character is inapplicable to these taxa.

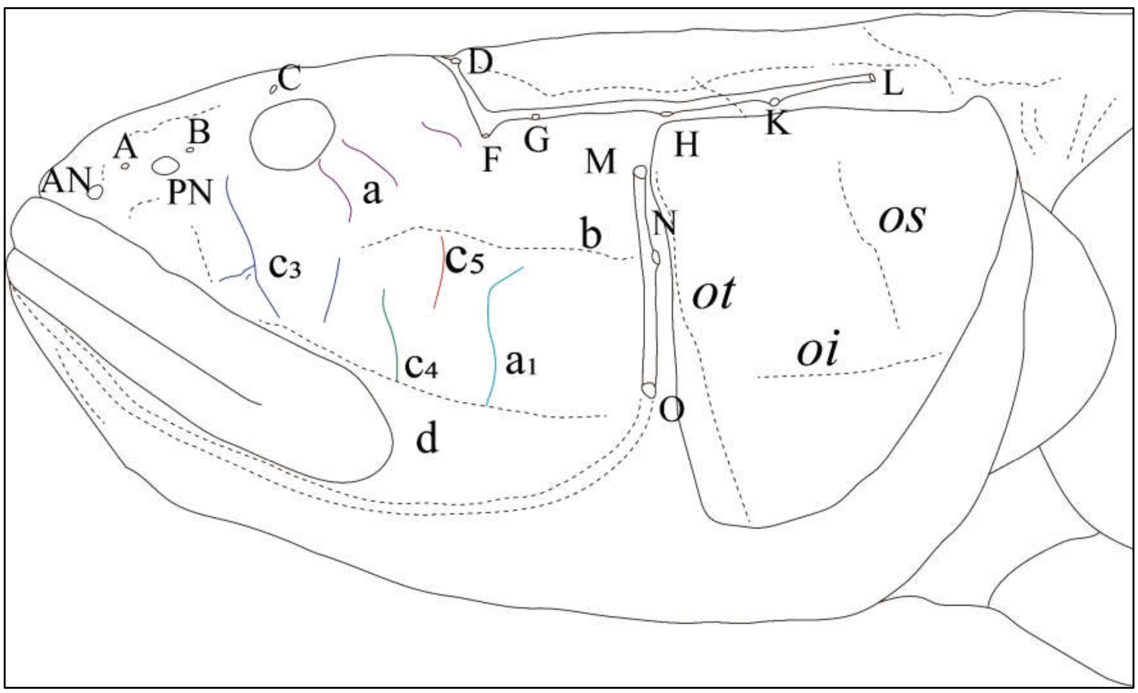

Figure 65 – *Gobioides broussonnetii* illustrating the pores and state of character of oculoscapular canal, along with the superficial cephalic neuromast lines. Pores are identified with capital letters, neuromast line colors and nomenclature follow the pattern presented in the methodology section of chapter 1. AN: anterior nasal opening, PN: posterior nasal opening (**MZUSP** 81124, 225.0 mm SL).

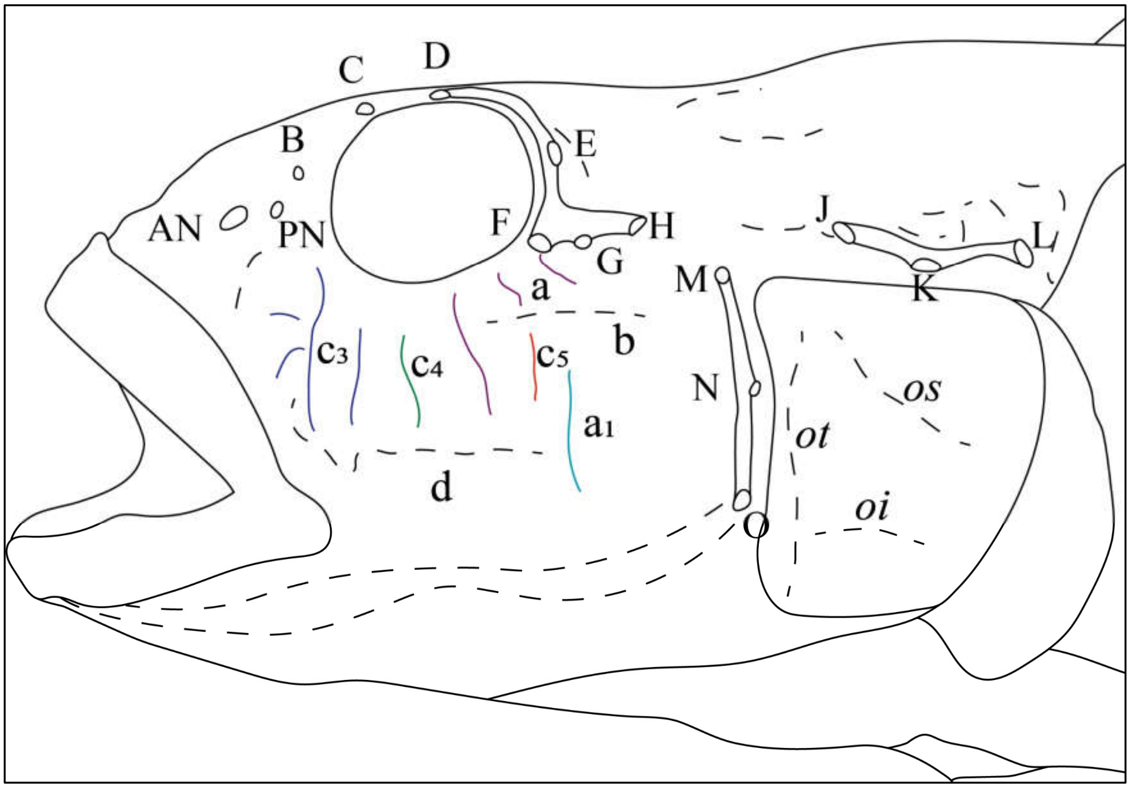

Figure 66 – *Gobius niger* illustrating the pores and state of character of oculoscapular canal, along with the superficial cephalic neuromast lines. Pores are identified with capital letters, neuromast line colors and nomenclature follow the pattern presented in the methodology section of chapter 1. AN: anterior nasal opening, PN: posterior nasal opening (**NMNH** 298489, 71.9 mm SL).

Character 30. Pore "A", position relative to the nares (adapted from Pezold (2004), character: 6).

Character states: (0) closer to the anterior nasal opening, (1) closer to the posterior nasal opening.

In *Stenogobius* (*Insularigobius*) *genivittatus* (**Figure 67**) and *Evorthodus* the pore "A" is located closer to the posterior nasal opening, while in other taxa this pore is located closer to the anterior nasal opening.

Inapplicability: *Bathygobius* and *Gobius* have no pore "A" and *Odontobutis* and *Eleotris* have no oculoscapular canal, therefore, this character is inapplicable to these taxa.

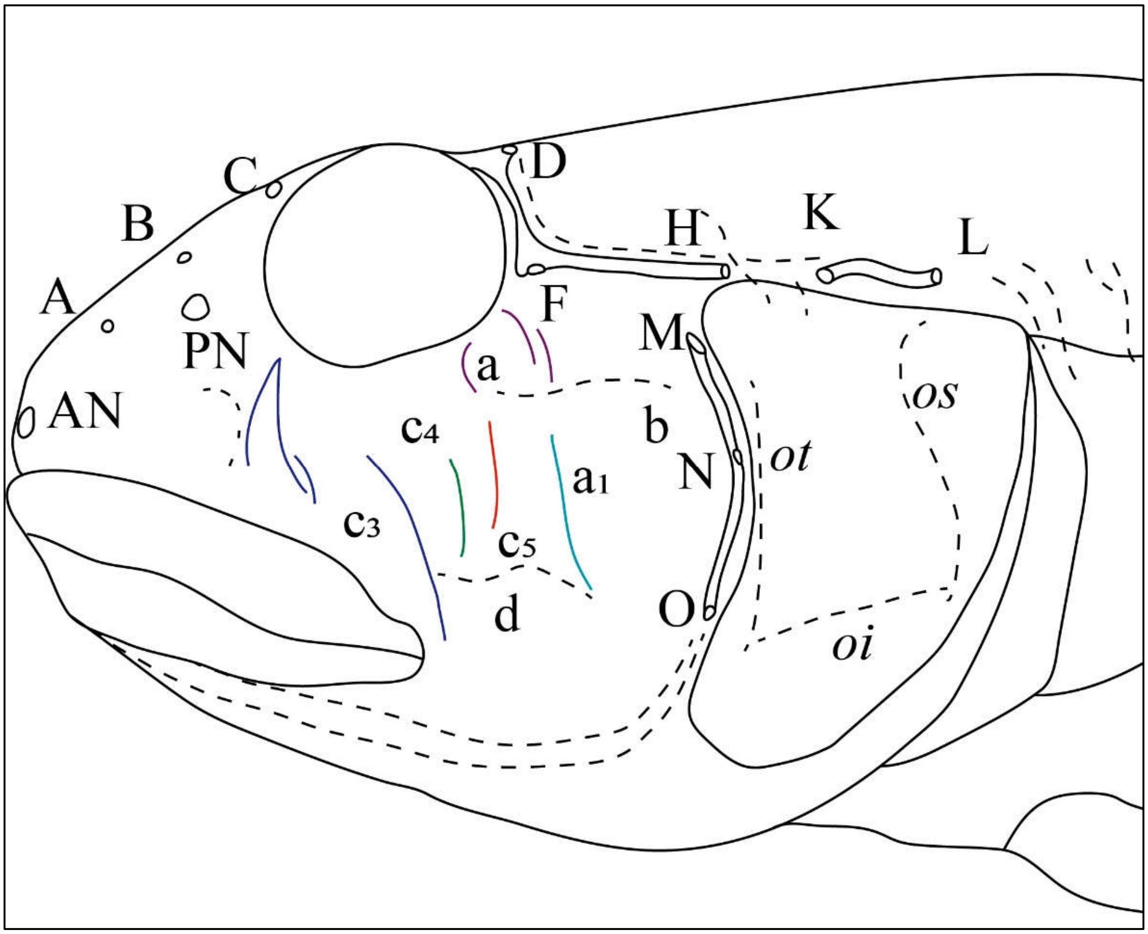

Figure 67 – *Stenogobius genivittatus* illustrating the pores and state of character of oculoscapular canal, along with the superficial cephalic neuromast lines. Pores are identified with capital letters, neuromast line colors and nomenclature follow the pattern presented in the methodology section of chapter 1. AN: anterior nasal opening, PN: posterior nasal opening (**NMNH** 278704, 63.9 mm SL).

Character 31. Pore "B", position relative to posterior nasal opening.

Character states: (0) anterior, (1) dorsal, (2) posterior.

In *Rhyacichthys*, *Sicydium* e *Sicyopterus* pore "B" is located anteriorly to the posterior nasal opening, in *Awaous* (*Chonophorus*), *Awaous* (*Awaous*), *Stenogobius*, *Cotylopus* and *Lentipes* this pore is placed dorsally to the posterior nasal opening, while in *Gobius*, *Evorthodus*, *Gobioides*, *Gobionellus*, *Oxyurichthys* and *Awaous* (*Euctenogobius*) *flavus* this pore was observed posteriorly to the posterior nasal opening.

Inapplicability: *Odontobutis* and *Eleotris* have no oculoscapular canal, thus this character is inapplicable to these taxa.

Character 32. Pore "E", presence (BIRDSONG *et al.*, 1988, LARSON, 2001, character: 41).

Character states: (0) present, (1) absent.

The absence of the pore "E" is considered characteristic of members of Sicydiinae and Gobionellinae by Birdsong *et. al* (1988) and Larson (2001). In fact, among the taxa analyzed only *Rhyacichthys*, *Gobius* and *Bathygobius* presented the pore "E" (Figure 66). In other taxa this pore is absent.

Inapplicability: *Odontobutis* and *Eleotris* have no oculoscapular canal, thus this character is inapplicable to these taxa.

Character 33. Pore "F", state of duplication (WATSON, 1996).

Character states: (0) single, (1) duplicated.

The F pore is duplicated only in *Awaous* (*Chonophorus*) *banana* (**Figure 68**) and *Awaous* (*Chonophorus*) *transandeanus*. In all other taxa there is a single pore "F".

Inapplicability: *Odontobutis* and *Eleotris* have no oculoscapular canal, thus this character is inapplicable to these taxa.

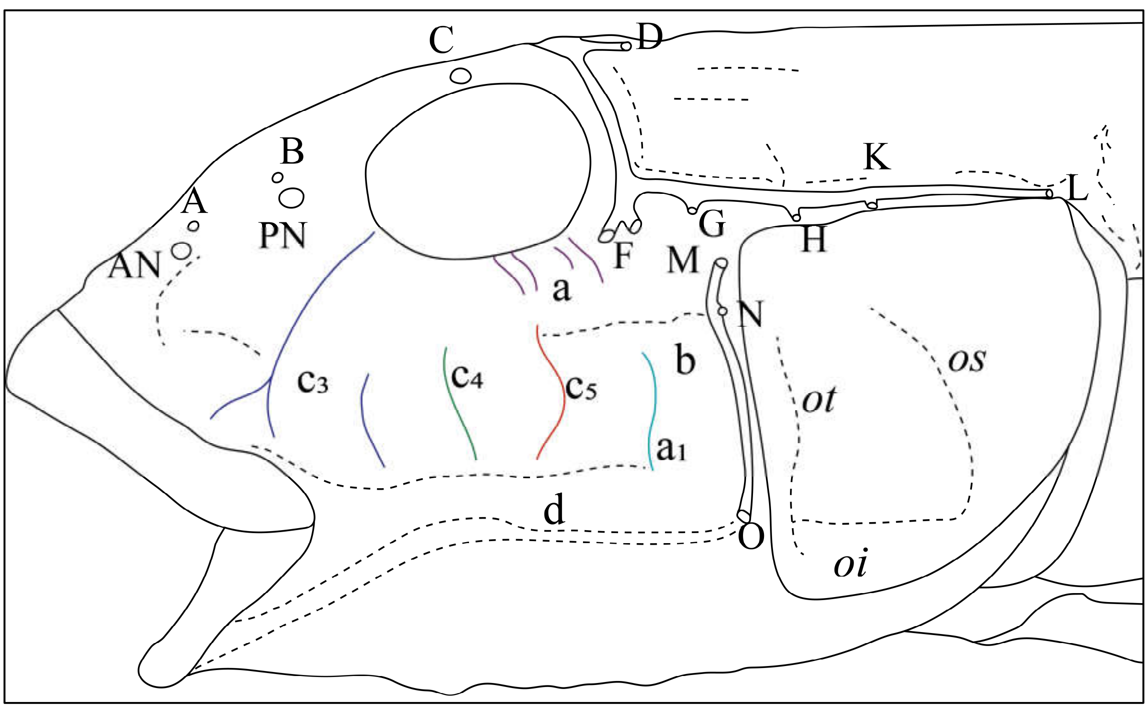

Figure 68 – *Awaous* (*Chonophorus*) *banana* illustrating the pores and state of character of oculoscapular canal, along with the superficial cephalic neuromast lines. Pores are identified with capital letters, neuromast line colors and nomenclature follow the pattern presented in the methodology section of chapter 1. AN: anterior nasal opening, PN: posterior nasal opening (**AMNH** 264747, 51.3 mm CP, 63,9 mm SL).

Character 34. Pore “G”, presence

Character states: (0) present, (1) absent.

Pore “G” of the oculoscapular canal is absent in *Evorthodus*, *Gobionellus*, *Stenogobius* (**Figure 67**), *Lentipes* (**Figure 69**), *Cotylopus*, *Sicydium* and *Sicyopterus*. Other taxa have the pore “G” (**Figures 65**, **66** and **68**).

Inapplicability: *Odontobutis* and *Eleotris* have no oculoscapular canal, thus this character is inapplicable to these taxa.

Character 35. Pore “N”, presence (adapted from Miller (1973), Larson (2001), character: 28, Pezold (2004), character: 8 and Caires (2012), character: 119).

Character states: (0) present, (1) absent.

Usually authors prefer to use the conformation of the canal as a whole in the character states (MILLER, 1973; LARSON, 2001; PEZOLD, 2004; CAIRES, 2012). The states adopted herein are the presence and absence of each pore of the opercular canal, in order to better reflect distinct homologies. Since the pore “M” is present in every taxon, the starting point was the presence of the pore “N”. This pore is present in all of the examined genera, except in *Lentipes* (**Figure 69**) and *Cotylopus*.

Inapplicability: *Odontobutis*, *Eleotris* and *Oxyurichthys* have no opercular canal, thus this character is inapplicable to these taxa.

Character 36. Pore “P”, presence (adapted from Miller (1973), Larson (2001), character: 28; Pezold (2004), character: 8; Caires (2012), character: 119).

Character states: (0) present, (1) absent.

Following the anterior description, in this character the presence and absence of pore “P” was observed. Only *Rhyacichthys* presented this pore, in all other taxa this pore is absent.

Inapplicability: *Odontobutis*, *Eleotris* and *Oxyurichthys* have no opercular canal, thus this character is inapplicable to these taxa.

Character 37. Pore “Q”, presence (adapted from Miller (1973), Larson (2001), Character: 28; Pezold (2004), Character: 8; Caires (2012), Character: 119)

Character states: (0) present, (1) absent.

Finally, the presence and absence of pore "Q" was analyzed. This pore is also only present in *Rhyacichthys*.

Inapplicability: *Odontobutis*, *Eleotris* and *Oxyurichthys* have no opercular canal, thus this character is inapplicable to these taxa.

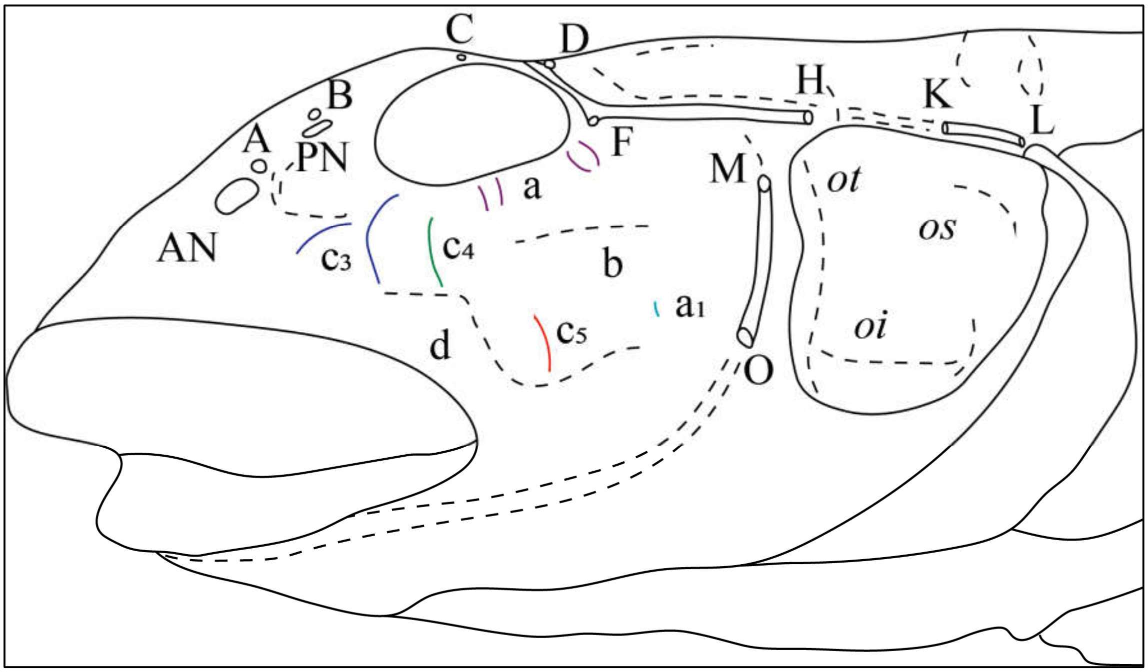

Figure 69 – *Lentipes concolor* illustrating the pores and state of character of opercular canal, along with the superficial cephalic neuromast lines. Pores are identified with capital letters, neuromast line colors and nomenclature follow the pattern presented in the methodology section of chapter 1. AN: anterior nasal opening, PN: posterior nasal opening (**NMNH** 316119, 63.9 mm SL).

Table 62 – State of cephalic sensory system characters in examined taxa. Traces represent inapplicable characters.

Terminal	Character									
	28	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**
Rhyacichthys aspro	0	0	0	0	0	0	0	0	0	0
Odontobutis obscurus	-	-	-	-	-	-	-	-	-	-
Eleotris perniger	-	-	-	-	-	-	-	-	-	-
Bathygobius soporator	1	1	-	1	0	0	0	0	1	1
Gobius niger	1	1	-	2	0	0	0	0	1	1
Evorthodus lyricus	1	0	1	2	1	0	1	0	1	1
Gobioides broussonnetii	0	0	0	2	1	0	0	0	1	1
Gobionellus oceanicus	1	0	0	2	1	0	1	0	1	1
Oxyurichthys cornutus	-	0	0	2	1	0	0	-	-	-
Stenogobius (*Insularigobius*) *genivittatus*	1	0	1	1	1	0	1	0	1	1
Stenogobius (*Stenogobius*) *laterisquamatus*	1	0	0	1	1	0	1	0	1	1
Cotylopus acutipinnis	0	0	0	1	1	0	1	1	1	1
Lentipes concolor	1	0	0	1	1	0	1	1	1	1
Sicydium plumieri	0	0	0	0	1	0	1	0	1	1
Sicyopterus longifilis	0	0	0	0	1	0	1	0	1	1
Awaous (*Awaous*) *commersonii*	1	0	0	1	1	0	0	0	1	1
Awaous (*Awaous*) *ocellaris*	1	0	0	1	1	0	0	0	1	1
Awaous (*Chonophorus*) *banana*	0	0	0	1	1	1	0	0	1	1
Awaous (*Chonophorus*) *lateristriga*	0	0	0	1	1	0	0	0	1	1
Awaous (*Chonophorus*) *tajasica*	0	0	0	1	1	0	0	0	1	1
Awaous (*Chonophorus*) *transandeanus*	0	0	0	1	1	1	0	0	1	1
Awaous (*Euctenogobius*) *flavus*	1	0	0	2	1	0	0	0	1	1

2.4.7. Superficial neuromast lines

Character 38. Superficial neuromast lines, suborbital portion, orientation (BIRDSONG *et al*., 1988, LARSON, 2001, character 8; PEZOLD, 2004, character 9).

Character states: (0) longitudinal, (1) transversal

The orientation of the superficial neuromast lines has been vastly used in the determination of lineages within Gobiidae (BIRDSONG *et al*., 1988; LARSON, 2001; PEZOLD, 2004). Pezold *in* Birdsong *et al*. (1988) claimed that *Awaous* would be more closely related to Gobionellinae by presenting superficial neuromast lines in a transverse orientation, disagreeing with the other authors who allocated the genus within the *Sicydium* group. An analysis of the available material revealed that *Eleotris*, *Gobius* (**Figure 66**), *Evorthodus*, *Gobionellus* (**Figure 11**), *Gobioides* (**Figure 65**), *Oxyurichthys*, *Stenogobius* (**Figure 67**), *Awaous* (**Figure 68**), *Lentipes* (**Figure 69**), *Cotylopus*, *Sicydium* and *Sicyopterus* present transverse-oriented superficial neuromast lines. Longitudinal oriented superficial neuromast lines were only observed in *Rhyacichthys*, *Odontobutis* and *Bathygobius* (**Figure 10**). Since members of Sicydiinae and Gobionellinae had the suborbital neuromast lines oriented in a transversal way it is not possible to say that *Awaous* would be closely related to Gobionellinae based on this characteristic.

Character 39. Lines derived from the line *a* (*sensu* SANZO, 1911), anterior portion, number when transversally oriented.

Character states: (0) one line, (1) two lines.

Awaous (*Awaous*), *Awaous* (*Chonophorus*) (**Figure 68**), *Gobioides* (**Figure 65**), *Lentipes* (**Figure 69**), *Sicydium* and *Sicyopterus* present two lines derived from the line *a* anteriorly, while other taxa presented only one line derived from the line *a* in this region.

Inapplicability: this character does not apply to *Rhyacichthys* since it lacks the line *a* and *Odontobutis* and *Bathygobius* since in these genera lines derived from the line *a* are longitudinally oriented (**Figure 10**).

Character 40. Transverse lines derived from line *a* (*sensu* SANZO, 1911), posterior portion, number when transversally oriented.

Character states: (0) two lines, (1) one line.

Awaous (*Euctenogobius*) *flavus*, *Gobioides*, *Gobionellus*, *Evorthodus* and *Eleotris* have one line derived from the line *a* in the posterior region Other examined genera have two.

Inapplicability: this character does not apply to *Rhyacichthys* since it lacks the line *a*. Also, it does not apply to *Odontobutis* and *Bathygobius* since in these genera lines derived from the line *a* are longitudinally oriented.

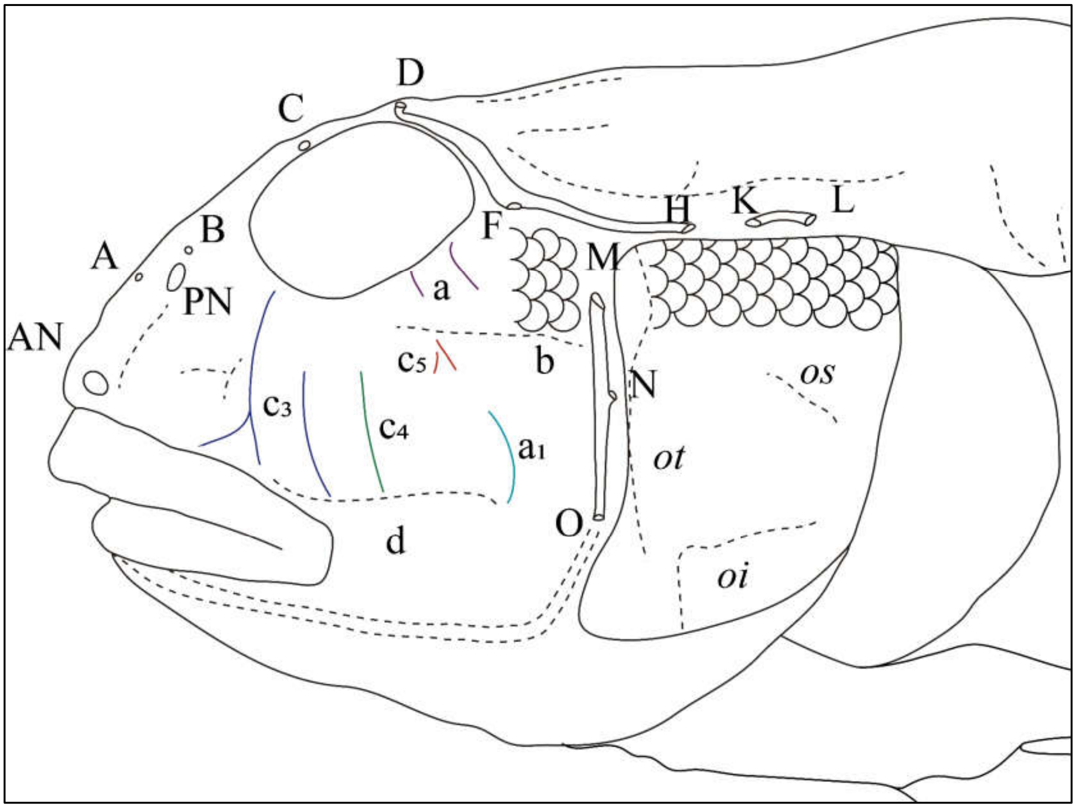

Figure 70 – *Evorthodus lyricus* illustrating the pores and state of character of opercular canal, along with the superficial cephalic neuromast lines. Pores are identified with capital letters, neuromast line colors and nomenclature follow the pattern presented in the methodology section of chapter 1. AN: anterior nasal opening, PN: posterior nasal opening (**MZUSP** 66355, 54.6 mm SL).

Character 41. Superficial neuromast line *b*, posterior extension in relation to line c_4 (adapted from Pezold (2004), character: 10).

Character states: (0) not reaching line c_4 anteriorly, (1) reaching line c_4 anteriorly, (2) exceeding line c_4 anteriorly.

Pezold (2004) comments in his character 10 that the anterior extension of line *b* could be phylogenetically informative. The state (0) was found in *Awaous* (*Chonophorus*), *Awaous* (*Awaous*) *ocellaris, Evorthodus*, *Lentipes* and *Sicyopterus* (**Figures 68** and **69**). State (2) was found in *Awaous* (*Awaous*) *commersonii*, *Awaous* (*Euctenogobius*), *Gobioides*, *Gobionellus* and *Oxyurichthys* (**Figure 65**). Other taxa present the state (1). We were unable to set character state in *Sicydium* because lines were poorly preserved in the examined specimen.

Inapplicability: this character does not apply to *Rhyacichthys* since it lacks line *c* and *Odontobutis* and *Bathygobius* since lines are longitudinally oriented in these genera.

Character 42. Superficial neuromast line *b*, anterior extension in relation to transverse line c_3 (adapted from Pezold (2004), character: 10).

Character states: (0) not reaching line c_3 anteriorly, (1) reaching line c_3 anteriorly.

The state (1) was found in *Gobioides*, *Gobionellus* and *Oxyurichthys*. In *Awaous* (*Awaous*) *commersonii* and *Awaous* (*Euctenogobius*) *flavus* the line *b* does not reach the line *c3* anteriorly. We were unable to set character state in *Sicydium* because lines were poorly preserved in the examined specimen.

Inapplicability: this character does not apply to *Rhyacichthys* as it lacks line *c* and *Odontobutis* and *Bathygobius* since in these genera the lines are longitudinally oriented. In addition, it does not apply to genera presenting the state (0) or (1) of character 41.

Character 43. Superficial neuromast line *d*, posterior extension in relation to transverse line a_1 (HARRISON, 1989).

Character states: (0) reaching line a_1 posteriorly (1) exceeding line a_1 posteriorly.

Gobioides (**Figure 65**), *Gobionellus* and *Oxyurichthys* (**Figure 71**) have the state (1), while other genera have state (0).

Inapplicability: this character does not apply to *Rhyacichthys*, *Odontobutis* and *Bathygobius* since all lack line *a1*.

Character 44. Superficial neuromast lines of the opercular series, line *os*, orientation.

Character states: (0) transversally oriented (closer to 90° angle), (1) not transversally oriented (closer to 45° angle).

Opercular line *os* is not transversally oriented in *Gobius*, *Evorthodus* (**Figure 70**), *Oxyurichthys* (**Figure 71**), *Lentipes* (**Figure 69**), *Sicydium* and *Sicyopterus*. In other taxa this line is transversally oriented (**Figure 68**).

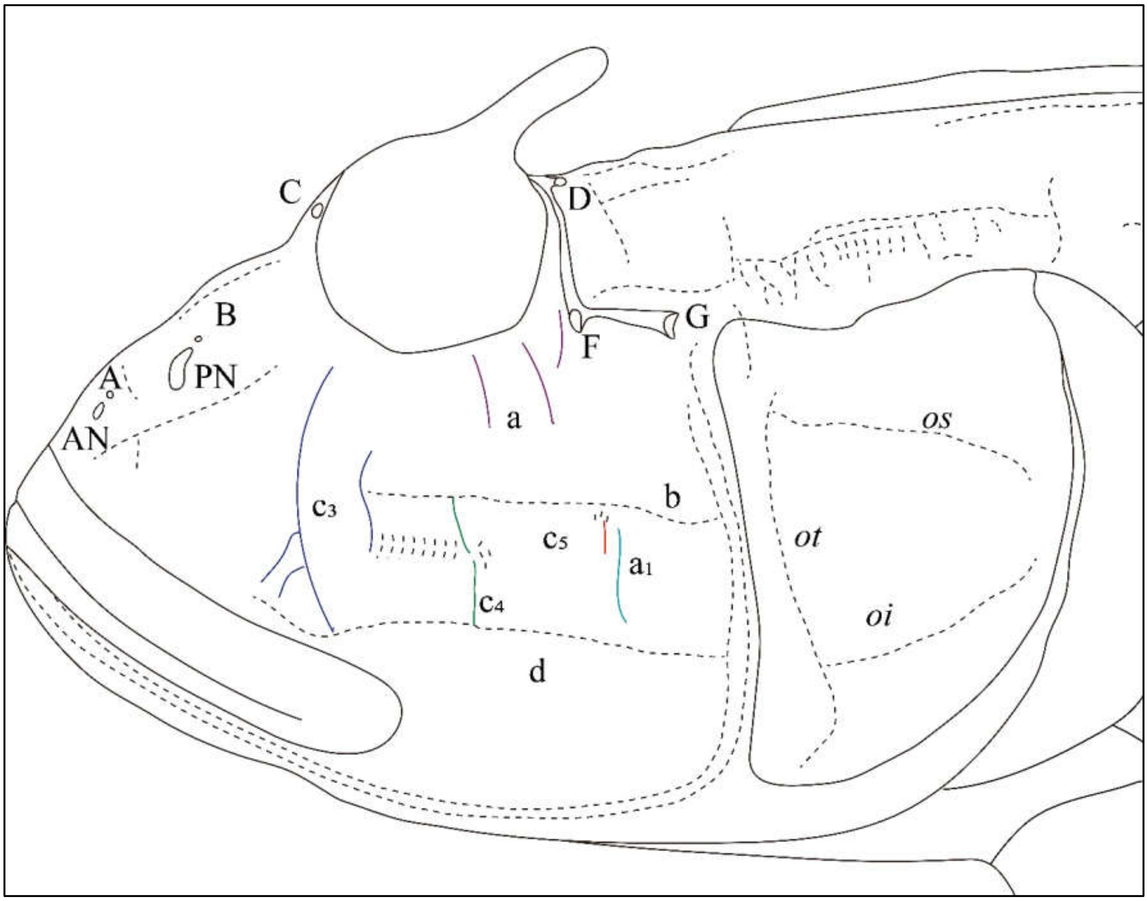

Figure 71 – *Oxyurichthys cornutus* illustrating the pores and state of character of opercular canal, along with the superficial cephalic neuromast lines. Pores are identified with capital letters, neuromast line colors and nomenclature follow the pattern presented in the methodology section of chapter 1. AN: anterior nasal opening, PN: posterior nasal opening (**NMNH** 372810, 77.9 mm SL).

Character 45. Superficial neuromast lines on the lateral surface of the body, presence (adapted from Watson (1996)).

Character states: (0) present, (1) absent.

Lines on the lateral surface of the body are absent in *Awaous* (*Euctenogobius*), *Stenogobius* (*Stenogobius*) *laterisquamatus* and *Sicydium*. In other taxa these lines are present.

Table 63 – State of superficial neuromast lines characters in examined taxa. Traces represent inapplicable characters (-). Question marks (?) represent missing data.

Terminal	Character							
	38	**39**	**40**	**41**	**42**	**43**	**44**	**45**
Rhyacichthys aspro	0	-	-	-	-	-	-	0
Odontobutis obscurus	0	0	-	-	-	-	1	0
Eleotris perniger	1	-	1	0	-	0	0	0
Bathygobius soporator	0	-	-	-	-	-	0	0
Gobius niger	1	0	0	0	-	0	1	0
Evorthodus lyricus	1	0	1	1	-	0	1	0
Gobioides broussonnetii	1	1	1	2	1	1	0	0
Gobionellus oceanicus	1	0	1	2	1	1	0	0
Oxyurichthys cornutus	1	0	0	2	1	1	1	0
Stenogobius (*Insularigobius*) *genivittatus*	1	0	0	0	-	0	0	0
Stenogobius (*Stenogobius*) *laterisquamatus*	1	0	0	0	-	0	0	1
Cotylopus acutipinnis	1	0	0	0	-	0	0	0
Lentipes concolor	1	1	0	1	-	0	1	0
Sicydium plumieri	1	1	0	?	?	0	1	1
Sicyopterus longifilis	1	1	0	0	-	0	1	0
Awaous (*Awaous*) *commersonii*	1	1	0	2	0	0	0	0
Awaous (*Awaous*) *ocellaris*	1	1	0	1	-	0	0	0
Awaous (*Chonophorus*) *banana*	1	1	0	1	-	0	0	0
Awaous (*Chonophorus*) *lateristriga*	1	1	0	1	-	0	0	0
Awaous (*Chonophorus*) *tajasica*	1	1	0	1	-	0	0	0
Awaous (*Chonophorus*) *transandeanus*	1	1	0	1	-	0	0	0
Awaous (*Euctenogobius*) *flavus*	1	0	1	2	0	0	0	1

2.4.8. Cranium

Character 46. Lateral ethmoid, dorsal margin, presence of crenulated surface (CAIRES, 2012, character: 9).

Character states: (0) absent, (1) present.

Caires (2012) affirmed that only *Awaous*, *Evorthodus* and *Ctenogobius* have the dorsal margin of the lateral ethmoid crenulated, indicating that this could be an informative feature for Gobionellinae. *Rhyacichthys*, *Odontobutis*, *Eleotris*, *Lentipes* and *Sicydium* lack a crenulated margin (0). Other genera have the dorsal surface of the lateral ethmoid crenulated in at least one region, demonstrating that this character may be present in more than one lineage of Gobiidae (**Figure 72**).

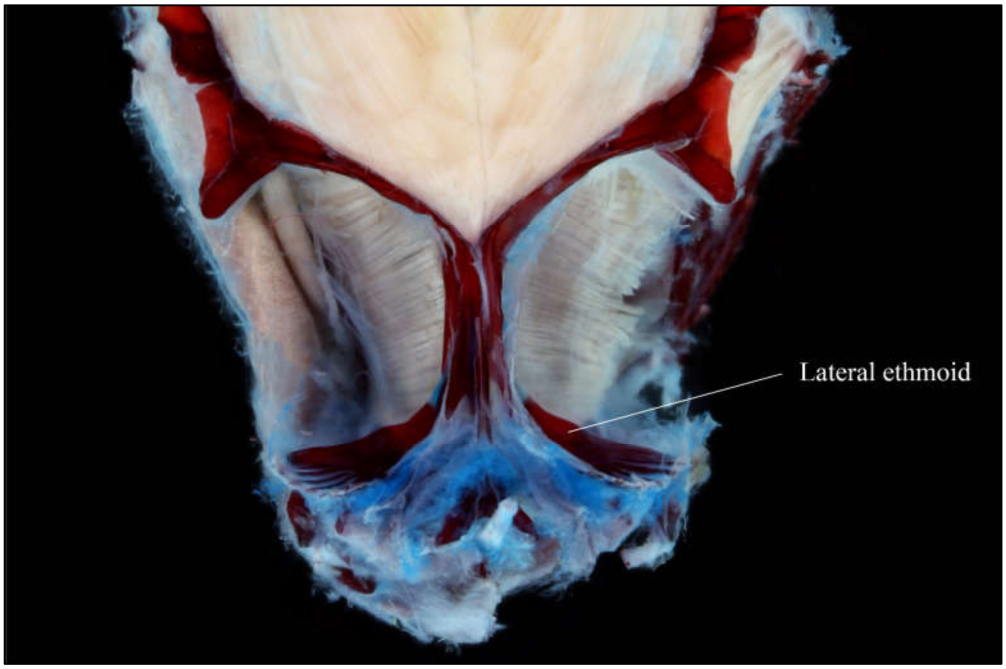

Figure 72 – Dorsal view of the head of *Evorthodus lyricus* (**MZUSP** 66355, 54.6 mm SL).

Character 47. Mesethmoid, anterolateral process, presence (adapted from Caires (2012), character: 12).

Character states: (0) absent, (1) present

Caires (2012) postulated three different states for the dorsal surface of the mesethmoid, being (0) dorsal surface without any dorsal process, (1) dorsal surface with two small triangular shaped dorsal projection and (2) dorsal surface with two large projections forming two dorsal *cornua*. We were unable to distinguish between the small and huge projections, thus herein only two states are considered, presence or absence of a dorsal process. In *Rhyacichthys*, *Odontobutis*, *Eleotris*, *Bathygobius* and *Gobius* the dorsal surface of the mesethmoid lacks any dorsal process, state (0). In all other taxa the dorsal process is present, state (1).

Character 48. Frontal, width in supraorbital region in relation to orbital diameter (adapted from Birdsong (1975); Caires (2012), character 1).

Character states: (0) width contained twice or less in orbital diameter, (1) width contained more than twice in orbital diameter.

Birdsong (1975) and Caires (2012), postulated that a large supraorbital portion of the is the a plesiomorphic state for gobioids. State (1) was found in *Rhyacichthys*, *Odontobutis* and *Eleotris,* the basal clades included in this phylogenetic analysis, but also in *Stenogobius* (*Stenogobius*) *laterisquamatus*, *Cotylopus*, *Lentipes*, *Sicydium* and *Sicyopterus*. *Gobius*, *Bathygobius*, *Awaous*, *Stenogobius* (*Insularigobius*) *genivittatus*, *Evorthodus*, *Gobionellus*, *Gobioides*, and *Oxyurichthys* have a narrow frontal in the suborbital region, state (1).

Table 64 – State of cranial characters in examined taxa.

Terminal	Character		
	46	**47**	**48**
Rhyacichthys aspro	0	0	0
Odontobutis obscurus	0	0	0
Eleotris perniger	0	0	0
Bathygobius soporator	1	0	1
Gobius niger	1	0	1
Evorthodus lyricus	1	1	1
Gobioides broussonnetii	1	1	1
Gobionellus oceanicus	1	1	1
Oxyurichthys cornutus	1	1	1
Stenogobius (*Insularigobius*) *genivittatus*	1	1	1
Stenogobius (*Stenogobius*) *laterisquamatus*	1	1	0
Cotylopus acutipinnis	1	1	0
Lentipes concolor	0	1	0
Sicydium plumieri	0	1	0
Sicyopterus longifilis	1	1	0
Awaous (*Awaous*) *commersonii*	1	1	1
Awaous (*Awaous*) *ocellaris*	1	1	1
Awaous (*Chonophorus*) *banana*	1	1	1
Awaous (*Chonophorus*) *lateristriga*	1	1	1
Awaous (*Chonophorus*) *tajasica*	1	1	1
Awaous (*Chonophorus*) *transandeanus*	1	1	1
Awaous (*Euctenogobius*) *flavus*	1	1	1

2.4.9. Jaws and Suspensorium

Character 49. Premaxilla, differentiation of ascending process in relation to articular process (PARENTI; MACIOLEK, 1993, character: 5)

Character states: (0) differentiated, (1) indistinct.

Parenti and Maciolek (1993) postulated that an indistinct ascending process of the premaxilla is a synapomorphy of Sicydiinae. In fact, in *Lentipes*, *Cotylopus*, *Sicydium* and *Sicyopterus* (**Figure 74**) the ascending process is indistinct. All other taxa have the articular process and the ascending process clearly separated (**Figure 73**).

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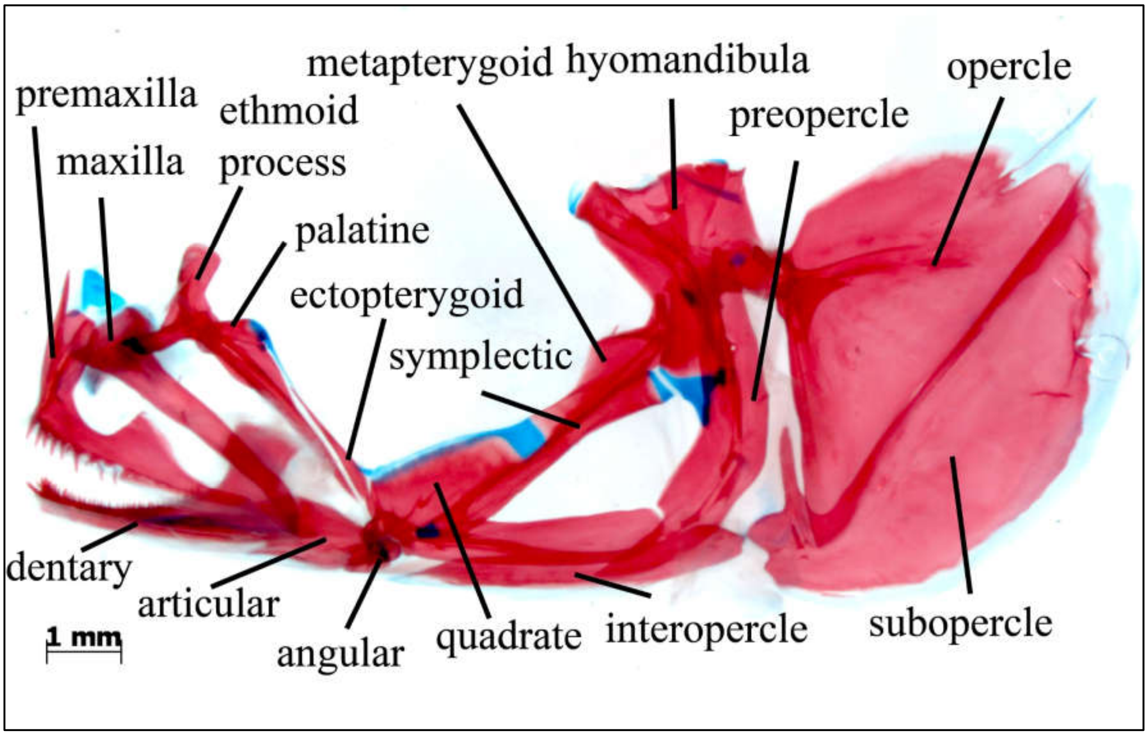

Figure 73 – Medial view of palatine arch of *Stenogobius* (*Stenogobius*) *laterisquamatus* (**NMNH** 372810, 77.9 mm SL).

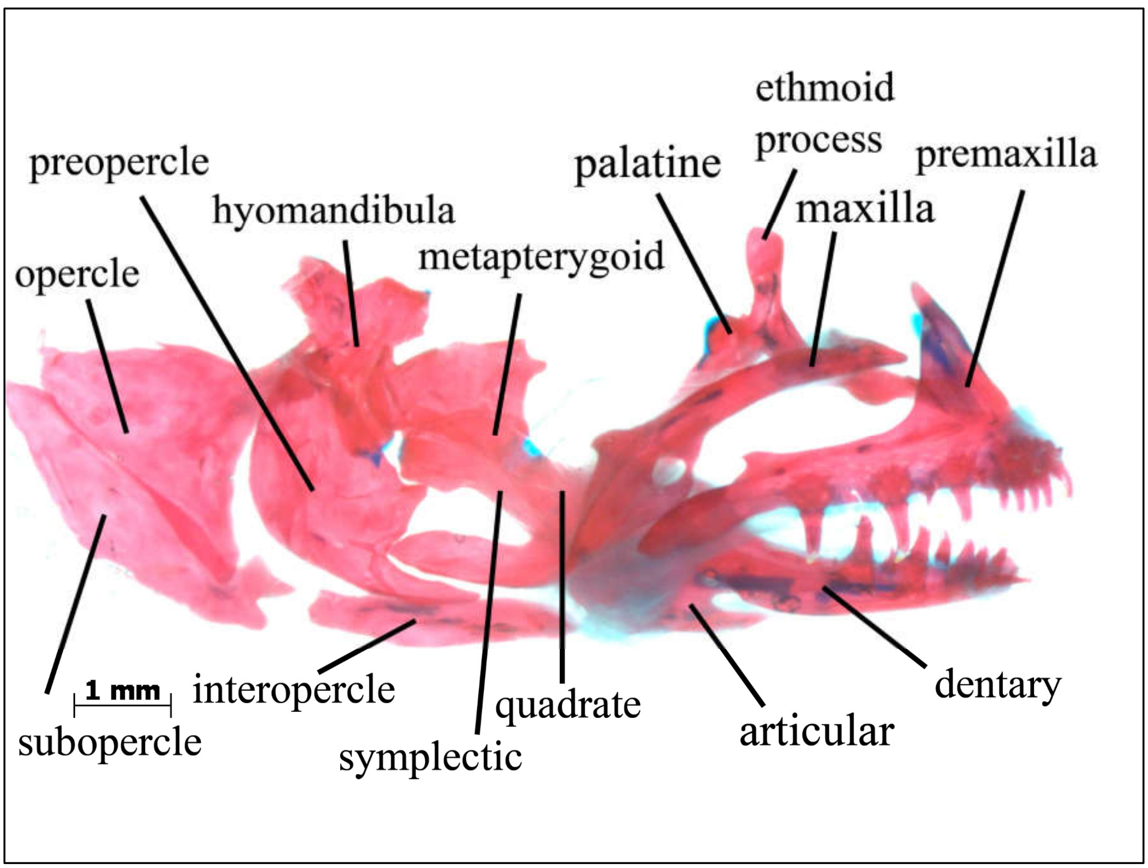

Figure 74 – Lateral view of palatine arch of *Lentipes concolor* (**NMNH** 316119, 67.1 mm SL).

Character 50. Premaxilla, indistinct ascending process, format (adapted from Parenti and Maciolek (1993), character: 5).

Character states: (0) triangular, (1) blunt

Parenti and Maciolek (1993) also commented that a blunt process could be indicative of a clade formed by *Sicydium* and *Sicyopterus*. *Lentipes* (**Figure 74**) and *Cotylopus* presents a process in a triangular shape, while in *Sicydium* and *Sicyopterus* (**Figure 75**) the blunt shape was observed.

Inapplicability: this character does not apply to taxa presenting different ascending and articular processes in the premaxilla.

Character 51. Pré-maxilla, sac of replacement teeth, presence (SAKAI; NAKAMURA, 1979; PARENTI; MACIOLEK, 1993).

Character states: (0) absent, (1) present.

Sakai and Nakamura (1979) and Parenti and Maciolek (1993) commented about the importance of a sac of replacement teeth in the premaxilla to diagnose the Sicydiinae. In the examined taxa only *Cotylopus*, *Sicydium* and *Sicyopterus* have structure (**Figure 75**), which is absent in *Lentipes* and all other examined genera.

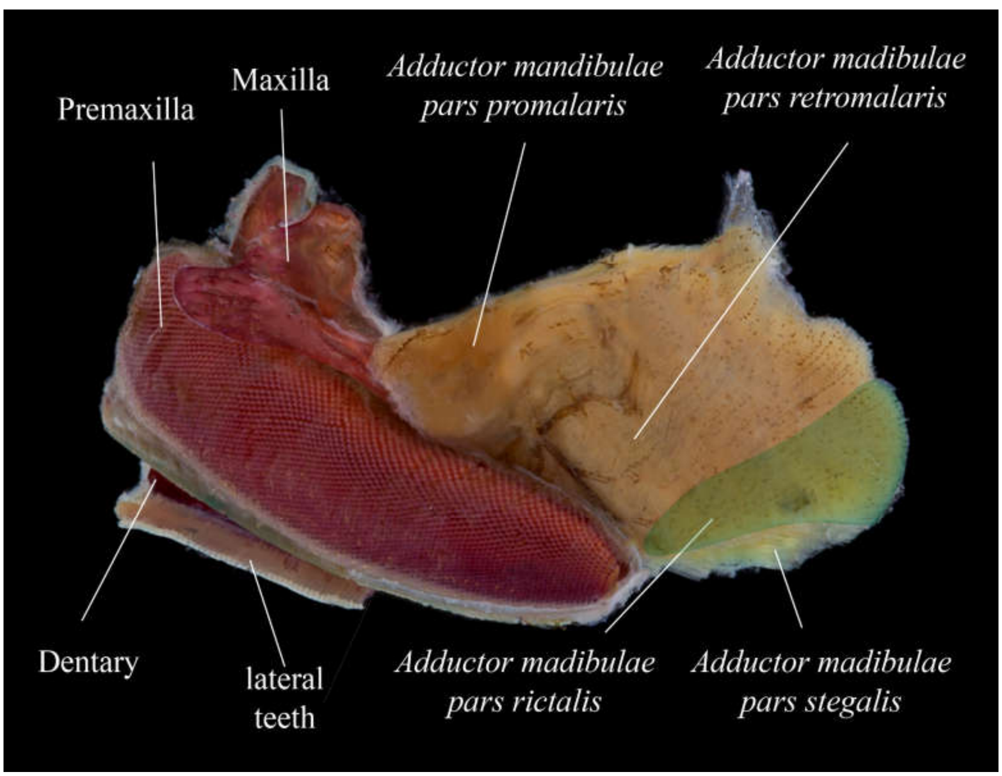

Figure 75 – Lateral view of cheek region of *Sicydium plumieri* (**NMNH** 144033, 73 mm SL).

Character 52. Dentary, Coronoid process, format (adapted from Caires (2012), character 59).

Character states: (0) rectangular, (1) triangular

In *Gobionellus*, *Lentipes*, *Cotylopus*, *Sicydium* and *Sicyopterus* the dorsal face of the coronoid process of the dentary presents a triangular shape, while in other taxa this process is rectangular. We were unable to determine the state of this character in *Odontobutis*, because of an impossibility to observe the coronoid process in the exemplar stained for musculature.

Character 53. Dentary, number of rows of teeth (MILLER, 1973b; HARRISON, 1989).

Character states: (0) two or more, (1) only one.

Miller (1973b) and Harrison (1989) postulated that a single row of conic teeth in the dentary is a specialization of Sicydiinae. In *Rhyacichthys* and most examined taxa the dentary has several rows of teeth. A single row of teeth was only observed in *Lentipes* (**Figure 74**), *Cotylopus*, *Sicydium* and *Sicyopterus*.

Character 54. Dentary, teeth height in relation to the median portion of the dentary.

Character states: (0) height smaller than height of the median region of dentary, (1) at least one tooth with the height greater than height of the median region of dentary.

Usually the condition observed in examined taxa is the presence of several rows of small teeth. However, *Lentipes* (**Figure 74**), *Cotylopus*, *Sicydium*, *Sicyopterus* and *Bathygobius* presented at least one tooth with height greater than the height of the median region of the dentary.

Character 55. Dentary, presence of laterally oriented teeth (SAKAI; NAKAMURA, 1979; PARENTI; MACIOLEK, 1993).

Character states: (0) absent, (1) present

The presence of laterally oriented teeth in Sicydiinae is a noticeable feature. It is not clear in the literature if this is an exclusive characteristic for the whole subfamily or a characteristic defining a subgroup within Sicydiinae (see Parenti and Maciolek (1993) for further discussion). The purpose of this dissertation is not to understand the origins of laterally oriented teeth. However, this characteristic was only reported in *Lentipes*, *Cotylopus*, *Sicydium* (**Figure 75**) and *Sicyopterus*, taxa nowadays considered member of Sicydiinae.

Character 56. Ectopterygoid, format (HARRISON, 1989, PARENTI; MACIOLEK, (1993), character: 4; CAIRES, 2012, character: 58).

Character states: (0) triangular, (1) trapezoid.

The shape of the ectopterygoid is commonly considered an informative character in the classification of gobies (HARRISON, 1989; PARENTI; MACIOLEK, 1993; CAIRES, 2012). In *Rhyacichthys* and most examined taxa the ectopterygoid is triangular (**Figure 73**), but in *Cotylopus*, *Sicydium* and *Sicyopterus* it is trapezoidal in shape (**Figure 76**).

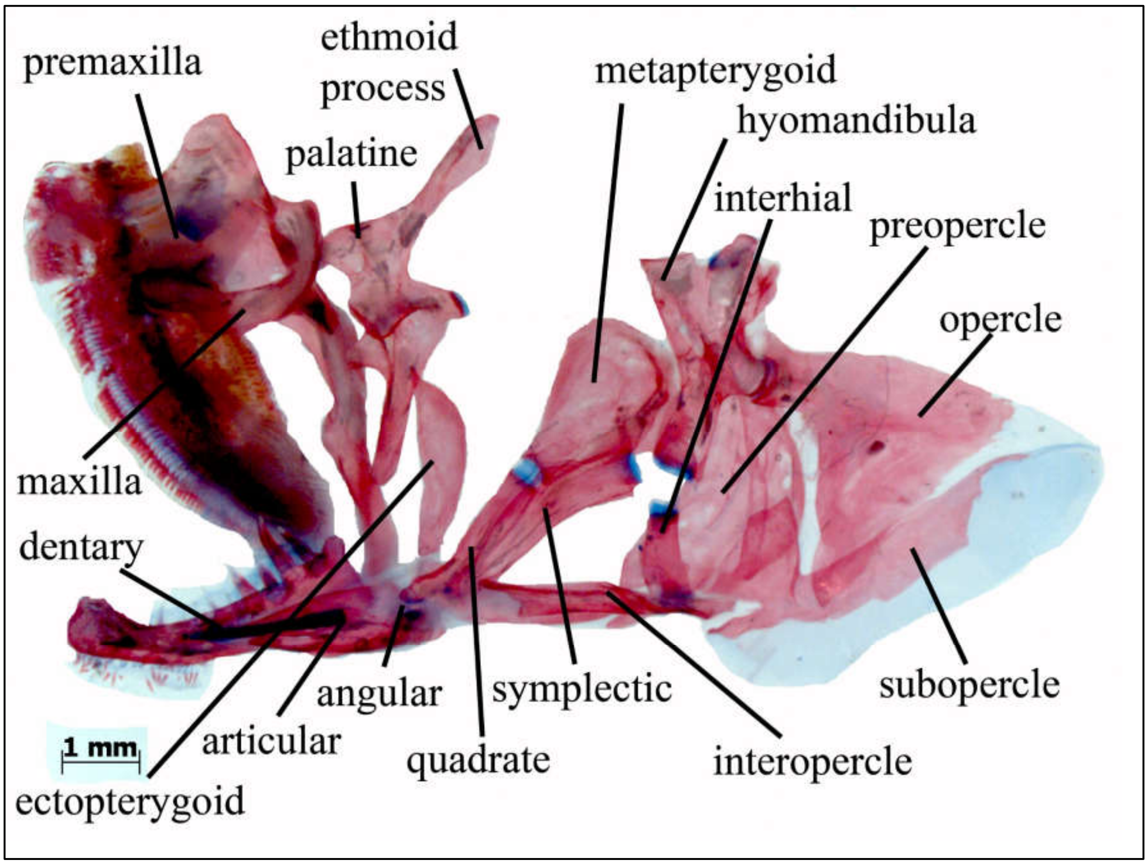

Figure 76 – Medial view of palatine arch of *Sicyopterus longifilis* (**MZB** 24873, 62.4 mm SL).

Character 57. Palatine, ethmoid process, length in relation to maxillary process (HARRISON, 1989; PARENTI; MACIOLEK, 1993, character: 4; CAIRES, 2012, character: 58).

Character states: (0) smaller than maxillary process, (1) as large as the maxillary process.

Several authors noted the importance of this character (HARRISON, 1989; PARENTI; MACIOLEK, 1993; CAIRES, 2012). In *Rhyacichthys*, *Odontobutis*, *Eleotris*, *Bathygobius* and *Gobius* the ethmoid process of the palatine is smaller than the maxillary process (**Figure 77**). However, in *Awaous*, *Stenogobius*, *Evorthodus, Gobioides*, *Gobionellus*, *Oxyurichthys*, *Cotylopus*, *Lentipes*, *Sicydium* and *Sicyopterus* (**Figure 71**) it is much more conspicuous being as large as the maxillary process.

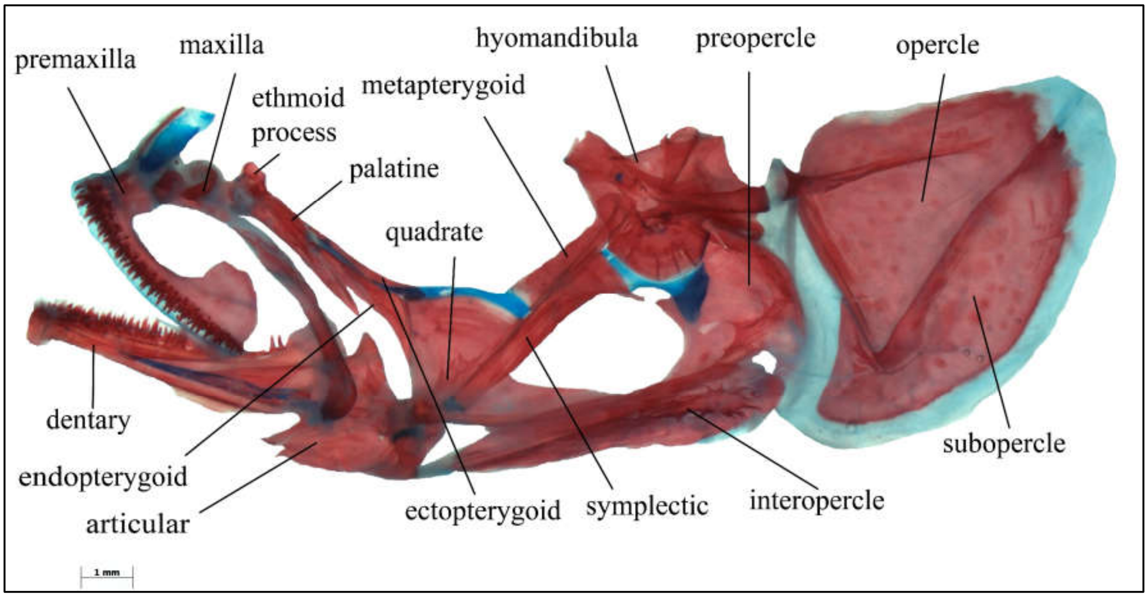

Figure 77 – Medial view of palatine arch of *Eleotris perniger* (**NMNH** 314440, 60.7 mm SL).

Character 58. Preopercle, anterior expansion, presence (MILLER, 1973; HARRISON, 1989).

Character states: (0) present, (1) absent.

Harrison (1989) noted that the preopercle is not expanded toward the symplectic in the same way in *Awaous* and Sicydiinae. In *Rhyacichthys* and in most of the analyzed taxa, the preopercle is not anteriorly expanded, but in *Bathygobius*, *Gobius*, *Lentipes* (**Figure 74**), *Cotylopus*, *Sicydium* and *Sicyopterus* (**Figure 76**) a round dorsal expansion in the anterior region of preopercle is present.

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Table 65 – State of palatine arch characters in examined taxa. Traces represent inapplicable characters (-). Question marks (?) represent missing data.

Terminal	Character									
	49	**50**	**51**	**52**	**53**	**54**	**55**	**56**	**57**	**58**
Rhyacichthys aspro	0	-	0	0	0	0	0	0	0	0
Odontobutis obscurus	0	-	0	?	0	0	0	0	0	1
Eleotris perniger	0	-	0	0	0	0	0	0	0	1
Bathygobius soporator	1	0	0	0	0	1	0	0	0	1
Gobius niger	1	0	0	0	0	0	0	0	0	1
Evorthodus lyricus	0	-	0	0	0	0	0	0	1	0
Gobioides broussonnetii	0	-	0	0	0	0	0	0	1	0
Gobionellus oceanicus	0	-	0	1	0	0	0	0	1	0
Oxyurichthys cornutus	0	-	0	0	0	0	0	0	1	0
Stenogobius (*Insularigobius*) *genivittatus*	0	-	0	0	0	0	0	0	1	0
Stenogobius (*Stenogobius*) *laterisquamatus*	0	-	0	0	0	0	0	0	1	0
Cotylopus acutipinnis	1	1	1	1	1	1	1	1	1	1
Lentipes concolor	1	1	0	1	1	1	1	0	1	1
Sicydium plumieri	1	1	1	1	1	1	1	1	1	1
Sicyopterus longifilis	1	1	1	1	1	1	1	1	1	1
Awaous (*Awaous*) *commersonii*	0	-	0	0	0	0	0	0	1	0
Awaous (*Awaous*) *ocellaris*	0	-	0	0	0	0	0	0	1	0
Awaous (*Chonophorus*) *banana*	0	-	0	0	0	0	0	0	1	0
Awaous (*Chonophorus*) *lateristriga*	0	-	0	0	0	0	0	0	1	0
Awaous (*Chonophorus*) *tajasica*	0	-	0	0	0	0	0	0	1	0
Awaous (*Chonophorus*) *transandeanus*	0	-	0	0	0	0	0	0	1	0
Awaous (*Euctenogobius*) *flavus*	0	-	0	0	0	0	0	0	1	0

2.4.10. Dorsal fins

Character 59. First dorsal-fin pterygiophores, interdigitation with neural spines (BIRDSONG *et al*., 1988, HARRISON, 1989, CAIRES, 2012, character: 108).

Character states: (0) (3-2212), (1) (3-1221), (2) (3-2211), (3) (3-12201)

Birdsong *et al*. (1988) performed a detailed study of the vertebral column showing the importance of the pterygiophore formula in relation to vertebra among the lineages within Gobiidae. In *Rhyacichthys* the anterior most pterygiophore of the first dorsal fin is associated with the gap between the 3rd and 4th vertebrae, and the number of pterygiophores associated with other gaps follows the formula (3-2212). *Eleotris*, *Awaous*, *Stenogobius*, *Gobionellus*, *Oxyurichthys*, *Evorthodus*, *Lentipes*, *Cotylopus*, *Sicydium* and *Sicyopterus* have the formula (3-1221), state (1), *Bathygobius* and *Gobius* have state (2) and *Gobioides* presents a unique derived formula, state (3). We were unable to determine the Character state in *Odontobutis*, since it was not possible to observe the relation of the vertebrae and pterygiophores in the exemplar stained for muscular analysis.

2.4.11. Pelvic fins

Character 60. Pelvic fin spine, position in relation to the first branched ray when the fin is fused to a suction cup (adapted from Hoese (1984) and Parenti and Maciolek (1993), character: 1).

Character states: (0) equidistanct between pelvic fin spines and rays, (1) pelvic-fin spine and first ray close together at their proximal ends, and separated from remaining four pelvic-fin rays.

This character was used by Parenti and Maciolek (1993) to define the Sicydiinae family (**Figure 56**). In *Bathygobius*, *Gobius*, *Awaous*, *Evorthodus*, *Gobioides*, *Gobionellus*, *Oxyurichthys* and *Stenogobius* the spines and rays are equidistant with each other. However, in *Lentipes*, *Cotylopus*, *Sicydium* and *Sicyopterus* the spine and the first branched ray are closer to each other than to the others.

Inapplicability: this character does not apply to *Rhyacichthys*, *Odontobutis* and *Eleotris* since these genera do not have fused pelvic fins.

Character 61. Pelvic fin spine, position in relation to joint with bone (PARENTI; THOMAS, 1998, character: 1).

Character states: (0) spine inserted non-perpendicularly, (1) spine of pelvic fin inserted perpendicularly.

This character was enhanced by Parenti and Thomas (1998) as a complement to the characters defined in Parenti and Maciolek (1993) as a synapomorphy for Sicydiinae. Perpendicular insertion of pelvic-fin spine was only observed in *Lentipes*, *Cotylopus*, *Sicydium* and *Sicyopterus* (**Figure 56**) as opposed to the non-perpendicular insertion observed in other examined genera.

Inapplicability: this character does not apply to *Rhyacichthys*, *Odontobutis* and *Eleotris* since these genera do not have fused pelvic fins.

2.4.12. Caudal fin

Character 62. Epurals, number (MILLER, 1973, GOSLINE, 1955, SPRINGER, 1983, BIRDSONG *et al.*, 1988, LARSON (2001), character: 5; CAIRES (2012), character: 97).

Character states: (0) three epurals, (1) two epurals, (2) one epural

Birdsong *et al*. (1988) noted the presence of only a single epural in *Awaous* and Sicydiinae. Among the examined taxa a single epural characterizes *Bathygobius*, *Gobius*, *Awaous*, *Evorthodus*, *Lentipes*, *Cotylopus*, *Sicydium* and *Sicyopterus*. *Rhyacichthys* has three epurals, and *Eleotris*, *Stenogobius*, *Gobioides*, *Gobionellus* and *Oxyurichthys* have two We were unable to determine the character state in *Odontobutis*, since tese structures were not visible in the exemplar prepared for muscular analysis.

Table 66 – State of fin characters in examined taxa. Traces represent inapplicable characters (-). Question marks (?) represent missing data.

Terminal	Character			
	59	**60**	**61**	**62**
Rhyacichthys aspro	0	-	-	0
Odontobutis obscurus	?	-	-	?
Eleotris perniger	1	-	-	1
Bathygobius soporator	2	0	0	2
Gobius niger	2	0	0	2
Evorthodus lyricus	1	0	0	2
Gobioides broussonnetii	3	0	0	1
Gobionellus oceanicus	1	0	0	1
Oxyurichthys cornutus	1	0	0	1
Stenogobius (*Insularigobius*) *genivittatus*	1	0	0	1
Stenogobius (*Stenogobius*) *laterisquamatus*	1	0	0	1
Cotylopus acutipinnis	1	1	1	2
Lentipes concolor	1	1	1	2
Sicydium plumieri	1	1	1	2
Sicyopterus longifilis	1	1	1	2
Awaous (*Awaous*) *commersonii*	1	0	0	2
Awaous (*Awaous*) *ocellaris*	1	0	0	2
Awaous (*Chonophorus*) *banana*	1	0	0	2
Awaous (*Chonophorus*) *lateristriga*	1	0	0	2
Awaous (*Chonophorus*) *tajasica*	1	0	0	2
Awaous (*Chonophorus*) *transandeanus*	1	0	0	2
Awaous (*Euctenogobius*) *flavus*	1	0	0	2

2.4.13. Myological Characters

Dorsal view

Character 63. Epaxial musculature, medial portion, position relative to lateral portion.

Character states: (0) medial portion not covering lateral portion dorsally, (1) medial portion completely covering lateral portion dorsally.

In *Rhyacichthys* and *Odontobutis* the lateral portion of the epaxial musculature is lies lateral to the medial portion, not covering it (**Figure 77**). In the other genera exmined, the medial portion completely overlaps the lateral portion, leaving the lateral portion accessible only when the medial portion is dissected (**Figure 78**).

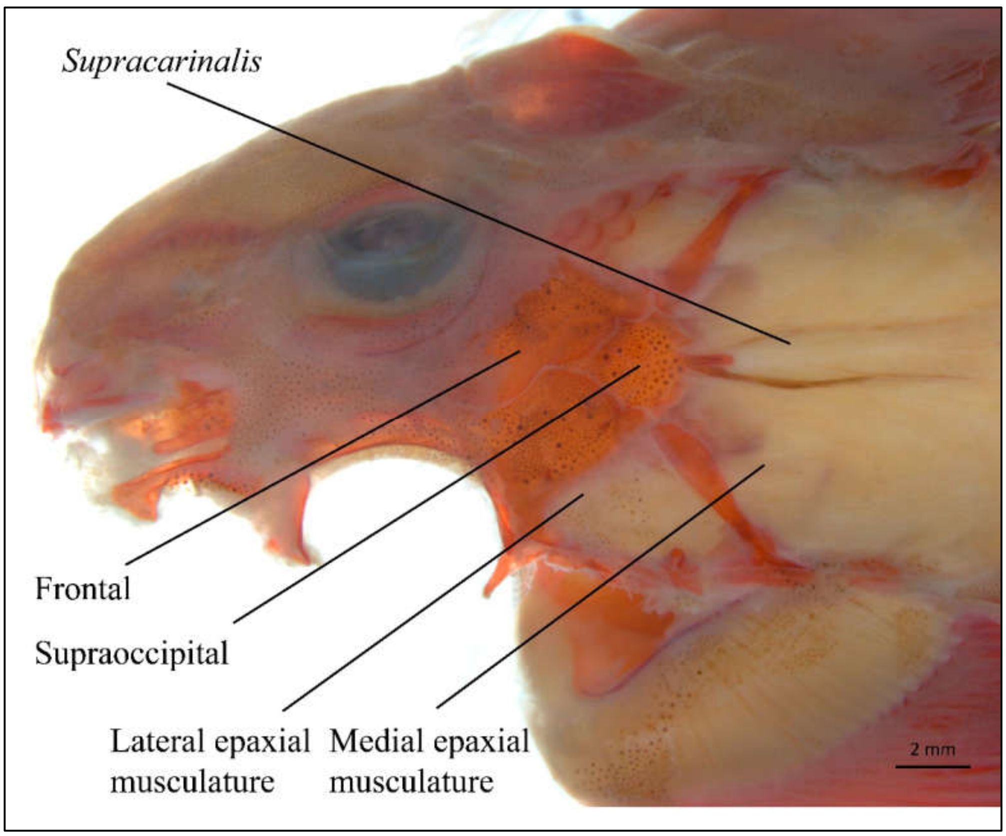

Figure 77 – Dorsal view of the head of *Rhyacichthys aspro* (**NMNH** 371845, 59.9 mm SL).

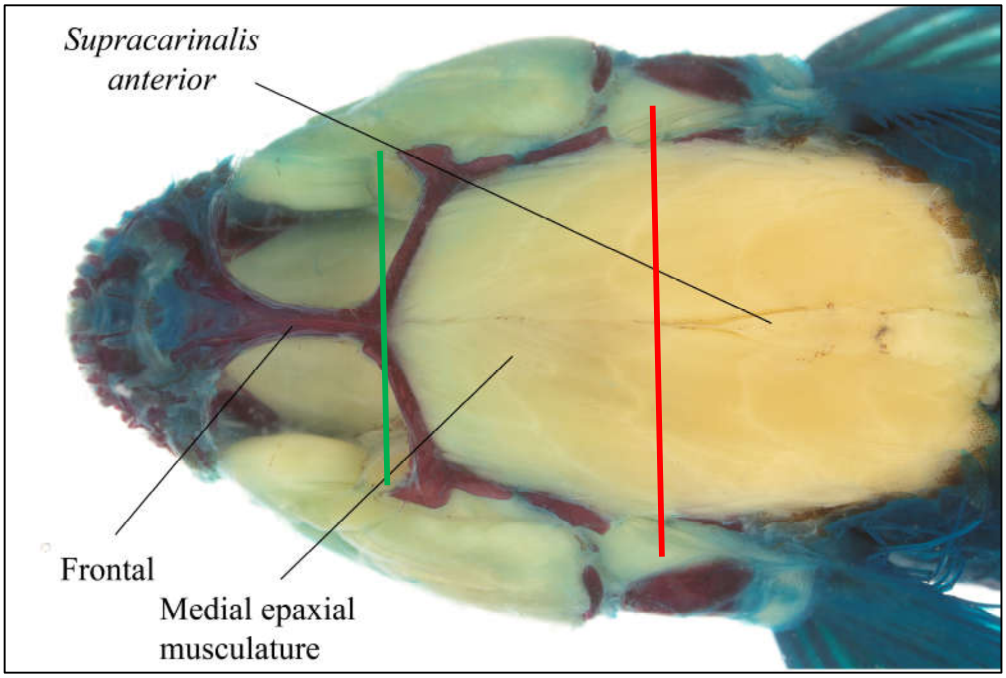

Figure 78 – Dorsal view of the head of *Bathygobius soporator* (**LIRP** 1414, 58.2 mm SL), green line indicates the anterior limit of insertion of the medial portion of the *epaxialis*, red line point to anterior limit of *supracarinalis*.

Character 64. Epaxial musculature, medial portion, insertion in relation to posterior limit of orbital region.

Character states: (0) insertion posterior to posterior margin of orbital region, (1) insertion into exact region of end of orbit, (2) insertion anterior to posterior margin of orbital region.

In *Rhyacichthys*, *Odontobutis Awaous, Stenogobius, Gobioides and Lentipes* the medial portion of the epaxial musculature is located posterior to the orbit limit as in *Gobionellus* (**Figure 79**), *Oxyurichthys* and *Cotylopus* this musculature inserts in the exact region of the end of the orbit. Lastly, in *Eleotris*, *Bathygobius*, *Gobius*, *Evorthodus*, *Sicydium* and *Sicyopterus* the medial portion of the epaxial musculature inserts anterior to the posterior limit of the orbit.

Character 65. Epaxial musculature, medial portion, insertion relative to orbital margins.

Character states: (0) insertion reaching the margin of the orbital region, (1) never inserting at the margin of the orbital region.

In *Bathygobius*, *Gobius*, *Gobionellus*, *Oxyurichthys* and *Evorthodus* the insertion never reaches the margin of the orbit, whereas in *Eleotris* (**Figure 78**), *Cotylopus*, *Sicydium* and *Sicyopterus* the insertion reaches the margin of the orbital region.

Inapplicability: this character does not apply to taxa which medial portion of epaxial musculature inserts posteriorly to the posterior limit of the orbital region.

Character 66. Epaxial musculature, medial portion, insertion in relation to orbital region, anterior limit of insertion at the orbital margin.

Character states: (0) anterior insertion limit reaching the final third of the orbital region, (1) anterior insertion limit not reaching the final third of the orbital region.

In *Cotylopus* the insertion limit of the epaxial musculature in the orbital region does not reach the final third of the orbit, while in *Eleotris*, *Sicydium* and *Sicyopterus* the insertion covers the final third of the orbit.

Inapplicability: this character does not apply to taxa presenting epaxial musculature that are inserted posteriorly to the posterior limit of the orbital region and does not apply to taxa which epaxial musculature does not reach the margins of the orbital region.

Character 67. Epaxial musculature, medial portion, anterior limit of insertion of lateral and medial portion.

Character states: (0) anterior limit of insertion of the medial portion of the epaxial musculature posterior in relation to the lateral region, (1) anterior limit of insertion of the lateral and medial portion aligned, (2) anterior limit of the medial region of the medial portion of the epaxial musculature anterior in relation to the lateral region.

In *Rhyacichthys*, *Odontobutis*, *Bathygobius*, *Gobius*, *Gobioides*, *Gobionellus*, *Oxyurichthys*, *Evorthodus*, *Sicydium* and *Sicyopterus* the anterior limit of insertion of the medial region of the medial portion of the epaxial musculature inserts posteriorly to the lateral region, state (0). In *Awaous* (*Awaous*) *ocellaris* and *Stenogobius* the anterior limit of insertion of medial and lateral portion of the medial portion of the epaxial musculature coincides, state (1). Finally, in *Eleotris*, *Awaous* (*Chonophorus*), *Awaous* (*Euctenogobius*), *Awaous* (*Awaous*) *Commersonii*, *Cotylopus* and *Lentipes* the anterior limit of insertion of the medial region of the medial portion of the epaxial musculature is located anteriorly in relation to the lateral portion, state (2).

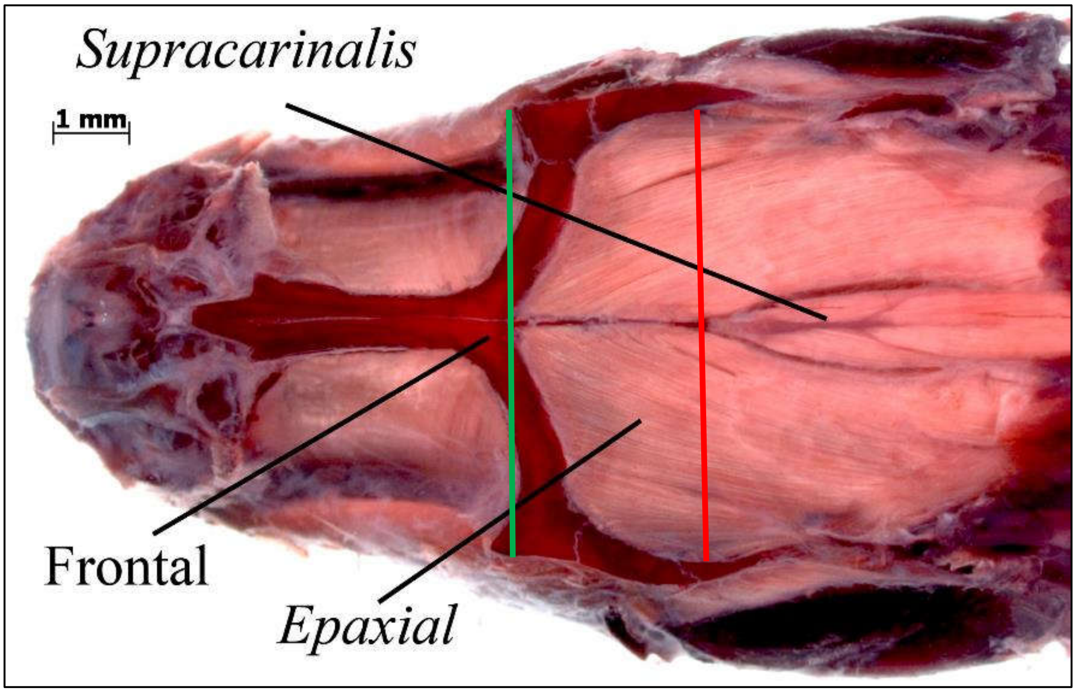

Figure 79 – Dorsal view of the head of *Gobionellus oceanicus* (**NMNH** 352117, 93.4 mm SL), green line indicates the anterior limit of insertion of the medial portion of the *epaxialis*, red line point to anterior limit of insertion of *supracarinalis*.

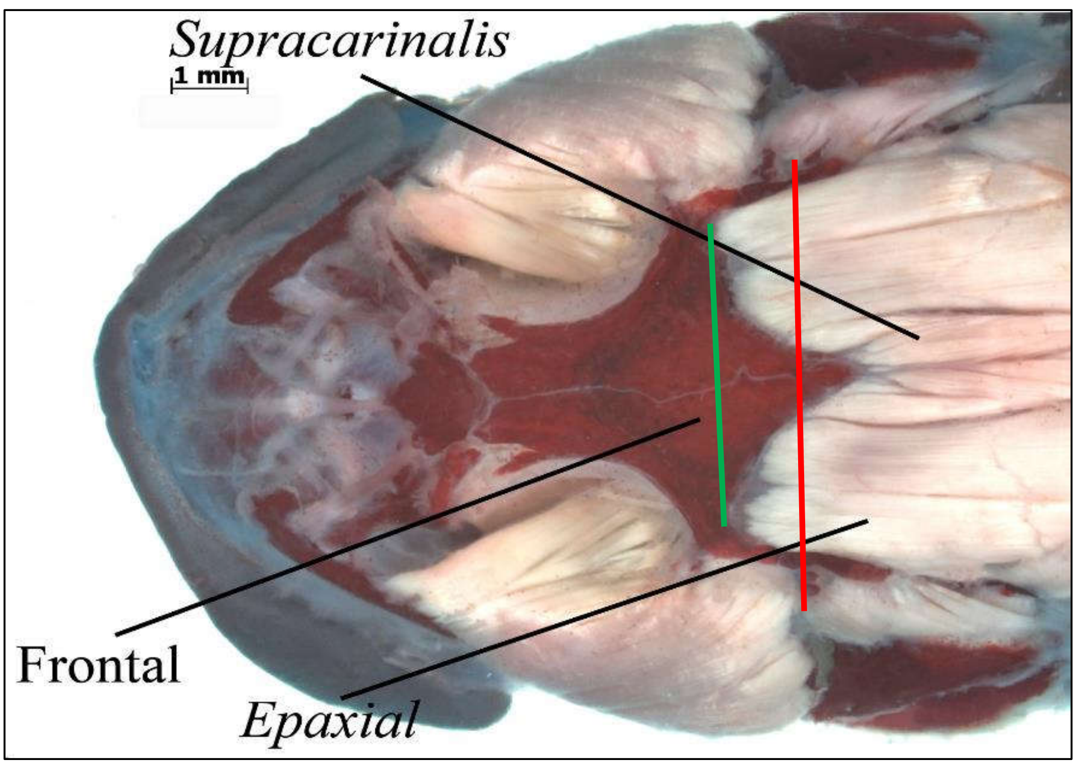

Figure 80 – Dorsal view of the head of *Lentipes concolor* (**NMNH** 316119, 56.3 mm SL), green line indicates the anterior limit of insertion of the medial portion of the *epaxialis*, red line point to anterior limit of insertion of *supracarinalis*.

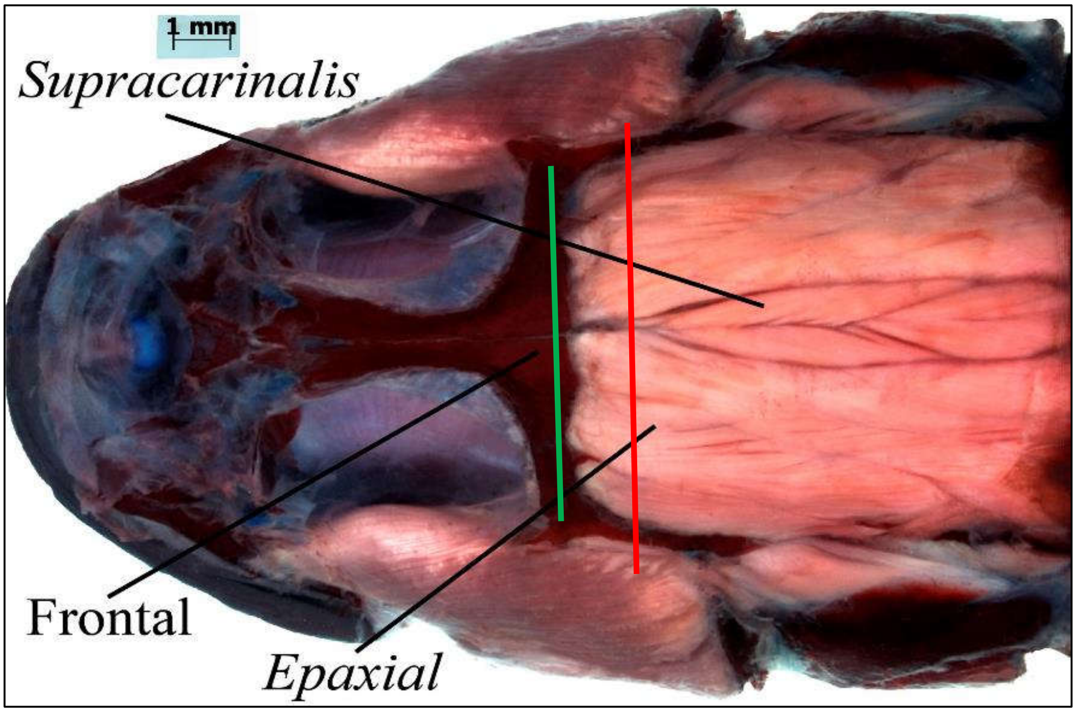

Figure 81 – Dorsal view of the head of *Stenogobius genivittatus* (**NMNH** 278704, 69.1 mm SL), green line indicates the anterior limit of insertion of the medial portion of the *epaxialis*, red line point to anterior limit of insertion of *supracarinalis*.

Character 68. *Supracarinalis*, insertion in relation to the medial portion of the epaxial musculature.

Character states: (0) insertion posterior to the anterior limit of insertion of the medial portion of the epaxial musculature, (1) insertion at the anterior limit of insertion of the epaxial musculature.

In *Awaous* (*Awaous*) *ocellaris* and *Stenogobius* (*Stenogobius*) *laterisquamatus* the anterior limit of insertion of the *supracarinalis* remains in the same region of the anterior limit of the medial portion of epaxial musculature. In all other taxa the supracarinalis insets posteriorly to the anterior limit of insertion of the medial portion of the epaxial musculature.

Character 69. *Supracarinalis*, insertion in relation to anterior limit of opercular region.

Character states: (0) insertion posteriorly to the vertical traced at the anterior margin of the opercle, (1) insertion anteriorly to the vertical traced in the anterior margin of the opercle

In *Rhyacichthys*, *Odontobutis*, *Eleotris*, *Bathygobius*, *Gobius, Gobioides*, *Gobionellus*, *Oxyurichthys* and *Evorthodus* the *supracarinalis* inserts posteriorly to vertical traced in the anterior margin of the opercle. *Supracarinalis* inserts anteriorly to the vertical traced in the anterior margin of the opercle in *Awaous, Stenogobius* (**Figure 81**), *Cotylopus*, *Lentipes*, *Sicydium* and *Sicyopterus*.

Character 70. *Supracarinalis*, insertion in relation to supraoccipital.

Character states: (0) not completely covering the anterior region of the supraoccipital, (1) completely covering the anterior region of the supraoccipital.

In *Rhyacichthys* (**Figure 77**), *Odontobutis*, *Awaous* (*Chonophorus*) *lateristriga*, *Gobioides*, *Cotylopus*, *Lentipes* and *Sicyopterus* the *supracarinalis* does not cover completely the anterior region of the supraoccipital (**Figure 82**), while in other taxa this bone is completely covered by the *supracarinalis* in dorsal view.

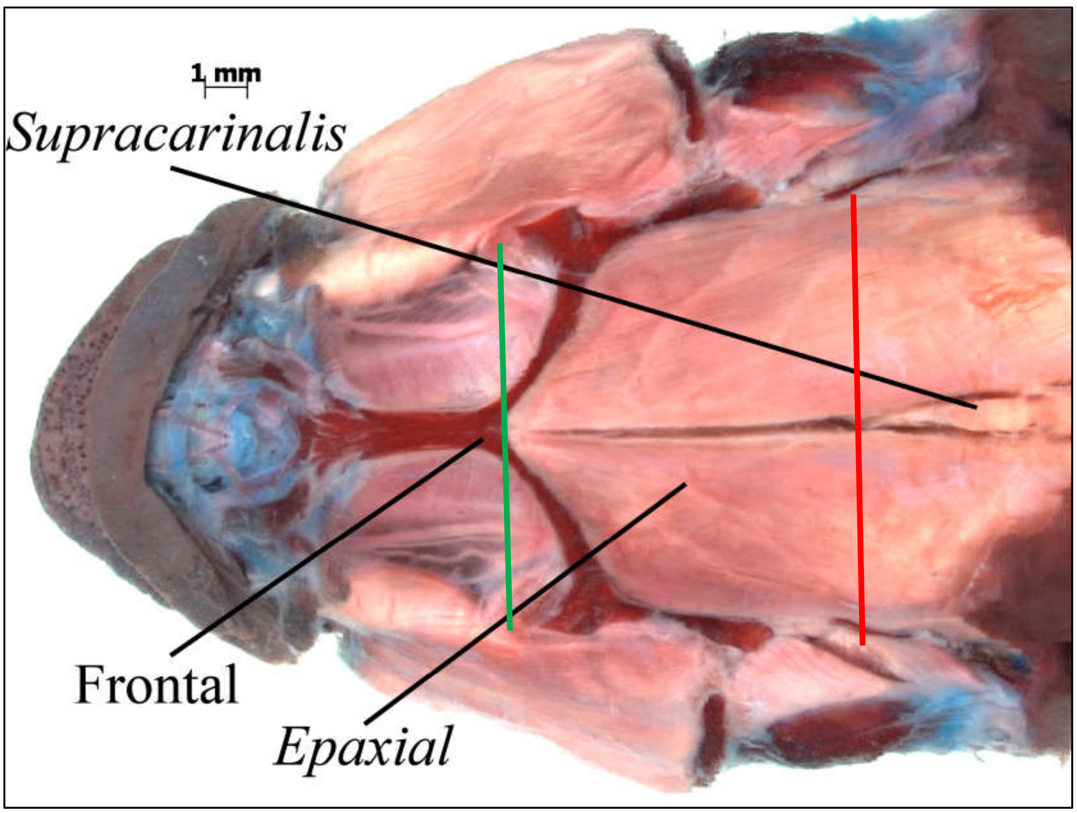

Figure 82 – Dorsal view of the head of *Gobius niger* (**NMNH** 298489, 76.2 mm SL).

Ventral view

Character 71. Interhyoideus, posterior portion, medial fibers, medial expansion, presence.

Character states: (0) absent, (1) present.

In *Eleotris* and *Gobius* a medial expansion of the fibers of the posterior portion of *Interhyoideus* (*sensu* DATOVO; RIZZATO, 2018) (**Figure 83**) is present, this expansion is absent in all other taxa (**Figure 84, 85** and **86**).

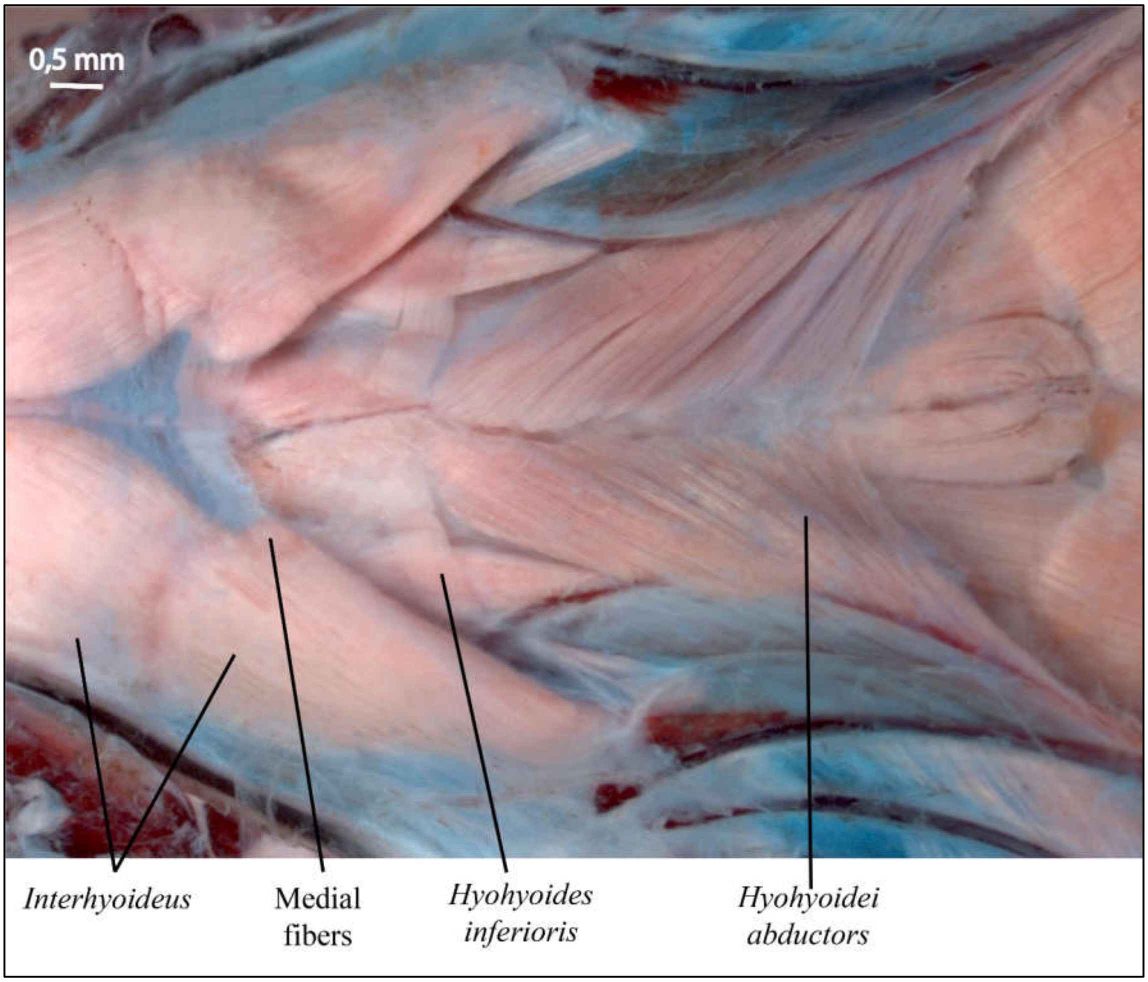

Figure 83 – Dorsal view of the head of *Gobius niger* (**NMNH** 298489, 76.2 mm SL).

Character 72. *Hyohyoides inferioris posterioris*, presence.

Character states: (0) absent, (1) present.

In *Rhyacichthys*, *Odontobutis*, *Eleotris*, *Bathygobius*, *Gobius* (**Figure 83**), *Evorthodus*, *Gobioides*, *Gobionellus* and *Oxyurichthys* the posterior portion of the *Hyohyoides inferioris* is absent. However, this portion is present in *Awaous* (**Figures 84** and **85**), *Stenogobius* (**Figure 86**), *Cotylopus*, *Lentipes* and *Sicydium*. Unfortunately, this character cannot be observed in *Sicyopterus longifilis*, however, this structure was identified in a specimen of *Sicyopterus calliochromus* indicating that this muscle may be characteristic of this genus.

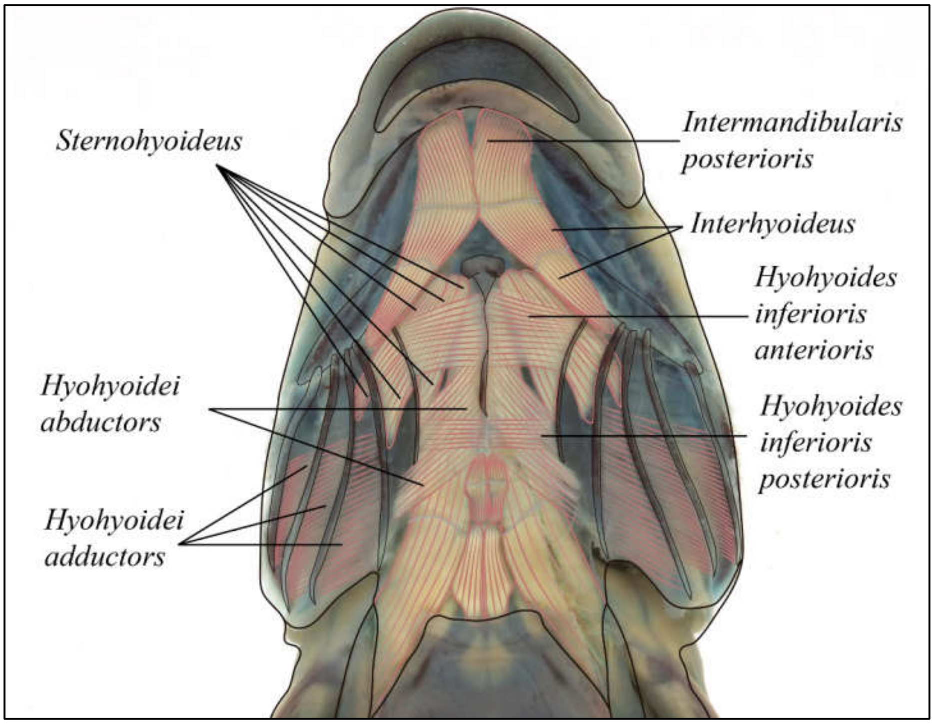

Figure 84 – Ventral view of *Awaous* (*Chonophorus*) *tajasica*. (**MZUSP** 26842, 90,3 mm SL).

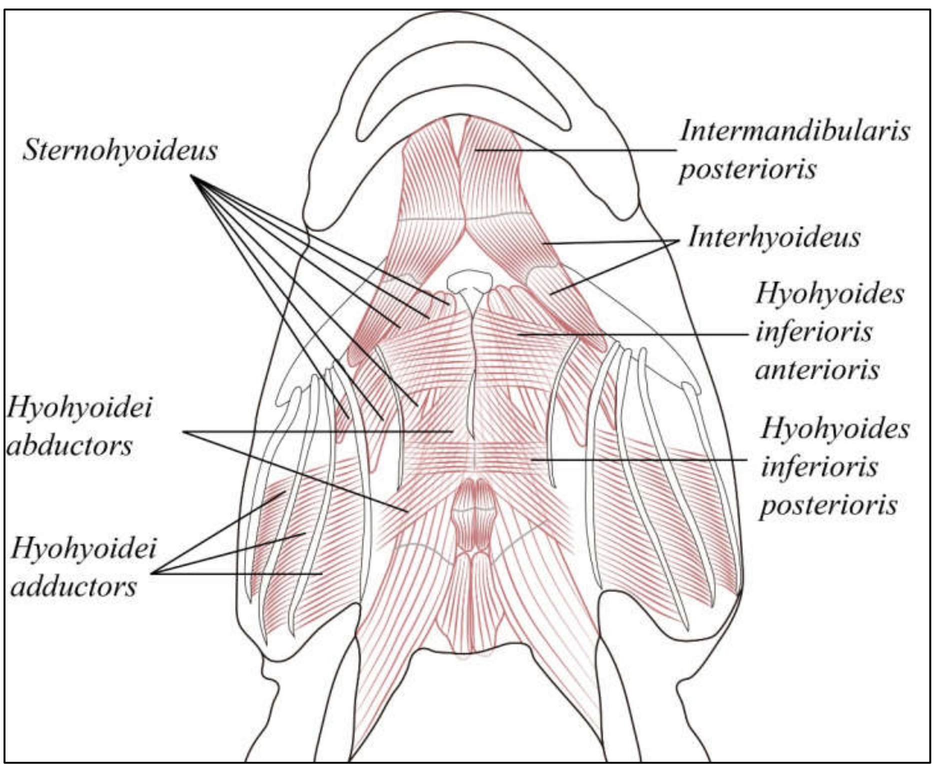

Figure 85 – Illustration of the ventral view of *Awaous* (*Chonophorus*) *tajasica*. (**MZUSP** 26842, 90.3 mm SL).

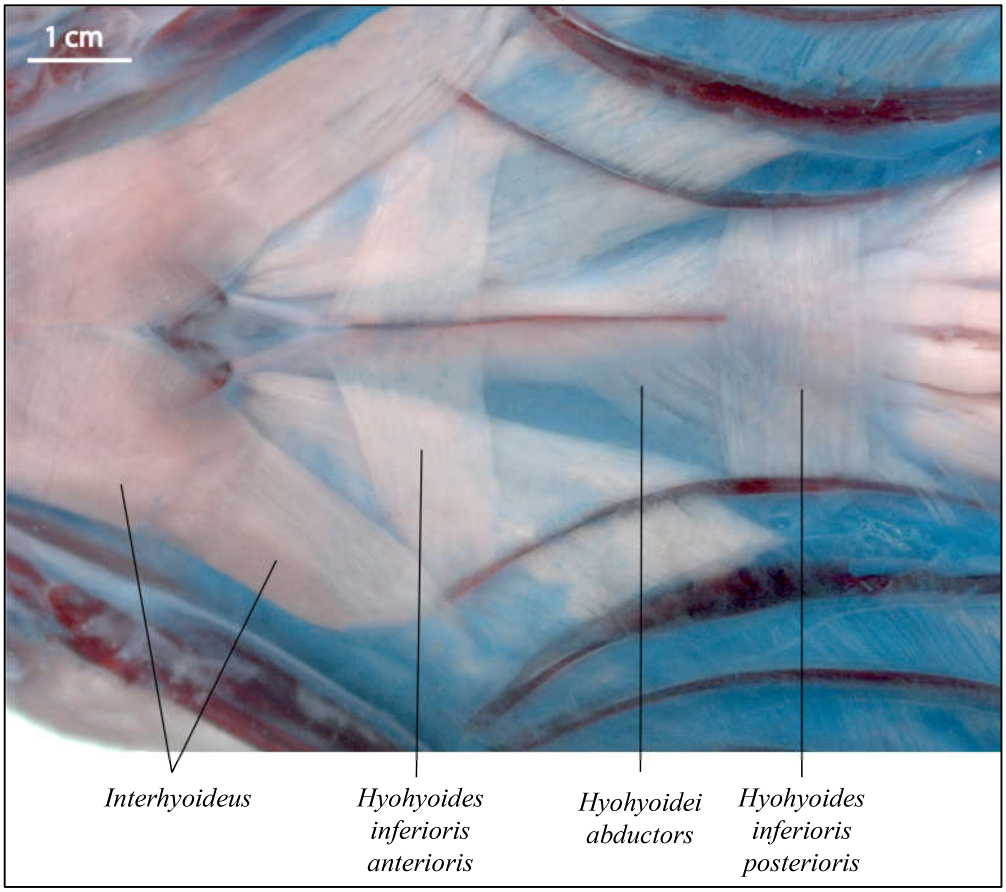

Figure 86 – Ventral view of the head of *Stenogobius* (*Stenogobius*) *laterisquamatus* (**NMNH** 298697, 83.9 mm SL).

Lateral view

Character 73. *Adductor mandibulae*, *segmentum facialis pars retromalaris*, insertion.

Character states: (0) inserting on the coronoid process of the dentary, (1) inserting on the maxilla.

In *Rhyacichthys*, *Odontobutis*, *Eleotris*, *Awaous*, *Stenogobius*, *Gobionellus*, *Oxyurichthys* and *Gobius* the *segmentum facialis pars retromalaris* inserts on the coronoid process. Meantime in *Lentipes*, *Cotylopus* (**Figure 87)**, *Sicydium* and *Sicyopterus* this muscle inserts on the maxilla.

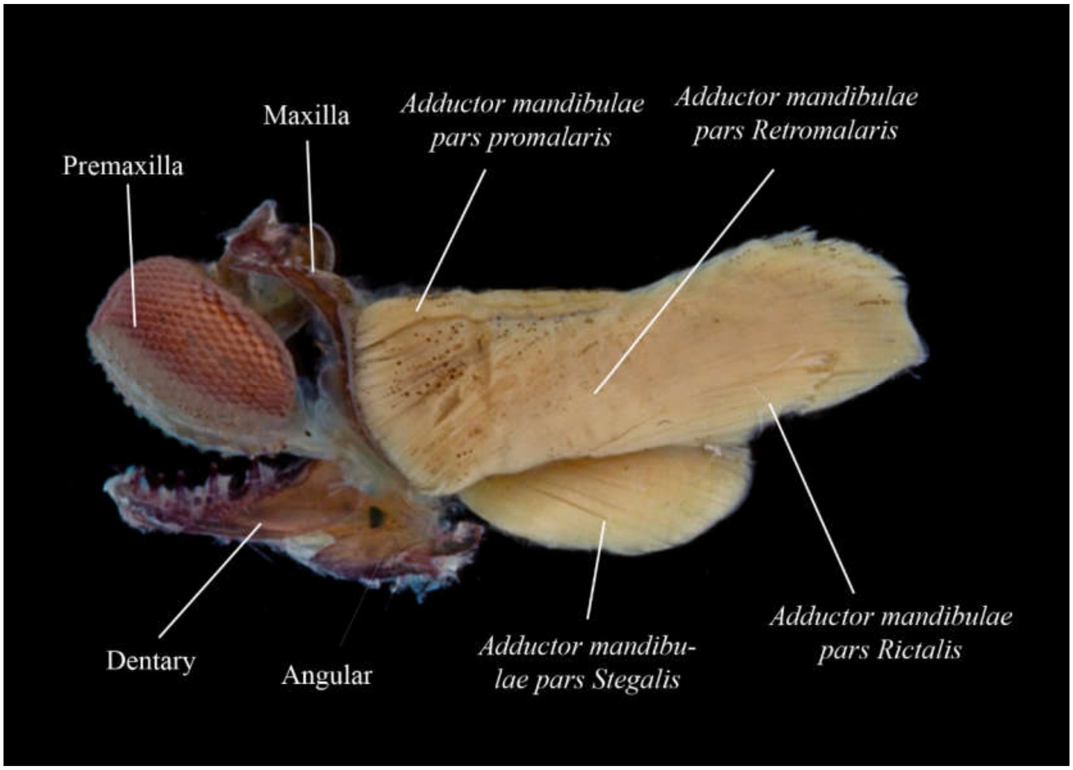

Figure 87 – Lateral view of the check of *Cotylopus acutipinnis* (**MNHN** 1984-0809, 52.5 mm SL.).

Character 74. *Adductor mandibulae*, *segmentum facialis pars stegalis*, position in in relation to *pars malaris* and *pars rictalis*.

Character states: (0) placed medially to the *Adductor mandibulae*, *pars retromalaris* and *Adductor mandibulae*, *pars rictalis*, not visible in lateral view, (1), placed between the *Adductor mandibulae*, *pars retromalaris* and *Adductor mandibulae*, *pars rictalis*, visible in lateral view.

In *Odontobutis*, *Eleotris* (**Figure 88**), *Awaous* and *Stenogobius* (**Figure 89**) the *pars stegalis* of the *segmentum facialis* is placed between the *pars retromalaris* and *pars rictalis*. In other taxa the *pars stegalis* is placed medially.

Character 75. *Adductor mandibulae*, *segmentum facialis*, *pars stegalis*, position in relation to *pars malaris* and *pars rictalis*, when placed medially.

Character states: (0) placed medially, not visible in lateral view, (1) placed ventrally, visible in lateral view, (2) placed medially, visible in lateral view.

In *Bathygobius*, *Gobius*, *Gobioides*, *Gobionellus*, *Oxyurichthys* and *Lentipes* the *Adductor mandibulae*, *pars stegalis* is placed medially to *Adductor mandibulae*, *pars malaris* and *rictalis*, fully concealed in lateral view, state (0). In *Cotylopus* (**Figure 87**), *Sicydium* (**Figure 74**) and *Sicyopterus* the *Adductor mandibulae*, *pars stegalis* is placed medially and ventrally to the *Adductor mandibulae*, *pars malaris* and *rictalis*, visible in lateral view, state (1). Lastly, in *Evorthodus* the *Adductor mandibulae*, *pars stegalis* is placed medially to *Adductor mandibulae*, *pars malaris* and *rictalis* but in this genus the posterior portion of this muscle is visible in lateral view, state (2).

Inapplicability: this character does not apply to *Eleotris*, *Awaous* and *Stenogobius* since in these genera the *Adductor mandibulae*, *pars stegalis* is placed in between the *Adductor mandibulae*, *pars malaris* and *pars rictalis*.

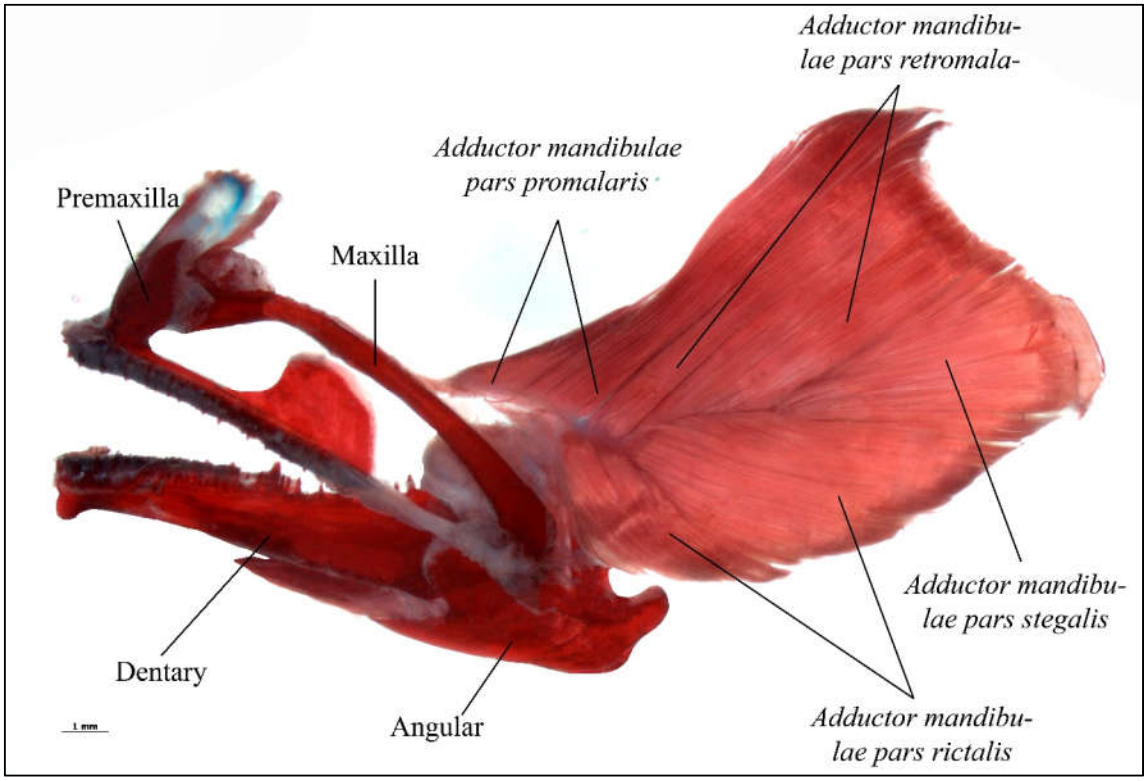

Figure 88 – Lateral view of the check of *Eleotris perniger* (**NMNH** 314440, 88.1 mm SL).

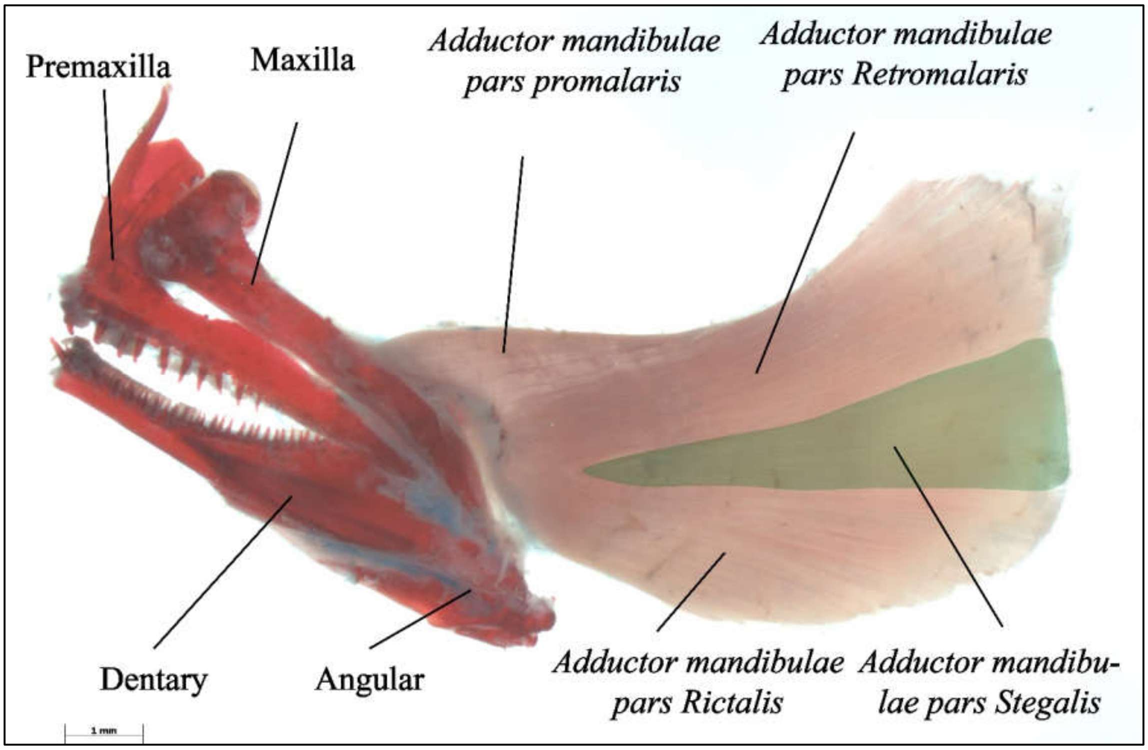

Figure 89 – Lateral view of the check of *Stenogobius laterisquamatus* (**NMNH** 298697, 83.9 mm SL).

Table 67 – State of myological characters in examined taxa. Traces represent inapplicable characters (-). Question marks (?) represent missing data.

Terminal	Character												
	63	**64**	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**	**73**	**74**	**75**
Rhyacichthys aspro	0	0	-	-	0	0	0	0	0	0	0	0	0
Odontobutis obscurus	0	0	-	-	2	0	0	0	0	0	0	1	-
Eleotris perniger	1	2	0	0	2	0	0	1	1	0	0	1	-
Bathygobius soporator	1	2	1	-	0	0	0	1	0	0	0	0	0
Gobius niger	1	2	1	-	0	0	0	1	1	0	0	0	0
Evorthodus lyricus	1	2	1	-	0	0	0	1	0	0	0	0	2
Gobioides broussonnetii	1	0	-	-	0	0	0	0	0	0	0	0	0
Gobionellus oceanicus	1	1	1	-	0	0	0	1	0	0	0	0	0
Oxyurichthys cornutus	1	1	1	-	0	0	0	1	0	0	0	0	0
Stenogobius (*Insularigobius*) *genivittatus*	1	0	-	-	1	0	1	1	0	1	0	1	-
Stenogobius (*Stenogobius*) *laterisquamatus*	1	0	-	-	1	1	1	1	0	1	0	1	-
Cotylopus acutipinnis	1	1	0	1	0	0	1	0	0	1	1	0	1
Lentipes concolor	1	0	-	-	0	0	1	0	0	1	1	0	0
Sicydium plumieri	1	2	0	0	0	0	1	1	0	1	1	0	1
Sicyopterus longifilis	1	2	0	0	0	0	1	0	0	?	1	0	1
Awaous (*Awaous*) *commersonii*	1	0	-	-	2	0	1	1	0	1	0	1	-
Awaous (*Awaous*) *ocellaris*	1	0	-	-	1	1	1	1	0	1	0	1	-
Awaous (*Chonophorus*) *banana*	1	0	-	-	2	0	1	1	0	1	0	1	-
Awaous (*Chonophorus*) *lateristriga*	1	0	-	-	2	0	1	0	0	1	0	1	-
Awaous (*Chonophorus*) *tajasica*	1	0	-	-	2	0	1	1	0	1	0	1	-
Awaous (*Chonophorus*) *transandeanus*	1	0	-	-	2	0	1	1	0	1	0	1	-
Awaous (*Euctenogobius*) *flavus*	1	0	-	-	2	0	1	1	0	1	0	1	-

2.4.14. Phylogenetic reconstruction

The analysis by implicit enumeration revealed two most parsimonious trees (**Figures 90** and **91**), with score of 190.760. The generated strict consensus tree presented the same topology as Tree 0 (**Figure 92**).

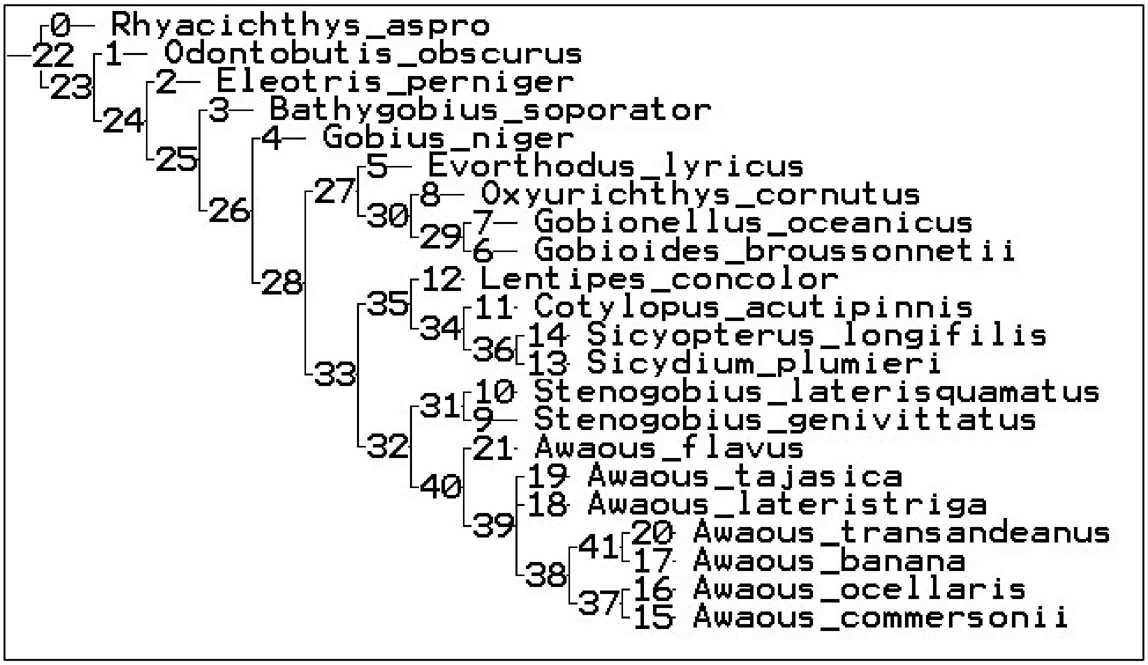

Figure 90 – Tree 0. Generated using implicit enumeration in TNT.

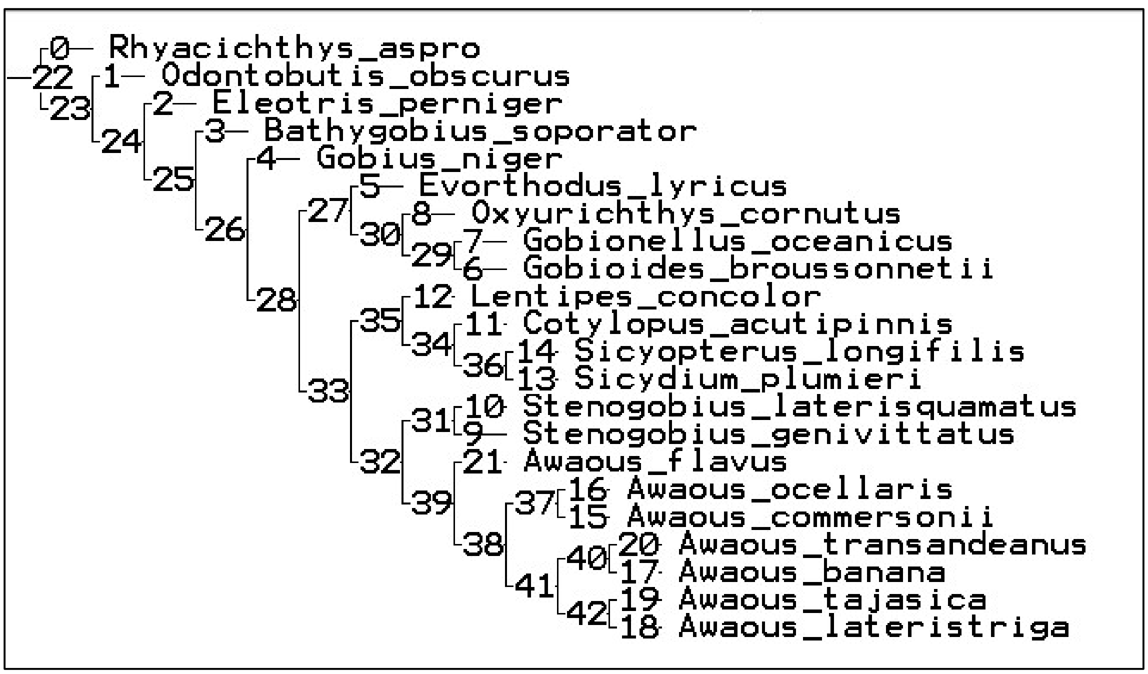

Figure 91 – Tree 1. Generated using implicit enumeration in TNT.

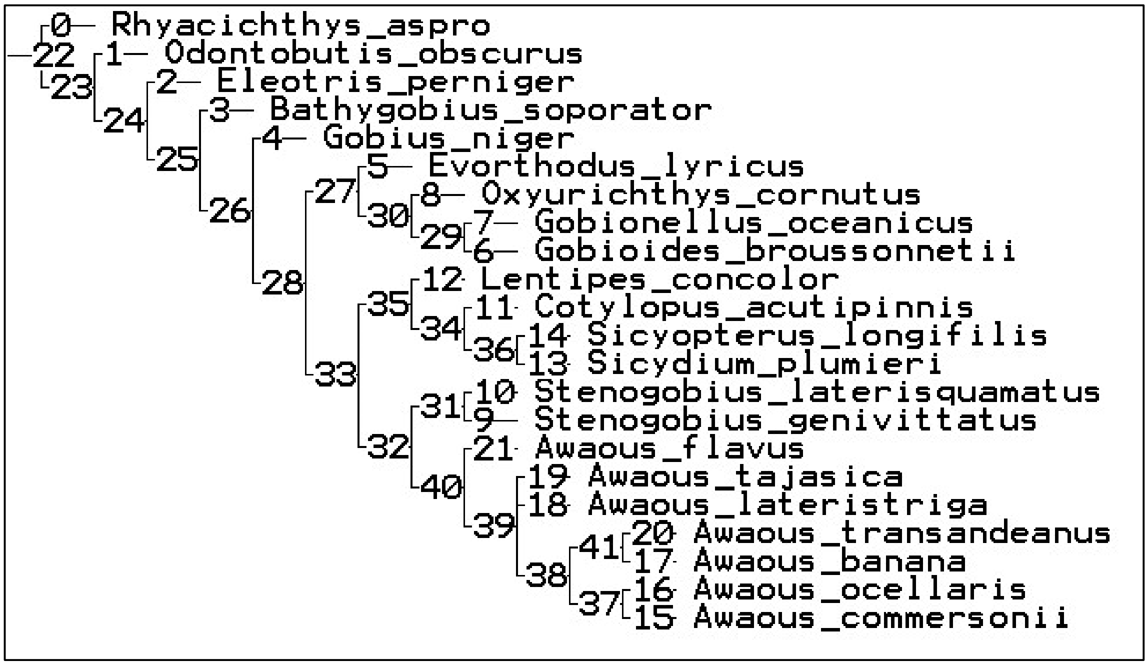

Figure 92 – Strict consensus tree. Generated using implicit enumeration in TNT.

2.4.15. List of synapomorphies

The nodes obtained in Trees 0 and 1 are almost identical, thus the nodes of Tree 1 presented below are the ones diverging from Tree 0.

Tree 0:

Rhyacichthys aspro:

No autapomorphies.

Odontobutis obscurus: Char. 1: 0.140-0.440 –> 0.050, Char. 2: 0.650 –> 0.560, Char. 3: 0.070-0.080 –> 0.060, Char. 19: 0 –> 1.

Eleotris perniger: Char. 0: 0.090-0.170 –> 0.000, Char. 17: 1 –> 0, Char. 25: 0 –> 1, Char. 71: 0 –> 1.

Bathygobius soporator: Char. 2: 0.650 –> 0.580, Char. 54: 0 –> 1.

Gobius niger: Char. 2: 0.710-0.760 –> 0.780, Char. 4: 0.400 –> 0.500, Char. 71: 0 –> 1.

Evorthodus lyricus: Char. 18: 1 –> 0, Char. 19: 1 –> 0, Char. 30: 0 –> 1, Char. 75: 0 –> 2.

Gobioides broussonnetii: Char. 0: 0.290 –> 0.120, Char. 3: 0.800 –> 1.000, Char. 4: 0.700 –> 1.000, Char. 5: 0.900 –> 1.000, Char. 13: 1 –> 0, Char. 16: 1 –> 0, Char. 28: 1 –> 0, Char. 39: 0 –> 1, Char. 59: 1 –> 3, Char. 64: 1 –> 0, Char. 70: 1 –> 0.

Gobionellus oceanicus: Char. 2: 0.800 –> 0.920, Char. 8: 0 –> 1, Char. 9: 0 –> 1, Char. 11: 1 –> 0, Char. 52: 0 –> 1.

Oxyurichthys cornutus: Char. 22: 1 –> 2.

Stenogobius genivittatus: Char. 3: 0.450 –> 0.510, Char. 4: 0.400 –> 0.500, Char. 5: 0.500 –> 0.600, Char. 20: 0 –> 1, Char. 27: 0 –> 1, Char. 30: 0 –> 1.

Stenogobius laterisquamatus: Char. 0: 0.390 –> 0.290, Char. 1: 0.110 –> 0.000, Char. 2: 0.710-0.760 –> 0.800, Char. 9: 0 –> 1, Char. 13: 0 –> 1, Char. 16: 0 –> 1, Char. 18: 1 –> 0, Char. 45: 0 –> 1, Char. 48: 1 –> 0, Char. 68: 0 –> 1.

Cotylopus acutipinnis: Char. 3: 0.360 –> 0.340, Char. 44: 1 –> 0, Char. 66: 0 –> 1.

Lentipes concolor: Char. 0: 0.670 –> 0.720, Char. 2: 0.710-0.760 –> 0.690, Char. 46: 1 –> 0.

Sicydium plumieri: Char. 0: 0.670 –> 0.570, Char. 1: 0.560-0.650 –> 1.000, Char. 13: 0 –> 1, Char. 45: 0 –> 1, Char. 46: 1 –> 0, Char. 70: 0 –> 1.

Sicyopterus longifilis: Char. 0: 0.670 –> 0.750, Char. 2: 0.860-0.930 –> 1.000, Char. 3: 0.360 –> 0.410, Char. 9: 1 –> 0, Char. 12: 0 –> 1.

Awaous (*Awaous*) *commersonii*: Char. 0: 0.620 –> 0.630, Char. 1: 0.640 –> 0.400, Char. 3: 0.340-0.370 –> 0.290, Char. 15: 1 –> 0, Char. 41: 1 –> 2.

Awaous (*Awaous*) *ocellaris*: Char. 2: 0.680 –> 0.820, Char. 3: 0.340-0.370 –> 0.380, Char. 18: 1 –> 0, Char. 67: 2 –> 1, Char. 68: 0 –> 1.

Awaous (*Chonophorus*) *banana*: Char. 1: 0.660-0.750 –> 0.990.

Awaous (*Chonophorus*) *lateristriga*: Char. 0: 0.520 –> 0.480, Char. 1: 0.750 –> 0.890, Char. 2: 0.460 –> 0.430, Char. 3: 0.340-0.370 –> 0.310, Char. 15: 1 –> 0, Char. 70: 1 –> 0.

Awaous (*Chonophorus*) *tajasica*:

No autapomorphies.

Awaous (*Chonophorus*) *transandeanus*: Char. 0: 0.550-0.620 –> 0.640, Char. 2: 0.610-0.680 –> 0.710, Char. 3: 0.340-0.370 –> 0.420.

Awaous (*Euctenogobius*) *flavus*: Char. 0: 0.520 –> 0.590, Char. 1: 0.750 –> 0.850, Char. 2: 0.460 –> 0.000, Char. 3: 0.340-0.370 –> 0.000, Char. 31: 1 –> 2, Char. 40: 0 –> 1, Char. 41: 1 –> 2, Char. 45: 0 –> 1.

Node 23:

No synapomorphies.

Node 24: Char. 4: 0.000 –> 0.200, Char. 5: 0.100 –> 0.300, Char. 16: 0 –> 1, Char. 18: 0 –> 1, Char. 63: 0 –> 1, Char. 64: 0 –> 2, Char. 70: 0 –> 1.

Node 25: Char. 3: 0.070-0.080 –> 0.280, Char. 4: 0.200 –> 0.300, Char. 6: 0 –> 1, Char. 7: 0 –> 1, Char. 46: 0 –> 1, Char. 48: 0 –> 1, Char. 62: 1 –> 2.

Node 26: Char. 2: 0.650 –> 0.710-0.760, Char. 3: 0.280 –> 0.360-0.480, Char. 4: 0.300 –> 0.400, Char. 5: 0.300 –> 0.500-0.600, Char. 19: 0 –> 1, Char. 21: 0 –> 1.

Node 27: Char. 1: 0.440-0.460 –> 0.260, Char. 3: 0.360-0.480 –> 0.570, Char. 13: 0 –> 1, Char. 25: 0 –> 2.

Node 28: Char. 0: 0.120-0.170 –> 0.300-0.320, Char. 32: 0 –> 1, Char. 47: 0 –> 1, Char. 57: 0 –> 1.

Node 29: Char. 0: 0.300 –> 0.290, Char. 1: 0.250 –> 0.130, Char. 2: 0.790 –> 0.800, Char. 3: 0.700 –> 0.800, Char. 4: 0.600 –> 0.700, Char. 5: 0.800 –> 0.900, Char. 44: 1 –> 0.

Node 30: Char. 1: 0.260 –> 0.250, Char. 2: 0.760 –> 0.790, Char. 3: 0.570 –> 0.700, Char. 4: 0.400 –> 0.600, Char. 5: 0.600 –> 0.800, Char. 41: 1 –> 2, Char. 43: 0 –> 1, Char. 62: 2 –> 1.

Node 31: Char. 1: 0.440-0.460 –> 0.110, Char. 19: 1 –> 0, Char. 25: 0 –> 1, Char. 62: 2 –> 1.

Node 32: Char. 23: 0 –> 1, Char. 44: 1 –> 0, Char. 67: 0 –> 1, Char. 74: 0 –> 1.

Node 33: Char. 0: 0.300-0.320 –> 0.390-0.520, Char. 16: 1 –> 0, Char. 20: 12 –> 0, Char. 69: 0 –> 1, Char. 72: 0 –> 1.

Node 34: Char. 1: 0.460 –> 0.560-0.650, Char. 2: 0.710-0.760 –> 0.860-0.930, Char. 8: 0 –> 1, Char. 28: 1 –> 0, Char. 51: 0 –> 1, Char. 56: 0 –> 1, Char. 75: 0 –> 1.

Node 35: Char. 0: 0.390-0.520 –> 0.670, Char. 9: 0 –> 1, Char. 26: 0 –> 1, Char. 48: 1 –> 0, Char. 49: 0 –> 1, Char. 52: 0 –> 1, Char. 53: 0 –> 1, Char. 54: 0 –> 1, Char. 55: 0 –> 1, Char. 60: 0 –> 1, Char. 61: 0 –> 1, Char. 70: 1 –> 0, Char. 73: 0 –> 1.

Node 36: Char. 31: 1 –> 0, Char. 50: 0 –> 1, Char. 64: 1 –> 2.

Node 37: Char. 1: 0.660-0.750 –> 0.640, Char. 19: 1 –> 0, Char. 28: 0 –> 1.

Node 38: Char. 0: 0.520 –> 0.550-0.620, Char. 2: 0.460 –> 0.610-0.680, Char. 16: 0 –> 1.

Node 39: Char. 10: 0 –> 1, Char. 12: 0 –> 1, Char. 14: 0 –> 1, Char. 28: 1 –> 0, Char. 39: 0 –> 1.

Node 40: Char. 1: 0.440-0.460 –> 0.750, Char. 2: 0.710-0.760 –> 0.460, Char. 24: 0 –> 1, Char. 67: 1 –> 2.

Node 41: Char. 33: 0 –> 1.

Tree 1:

Node 37: Char. 0: 0.550-0.590 –> 0.620, Char. 19: 1 –> 0.

Node 38: Char. 10: 0 –> 1, Char. 12: 0 –> 1, Char. 14: 0 –> 1, Char. 39: 0 –> 1.

Node 39: Char. 1: 0.440-0.460 –> 0.640-0.750, Char. 2: 0.710-0.760 –> 0.610-0.680, Char. 24: 0 –> 1, Char. 67: 1 –> 2.

Node 40: Char. 33: 0 –> 1.

Node 41: Char. 28: 1 –> 0.

Node 42: Char. 0: 0.550-0.590 –> 0.520, Char. 2: 0.610-0.680 –> 0.460.

2.4.16. Character indexes

Index of consistence and rescaled consistence are presented in **Table 68**.

Table 68 – Index of consistence and rescaled consistence for each character. Indexes in bold diverge in each tree.

Character indexes								
Character	Tree: 0				Tree: 1			
0	CI:	0.385	RC:	0.218	CI:	0.385	RC:	0.218
1	CI:	0.292	RC:	0.138	CI:	0.292	RC:	0.138
2	CI:	0.408	RC:	0.152	CI:	0.408	RC:	0.152
3	CI:	0.532	RC:	0.352	CI:	0.532	RC:	0.352
4	CI:	0.833	RC:	0.714	CI:	0.833	RC:	0.714
5	CI:	0.833	RC:	0.741	CI:	0.833	RC:	0.741
6	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
7	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
8	CI:	0.500	RC:	0.333	CI:	0.500	RC:	0.333
9	CI:	0.250	RC:	0.063	CI:	0.250	RC:	0.063
10	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
11	CI:	0.250	RC:	0.063	CI:	0.250	RC:	0.063
12	CI:	0.500	RC:	0.417	CI:	0.500	RC:	0.417
13	CI:	0.250	RC:	0.063	CI:	0.250	RC:	0.063
14	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
15	CI:	0.500	RC:	0.000	CI:	0.500	RC:	0.000
16	CI:	0.200	RC:	0.120	CI:	0.167	RC:	0.083
17	CI:	0.333	RC:	0.238	CI:	0.333	RC:	0.238
18	CI:	0.250	RC:	0.063	CI:	0.250	RC:	0.063
19	CI:	0.200	RC:	0.086	CI:	0.200	RC:	0.086
20	CI:	0.333	RC:	0.143	CI:	0.333	RC:	0.143
21	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
22	CI:	0.500	RC:	0.000	CI:	0.500	RC:	0.000
23	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000

Character indexes

Character	Tree: 0				Tree: 1			
24	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
25	CI:	0.500	RC:	0.389	CI:	0.500	RC:	0.389
26	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
27	CI:	0.250	RC:	0.063	CI:	0.250	RC:	0.063
28	CI:	0.200	RC:	0.100	CI:	**0.250**	**RC:**	**0.156**
29	CI:	0.500	RC:	0.000	CI:	0.500	RC:	0.000
30	CI:	0.500	RC:	0.000	CI:	0.500	RC:	0.000
31	CI:	0.400	RC:	0.229	CI:	0.400	RC:	0.229
32	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
33	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
34	CI:	0.250	RC:	0.143	CI:	0.250	RC:	0.143
35	CI:	0.500	RC:	0.000	CI:	0.500	RC:	0.000
36	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
37	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
38	CI:	0.500	RC:	0.250	CI:	0.500	RC:	0.250
39	CI:	0.250	RC:	0.156	CI:	0.250	RC:	0.156
40	CI:	0.250	RC:	0.063	CI:	0.250	RC:	0.063
41	CI:	0.333	RC:	0.185	CI:	0.333	RC:	0.185
42	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
43	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
44	CI:	0.200	RC:	0.067	CI:	0.200	RC:	0.067
45	CI:	0.333	RC:	0.000	CI:	0.333	RC:	0.000
46	CI:	0.333	RC:	0.167	CI:	0.333	RC:	0.167
47	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
48	CI:	0.333	RC:	0.238	CI:	0.333	RC:	0.238
49	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
50	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
51	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
52	CI:	0.500	RC:	0.375	CI:	0.500	RC:	0.375
53	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
54	CI:	0.500	RC:	0.375	CI:	0.500	RC:	0.375
55	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
56	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
57	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
58	CI:	0.333	RC:	0.238	CI:	0.333	RC:	0.238
59	CI:	0.750	RC:	0.000	CI:	0.750	RC:	0.000
60	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
61	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
62	CI:	0.500	RC:	0.333	CI:	0.500	RC:	0.333
63	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
64	CI:	0.250	RC:	0.135	CI:	0.250	RC:	0.135
65	CI:	0.500	RC:	0.333	CI:	0.500	RC:	0.333
66	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000

Character indexes								
Character	Tree: 0				Tree: 1			
67	CI:	0.286	RC:	0.202	CI:	0.286	RC:	0.202
68	CI:	0.500	RC:	0.000	CI:	0.500	RC:	0.000
69	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
70	CI:	0.200	RC:	0.067	CI:	0.200	RC:	0.067
71	CI:	0.500	RC:	0.000	CI:	0.500	RC:	0.000
72	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
73	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000
74	CI:	0.333	RC:	0.267	CI:	0.333	RC:	0.267
75	CI:	1.000	RC:	1.000	CI:	1.000	RC:	1.000

2.5. DISCUSSION

As expected *Odontobutis* is placed at the base of the trees. The families Rhyacichthyidae and Odontobutidae are considered a basal stock of the order Gobioidei (MILLER, 1973, GILL; MOOI, 2012).

Node 24, Eleotridae and Gobiidae: *Eleotris*, *Bathygobius*, *Gobius*, *Awaous*, *Stenogobius*, *Cotylopus*, *Lentipes*, *Sicydium*, *Sicyopterus*, *Evorthodus*, *Gobioides*, *Gobionellus*, *Oxyurichthys*.

Synapomorphies: Char. 4: 0.000 –> 0.200, Char. 5: 0.100 –> 0.300, Char. 16: 0 –> 1, Char. 18: 0 –> 1, Char. 63: 0 –> 1, Char. 64: 0 –> 2, Char. 70: 0 –> 1.

This clade is supported by an increase in in number of the second dorsal-fin rays (Char. 4: 0.000 –> 0.200), increase in anal fin ray number (Char. 5: 0.100 –> 0.300), presence of scales in the chest region (Char. 16: 0 –> 1) and absence of cycloid scales posterior to the vertical from the anterior spine of the first dorsal fin (Char. 18: 0 –> 1), the medial portion of the epaxial musculature overlapping the lateral portion (Char. 63: 0 –> 1), the *epaxial* musculature inserting much more anteriorly (Char. 64: 0 –> 2) and the *supracarinalis* completely covering the supraoccipital bone in dorsal view (Char. 70: 0 –> 1). The epaxial musculature was never analyzed in a phylogenetic context for the examined taxa. Future analysis may confirm if the position of the epaxial and supracarinal musculature is different between Rhyacichthydae, Odontobutidae and the clade formed by Eleotridae and Gobiidae.

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Node 25, Gobiidae (*sensu* GILL; MOOI, 2012): *Bathygobius*, *Gobius*, *Awaous*, *Stenogobius*, *Cotylopus*, *Lentipes*, *Sicydium*, *Sicyopterus*, *Evorthodus*, *Gobioides*, *Gobionellus*, *Oxyurichthys*.

Synapomorphies: Char. 3: 0.070-0.080 –> 0.280, Char. 4: 0.200 –> 0.300, Char. 6: 0 –> 1, Char. 7: 0 –> 1, Char. 46: 0 –> 1, Char. 48: 0 –> 1, Char. 62: 1 –> 2.

This clade was supported by an increase in length of the dorsal fin (Char. 3: 0.070-0.080 –> 0.280), increase in number of the second dorsal-fin rays (Char. 4: 0.200 –> 0.300), presence of five branchiostegal rays (Char. 6: 0 –> 1), presence of six spines in the first dorsal fin (Char. 7: 0 –> 1), dorsal margin of the lateral ethmoid crenulate (Char. 46: 0 –> 1), reduction of the width of the frontal (Char. 48: 0 –> 1) and presence of one epural (Char. 62: 1 –> 2).

The presence of five branchiostegal rays as a synapomorphy for this clade, as proposed by Gill and Mooi (2012), was herein corroborated. The presence of six spines in the first dorsal fin is a controversial synapomorphy for the family since some members of Gobiinae present seven spines (*e.g.* *Gobiosoma*). The presence of a crenulate margin in the lateral ethmoid was also recovered as a synapomorphy for Gobiidae. Caires (2012) commented that this characteristic would be important for the classification of Gobionellinae, but results obtained in this analysis suggests that this feature is a synapomorphy for a much more inclusive group.

Node 28, ***Stenogobius* lineage (*sensu* AGORRETA *et al*., 2013)**: *Awaous*, *Stenogobius*, *Cotylopus*, *Lentipes*, *Sicydium*, *Sicyopterus*, *Evorthodus*, *Gobioides*, *Gobionellus*, *Oxyurichthys*.

Synapomorphies: Char. 0: 0.120-0.170 –> 0.300-0.320, Char. 32: 0 –> 1, Char. 47: 0 –> 1, Char. 57: 0 –> 1.

Synapomorphies for this clade include the absence of the pore E (Char. 32: 0 –> 1), considered a characteristic for the members of Sicydiinae plus Gobionellinae by Birdsong et. *al* (1988), the presence of a dorsal expansion on the dorsal face of the mesethmoid (Char. 47: 0 –> 1) and the presence of a long ethmoidal process in the palatine (57: 0 –> 1).

This was the first time that a morphological analysis recovered, at the same time, *Awaous* and *Stenogobius* as sister genera (Clade 32), being this group closely related to Sicydiinae (Clade 34), while this clade was hypothesized to be the sister group of Gobionellinae (*sensu* PEZOLD, 1993). The phylogenetic placement of Sicydiinae in Pezold (1993) and Larson (2001) is undetermined since these authors did not included members of this subfamily. In addition, the results are not comparable with Parenti and Thomas (1998) since *Tukugobius* and

Rhinogobius were not included herein. The results disagree with Thacker (2009; 2015) and the rhodopsin-based tree of Tornabene (2013), since *Awaous* was considered closer to Sicydiinae than to *Stenogobius*. The consensus tree herein obtained also diverges from Thacker (2013) who suggested that the clades currently assigned to Gobionellinae would be basal lineages, successively closer to *Awaous*, *Stenogobius* and Sicydiinae, and, again, considering *Awaous* closer to Sicydiinae than to *Stenogobius*. Lastly, the results are not the same obtained by Agorreta (2013) who considered *Awaous* (*Chonophorus*) *banana* closely related to *Stenogobius*.

In conclusion the final phylogenetic tree agreed with Thacker (2002), Agorreta & Rüber (2012) and the consensus tree of Tornabene (2013), placing *Awaous* + *Stenogobius* as sister to Sicydiinae, being this clade sister to other Gobionellinae.

Node 27, Gobionellinae *Clade II* (*sensu* AGORRETA; RUBER, 2012): *Evorthodus*, *Gobioides*, *Gobionellus*, *Oxyurichthys*.

Synapomorphies: Char. 1: 0.440-0.460 –> 0.260, Char. 3: 0.360-0.480 –> 0.570, Char. 13: 0 –> 1, Char. 25: 0 –> 2.

The synapomorphies for this clade include the slightly increase in the upper lip thickness (Char. 1: 0.440-0.460 –> 0.260), the increase in the length of the second dorsal fin (Char. 3: 0.360-0.480 –> 0.570), absence of papillae in the posterior region of the palate (Char. 13: 0 –> 1) and the presence of a lanceolate caudal fin (Char. 25: 0 –> 2). The lanceolate caudal fin was recovered as a synapomorphy but it is controversial, since other members of the *Stenogobius* group (*sensu* LARSON, 2001), not included in this analysis, present a truncated caudal fin (*e.g.* *Rhinogobius* and *Schismatogobius* de Beaufort, 1912).

Node 30, unammed, *Gobionellus*, *Gobioides* and *Oxyurichthys*

Synapomorphies: Char. 1: 0.260 –> 0.250, Char. 2: 0.760 –> 0.790, Char. 3: 0.570 –> 0.700, Char. 4: 0.400 –> 0.600, Char. 5: 0.600 –> 0.800, Char. 41: 1 –> 2, Char. 43: 0 –> 1, Char. 62: 2 –> 1.

This clade is supported by some morphometric (Char. 1: 0.260 –> 0.250, Char. 2: 0.760 –> 0.790, Char. 3: 0.570 –> 0.700) and meristic characteristics (Char. 41: 1 –> 2, Char. 43: 0 –> 1, Char. 62: 2 –> 1), in addition with line *b* exceeding line c_4 anteriorly (Char. 41: 1 –> 2), line *d* exceeding line a_1 posteriorly (Char. 43: 0 –> 1) and presence of two epurals (Char. 62: 2 –> 1).

Harrison (1989) considered *Oxyurichthys* as distantly related to *Evorthodus*, *Gobioides* and *Gobionellus* forming a different lineage called '*Oxyurichthys* group'. In the present work this relation was not observed. *Evorthodus* was considered basal, since it has only one epural and shorter lines *b* and *d*.

Node 29, **unnamed**: *Gobioides* and *Gobionellus*.

Synapomorphies: Char. 0: 0.300 –> 0.290, Char. 1: 0.250 –> 0.130, Char. 2: 0.790 –> 0.800, Char. 3: 0.700 –> 0.800, Char. 4: 0.600 –> 0.700, Char. 5: 0.800 –> 0.900, Char. 44: 1 –> 0.

This clade is supported by decreasing in the snout length and upper lip thickness (Char. 0: 0.300 –> 0.290; Char. 1: 0.250 –> 0.130), and increase in the second dorsal and anal fin length (Char. 2: 0.790 –> 0.800; Char. 3: 0.700 –> 0.800). In addition, with an increase in second dorsal fin and anal fin rays (Char. 4: 0.600 –> 0.700; Char. 5: 0.800 –> 0.900), and by presenting the line *os* of the opercular series not transversally orientated, despite been transversal in *Gobionellus*. This relation was also proposed by Harrison (1989), Pezold (2004) and Caires (2012).

Node 33, unnamed: *Awaous*, *Stenogobius*, *Cotylopus*, *Lentipes*, *Sicydium* and *Sicyopterus*.

Synapomorphies: Char. 0: 0.300-0.320 –> 0.390-0.520, Char. 16: 1 –> 0, Char. 20: 2 –> 0, Char. 69: 0 –> 1, Char. 72: 0 –> 1.

This clade is supported by an increase in the snout length (Char. 0: 0.300-0.320 –> 0.390-0.520), absence of scales in the chest region (Char. 16: 1 –> 0), subterminal mouth (Char. 20: 2 –> 0), *Supracarinalis* inserting anteriorly to the vertical traced in the anterior margin of the opercle (Char. 69: 0 –> 1) and by the presence of *Hyohyoides inferioris posterioris* (Char. 72: 0 –> 1).

The synapomorphies obtained herein, including two new myological, offer strong support for this clade. Based on these synapomorphies and in the fact that subfamilies must be comparable to groups in the same category it would be better to refer at this clade as the Sicydiinae subfamily.

Node 35, Sicydiinae (*sensu* PARENTI; MACIOLEK, 1993): *Lentipes*, *Cotylopus*, *Sicydium* and *Sicyopterus*.

Synapomorphies: Char. 0: 0.390-0.520 –> 0.670, Char. 9: 0 –> 1, Char. 26: 0 –> 1, Char. 48: 1 –> 0, Char. 49: 0 –> 1, Char. 52: 0 –> 1, Char. 53: 0 –> 1, Char. 54: 0 –> 1, Char. 55: 0 –> 1, Char. 60: 0 –> 1, Char. 61: 0 –> 1, Char. 70: 1 –> 0, Char. 73: 0 –> 1.

This clade is supported by increase in snout length (Char. 0: 0.390-0.520 –> 0.670), absence of papillae in the vomerine region (Char. 9: 0 –> 1), round suction cup formed by fusion of the pelvic fins (Char. 26: 0 –> 1), increased width of supraorbital region (Char. 48: 1 –> 0), no differentiation of ascending process in relation to articular process (Char. 49: 0 –> 1), triangular shape of the coronoid process (Char. 52: 0 –> 1), one row of teeth in the dentary (Char. 53: 0 –> 1), at least one tooth higher than the median region of the dentary (Char. 54: 0 –> 1), presence of laterally oriented teeth (Char. 55: 0 –> 1), pelvic-fin spine and first ray close together at their proximal ends and separated from remaining four pelvic-fin rays (Char. 60: 0 –> 1), pelvic-fin spine inserted perpendicularly (Char. 61: 0 –> 1), *supracarinalis* not completely covering the anterior region of the supraoccipital (Char. 70: 1 –> 0) and *Adductor mandibulae*, *segmentum facialis pars retromalaris* inserting on the maxilla.

This clade unequivocally monophyletic and was recovered in a number of previous phylogenetic reconstructions (PARENTI; MACIOLEK, 1993; PARENTI; THOMAS, 1998; WANG *ET AL.*, 2001; THACKER, 2003; KEITH *ET AL.*, 2011; AGORRETA; RÜBER, 2012; TORNABENE, 2013). Results herein revealed six new synapomorphies for this clade, including the absence of papillae in the vomer region, at least one tooth higher than the median region of the dentary and the *Adductor mandibulae*, *segmentum facialis pars retromalaris* inserting on the maxilla. This clade is frequently referred as Sicydiinae sub-family, but based on the topology obtained herein it is referred as the tribe Sicydiini of the Sicydiinae.

Node 34, unnamed: *Cotylopus*, *Sicydium* and *Sicyopterus*.

Synapomorphies: Char. 1: 0.460 –> 0.560-0.650, Char. 2: 0.710-0.760 –> 0.860-0.930, Char. 8: 0 –> 1, Char. 28: 1 –> 0, Char. 51: 0 –> 1, Char. 56: 0 –> 1, Char. 75: 0 –> 1.

Features supporting this clade include an increase in the upper lip thickness (Char. 1: 0.460 –> 0.560-0.650), increase in the first dorsal fin length (Char. 2: 0.710-0.760 –> 0.860-0.930), absence of papillae in the post-dental membrane (Char. 8: 0 –> 1), oculoscapular canal interrupted between pores “H” and “K” (Char. 28: 1 –> 0), presence of a sac of replacement teeth in pre-maxilla (Char. 51: 0 –> 1), trapezoidal shape of the ectopterygoid (Char. 56: 0 –> 1), *Adductor mandibulae*, *segmentum facialis*, *pars stegalis* placed medially, visible in lateral view (Char. 75: 0 –> 1).

Parenti and Maciolek (1993) commented that *Lentipes* figures as a basal member of the Sicydiinae, and interpreted the presence of a sac of replacement teeth as a derived feature among this lineage. Moreover, Harrison (1989) and Parenti and Maciolek (1993) noted a change in the shape of the ectopterygoid.

Keith *et al*. (2011) suggested *Cotylopus* in the base of the Sicydiinae and *Sicydium* plus *Sicyopterus* forming a derivative clade. *Lentipes* would form an even more derivative clade. The final topology obtained herein reflects almost the opposite result.

This clade is congruent with others obtained previously (PARENTI; MACIOLEK, 1993; PARENTI; THOMAS, 1998). In addition, two new unique synapomorphies were proposed by this clade including absence of papillae in the post-dental membrane (Char. 8: 0 –> 1) and *Adductor mandibulae*, *segmentum facialis*, *pars stegalis* placed medially, visible in lateral view (Char. 75: 0 –> 1).

Node 36, unnamed: *Sicydium* and *Sicyopterus*

Synapomorphies: Char. 31: 1 –> 0, Char. 50: 0 –> 1, Char. 64: 1 –> 2.

Three synapomorphies support this clade, including B pore located anteriorly to the posterior nasal pore (Char. 31: 1 –> 0), blunt form of the indistinct ascending process (Char. 50: 0 –> 1) and medial portion of epaxial musculature inserting anterior to posterior margin of orbital region (Char. 64: 1 –> 2).

This result agrees with Parenti and Maciolek (1993) and Parenti and Thomas (1998). The anterior insertion of the epaxial musculature is reported as synapomorphic for this clade, and future research may confirm if it is present in other Sicydiini taxa.

Node 32, unnamed: *Awaous* and *Stenogobius*.

Synapomorphies: Char. 23: 0 –> 1, Char. 44: 1 –> 0, Char. 67: 0 –> 1, Char. 74: 0 –> 1.

Synapomorphies of this clade include the presence of fleshy lobes on the inner edge of the pectoral girdle (Char. 23: 0 –> 1), line *os* of the opercular series transversally orientated (Char. 44: 1 –> 0), the medial region of the medial portion of the epaxial musculature inserting anterior to the lateral portion (Char. 67: 0 –> 1), and placement of the *pars stegalis* of the *segmentum facialis* between the *pars retromalaris* and *pars rictalis*. Usually only the presence of fleshy lobes in the inner edge of the pectoral girdle is mentioned in the literature as synapomorphic for this clade, but herein three additional characters support it.

This clade is referred as *Stenogobini*, a tribe within the Sicydiinae subfamily, because the *Stenogobius* group (LARSON, 2001) and *Stenogobius* lineage (THACKER, 2013) were already proposed.

Tree zero, node 40, and tree 1 node 39, *Awaous sensu stricto*: *Awaous* (*Awaous*) *ocellaris*, *Awaous* (*Awaous*) commersonii, *Awaous* (*Chonophorus*) *banana*, *Awaous* (*Chonophorus*) *lateristriga*, *Awaous* (*Chonophorus*) *tajasica*, *Awaous* (*Chonophorus*) *transandeanus* and *Awaous* (*Euctenogobius*) *flavus*.

Synapomorphies: Char. 1: 0.440-0.460 –> 0.750, Char. 2: 0.710-0.760 –> 0.460, Char. 24: 0 –> 1, Char. 67: 1 –> 2.

Awaous was recovered as a monophyletic genus based on the following synapomorphies : an increase in upper lip thickness (Char. 1: 0.440-0.460), increase in first dorsal-fin length (Char. 2: 0.710-0.760), presence of sensory papillae over much of the gill structure (Char. 24: 0 –> 1) and limit of insertion of the medial region of the medial portion of the epaxial musculature located anteriorly in relation to the lateral portion (Char. 67: 1 –> 2).

Watson (1992) established monophyly of *Awaous* based on the exclusive presence of papillae in the gill structure, reaffirmed herein. The limit of insertion of the medial region of the medial portion of the epaxial musculature located anteriorly in relation to the lateral portion is considered a synapomorphy for the genus, despite absent in *Awaous* (*Awaous*) *ocellaris*. The same synapomorphies were obtained by both generated trees.

Tree zero, node 39 and tree 1, node 38, unnamed, new: *Awaous* (*Awaous*) *ocellaris*, *Awaous* (*Awaous*) commersonii, *Awaous* (*Chonophorus*) *banana*, *Awaous* (*Chonophorus*) *lateristriga*, *Awaous* (*Chonophorus*) *tajasica* and *Awaous* (*Chonophorus*) *transandeanus*.

Synapomorphies: Tree 0: Char. 10: 0 –> 1, Char. 12: 0 –> 1, Char. 14: 0 –> 1, **Char. 28: 1 –> 0**, Char. 39: 0 –> 1.

Tree 1: Char. 10: 0 –> 1, Char. 12: 0 –> 1, Char. 14: 0 –> 1, Char. 39: 0 –> 1.

Two different most parsimonious trees were generated during the phylogenetic analysis, differing in the relative placement of the subgenus within *Awaous*. Since *Awaous* is the main focus of this dissertation both trees will be discussed. Both trees recovered *Awaous* (*Euctenogobius*) *flavus* as the basal clade. Despite recovering *Stenogobius sp* as a member of

Awaous, Agorreta *et al.* (2013) also postulated a basal position of *Awaous* (*Euctenogobius*) *flavus* in the diversification of *Awaous*.

Awaous (*Chonophorus*) is considered paraphyletic in tree 0 and monophyletic in tree 1. Synapomorphies presented in both trees include: conic papillae in the vomer region (Char. 10: 0 –> 1), conic papillae in the parasphenoid region (Char. 12: 0 –> 1) and conic papillae in the posterior region of the palate (Char. 14: 0 –> 1), (Char. 28: 1 –> 0). In tree 0 presence of a continuous oculoscapular canal is also considered a synapomorphy for this clade (Char. 28: 1 –> 0).

Since the support for the subgenus *Awaous* (*Chonophorus*) is weak, and *Awaous* (*Euctenogobius*) is monotypic, the subgeneric classification is not recommended. Thus, *Awaous flavus* is considered a basal species of *Awaous* and the monophyletic clades *Awaous banana* plus *Awaous transandeanus* and *Awaous ocellaris* plus *Awaous commersonii* derivative linages of the genus.

Node 37, *Awaous* (*Awaous*) (*sensu* WATSON, 1992): *Awaous ocellaris* and *Awaous commersonii*.

Synapomorphies: tree 0: Char. 1: 0.660-0.750 –> 0.640, Char. 19: 1 –> 0, Char. 28: 0 –> 1.

Tree 1: Char. 0: 0.550-0.590 –> 0.620, Char. 19: 1 –> 0.

The only synapomorphy recovered by both trees is the presence of scales in the base of the pectoral fin (Char. 19: 1 –> 0). In Tree a thin upper lip (Char. 1: 0.660-0.750 –> 0.640) and a discontinuous oculoscapular canal (Char. 28: 0 –> 1) are synapomorphic, while in tree 1 the increase in the snout length is considered synapomorphic (Char. 0: 0.550-0.590).

Tree one, node 41, *Awaous* (*Chonophorus*) (*sensu* WATSON, 1996): *Awaous banana*, *Awaous lateristriga*, *Awaous tajasica* and *Awaous transandeanus*.

Synapomorphies: Char. 28: 1 –> 0.

Tree 1 one recovered only the presence of a complete oculoscapular canal as synapomorphic for *Awaous* (*Chonophorus*) (Char. 28: 1 –> 0). This character presented a higher index of consistency and rescaled consistence in tree 1: CI: 0.250, RC: 0.156 (*vs*. CI: 0.200, RC:0.100 in tree zero). This was the only character which index varied in both trees.

Tree zero, node 41 and tree one, node 40, new, unnamed: *Awaous banana* and *Awaous transandeanus*.

Synapomorphies: tree zero: Char. 33: 0 –> 1.

Tree one: Char. 33: 0 –> 1.

The synapomorphy recovered in both trees for this clade is the presence of a duplicated pore "F" in the oculoscapular canal (Char. 33: 0 –> 1). This is a characteristic not found in any other examined taxa.

Tree one, node 42, new, unnamed: *Awaous lateristriga* and *Awaous tajasica*.

Synapomorphies: Char. 0: 0.550-0.590 –> 0.520, Char. 2: 0.610-0.680 –> 0.460.

Only tree 1 recovered the clade formed by *Awaous lateristriga* and *Awaous tajasica*. Synapomorphies include an increase in snout length (Char. 0: 0.550-0.590 –> 0.520) and decrease in the length of the first dorsal fin (Char. 2: 0.610-0.680 –> 0.460). The taxonomic revision reveled that the measurements tend to be extremely conservative in the species formerly grouped in *Awaous* (*Chonophorus*), thus to consider this clade based on two morphometric synapomorphies would be preposterous.

2.6. FINAL CONSIDERATIONS

The two most parsimonious trees revealed some interesting results. This was the first time that oral papillae and myological characters were include in a phylogenetic hypothesis of members of *Stenogobius* lineage.

Among the most interesting results remain the insertion of the *supracarinalis* and the position of medial portion of the *epaxialis* in all representatives of Eleotridae and Gobiidae, Diverging from members of Rhyacichthydae and Odontobutidae. Future analysis including more members of basal families within Gobioidei are needed to determine if the observed changes in the arrangement of *epaxialis* and *supracarinalis* are synapomorphic for the clade formed by Gobiidae and Eleotridae.

A new Sicydiinae subfamily is proposed, including *Awaous* and *Stenogobius*, based on five synapomorphies including two new myological ones. This subfamily comprises the tribe Stenogobini, with *Awaous* and *Stenogobius* and the tribe Sicydiini including the taxa currently considered Sicydiinae (*sensu* PARENTI; MACIOLEK, 1993).

The clade formed by *Cotylopus*, *Sicydium* and *Sicyopterus* have the medially placed *Adductor mandibulae*, *segmentum facialis*, *pars stegalis* visible in lateral view. This distinctive feature should be examined in more Sicydiini taxa to elucidate the phylogenetic significance of its overall distribution.

Node 39 of tree 0 and node 38 of tree 1 placed *Awaous flavus* as the basal species of *Awaous,* and recovered at least four exclusive synapomorphies for the clade containing *Awaous* (*Awaous*) and *Awaous* (*Chonophorus*). Despite tree 1 recovering *Awaous* (*Chonophorus*) as monophyletic this decision may present some problems. The only synapomorphy for this clade would be the presence of an oculoscapular canal, and if the subgenus *Awaous* (*Chonophorus*) is considered monophyletic, the clade formed by *Awaous lateristriga* and *Awaous tajasica* would be supported only by morphometric synapomorphies. Based on this result it might be better to consider *Awaous* (*Chonophorus*) a paraphyletic lineage within *Awaous*, pending additional research that includes all *Awaous* species.

3. REFERENCES

AGORRETA, A.; RÜBER, L. A standardized reanalysis of molecular phylogenetic hypotheses of Gobioidei. **Systematics and Biodiversity,** v. 10, n. 3, p. 375–390, 2012.

AGORRETA, A.; SAN MAURO, D.; SCHLIEWEN, U.; VAN TASSELL, J.L.; KOVAČIĆ, M.; ZARDOYA, R.; RÜBER, L. Molecular phylogenetics of Gobioidei and phylogenetic placement of European gobies. **Molecular Phylogenetics and Evolution,** v. 69, p. 619–633, 2013.

AKIHITO, P. (1969) A systematic examination of the gobiid fishes based on the mesopterygoid, postcleithra, branchiostegals, pelvic fins, scapula, and suborbital. **Japanese Journal of Ichthyology,** v. 16, p. 93–114, 1969.

AKIHITO, P.; HAYASHI, M.; YOSHINO, T.; SHIMADA, K.; SENOU, H.; YAMAMOTO, T. Suborder Gobioidei. In: H. Masuda, K. Amaoko, C. Araga, T. Uyeno, and T. Yoshino (Eds), **The fishes of the Japanese Archipelago**. Tokyo University press., Toquio, p. 236–289, 1984.

AKIHITO, P. Some morphological characters considered to be important in gobiid phylogeny. In: **Indo-Pacific Biology: Proceedings of the Second International Conference on Indo-Pacific Fishes.** The Ichthyological Society of Japan, Tokyo, p. 629–639, 1986.

ASAOKA, R.; NAKAE, M; SASAKI, K. Description and innervation of the lateral line system in two gobioids, *Odontobutis obscura* and *Pterogobius elapoides* (Teleostei: Perciformes). **Ichthyological Research**, v. 58, p. 51–61, 2011.

ASAOKA, R.; NAKAE, M.; SASAKI, K. Innervation of the lateral line system in *Rhyacichthys aspro*: the origin of superficial neuromast rows in gobioids (Perciformes: Rhyacichthyidae). **Ichthyological Research**, v. 61, p. 49–58, 2014.

BERRA, T.M. **Freshwater Fish Disturbution**. Chicago: University of Chicago Press, 2008. 615 p.

BIRDSONG, R.S.; MURDY, E.O; PEZOLD, F.L. A study of the vertebral column and median fin osteology in Gobioid fishes with comments on Gobioid relationships. **Bulletin of Marine Sciences,** v. 42, p. 174–214, 1988.

BLEEKER, P. Esquisse d'un système nature1 des Gobioides. **Archives Néerlandaises des Sciences Exactes et Naturelles,** v. 9, 289–331, 1874.

BÖHLKE, J.E.; ROBINS, R.C. Western atlantic seven-spined gobies, with descriptions of ten new species and a new genus, and comments on pacific relatives. **Proceedings of the Academy of Natural Sciences of Philadelphia,** v. 120, p. 45–174, 1968.

BLOCH, M.E.; SCHNEIDER, J.G. **Systema Ichthyologiae: Iconibus CX Illustratum**. Berolini : Sumtibus auctoris impressum et Bibliopolio Sanderiano commissum, v. 2, 1801.

BROUSSONET, P. M. A. **Ichthyologia, sistens piscium descriptiones et icons**. London, v. 49, 1782.

BUSSING, W.A. **Peces De Las Aguas Continentales De Costa Rica**. San José: Editorial de la Universidad de Costa Rica, 2002. 271 p.

CAIRES, R.A. **Revisão Taxonômica, Anatomia Esquelética E Filogenia Do Gênero *Microphilypnus* Myers, 1927 (Teleostei: Gobiiformes: Eleotridae)**. 2012. 265 f. Tese (Doutorado em Ciências) - Instituto de Biociências, Universidade de São Paulo, 2012.

CHEN, I-S.; SHAO, K.T. A taxonomic review of the gobiid fish genus *Rhinogobius* Gill, 1859, from Taiwan, with descriptions of three new species. **Zoological Studies,** v. 35, p. 200–214, 1996.

DATOVO, A. S.; VARI, R. P. The jaw adductor muscle complex in teleostean fishes: evolution, homologies and revised nomenclature (osteichthyes: actinopterygii). **Plos One,** v. 8, n. 4, p. 1–23, 2013.

DATOVO, A.; RIZZATO, P.P. Evolution of the facial musculature in basal ray-finned fishes. **Frontiers in Zoology,** v. 15, p. 1–29, 2018.

DAWSON, C.E. Notes on the species of the goby genus *Evorthodus*. **Copeia**, v. 1967, n. 4, p. 855–857, 1967.

DEBROT, A.O. A review of the freshwater fishes of Curaçao, with comments on those of Aruba and Bonaire. **Caribbean Journal of Sciences,** v. 39, p. 100–108, 2003.

DÚMERIL, A.H.A. Poissons de la côte occidentale d'Afrique. **Archives du Muséum d'Histoire Naturelle,** v. 10, p. 247–251, 1861.

ESCHMEYER, W.N. ; FONG, J.D. **Species by Family/Subfamily**. Avialable in: <http://researcharchive.calacademy.org/research/ichthyology/catalog/SpeciesByFamily.asp>. Electronic version accessed in 06/26/2018.

ESCHMEYER, W.N.; FRICKE, R.; VAN DER LAAN, R. **Catalog of Fishes: Genera, Species, References**. Avialable in: <http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp>. Electronic version accessed in 05/26/2018.

GEE, J.H.; GEE, P.A. Aquatic surface respiration, buoyancy control and the evolution of air-breathing in gobies (gobiidae: pisces). **The Journal of Experimental Biology,** v. 198, p. 79–89, 1995.

GILL, A.C.; MOOI, R.D. Thalasseleotrididae, new family of marine gobioid fishes from New Zealand and temperate Australia, with a revised definition of its sister taxon, the Gobiidae (Teleostei: Acanthomorpha). **Zootaxa,** v. 3266, p. 41–52, 2012.

GIRARD, M.D.C. Notes upon various New Genera and New Species of fishes, in the Museum of the Smithsonian Institution, and collected in connection with the United States and Mexican Boundary Survey: Major William Emory, Commissioner. **Proceedings of the Academy of Natural Sciences of Philadelphia,** v. 168, 1858.

GOLOBOFF P.A.; FARRIS J.S.; NIXON K.C. TNT, a free program for phylogenetic analysis. **Cladistics**, v.24, p. 774–786, 2008.

GOSLINE, W.A. The osteology and relationships of certain gobioid fishes, with particular reference to the genera *Kraemeria* and *Microdesmus*. **Pacific Scientific,** v. 9, p. 158–170, 1955.

GÜNTHER, A.C. Order 1: Acanthopterygii. Fam. 19. Gobiidae. In: Günther, A.C. (ed) **Catalogue of the Acanthopterygian Fishes in the Collection of the British Museum**. London: Order of the trustees, p. 1–153, 1861.

HARRISON, I.J. Specialization of the gobioid palatopterygoquadrate complex and its relevance to gobioid systematics. **Journal of Natural History,** v. 23, p. 325–353, 1989.

HASTINGS, P.A.; FINDLEY, L.T. *Chriolepis prolata*, a new species of Atlantic goby (Teleostei: Gobiidae) from the North American continental shelf. **Zootaxa,** v. 3904, p. 589–595, 2015.

HOESE, D. Gobioidei: Relationship. In: **Ontogeny and Systematics of Fishes: Based on an International Symposium Dedicated to The Memory of Elbert Halvor Ahlstrom**. New York: American Society of Ichthyologists and Herpetologists, p. 589–591, 1984.

HOESE, D.; GILL, A.C. Phylogenetic relationships of eleotridid fishes (perciformes: gobioidei). **Bulletin of Marine Science**, 52, 415–440, 1993.

HUANG, S.P., ZEEHAN, J. & CHEN, I.S. A new genus of *Hemigobius* generic group goby based on morphological and molecular evidence, with description of a new species. **Journal of Marine Science and Technology,** v. 21, p. 146–155, 2013.

KEITH, P.; LORD, C.; LORION, J.; WATANABE, S.; TSUKAMOTO, K.; COULOUX, A.; DETTAI, A. Phylogeny and biogeography of Sicydiinae (Teleostei: Gobiidae) inferred from mitochondrial and nuclear genes. **Marine Biology,** v. 158, p. 311–326, 2011.

KOUMANS, F.P. A preliminary revision of the genera of the gobioid fishes with united ventral fins. Lisse: Drukkerij Imperator, N.V., 1931. 174 pp.

LACEPEDE, B.G.E. **Histoire Naturelle des Poissons**. Paris: Chez Plassan, 1800. 566p.

LACHNER, E.A.; KARNELLA S.J. Fishes of the Indo-Pacific genus *Eviota* with descriptions of eight new species (Teleostei: Gobiidae). **Smithsonian Contributions to Zoology,** v. 315, p. 1–126, 1980.

LARSON, H.K. A revision of the gobiid fish genus *Mugilogobius* (Teleostei: Gobioidei), and its systematic placement. **Records of the Western Australian Museum Supplement**, v. 62, p. 1–233, 2001.

LASSO-ALCALÁ, O.M.; LASSO, C.A. Revisión taxonómica del género *Awaous* Valenciennes 1837, (Pisces: Perciformes, Gobiidae) en Venezuela, con notas sobre su distribución y hábitat. **Memoria de la Fundación La Salle de Ciencias Natural,** v. 168, p. 117–140, 2008.

LINDSTROM, D.P.; BLUM, M.J.; WALTER, R.P.; GAGNE, R.B.; GILLIAM, J.F. Molecular and morphological evidence of distinct evolutionary lineages of *Awaous guamensis* in Hawai'i and Guam. **Copeia,** v. 2012, p. 293–300, 2012.

LINNAEUS, C. **Systema Naturae Regnum Animale**. Lípsia: Cura societatis zoologioe germanioe, p. 262–264, 1758.

MILLER, P.J. The osteology and adaptive features of *Rhyacichthys aspro* (Teleostei: Gobioidei) and the classification of Gobioid fishes. **Journal of Zoology,** v. 171, p. 397–434, 1973a.

MILLER, P.J. The species of *Pseudaphya* (Teleostei:Gobiidae) and the evolution of aphyiine gobies. **Journal of Fish Biology,** v. 5, p. 353–365, 1973b.

MYERS, G. Usage of anadromous, catadromous and allied terms for migratory fishes. **Copeia,** v. 2, p. 89–97, 1949.

NELSON, G.; PLATNICK, N.I. **Systematics and Biogeography: Cladistics and Vicariancy**. New York: Columbia University press, v. 12, 1981.

NELSON, J.S.; GRANDE, T.C.; WILSON, M.V.H. **Fishes of the World.** J. Hoboken: Wiley (Ed). Wiley & sons, 2016. 752p.

PALLAS, P.S. **Spicilegia Zoologica Quibus Novae Imprimis et Obscurae Animalium Species Iconibus, Descriptionibus Atque Commentariis Illustrantur**. Tomo I, fascículo 10, Berolini, Gottlieb August Lange, p. 3–20, p. 1770.

PARENTI, L.R.; MACIOLEK, J.A. New Sicydiinae gobies from Ponape and Palau, Micronesia, with comments on systematics of the subfamily Sicydiinae (Teleostei: Gobiidae). **Bulletin of Marine Sciences,** v. 53, p. 945–972, 1993.

PARENTI, L.R.; THOMAS, K.R. Pharyngeal jaw morphology and homology in sicydiine gobies (Teleostei: Gobiidae) and allies. **Journal of Morphology,** v. 237, p. 257–274, 1998.

PARK, J.Y.; KIM, I.S.; LEE, Y.J. A study on the vascularization and structure of the epidermis of the air-breathing mudskipper, *Periophthalmus magnuspinnatus* (Gobiidae, Teleostei), along different parts of the body. **Journal of Applied Ichthyology,** v. 22, p. 62–67, 2006.

PEZOLD, F. Evidence for a monophyletic Gobiinae. **Copeia,** v. 1993, p. 634–643, 1993.

PEZOLD, F. Phylogenetic analysis of the genus *Gobionellus* (Teleostei: Gobiidae). **Copeia,** v. 2004, p. 260–280, 2004.

PEZOLD, F. Systematics of the family Gobionellidae. In: Patzner, R. A., van Tassel, J. L., Kovačić, M., and Kapoor, B. G. (Eds), **The Biology of Gobies**. Enfied: CRC Press, Taylor & Francis Group, p. 1–11, 2011.

PINTO, S.Y. Um nova Gobiidae do Estado da Bahia, Brasil (Acanthopterygii - Perciformes). **Boletim do Museu Nacional do Rio de Janeiro, Zoologia, Nova Série,** v. 218, p. 1–9, 1960.

PRENDINI, L. Species or supraspecific taxa as terminals in cladistic analysis? groundplans versus exemplars revisited. **Systematic Biology,** v. 50, p. 290–300. 2001.

RADTKE, R.L.; KINZIE, R.A.; FOLSOM, S.D. Age at recruitment of Hawaiian freshwater gobies. **Environmental Biology of Fishes,** v. 23, 205–213, 1988.

REGAN, C. T. The osteology and classification of the Gobioid fishes. **Annals and Magazine of Natural History,** v. 8, p. 729-733, 1911.

ROCHA, L.A.; ROBERTSON, D.R.; ROMAN, J.; BOWEN, B.W. Ecological speciation in tropical reef fishes. **Proceedings of the Royal Society of London B,** v. 272, p. 573–579, 2005.

RUIZ-CAMPOS, G. **Catálogo de Peces Dulceacuícolas de Baja California Sur**. México: Progreso, 2012.

RUIZ-CAMPOS, G.; CASTRO-AGUIRRE, J.L.; GONZÁLEZ GUZMÁN, S.; SÁNCHEZ-GONZÁLES, S. First records of two tropical gobies, *Awaous tajasica* and *Ctenogobius sagittula* (Pisces: Gobiidae), in the continental waters of Baja California, México. **Bulletin of Southernn California Academy of sciences,** v. 98, p. 131–136, 1993.

RUIZ-CAMPOS, G.; CASTRO-AGUIRRE, J.L.; CONTRERAS-BALDERAS, S.; LOZANO-VILANO, M. DE L.; GONZÁLEZ-ACOSTA, A.F.; SÁNCHEZ-GONZÁLES, S. An annotated distributional checklist of the freshwater fish from Baja California Sur, Mexico. **Reviews in Fish Biology and Fisheries,** v. 12, 143–155, 2002.

SABINO, J.; CASTRO, R.M.C. Alimentação, período de atividade e distribuição espacial dos peixes de um riacho da Floresta Atlântica (Sudeste do Brasil). **Revista Brasileira de Biologia,** v. 50, p. 23-36, 1991.

SAKAI, H.; NAKAMURA; M. Two new species of freshwater gobies (Gobiidae: Sicydiaphiinae) from Ishigaki island, Japan. **Japanese Journal of Ichthyology,** v. 26, p. 43 – 54, 1979.

SANTOS, W.A. dos. **História Natural do "Peixe De Areia",** ***Awaous tajasica*** **(Lichtenstein, 1822) (Teleostei: Gobiidae) no Baixo São Francisco, Nordeste do Brasil**. 2019. 93 f. Dissertação (Mestrado em Diversidade Biológica e Conservação nos Trópicos) – Instituto de Ciências Biológicas e da Saúde, Programa de Pós-Graduação em Diversidade Biológica e Conservação nos Trópicos, Universidade Federal de Alagoas, Maceió, 2015.

SPRINGER, V.G. *Tyson belos*, new genus and species of western Pacific fish (Gobiidae, Xenisthminae), with discussions of gobioid osteology and classification. **Smithsonian Contributions to Zoology,** v. 390, p. 1–40. 1983.

STEINDACHNER, F. Die fishes des Itapocu und seiner Zuflüsse im State Santa Catarina (Brasilien). **Annalen des Naturhistorischen Museums in Wien**. v.24, p. 423–425, 1911.

SANZO, L. Distribuzione delle papille cutanee (organi ciatiformi) e suo valore sistematice nei Gobi. **Mittheilungen aus der Zoologischen Station zu Neapel,** v. 20, p. 249–328, 1911.

SCHIMIT, R.E.; MC MULLIN, E.R. Freshwater and brackish-water fishes observed on Montserrat, lesser antilles, west indies. **Caribbean Naturalist,** v. 1–12, 2015.

SEARCH FORM OF ***SPECIESLINK***. Avialable in: <http://www.splink.org.br/index?lang=pt> . Electronic version accessed in 09/03/2018.

SEARCH FORM OF ***FISHNET2***. Avialable in: <http://www.fishnet2.net> . Electronic version accessed in 10/03/2018.

SPALDING, M.D.; FOX, H.E.; ALLEN, G.R.; DAVIDSON, N.; FERDAÑA, Z.A.; FINLAYSON, M.; HALPERN, B.S.; JORGE, M.A.; LOMBANA, A.; LOURIE, S.A.; MARTIN, K.D.; MCMANUS, E.; MOLNAR, J.; RECCHIA, C.A.; ROBERTSON, J. Marine Ecoregions of the World: A Bioregionalization of Coastal and Shelf Areas. **American Institute of Biological Sciences,** v. 57, p. 573–583, 2007.

TAYLOR, W.R.; VAN DYKE, G.C. Revised procedures for staining and clearing small fishes and other vertebrates for bone and cartilage study. **Cybium,** v. 9, p. 107-119, 1985.

THACKER, C.E. Molecular phylogeny of the gobioid fishes (Teleostei: Perciformes: Gobioidei). **Molecular Phylogenetics and Evolution,** v. 26, p. 354–368, 2003.

THACKER, C.E. Phylogeny of Gobioidei and placement within Acanthomorpha, with a new classification and investigation of diversification and character evolution. **Copeia,** v. 2009, p. 93–104, 2009.

THACKER, C.E. Phylogenetic placement of the european sand gobies in Gobionellidae and characterization of gobionellid lineages (Gobiiformes: Gobioidei). **Zootaxa,** v. 3619, p. 369–382, 2013.

THACKER, C.E. Biogeography of goby lineages (Gobiiformes: Gobioidei): origin, invasions and extinction throughout the cenozoic. **Journal of Biogeography,** v. 42, p. 1615–1625, 2015.

TORNABENE, L.; CHEN, Y.J.; PEZOLD, F. Gobies are deeply divided: phylogenetic evidence from nuclear DNA (Teleostei: Gobioidei: Gobiidae). **Systematics and Biodiversity,** v. 11, p. 345–361, 2013.

TREVISAN, J.P. **Revisão Taxonômica e Anatomia de *Awaous tajasica* (Lichtenstein, 1822) (Gobiiformes: Gobiidae)**. 2019. 91 f. Monografia (Bacharelado em Ciências Biológicas) – Faculdade de Filosofia, Ciências e Letras de Ribeirão Preto, Universidade de São Paulo, 2016.

VALENCIENNES, A. Acanthoptérygiens à pectorales pédiculées. In: Cuvier, G. and Valenciennes, A. (Eds), **Histoire Naturelle des Poissons**. Paris: Imprimiere de F. G. Levrault, p. 1–507, 1937.

VAN TASSEL, J. **History of Gobioid Classification**. 2011. Available in: <http://gobiidae.com/histgoby.htm> . Electronic version accessed in 03/09/2018.

WANG, H.W.; Tsai, M.P.; Dean, J.; Lee, S.C. Molecular phylogeny of gobioid fishes (perciformes: gobioidei) based on mitochondrial 12s rrna sequences. **Molecular Phylogenetics and Evolution,** v. 20, p. 390–408, 2001.

WATSON, R.E. A provisional review of the genus *Stenogobius* with descriptions of a new subgenus and thirteen new species. (Pisces: Teleostei: Gobiidae). **Records of the South Australian Museum,** v. 15, p. 627–710, 1991.

WATSON, R.E. A review of the gobiid fish genus *Awaous* from insular streams of the Pacific Plate. **Ichthyological Exploration of Freshwaters,** v. 3, p. 161–176, 1992.

WATSON, R.E. Revision of the subgenus *Awaous* (*Chonophorus*) (Teleostei Gobiidae). **Ichthyological Exploration of Freshwaters,** v. 7, p. 1–18, 1996.

WATSON, R.E.; HORSTHEMKE, H. Revision of *Euctenogobius,* a monotypic subgenus of *Awaous,* with discussion of its natural history. **Revue Française d'Aquariologie,** v. 22, p. 83–92, 1995.

WINTERBOTTOM, R. *Trimma tevegae* and *T. caudomaculatum* revisited and redescribed (Acanthopterygii, Gobiidae), with descriptions of three new similar species from the western Pacific. **Zootaxa,** v. 4144, p. 1–53, 2016.

WONGRAT, P.; MILLER, P.J. The innervation of head neuromast rows in eleotridine gobies (Teleostei: Gobioidei). **The Zoological Society of London**, v. 225, p. 27–42, 1991.