



# Additions to the Systematic Inventory of Non-Marine Molluscs Occurring in the State of Santa Catarina/SC, Central Southern Brazil Region

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## Abstract

Based on the last list of non-marine molluscs from Santa Catarina State/SC published in March 2018, with 232 related forms, the current inventory of continental molluscs (land/terrestrial and limnic/freshwater) occurring in the State of Santa Catarina/SC is increased, with a new verified/confirmed registry of most other twenty (20) species (-fifteen (15) gastropods, thirteen (13) natives-*Pomacea maculata* Perry, 1810; *Phyllocaulis* sp (in determination process); *Drepanotrema kermatoides* (d'Orbigny, 1835); *Anisancylus obliquus* (Broderip & Sowerby, 1832); *Drymaeus* cf. *paucipunctus* (Pilsbry, 1898); *Leiostracus* cf. *polygrammus* (Moricand, 1836); *Leiostracus* sp (in determination process); *Omalonyx matheroni* (Potiez & Michaud, 1838); *Peltella* cf. *palliolum* (Férussac, 1821); *Peltella iheringi* Leme, 1968; *Streptaxis* cf. *subregularis* (Pfeiffer, 1846); *Streptaxis* cf. *tumescens* Suter, 1900; *Gastrocopta* cf. *servilis* (Gould, 1843); and two (2) non-native/exotic invasives forms - *Ovachlamys fulgens* (Gude, 1900); *Galba* (-*Lymnaea*) *truncatula* (Müller, 1774); ...besides five (5) native bivalves-*Diplodon charruana* (d'Orbigny, 1835); *Diplodon* (-*Rhipidodonta*) *suavidicus* (Lea, 1856); *Musculium argentinum* (d'Orbigny, 1835); *Eupera bahiensis* (Spix, 1827); *Cyanocyclus paranacensis* (d'Orbigny, 1835) -), for a new total verified/confirmed registry of 252 species and subspecies, sustained/consolidated product of complete 24 years of systematic field researches, examination of specimens deposited in collections of museums and parallel reference studies. Additional information regarding its known regional geographic distribution is incorporated/included.

## Keywords

Continental (land & freshwater) molluscs, Santa Catarina State, Central Southern Brazil region, Additions to the species inventory

## Abbreviations

CEMAR: Centre for Marine Studies, Bombinhas Museum and Marine Aquarium, Bombinhas/SC; FURBMO: Malacological Collection of Fundação Universidade Regional de Blumenau; LMSM: Laboratório de Malacologia e Sistemática Molecular (Laboratory of Malacology and Molecular Systematics), Zoology Department of Universidade Federal de Minas Gerais, Belo Horizonte/MG

Continuing the researches conducted since the year 1996, the present contribution incorporates a new verified/confirmed registry of most other twenty (20) species of continental molluscs (ten (10) land/terrestrial, one (1) amphibious/limnophile and nine (9) limnic/freshwater-four (4) gastropods & five (5) bivalves) to the systematic inventory of the State of Santa Catarina/SC previously established [1], sustained product of complete 24 years of systematic field researches, examination of specimens deposited in collections of museums and parallel reference studies, increasing to 252 its number of registered forms regionally known [1].

The taxonomic, systematic and biogeographic (Figure 1-Map) arrangement presented follow the previously established working parameters (54, 58) [1].

## Results

GASTROPODA Cuvier, 1795

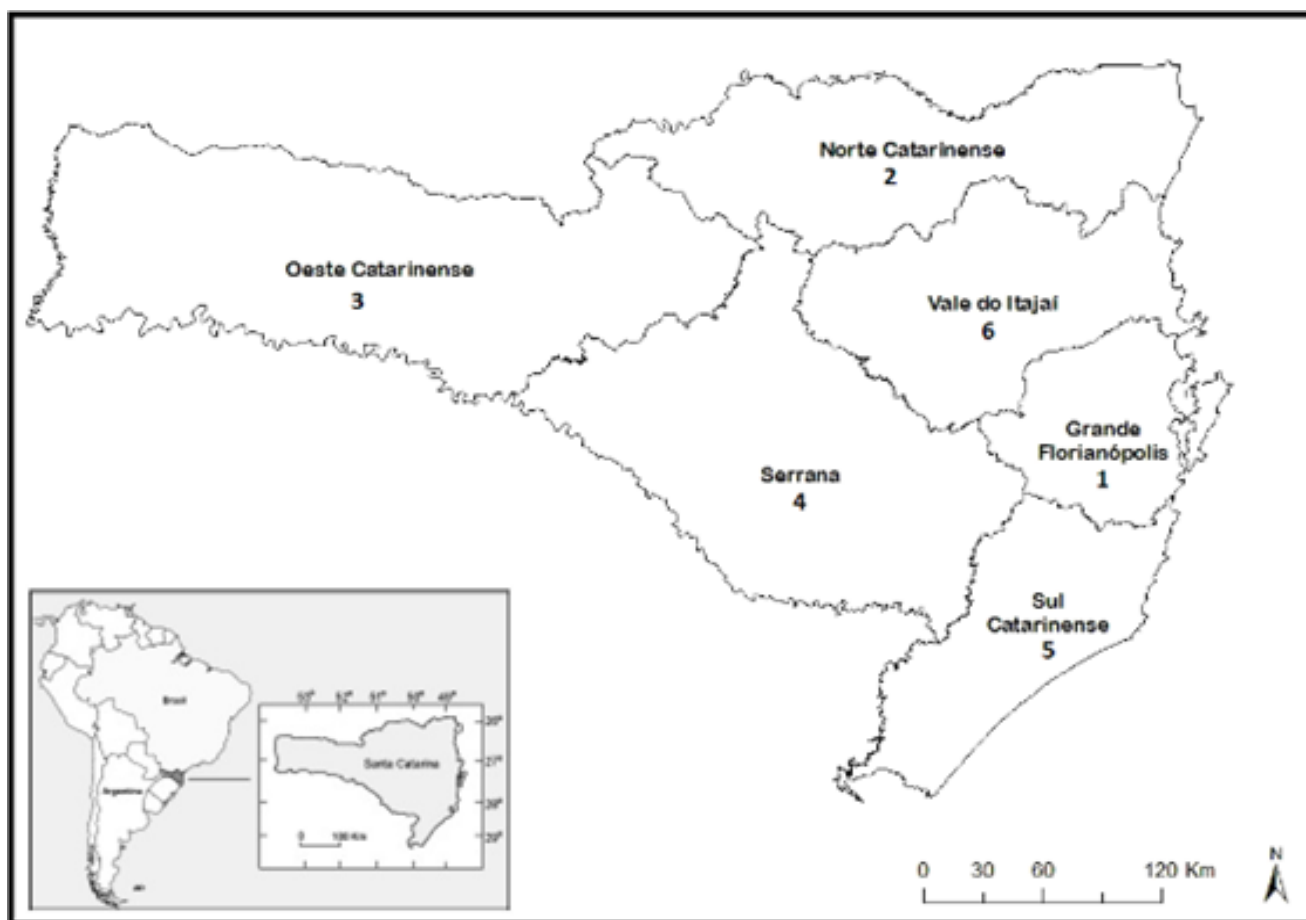
CAENOGASTROPODA Cox, 1960

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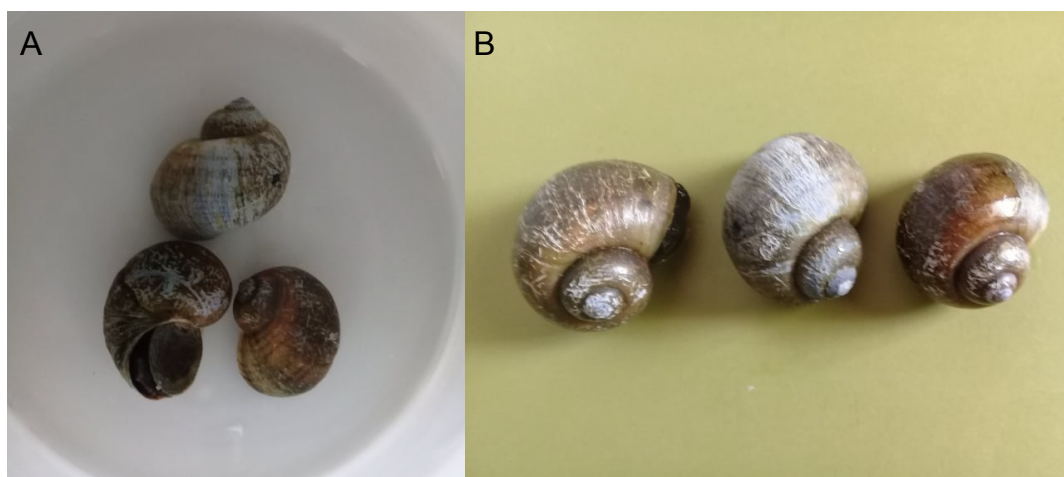
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**Figure 1:** Malacological division of the Santa Catarina State/SC geographic territory: (1) Greater Florianópolis, coastal and mountain Region; (2) Northern Region; (3) Western Region; (4) Highlands Region; (5) Southern Region; (6) Itajaí River Basin Valley region. Credit Map: Original by A. Ignacio Agudo-Padrón, staff of the “Project AM”.



**Figure 2:** Native freshwater apple snail *Pomacea maculata* Perry, 1810.

Family AMPULLARIIDAE Gray, 1824

*Pomacea maculata* Perry, 1810 (Figure 2)

“Aguas Mornas” Municipal District (27°41'38"S & 48°49'25"W), Malacological region 1-Greater Florianópolis (Mountain sector), 27/01/2020, Specimens found in “sport fishing lake” located in the hydrothermal/thermo-mineral

SPA installation “Aguas Mornas Palace Hotel”. Credit photos & field report: “Ignacio Agudo”, DataBase Project AM [2].

GYMNOPHILA Baker, 1955

Family VERONICELLIDAE Gray, 1840

*Phyllocaulis* sp (Figure 3)



Figure 3: Native forest leatherleaf slug *Phyllocaulis* sp (in determination process).



Figure 4: Exotic limnic snail *Galba truncatula* (Müller, 1774).

“Faxinal do Guedes” Municipal District (26°51'10"S & 52°15'36"W), Malacological region 3-Western, 29/10/2019, Specimen with aprox. 150 mm, found in ciliar area of the “Chapecozinho River” (26°46'S & 52°37'W), principal tributary of the “Chapecó River” in the Uruguay River Basin Valley. Credit photo & field report: “Douglas Meyer”, DataBase Project AM.

PULMONATA Cuvier, 1817

Family SUCCINEIDAE Beck, 1837

*Omalonyx matheroni* (Potiez & Michaud, 1838)

“Piçarras” (Vouchers LMSM 3942, 4024-4028), Malacological region 6 -- Itajaí Valley & “Biguaçu” (Vouchers LMSM 3507, 3508), Malacological region 1 -- Great Florianópolis (Figure 1) [3,4]. LMSM: Laboratório de Malacologia e Sistemática Molecular (Laboratory of Malacology and Molecular Systematics), Zoology Department of Universidade Federal de Minas

Gerais, Belo Horizonte/MG.

Family LYMNÆIDAE Rafinesque, 1815

*Galba* (-*Lymnaea*) *truncatula* (Müller, 1774) (Figure 4)

“Benedito Novo” (Vouchers FURB-MO 354 & FURB-MO 355), Blumenau Micro-region, Malacological region 6--Itajaí Valley [4,5]. FURB-MO: Malacological collection of Fundação Universidade Regional de Blumenau.

Family PLANORBIDAE Rafinesque, 1815

*Anisancylus obliquus* (Broderip & Sowerby, 1832)

*Drepanotrema kermatoides* (d’Orbigny, 1835)

“Porto União” (Pintado River, tributary of the Iguaçú River), Malacological region 2-North (Figure 3) [6].

Family BULIMULIDAE Tryon, 1867

*Drymaeus* cf. *paucipunctus* (Pilsbry, 1898) (Figure 5)



Figure 5: Native forest snail *Drymaeus* cf. *paucipunctus* (Pilsbry, 1898).



Figure 6: Native forest semi-slug *Peltella iheringi* Leme, 1968.



Figure 7: Native forest semi-slug *Peltella* cf. *palliolum* (Férussac, 1821).

“Linha Nova Teutônia” (27°10'49.05"S & 52°25'55.37"W), Malacological region 3-Western, 23/01/2020, Specimen

found in riparian area of the “Ariranha River”, tributary of the “Upper Uruguay River” in the Seara Municipal District. Cred-



**Figure 8:** Native forest snail *Leiostracus* cf. *polygrammus* (Moricand, 1836).



**Figure 9:** Native forest snail *Leiostracus* sp (in determination process).

it photo & field report: “Emanueli Marin Albino”, DataBase Project AM.

Family SIMPULOPSIDAE Schileyko, 1999

*Peltella iheringi* Leme, 1968 (Figure 6)

“Doutor Pedrinho”, Malacological region 6-Itajaí Basin

Valley, 26/06/2019, Specimen with aprox. 30 mm, found in local Forest environment to 530 meters above sea level. Credit photo & field report: “Douglas Meyer”, DataBase Project AM.

*Peltella* cf. *palliolium* (Férussac, 1821) (Figure 7)

“Joinville” (Dona Francisca Mountain Range Environmental Protection Area), Malacological region 2-North, 27/06/2018, Specimen with aprox. 40 mm, found in well preserved *Dense Ombrophyllous Forest* (on bromeliad leaf) to 300 meters above sea level. Credit photos & field report: “Fábio Longen”, DataBase Project AM [4].

*Leiostracus* cf. *polygrammus* (Moricand, 1836) (Figure 8)

“Praia Grande”, Malacological region 5-South, 10/01/2019, Young specimen, found on a wall. Credit photo & field report: “Amanda Perin Marcon”, DataBase Project AM.

*Leiostracus* sp (Figure 9)

“Morro da Boa Vista” (Zoobotanical Park of Joinville), Malacological region 2-North, 22/07/2019, Specimen in determination process with aprox. 10 mm, found to 250 meters above sea level in domain of Atlantic Slope Forest environment. Credit photo & field report: “Fábio Longen”, DataBase Project AM.

Family STREPTAXIDAE Gray, 1806

*Streptaxis* cf. *subregularis* (Pfeiffer, 1846)

“Urubici”, Malacological region 4-Highlands, 13/10/2018. Credit photo & report: iNaturalist Web DataBase < [https://www.inaturalist.org/observations/17510916?fbclid=IwAR0gDMIVVoCFNZzEQa2fZQnfNy\\_Doo4tLuCYyBdK-FliAVQcxLyETt3y78tg](https://www.inaturalist.org/observations/17510916?fbclid=IwAR0gDMIVVoCFNZzEQa2fZQnfNy_Doo4tLuCYyBdK-FliAVQcxLyETt3y78tg) >

*Streptaxis* cf. *tumescens* Suter, 1900 (Figure 10)

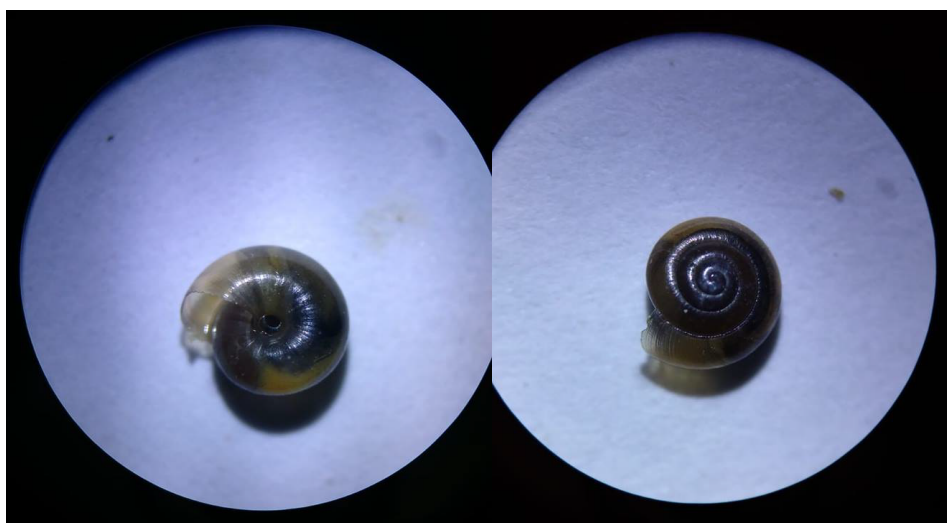


Figure 10: Native forest snail *Streptaxis cf. tumescens* Suter, 1900.



Figure 11: Native pupiform microsnail *Gastrocopta cf. servilis* (Gould, 1843).

“São José”, Malacological region 1-Great Florianópolis, 02/11/2018, Specimen with 4 mm, found in ornamental plants verified (orchids genus “*Oncidium*” and “*Catleya*”) sold in local floriculture. Credit photos & field report: “*Jefferson Souza da Luz*”, DataBase Project AM [4].

Family HELICARIONIDAE Bourguignat, 1877

*Ovachlamys fulgens* (Gude, 1900)

“Blumenau” (Voucher FURB-MO 179, eleventh (11) specimens), Malacological region 6--Itajaí Valley; “Bombinhas” (Voucher CEMAR 3176, two (2) specimens), Malacological region 6-Itajaí Valley; “Botuverá” (Field photo-report), Malacological region 6-Itajaí Valley [4,7]. FURB-MO: Malacological

collection of Fundação Universidade Regional de Blumenau; CEMAR: Centre for Marine Studies, Bombinhas Museum and Marine Aquarium, Bombinhas/SC.

Family VERTIGINIDAE Fitzinger, 1833

*Gastrocopta cf. servilis* (Gould, 1843) (Figure 11)

“Estreito”, Malacological region 1-Great Florianópolis, 05/04/2018, Specimen with aprox. 2.3 mm, found in particular garden neighbor of the “Pedro Medeiros” Urban Forest Park, clinging to a wall. Credit photo & Field report: “*Jefferson Souza da Luz*”, DataBase Project AM [4].

BIVALVIA Linnaeus, 1758



Figure 12: Native freshwater mussel/naiad *Diplodon charruana* (d'Orbigny, 1835).

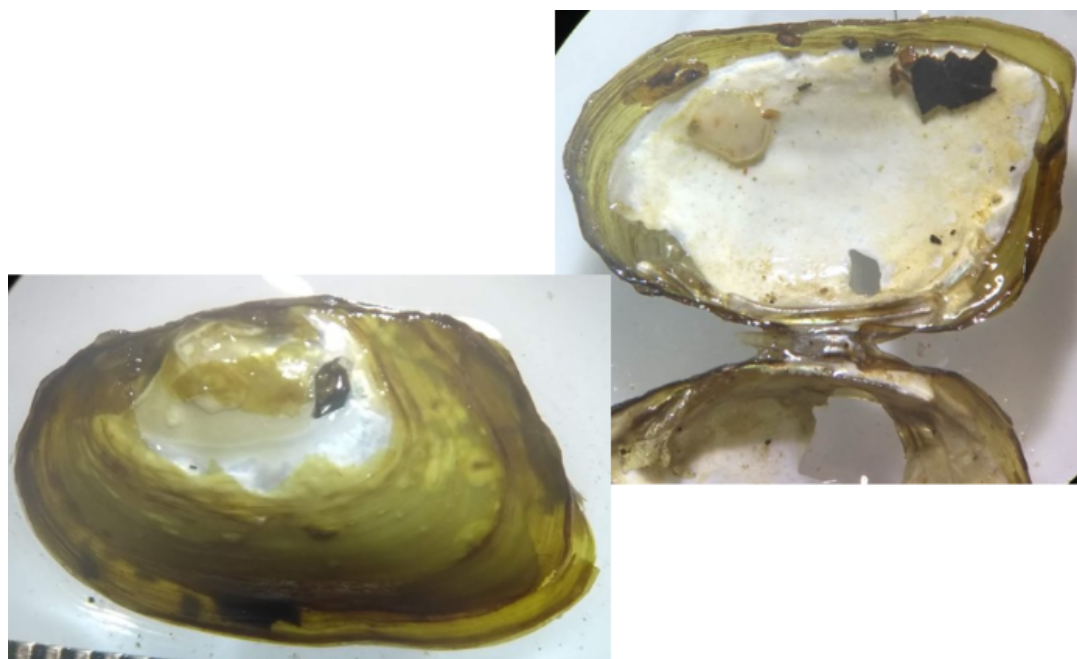


Figure 13: Native freshwater mussel/naiad *Diplodon* (- *Rhipidodonta*) *suavidicus* (Lea, 1856).

UNIONOIDA Stoliczka, 1871

Family HYRIIDAE Swainson, 1840

*Diplodon charruana* (d'Orbigny, 1835) (Figure 12)

“Benedito Novo” (Vouchers FURB-MO 357 and MO-358), Blumenau Micro-region, Malacological region 6--Itajaí Valley [4,8]. FURB-MO: Malacological collection of Fundação Universidade Regional de Blumenau.

*Diplodon* (- *Rhipidodonta*) *suavidicus* (Lea, 1856) (Figure 13)

“Benedito Novo” (Voucher FURB-MO 366-“Benedito River” Microbasin), Malacological region 6-Itajaí Basin Valley [9]. FURB-MO: Malacological collection of Fundação Universidade Regional de Blumenau.

VENEROIDA Gray, 1854

Family CYRENIDAE Gray, 1847

*Cyanocyclus paranacensis* (d'Orbigny, 1835) (Figure 14)

“Mafra” (“Rio da Lança” Basin), Malacological region 2-North, 17/04/2018, Specimen with aprox. 10 mm. Credit



Figure 14: Native freshwater clam *Cyanocyclus paranacensis* (d'Orbigny, 1835).

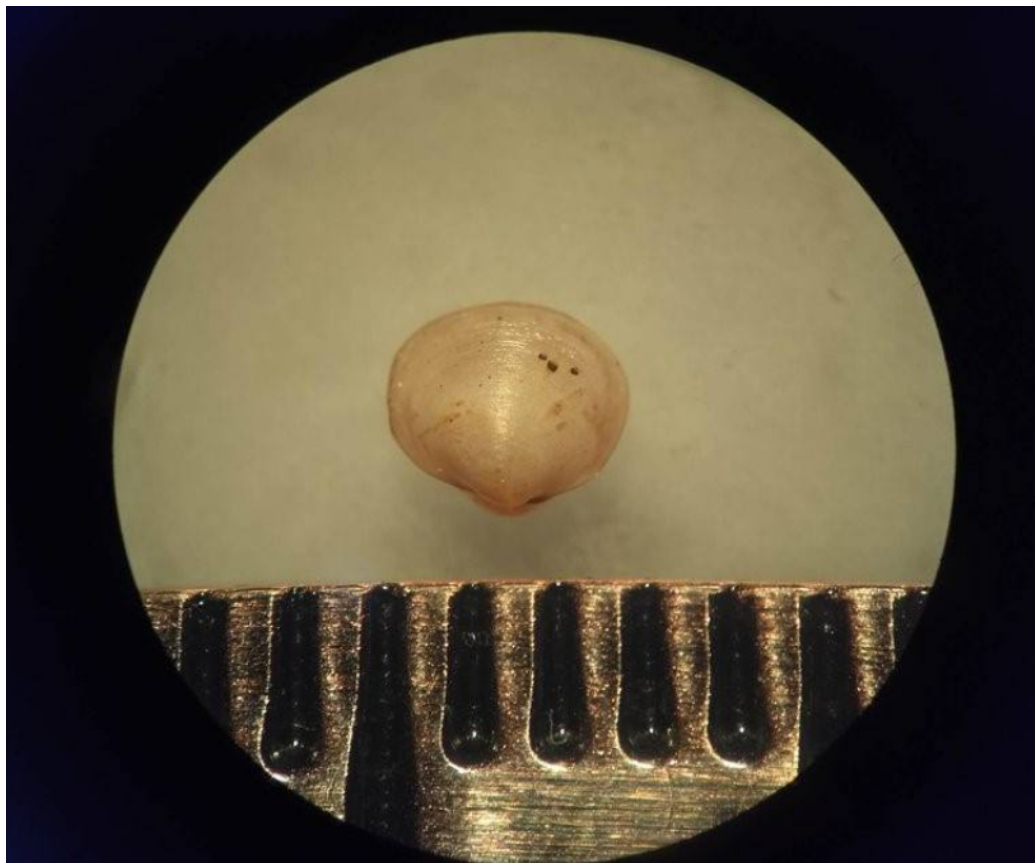


Figure 15: Native freshwater clam *Musculium argentinum* (d'Orbigny, 1835).

photo & report: "Anq Marta Schafaschek", DataBase Project AM [4,10]

Family SPHAERIIDAE Deshayes, 1855

*Musculium argentinum* (d'Orbigny, 1835) (Figure 15)

"São Francisco do Sul" (Voucher FURB-MO 363-"Rio Miranda" Basin), Malacological region 2-North [11]. FURB-MO: Malacological collection of Fundação Universidade Regional de Blumenau.

*Eupera bahiensis* (Spix, 1827) (Figure 16)





Figure 16: Native freshwater clam *Eupera bahiensis* (Spix, 1827).

“Guaramirim” (Voucher FURB-MO 361-“Rio Corticeirinha” Microbasin, Malacological region 2-North) & “Benedito Novo” (Voucher FURB-MO 370-“Benedito River” Microbasin), Malacological region 6-Itajaí Basin Valley [12]. FURB-MO: Malacological collection of Fundação Universidade Regional de Blumenau.

## Discussion & Conclusions

In this new opportunity other twenty (20) non-marine/continental mollusc species were confirmed and added to the last inventory available of Santa Catarina State/SC (Agudo-Padrón 2018 a), increasing to 252 its number of registered forms regionally known, including today an total of 104 genera (91 Gastropoda & 13 Bivalvia) and 41 families (36 Gastropoda & 5 Bivalvia).

Additionally, soon after six (6) years of uncertainty and expectations, and based on timely observations of a bioecological nature from the follow-up of its natural life cycle (growth series/age development, from the egg/newborn to the reproductive adult), is established/revealed that the native STROPHOCHEILIDAE species *Mirinaba fusoides* (Bequaert, 1948) is the correct taxonomic specific identity of the mystery forest snail so far determined as AMPHIBULIMIDAE *Plekocheilus* (*Eurytus*) aff. *rhodocheilus* (Reeve, 1848) (Agudo-Padrón 2018 a: 56), based on young specimen occasionally photographed in the field on November 16, 2013 found in leaf litter of native *Araucaria* forest at “Itaiópolis” Municipal District (26°20'11"S & 49°54'23"W), case who clearly demonstrates (once again) the critical state of “unfamiliarity” that still prevails among us

today about the bioecology and conservation status/situation of the forest non-marine molluscs occurring in the geographic territory of this State [13].

Additionally, the giant species STROPHOCHEILIDAE *Megalobulimus yporanganus* (Ihering & Pilsbry, 1901) went on to replace (synonymy accepted) the previous specific status *Megalobulimus toriii* Morretes, 1937 [15].

Currently, the Central Southern Brazilian State of Santa Catarina/SC account with a diversity of non-marine molluscs (land/terrestrial and limnic/freshwater) comprising up to date a total of 252 species and subspecies related/registered, with 213 gastropods (166 land, 3 amphibious/limnophiles, 44 limnic) and 39 freshwater bivalves. Of this, 28 are exotic/non-natives (24 gastropods-1 amphibian/limnophile, 5 freshwater, 18 terrestrial-and 4 bivalves) and 25 are endemic gastropods, plus 17 forms that still require field confirmation/verification (only reported in the literature), whose territorial geo-spatial distribution has been constantly monitored and updated by us, being that their “ecological-functional” importance of it lies not only in the increasing number of taxa involved but rather in its role in the functioning of the ecosystems they occupy (... a regional aspect that is practically unknown/taken into consideration !), contributing to the cycling of nutrients in the environments where they occur, promoting the flow of matter and energy through their position in the trophic chains, either as prey of other organisms, as pollinators, as filterers and removers of water and sediments in aquatic environments (bioturbation), or as “gardeners” of forests etc etc, contributing directly and effectively to the maintenance

of the natural balance.

When it comes to regional research with molluscs, the Santa Catarina State/SC historically have focused their effort and interest almost uniquely in the research and development of the creation/production of marine forms capable of commercial handling. Other general aspects of their knowledge are practically ignored and/or relegated to a background (57, 58) [1,14].

Ecology and natural history of neotropical land snails, by example, is almost unknown (... see our previous comment about the regional case of “mystery forest snail” !). It is necessary and urgent to recognize, valorization and attention to the study and reach of in depth knowledge about the “functional ecological importance” of this particular biodiversity, due to its relations with the “responsiveness” to the environmental variation (bioindicators) and its impact on ecosystems processes, through weighted assessments and sober of the threat categories they currently present, as well as their spatial and altitudinal distribution in the State (... this latter work, in parallel to the systematic inventory, carried out since 1996 by us !), ... key information for answering ecological and evolutionary questions, modeling the response of the species involved to estimated anthropogenic changes for the next decades, and designing conservation strategies that are really valid for this who is one of the most vulnerable wildlife groups in our region and in Brazil in general.

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