

Mollusca and environmental conservation in Santa Catarina State (SC, Southern Brazil): current situation

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ABSTRACT Available knowledge of malacofauna (mollusc species) conservation in the territory of Santa Catarina State, SC, central Southern Brazil region, is shortly analyzed and discussed herein. Present data originate from the author's active participation in three recent regional unpublished events dealing with biodiversity conservation in the State, carried out to cope the sensitive lack of population studies which is the main difficulty to face in order to provide accurate and detailed evaluations on biodiversity and its conservation status.

KEY WORDS Biodiversity, Conservation status, Mollusc fauna, Santa Catarina State, Southern Brazil region.

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INTRODUCTION

After fourteen years of pioneering systematic work spanning from 1996 to 2010, carried out in the territory of Santa Catarina State, SC, within the Brazilian Southern region, framed in the so-called Atlantic Slope of the Southern Cone of South America (Agudo-Padrón, 2008a), a basic list of continental (land and freshwater) and marine mollusc species was compiled. Besides constant interactions and consultations with numerous national and international specialists, such a list was mostly based on available literature and/or analyses of voucher specimens deposited in collections belonging to research centers or environmental education institutes.

To date (up to the first semester of 2010), this list comprises a total of 878 taxa (species and subspecies, including 695 marine and 183 continental forms), and these numbers are likely to increase as field surveys ensue.

In the present study, results obtained from the author's active participation in three recent regional field sampling expeditions dealing with marine and continental mollusc taxa, are reported.

I. Official State program for listing and control of invasive exotic species

Starting from November 2009, and for the first time in the history of Santa Catarina State, the presence of invasive allochthonous mollusc species in Santa Catarina State was studied and discussed through the organisation of seminars by the Official Foundation for the Environment of the State of Santa Catarina (Fundação do Meio Ambiente – FATMA) jointly with the Hórus Institute for Development and Environmental Conservation (Instituto Hórus de Desenvolvimento e Conservação Ambiental), with the main goal to compile the Official State List of Species. To date, the occurrence of a total of twenty allochthonous (exotic) forms of mollusc species has been confirmed, 14 Gastropoda and 6 Bivalvia [namely, 11 terrestrial gastropods, 5 freshwater taxa (3 gastropods and 2 bivalves) and 4 marine bivalves]. Taking into account the contributions of Agudo & Bleicker (2006a), Agudo-Padrón (2008b) and Agudo-Padrón & Lenhard (2010), the slug *Pallifera* sp. - the taxonomic determination of which is still in process (Thomé et al., 2006) - was included within such a list. Of these twenty

allochthonous species, 14 are invasive forms involving 10 Gastropoda (5 slugs and 5 snails, 1 of which is freshwater) and 4 Bivalvia (2 freshwater and 2 marine).

Notably, the Asian golden mussel, *Limnoperna fortunei* (Dunker, 1857), a highly invasive species, which up to now fortunately only shows a moderate presence in SC territory (Agudo-Padrón, 2007; 2008c; Agudo-Padrón & Lenhard, 2010), received particular attention in the course of the event. On the other hand, the marine cultivated mussel *Perna perna* (Linnaeus, 1758), interpreted as invasive exotic species (Junqueira et al., 2009; Agudo & Lenhard, 2010), was definitely deleted from the list based on extensive analyses and conclusive technical discussions that confirmed it to be a native species for Brazil and Santa Catarina State (Magalhães et al., 2007; Schaefer et al., 2009).

II. Construction of the official list of species threatened with extinction in Santa Catarina

Similarly, for the first time in the history of the State, the presence and the conservation status of the native molluscan fauna in SC State was examined and discussed. Sponsored, organized and driven by the Official Foundation for the Environment of the State of Santa Catarina (Fundação do Meio Ambiente – FATMA) jointly with the IGNIS – Planejamento e In-formação Ambiental (IGNIS – Planning and Environmental In-formation), works dealing with these regional invertebrate animals officially began in October 2009 (IGNIS online published informations are available via <http://www.ignis.org.br>). The event, denominated as “IV Forum IGNIS of Discussion”, was celebrated in March 2010, even if works were extended until April of the same year. In the mollusc specialist group, out of seven participant researchers, only two focus on continental (terrestrial and freshwater) species. This is in line with the fact that most scientists working in Santa Catarina have to date focused primarily on marine taxa, as clearly deducible from regional literature (e.g. Agudo, 2004; Agudo & Bleicker, 2005a, b; 2006a; Agudo-Padrón, 2008a, b; 2010; Agudo-Padrón et al., 2009).

A total of 675 marine and 82 continental molluscan forms were officially considered and recognized for area under review within the IGNIS database. In particular, 156 marine taxa (21 Cephalopoda, 89 Gastropoda and 46 Bivalvia) were included in the list, along with 17 new registrations of marine species (11 Cephalopoda and 6 Gastropoda) (Agudo-Padrón & Bleicker, 2011). Moreover, another three species of marine bivalves were incorporated to the malacological inventory, on the basis of the record in Caregnato et al. (2009).

As for continental taxa, taking into account available information (Agudo-Padrón, 2008b; 2009a, b; 2010) we strongly believe they have been under-appraised in this first census, probably due to the lack of information on their population structure and distribution. At the moment, out of 82 forms of continental molluscs, only 18 were included in the IGNIS list and just 14 (9 Bivalvia and 5 Gastropoda) were considered as valid species. Moreover, four freshwater bivalves (3 Mycetopodidae and 1 Hyriidae) were added to the list, based on the hypothesis of their “evident occurrence by zoogeographical reasons”. In fact, the presence of these taxa has not yet been confirmed by any official sources such as: (1) bibliographic references, (2) specimens collected in the field, (3) voucher material, coming from the State, deposited in naturalistic collections.

Class BIVALVIA Order UNIONOIDA

Family MYCETOPODIDAE

Anodontites trapezeus (Spix, 1827)
Anodontites trigonus (Spix, 1827)
Fossula fossiculifera (d’Orbigny, 1835)

Family HYRIIDAE

Castalia undosa Martens, 1885

On the other hand, three of the confirmed gastropod species underwent “interpretation conflicts” being considered, in the same way, as marine or continental forms due to their high ecological tolerance.

Class GASTROPODA
Subclass PROSOBRANCHIA
Order CAENOGASTROPODA

Family HYDROBIIDAE

Littoridina (= *Heleobia*) *australis* (d'Orbigny, 1835)

Within the continental forms, Simone (2006) recognized *Littoridina* (= *Heleobia*) *australis* (d'Orbigny, 1835) - already reported by Rios (2009) - and *Littoridina* (= *Heleobia*) *piscium* (d'Orbigny, 1835) - as two separate species, with the occurrence of these two species being definitely confirmed in the territory of Santa Catarina (Agudo & Bleicker, 2005a, c; Agudo-Padrón, 2008b; 2009a).

Subclass PULMONATA

Family ELLOBIIDAE

Melampus coffeus (Linnaeus, 1758)

Pedipes mirabilis (Muhlefeld, 1816)

These species – already reported for SC State (Agudo & Bleicker, 2005a, c; Agudo-Padrón, 2009a)- were included in the list of continental molluscs.

III. Malacological field research in the Itajaí-Açu river basin valley, SC State

In March 2010, the “Environmental Impact Study” (Estudo de Impacto Ambiental - EIA) was initiated by a private company in the medium valley of the Itajaí-Açu river basin [the largest Atlantic drainage-basin of the State (Siebert, 1997; Agudo-Padrón, 2008c)] (Figs. 1-3).

Emerging results (still unpublished) revealed a total of eight species of continental molluscs, 6 freshwater and 2 terrestrial. Notably, within these taxa, two freshwater forms, encountered inside bivalve shells deposits, are new records for the State:



Fig. 1



Fig. 2



Fig. 3

Figures 1, 2. Medium valley of the Itajaí-Açu river basin.
 Figure 3. *Pomacea sordida* on the Itajaí-Açu river basin.

Class GASTROPODA
Subclass PROSOBRANCHIA
Order CAENOGASTROPODA

Family HELICINIDAE

Helicina angulata Sowerby, 1873

The occurrence of this tree snail was confirmed in the field survey.

Family AMPULLARIIDAE

Pomacea sordida Swainson, 1823 (Fig. 4)

Family THIARIDAE

Aylacostoma sp. (Fig. 5)

This freshwater gastropod (river snail) genus was a new record for the area under review (Agudo-Padrón & Bleicker, 2011).

Family HYDROBIIDAE

Potamolithus catharinae Pilsbry, 1911 (Fig. 6)

Subclass PULMONATA

Family CHILINIDAE

Chilina globosa Frauenfeld, 1881

Family AGRIOLIMACIDAE

Deroceras laeve (Müller, 1774)

Class BIVALVIA
Order UNIONOIDA

Family HYRIIDAE

Diplodon aethiops (Lea, 1860) (Fig. 7)

This species was considered by Simone (2006) as one of the synonymous forms of the still contentious species *Rhipidodonta charruana* (d'Orbigny, 1835) (Agudo-Padrón, 2008b; 2009a).

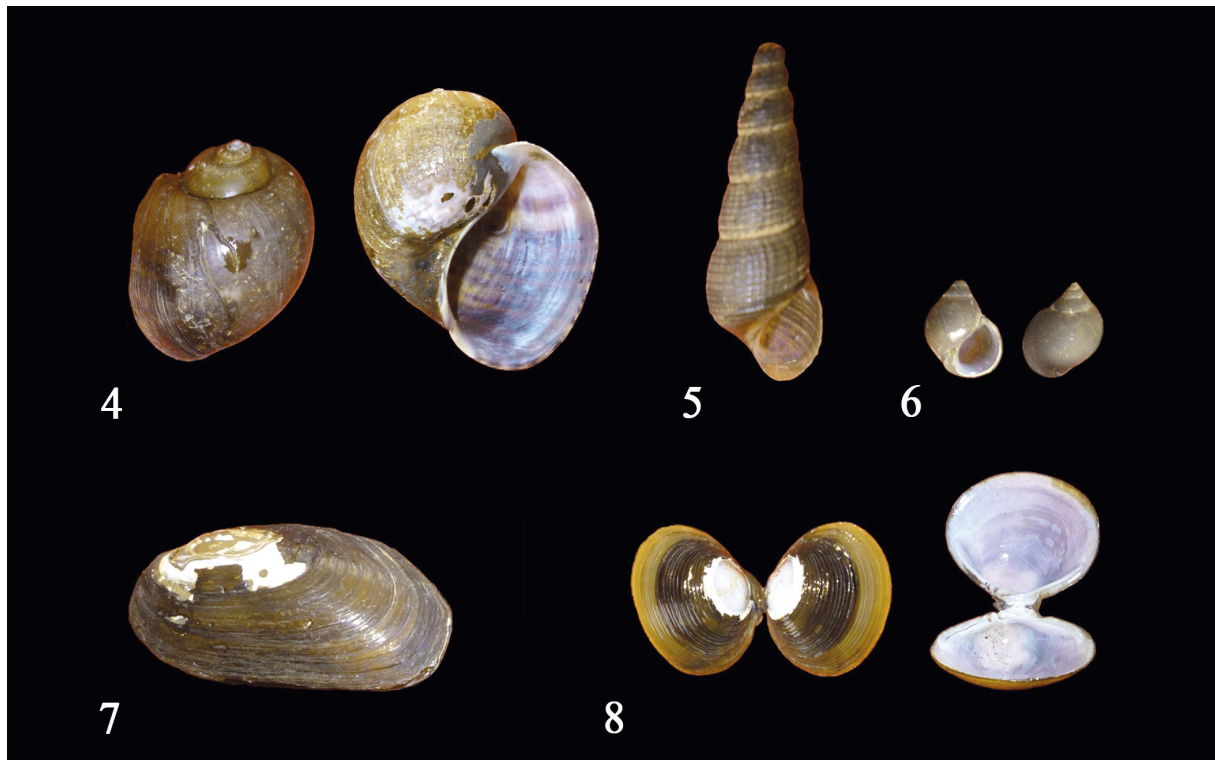


Figure 4. *Pomacea sordida* – Figure 5. *Aylacostoma* sp. – Figure 6. *Potamolithus catharinae* – Figure 7. *Diplodon aethiops* – Figure 8. *Corbicula largillierti*.

Order VENEROIDA

Family CORBICULIDAE

Corbicula largillierii (Philippi, 1844) (Fig. 8)

The whole malacological material presented herein has been deposited at the “Augusto Ruschi Zoobotanical Museum” (Museu Zoobotânico Augusto Ruschi – MUZAR), Passo Fundo University – UPF, Rio Grande do Sul State – RS, Southern Brazil region.

Present results, although still preliminary, constitute the first known effort at achieving a general knowledge on Mollusca distribution in the medium basin of the Itajaí-Açu river, since previous available data on this group, at regional level, is extremely scarce and fragmented (Agudo-Padrón, 2008b; 2009a).

As far as data on molluscan species in the region of Blumenau Municipal District and the Itajaí river valley are concerned, a few other previous studies have been conducted, including those by Morretes (1949; 1953), Prando & Bachia (1995), Silva & Veitenheimer-Mendes (2004), Agudo (2002), AA.VV. (2005), Agudo & Bleicker (2006a), Simone (2006), Molozzi et al. (2007) and Agudo-Padrón (2008b, c).

CONCLUSIONS

Generally speaking, molluscan fauna can be investigated from several perspectives, i.e. zoological diversity, biogeographical distribution, palaeontology, veterinary, agricultural plagues, invasive exotic species, conservation, as an alimentary resource (fishing and malacoculture), as bio-indicators of environmental quality and, last but not least, as a health hazard (as vectors or transmitters of human parasitic diseases) (Agudo 2004, 2007; Agudo & Bleicker, 2006b; Agudo-Padrón 2008a, 2010).

In the course of this study, it emerged that the lack of population studies is the main difficulty thwarting detailed evaluation of the conservation status of molluscan species already recorded in the State. In particular, for terrestrial taxa, the dearth of information is even more dire since the largest part of active limnologists in the area work on marine species. Hence, to overcome such a lack of information on mollusc fauna of

the State of Santa Catarina (Agudo & Bleicker, 2006b), a lot of work has still to be done, focusing exclusively on continental and allochthonous species.

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REFERENCES

- AA.VV., 2005. Moluscos gastrópodes em arroz irrigado, no sistema pré-germinado, pp. 92-93. *In*: Arroz irrigado: recomendações técnicas de pesquisa para o Sul do Brasil. Santa Marta, RS: Sociedade Sul-Brasileira de Arroz Irrigado, IV Congresso Brasileiro de Arroz Irrigado & XXVI Reunião da Cultura do Arroz Irrigado: 1-159. Available online at: http://www.agencia.cnpia.embrapa.br/Repositorio/Recomendacoes_Tecnicas_Arroz_2007_000fzrbdd8b02wx5ok0cpoo6adaexge2.pdf.
- Agudo A.I., 2002. Preliminary report about the freshwater mussels/clams (Bivalvia: Unionoida & Veneroida) of Santa Catarina State, Southern Brazil. *Ellipsaria*, 4: 10-11.
- Agudo A.I., 2004. Os moluscos continentais do Estado de Santa Catarina SC: uma síntese do seu atual conhecimento. *Informativo SBMa*, Rio de Janeiro, 35: 3-4.
- Agudo A.I., 2007. Biogeografia das doenças transmissíveis por moluscos vetores no Estado de Santa Catarina, com ênfase na “Angiostrongilíase abdominal”. *Revista Discente Expressões Geográficas*, 3: 104-105. Available online at: <http://www.geograficas.cfh.ufsc.br/arquivo/ed03/01tcc.pdf>.
- Agudo-Padrón A.I., 2007. Diagnóstico sobre a potencial ocorrência do mexilhão-dourado asiático, *Limnoperna fortunei* (Dunker, 1857), no Estado de Santa Catarina, Brasil. *Informativo SBMa*, Rio de Janeiro, 38: 4-5.
- Agudo-Padrón A.I., 2008a. Levantamento biogeográfico de moluscos no Estado de Santa Catarina, SC, região Sul do Brasil, Vertente Atlântica do Cone Meridional da América do Sul. *Caminhos de Geografia*, 9: 126-133. Available online at: <http://www.caminhosdegeografia.ig.ufu.br/viewarticle.php?id=664&layout=abstract>.

- Agudo-Padrón A.I., 2008b. Listagem sistemática dos moluscos continentais ocorrentes no Estado de Santa Catarina, Brasil. *Comunicaciones de la Sociedad Malacológica del Uruguay*, 9: 147-179. Available online at: <http://redalyc.uaemex.mx/redalyc/pdf/524/52412049003.pdf>.
- Agudo-Padrón A.I., 2008c. Vulnerabilidade da rede hidrográfica do Estado de Santa Catarina, SC, ante o avanço invasor do mexilhão-dourado, *Limnoperna fortunei* (Dunker, 1857). *Revista Discente Expressões Geográficas*, 4: 75-103. Available online at: <http://www.geograficas.cfh.ufsc.br/arquivo/ed04/artigo04.pdf>.
- Agudo-Padrón A.I., 2009a. Recent terrestrial and freshwater molluscs of Santa Catarina State, SC, Southern Brazil region: a comprehensive synthesis and check list. *VISAYA, Cebú - Philippines* (April 20, 2009): 1-12. <http://www.conchology.be/?t=41>.
- Agudo-Padrón A.I., 2009b. Endangered continental mollusks of Santa Catarina State, Southern Brazil: an brief overview. *Ellipsaria*, 11: 7-8.
- Agudo-Padrón A.I., 2010. The mollusc fauna of Santa Catarina State, Southern Brazil: knowledge gained from 13 years of research. *Tentacle*, 18: 32-37. Available online at: http://www.hawaii.edu/cowielab/tentacle/Tentacle_18.pdf.
- Agudo A.I. & Bleicker M.S., 2005a. Malacofauna marinha catarinense: uma aproximação ao estado atual do conhecimento dos moluscos marinhos. I: Gastropoda. *Informativo SBMa*, Rio de Janeiro, 36 (151): 3-7.
- Agudo A.I. & Bleicker M.S., 2005b. Malacofauna marinha catarinense: uma aproximação ao estado atual do conhecimento dos moluscos marinhos. II: Bivalvia. *Informativo SBMa*, Rio de Janeiro, 36 (152): 4-7.
- Agudo A.I. & Bleicker M.S., 2005c. Malacofauna marinha catarinense: uma aproximação ao estado atual do conhecimento dos moluscos marinhos. IV: Adenda: registros adicionais. *Informativo SBMa*, Rio de Janeiro, 36 (154): 4-6.
- Agudo A.I. & Bleicker M.S., 2006a. Moluscos exóticos no Estado de Santa Catarina. *Informativo SBMa*, Rio de Janeiro, 37: 6-8.
- Agudo A.I. & Bleicker M.S., 2006b. First general inventory of the malacological fauna of Santa Catarina State, Southern Brazil. *Tentacle*, 14: 8-10. Available online at: http://www.hawaii.edu/cowielab/tentacle/tentacle_14.pdf.
- Agudo-Padrón A.I. & Bleicker M.S., 2011. Additional new records on recent marine and continental molluscs of Santa Catarina State, SC, Southern Brazil region: synthesis and check list. *Ellipsaria*, 13: 20-26.
- Agudo-Padrón A.I., Bleicker M.S. & Saalfeld K., 2009. Recent marine molluscs of Santa Catarina State, SC, Southern Brazil region: a comprehensive synthesis and check list. *VISAYA, Cebú - Philippines* (April 20, 2009): 1-17. Available online at: <http://www.conchology.be/?t=41>.
- Agudo-Padrón A.I. & Lenhard P. 2010. Introduced and invasive exotic molluscs in Brazil: an brief overview. *Tentacle*, 18: 37-41. Available online at: http://www.hawaii.edu/cowielab/tentacle/Tentacle_18.pdf.
- Caregnato F.F., Wiggers F., Tarasconi J.C. & Veitenheimer-Mendes I.L., 2009. Taxonomic composition of mollusks collected from the stomach content of *Astropecten brasiliensis* (Echinodermata: Asteroidea) in Santa Catarina, Brazil. *Revista Brasileira de Biociências*, 7: 252-259. Available online at: <http://www6.ufrgs.br/seerbio/ojs/index.php/rbb/article/view/1182/870>.
- Junqueira A.O.R., Tavares M.D.S., Schaeffer-Novelli Y., Radashevsky V.I., Cirelli, J.O., Julio L.M., Romagnoli F.C., Santos K.C. dos & Ferreira-Silva M.A.G., 2009. Zoobentos, Cap. 6, pp. 145-371. *In*: Lopes, R.M. (Editor). *Informe sobre as espécies exóticas invasoras marinhas no Brasil*. Brasília, DF: MMA/SBF, Série Biodiversidade, 33, 440 pp.
- Magalhães A.R.M., Schaefer A.L.C. & Fossari T., 2007. Mexilhão *Perna perna* (Linnaeus, 1758): nativo sim do Brasil. Rio de Janeiro, RJ: Resumos XX Encontro Brasileiro de Malacologia, Biogeografia: 237.
- Molozzi J., Hepp L.U. & Dias A. da S., 2007. Influence of rice crop on the benthic community in Itajaí Valley (Santa Catarina, Brazil). *Acta Limnológica Brasiliensis*, 19: 383-392. Available online at: http://www.sblimno.org.br/pdf/acta19_vol4_02.pdf.
- Morretes F.L., 1949. Ensaio de Catálogo dos Moluscos do Brasil. Curitiba: Arquivos do Museu Paranaense, 7: 5-216.
- Morretes F.L., 1953. Addenda e Corrigenda ao Ensaio de Catálogo dos Moluscos do Brasil. Curitiba: Arquivos do Museu Paranaense, 10: 37-76.
- Prado H.F. & Bachia R.E., 1995. Ocorrência e controle de moluscos gastrópodes em arroz irrigado no sistema pré-germinado, em Santa Catarina. Porto Alegre, RS: IRGA, Anais XXI Reunião da Cultura do Arroz Irrigado: 229-231.
- Rios E. de C., 2009. Compendium of Brazilian Sea Shells. Rio Grande, RS: Evangraf, 668 pp.
- Schaefer A.L.C., Magalhães A.R.M. & Fossari T.D., 2009. Evidências da presença do mexilhão *Perna perna* em Sambaquis pré-coloniais brasileiros. Rio de Janeiro, RJ: Resumos XXI Encontro Brasileiro de Malacologia, Arqueologia: 432.
- Siebert C.F., 1997. Rede urbana do Vale do Itajaí. Blumenau, SC: Editora da FURB, 118 pp.
- Silva M.C.P. da & Veitenheimer-Mendes I.L., 2004. Redescrição de "*Potamolithus catharinae*" com base em topótipos (Gastropoda, Hydrobiidae), rio Hercílio, Santa Catarina, Brasil. *Iheringia, Série Zoologia*, Porto Alegre, 94: 83-88. Available online at: <http://www.scielo.br/pdf/isz/v94n1/20466.pdf>.
- Simone, L.R.L., 2006. Land and freshwater molluscs of Brazil. São Paulo, SP: FAPESP, 390 pp.
- Thomé J.W., Gomes S.R. & Picanço J.B., 2006. Os caracóis e as lesmas dos nossos bosques e jardins. Pelotas, RS: USEB, 123 pp.