



Newsletter of the Freshwater Mollusk Conservation Society
 Volume 13 – Number 4 December 2011

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**FMCS 2012 WORKSHOP:
 Incorporating Environmental Flows,
 Climate Change, and Ecosystem
 Services into Freshwater Mussel
 Conservation and Management**

April 19 & 20, 2012 Holiday Inn- Athens, Georgia

The FMCS 2012 Workshop will be held on April 19 and 20, 2012, at the Holiday Inn, 197 E. Broad Street, in Athens, Georgia, USA. The topic of the workshop is “Incorporating Environmental Flows, Climate Change, and Ecosystem Services into Freshwater Mussel Conservation and Management”. Morning and afternoon sessions on Thursday will address science, policy, and legal issues related to establishing and maintaining environmental flow recommendations for mussels. The session on Friday morning will consider how to incorporate climate change into freshwater mussel conservation; talks will range from an overview of national and regional activities to local case studies. The Friday afternoon session will cover the emerging science of “Ecosystem Services” and how this can be used in estimating the value of mussel conservation. There will be a combined student poster session and social on Thursday evening.

A block of rooms will be available at the Holiday Inn, Athens at the government rate of \$91 per night. In addition, there are numerous other hotels in the vicinity. More information on Athens can be found at: <http://www.visitathensga.com/>

Registration and more details about the workshop will be available by mid-December on the FMCS website (<http://molluskconservation.org/index.html>). An e-mail will be sent to all FMCS members and to mollusk-related lists once the Workshop web page is up and running.

Society News

Meeting Minutes, FMCS Fall 2011 Board Meeting Via Conference Call, November 17, 2011

Call to Order and Roll Call for Attendance – Caryn Vaughn, Patty Morrison, David Berg, Teresa Newton, Art Bogan, Steve McMurray, John Jenkinson, Greg Cope, Braven Beaty, Megan Bradley, Susan Oetker, Tom Watters, Danielle Kreeger, Monte McGregor, Jacob Culp, Heidi Dunn, Andy Roberts, Paul Johnson, Jeremy Tiemann.

Approval of 4-11-2011 Board Meeting Minutes (see June 2011 *Ellipsaria*). Greg Cope moved to accept, John Jenkinson seconded. All in favor.

Treasurer Report – Heidi Dunn. This year the 2-year membership kicked in, so we might need to adjust the membership term for next workshop so we can get everyone on the same cycle. Income \$ 99,467.46 for the year: \$19,075 from memberships, \$5166 from the auction, \$73,765 from the Louisville symposium, \$880 residual income from the 2010 workshop, \$340 from sale of misc items, and \$241.46 from interest. Expenses totaled \$84,785.98; \$2536.09 for awards, \$72,428.30 for the symposium, \$6,984.83 from the webpage, \$2854.81 from Paypal and credit card fees, \$4.75 for shipping, and a rebate of \$22.80 from our credit card. Net income for the year is \$14,681.48. Society balance \$100,261.05 in the checking and savings account.

Secretary Report – Patty Morrison taking minutes for Greg Zimmerman. No Secretary report.

Committee Reports

Symposium Committee

2012 Workshop Update – Caryn Vaughn, Robert Bringolf, Steve Golladay, Jason Wisnieski, Daniel Spooner, Patty Morrison, and grad student members Andrea Fritts and Carla Atkinson). Topic “Incorporating Environmental Flows, Climate Change, and Ecosystem Services into Freshwater Mussel Conservation and Management”. April 19-20, 2012, Athens, GA. Most speakers are lined up. All invited speakers for this workshop, with 9 speakers on environmental flows; 6 talks on climate change; and 4 on ecosystem services. Looking great so far. Registration should be about \$125, and are planning for 100 to 125 people. Final details will be available soon. The Committee will work with Sophie to set up online registration. Might consider also having a poster session so students can get funding to participate? Possibly Thursday night 4/19.

2013 Symposium Update – Paul Johnson, Patty Morrison, Jacob Culp, Monte McGregor, Heidi Dunn, Steve McMurray, Leroy Koch. The next Symposium is set for Guntersville State Park, Guntersville, AL in March 2013. Registration fees and form will be finalized by summer 2012, as many state agencies now require at least 60 days notice for out-of-state travel. Room rates are reasonable, cabins too. No special theme set yet, open to suggestions. Some unique local field trips are possible. We need to consider options for shuttling people to the site from the airport, as shuttle service from the Huntsville airport is \$200 round trip. Maybe we can rent some 15-passenger vans, or set up ride boards, or rent a bus service. Committee will continue to investigate options.

Beyond 2013. We already have the 2015 symposium set for St. Louis, MO, with a “Homecoming” theme, to be organized by Steve McMurray (Missouri DOC) and Heidi Dunn (Ecological Specialists, Inc). For 2014, we have 2 possibilities already – Mary McCann and Alan Christian in New England may be interested in hosting a workshop in New England on a timely topic of their choosing, unless the Board had a particular theme in mind. I had suggested mussel considerations during dam removal projects, and other connectivity issues. Dave Berg and the Genetics Committee suggested hosting a genetics workshop in 2014 at NCTC. The Board will be ready to accept presentations from both Mary McCann and Dave Berg on 2014 workshop ideas and locations at the April 2012 Board meeting in Georgia.

Awards – Teresa Newton, Emy Monroe, Greg Cope. This is now an off year, so not much new to report. Feedback from the 2011 Symposium was very positive, the new format worked well for judges.

Information Exchange

Walkerana – Tom Watters, Greg Cope, Wendell Haag. So far 7 papers are ready to go in final form. Four awaiting final review. We will have an issue this year, December 2011.

Ellipsaria – John Jenkinson. On track for December issue, workshop material coming in. Nice variety of articles.

Outreach – Megan Bradley, Andy Roberts, Tom Jones. Discussion on replacing and revamping Society traveling display board, looking at options and prices. Greg Cope has some catalog info on new banner type design technology (Godfrey Group). Also incorporate video capability, and have regional displays perhaps.

Website – Sophie Binder. Not on the call.

Environmental Quality and Affairs - Steve McMurray, Braven Beaty. Not able to comment on Cumberland River operations due to timeframe. Looking into commenting on mercury discharge variances. NiSource HCP comments deadline extended into December, for 50-year HCP. Long time frame. Primarily focuses on the pipeline corridors. Problem with compartmentalizing issues (fracking vs. pipelines vs. water withdrawals vs. brine disposal). FMCS should weigh in with constructive comments. Marcellus and Utica shale seminar coming up for industry at Kent State in Ohio. Who would we comment to for cumulative impacts? Corps of Engineers, state DEPs or EPAs, ORSANCO?. Need to get it to the right audience. Even posting as an open letter on our website would be valuable for members to refer to. Some regional letters have been sent to the Delaware River Basin commission, might be a good template. White paper by Bob Anderson and Danielle Kreeger may also be helpful. Cumulative impacts to the aquatic system need to be considered in all aspects of the gas development activities.

Gastropod Status and Distribution – Jeff Garner, Jeremy Tiemann. The AFS gastropod status assessment will soon be sent to the printer, due out in 2012 (see announcement below).

Genetics - Dave Berg, Curt Elderkin. Progress on three best practices papers: the importance of consulting type specimens in phylogenetic research; the importance of voucher specimens in freshwater mollusk research; and genetic considerations for propagation, translocation, augmentation and reestablishment actions. The committee is working on an idea for a sample exchange web page/bulletin board. They also advocate a need for tissue preservation for all propagation animals. This committee is willing to organize workshop for 2014 on genetics, possibly at NCTC.

Guidelines and Techniques - Rita Villela Bumgardner, Nevin Welte. Not on call. Just getting started stepping up to new activities.

Mussel Status and Distribution - Arthur Bogan, John Harris. From Jim Williams, the revised AFS mussel status assessment is in final stages, very close to submittal, should come out in Fisheries in 2012.

Atlas of Freshwater Mussels project. Possible funding sources still needed. Best route might be an atlas page through the FMCS website. Becomes dynamic, not static publication. Can be linked to Discover Life mapping, and identification application. Taxa and distribution information has been uploaded and several of the morphological characters have been up loaded to Discover Life. Soon they will be sending out requests for pictures.

Development of a Mussel ID App – Susan Oetker. Working with Texas A & M for possible mussel ID application, test it on small river basin first. Looking for some seed money to help garner support from other donors. Perhaps FMCS can then charge and keep the fee for people to

download the app. Once downloaded, you won't need internet access in the field. Then can link over to more detailed info on the web. Art and Susan can prepare a written proposal to the Board with cost estimate for prototype. Intellectual property issues may also emerge.

Nominations – Leroy Koch. Not on call.

Propagation, Restoration, and Introduction - Rachel Mair, Christopher Owen. Not on call.

Ad hoc Committee on Ecosystem Services – Daniel Spooner, Danielle Kreeger. Just formed this past summer. Goals put together (listed in the September issue of *Ellipsaria*). Asking for members to join in. They are working on a white paper for the Chesapeake Bay clean-up, on ecosystem services for water quality improvement through filtration. She will share draft with us.

Ad hoc Committee on Regional Mollusk Meetings - Steve McMurray, Susan Oetker. Formed this spring to explore relationships with regional mollusk groups. Draft questionnaire will be sent to the coordinators for the various groups. And how to deal with the other group's meeting announcements in *Ellipsaria*. We should support them and spread the word for all relevant meetings. Ask for contact info from all regional lists, use Unio and conch-L too.

Ad Hoc Committee on Revising the National Strategy – Catherine Gatenby, Patricia Morrison, Rita Vilella Bumgardner, Rachel Muir. Committee will meet next Monday, November 21st in White Sulphur Springs, WV.

Old Business

FMCS Procedures Manual – Steve McMurray, Greg Cope. This task has been started by Greg Cope and Greg Zimmerman.

Tribute for member Tom Proch (recently deceased) – Art Bogan and Rick Spear will work on a piece for the spring *Ellipsaria*.

New Business

None raised. Call ended at 4:00 pm.

Committee Goals and Plans

Much of the work that gets done by our society is accomplished by the chairs and members of our various committees. Since several committees elected new leadership last April, the September issue *Ellipsaria* started presenting the long-term goals and immediate plans of these new leaders. Here is the Goals and Plans statement from one more of our committees.

Genetics Committee

The revolution in molecular genetic techniques has created an unprecedented opportunity to understand the distribution of biodiversity within and among species, its evolution over time and space, the mechanisms driving changes in biodiversity, and the ways in which variation in DNA interacts with the environment to create differences in expression of phenotypic traits. The goals of the Genetics Committee are to:

1. Ensure best practices in research and management of freshwater mollusks. Such best practices include, but are not limited to, a) consideration of the significance of genetic and phenotypic variation within and among populations; b) use of appropriate techniques in systematics, phylogenetics, and species delimitation; c) propagation and breeding plans that consider the genetic consequences of establishing captive populations in artificial or semi-natural facilities.
 2. Provide professional opinions regarding issues of genetics, systematics and conservation when requested by the FMCS, resource agencies and conservation organizations.
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3. Educate members of the FMCS, resource agencies, conservation organizations, and the general public on the necessity for understanding genetic resources as a part of effective conservation of freshwater mollusks.

Areas of interest to the committee include, but are not limited to,:

1. Population genetics and the geographic distribution of genetic variation.
2. Systematics, taxonomy, phylogenetics and evolution of freshwater mollusks.
3. Conservation genetics and implications relative to the Endangered Species Act and other legislation.
4. Functional genomics of freshwater mollusks.
5. Genetic considerations in captive breeding, reintroduction, translocation, and population augmentation.

Current activities of the Committee include:

1. Creation of “best practices” papers – short discussions of topics in genetics and related areas. We have identified and begun working on three of these:
 - o The importance of consulting type specimens in phylogenetic research; this is now in review by other members of the Genetics Committee.
 - o The importance of voucher specimens in freshwater mollusk research; drafted and ready for initial review.
 - o Genetic considerations for propagation, translocation, augmentation and reestablishment actions; currently being drafted.

We are seeking additional topics for this series and hope to have these papers posted on the FMCS website and circulated to agencies and researchers involved in freshwater mollusk conservation.
2. Discussion of whether the Genetics Committee would be willing to organize the 2014 FMCS Workshop. This would be 10 years after the first Genetics Workshop and would serve to update members and other practitioners on the state of genetic techniques for use in freshwater mollusk conservation.
3. Initial discussion of a sample-exchange web page as part of the Genetics Committee web page on the FMCS website. This would work like a bulletin board, with persons posting “need this sample” requests.
4. Discussed the need for preservation of tissue samples from all propagation efforts. A standard procedure should: 1) allow confirmation of the identity of propagated individuals; 2) allow monitoring of changes in genetic structure that might occur throughout and after the propagation process; and 3) allow monitoring of mixing between propagated and “native” individuals during and after augmentation projects.

Co-Chairs: David Berg (bergdj@muohio.edu) and Curt Elderkin (elderkin@tcnj.edu)

Announcements

AFS Freshwater Gastropod Conservation Status Review

After almost a decade of work, the American Fisheries Society (AFS) gastropod conservation status review is almost complete. The document covers all native species in Canada and the United States and includes updated taxonomy and state distributions in addition to current conservation status. Also included are brief descriptions of each family, plates of shells with representatives of each family, and some photos of live individuals and brief discussion of threats and imperilment patterns. In addition, there are several examples of recent gastropod recovery success stories. Six hundred ninety eight species, representing 16 families are recognized. Of those, 67 are considered likely extinct, 275 endangered, 102 threatened and 71 vulnerable. Only 157 species (26%) are considered currently stable and 26 are of unknown status. The manuscript has been through a lengthy review process and should go to press early in 2012. In an agreement with AFS, the gastropod and forthcoming revised mussel databases will be hosted on the FMCS website.

Still Need Contacts for Regional Mollusk Meetings

As indicated in the September issue of *Ellipsaria*, the Regional Mollusk Meeting Ad-hoc Committee has been tasked with developing a survey or questionnaire to find ways that FMCS can work with the many regional groups out there to help conserve the aquatic mollusk fauna. As we develop this survey, there is one important piece of information that we are missing: **CONTACT INFORMATION!** So, if you lead, are involved with, or know someone who coordinates one of the many regional mollusk meetings, please make sure information about the group and who to contact gets to either Susan Oetker (Susan.Oetker@fws.gov) or Steve McMurray (Stephen.McMurray@mdc.mo.gov).

Louisiana State University in Shreveport Museum of Life Sciences Mollusk Collection

The LSU Shreveport Museum Life Sciences mollusk collection consists of approximately 36,000 specimens. Of these, about 22,000 specimens are freshwater mussels from Louisiana and throughout the southeastern United States. Most of the freshwater mussels were collected between 1970 and 2005 by Dr. Malcolm Vidrine during his studies of freshwater mites (*Najadicola* and *Unionicola*) in North America. Enhancement of the mollusk collection was made possible by a grant (number 0844726 to Laurence M. Hardy and Amanda Lewis) from the National Science Foundation, American Recovery and Reinvestment Act of 2009. The collection holdings can be viewed at: <http://lifesciences.lsus.edu/collections/mollusca/>

For more information about the mollusk collection or about visiting, please contact Dr. Laurence M. Hardy, Museum of Life Sciences, LSU in Shreveport, One University Place, Shreveport, LA USA 71115-2399 lhardy@lsus.edu Office & FAX - 318-797-5338; Home - 318-687-6738; Cell - 318-518-5709

Columbus Zoo and its Partners Receive Top Honors and Conservation Award

Top Honors were received by both the Columbus Zoo and *the Wilds* in the North American Conservation Award category for the Freshwater Mussel Conservation and Research Center (FMCRC). This award recognizes exceptional efforts by Association of Zoos and Aquariums (AZA) institutions toward regional habitat preservation, species restoration, and support of biodiversity in the wild.

The FMCRC is a unique and dynamic partnership between the Columbus Zoo and Aquarium, *the Wilds*, The Ohio State University, the Ohio Department of Natural Resources Division of Wildlife, the U.S. Fish and Wildlife Service, and the Columbus Recreation and Parks Department. The FMCRC was opened in 2001 along the banks of the Scioto River near the Columbus Zoo to assist in the propagation and conservation of highly endangered freshwater mussel species. The primary goals of the Center are to: 1) establish brood stock of target endangered species; 2) conduct basic conservation research on mussels including host identification, phylogenetic analyses, and health parameters; 3) culture and propagate newly transformed mussels for eventual introduction to the wild; 4) translocation of targeted endangered species; 5) offer temporary refuge to mussels removed from situations where there have been environmental disasters; and 6) provide educational outreach opportunities for the citizens of Central Ohio.

The Freshwater Gastropods of Tennessee

The Freshwater Gastropods of North America project (FWGNA) is pleased to announce the launch of our new web-based resource, "The Freshwater Gastropods of Tennessee," by R. T. Dillon and Martin Kohl. This brings to five the number of states currently covered by the project.

Our study area extends over the eastern third of the state at the present time, treating the freshwater snails of the Tennessee River and its tributaries upstream from the Alabama line just south of Chattanooga. The area also includes eight counties in southwest Virginia, fifteen counties in western North Carolina, and seven counties in north Georgia, for a catchment of approximately 57,000 km².

A total of 38 freshwater gastropod species are documented from 766 sample sites, with distribution maps, taxonomic notes, a dichotomous key, a photo gallery, and conservation recommendations. Here's the direct link: <http://www.fwgna.org/FWGTN/>

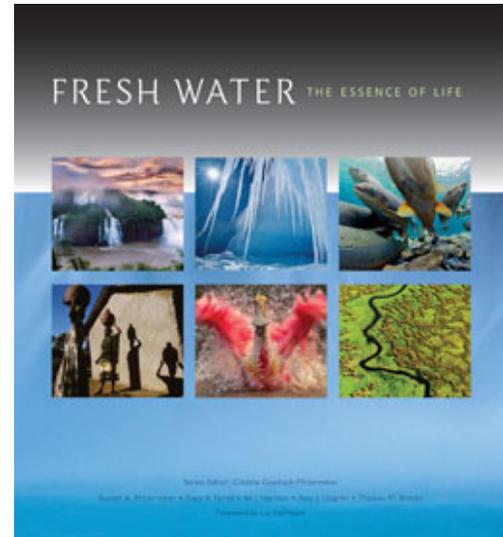
Our appreciation is due to the Virginia Department of Game & Inland Fisheries for support of this work, as well as to the Office of Inventory and Monitoring at the Great Smoky Mountains National Park.

New Book: *Fresh Water: The Essence of Life*

Russell A. Mittermeier, Tracy A. Farrell, Ian J. Harrison, Amy J. Uppgren, and Thomas M. Brooks (eds.).

Conservation International, in association with the International League of Conservation Photographers, CEMEX, NatureServe, Wetlands International, and Ramsar proudly announce the publication of the book *Freshwater: The Essence of Life*. A large-format illustrated book, launched in December, 2010, *Freshwater* is currently available in both English and Spanish editions.

Freshwater: The Essence of Life includes a wealth of information on the current state of Earth's freshwater ecosystems. As the latest publication in the CEMEX Conservation Book Series and alerts readers to key issues concerning fresh water: its resources, uses and abuses, and future. Individual chapters are co-authored by a variety of professionals in various fields and each page is beautifully illustrated with full color professional photographs by some of the world's most accomplished photographers. Chapters include:



Ch. 1. A Wealth of Life: Species Diversity in Freshwater Ecosystems

Ch. 2. Aquatic Ecosystems: Diversity and Dynamism

Ch. 3. Freshwater Ecosystems Under Threat: The Ultimate Hotspot

Ch. 4. Protected Areas for Freshwater Ecosystems: Essential but Underrepresented

Ch. 5. Freshwater Ecosystem Services: Essential for Human Well-Being

Ch. 6. Fresh Water for the Future: Policy to Secure an Essential Service for All

An appendix of examples of common engagement for conserving the world's wetlands as well as author biographies, references, acknowledgements, and credits are also provided.

A significant portion of this work is dedicated to the plight of the world's freshwater mollusks (mussels and snails) and it includes what may very well be the only global assessment of threat and percent imperilment status for all freshwater organisms published to date. Also of interest are a detailed representation of numbers of freshwater species by major taxonomic group and in depth descriptions of major threats to freshwater species and ecosystems. It is the stunning and poignant photographs throughout this book, however, that truly make it worthwhile. Each is executed in superb detail and each makes a much more profound statement as to the beauty and grandeur of the freshwater organisms and ecosystems, and the threats they face across the planet, than the accompanying text alone can provide (my meager contributions notwithstanding).

Price: \$58.00 (includes UPS Ground shipping within the continental United States)

Fresh Water: The Essence of Life can be purchased directly from Conservation International. Simply print and fill out the order form, and follow the instructions to mail it or fax it to CI.

Jill Lucena, Conservation International, 2011 Crystal Drive, Suite 500, Arlington, VA 22202 USA

 [Download the order form in PDF format](http://www.conservation.org/Documents/Order_forms/orderform_freshwater_book.pdf) (PDF - 17 KB)

[http://www.conservation.org/Documents/Order_forms/orderform_freshwater_book.pdf]

If this download does not function properly, go to the official announcement page at:

<http://www.conservation.org/publications/Pages/fresh-water-book.aspx>

Recent Publications

- Galbraith, H.S., C.M. Smith, K.M. Wozney, D.T. Zanatta, and C.C. Wilson. 2011. Development and characterization of nine microsatellite loci for the endangered Kidneyshell, *Ptychobranthus fasciolaris*, and cross-amplification in closely-related lampsilines (Bivalvia: Unionoida). *Conservation Genetics Resources*. 3:533-536.
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Upcoming Meetings

- January 11 – 12, 2012** -- The biennial Southeast Atlantic Slope Mollusk Meeting, Raleigh, NC For further details, contact Angie Rodgers at (828) 713-3297 or angeline.rodgers@ncdenr.gov.
- January 17 – 19, 2012** – Alabama Non-game Fish (17th – 18th) and Mollusk and Crayfish (18th – 19th) information sharing meetings, Joe Wheeler State Park Lodge, Rogersville, AL For further information, contact andrew.henderson@dcnr.alabama.gov (fish) or paul.johnson@dcnr.alabama.gov (invertebrates)
- April 19 & 20, 2012** -- **FMCS Workshop Holiday Inn, Athens, Georgia Theme: “Incorporating Environmental Flows, Climate Change, and Ecosystem Services into Freshwater Mussel Conservation and Management”**. Details shortly on FMCS web site (<http://molluskconservation.org/index.html>).
- May 20 – 26, 2012** – Society for Freshwater Science [formerly North American Benthological Society] Annual Meeting, Marriott Louisville Downtown, Louisville, Kentucky Theme: “Freshwater Stewardship: Challenges and Solutions” <http://www.benthos.org/Annual-Meeting/Future-Meetings.aspx>
- September 4 – 7, 2012** -- International Meeting on Biology and Conservation of Freshwater Bivalves, Campus of Santa Apolónia of the Polytechnic Institute of Bragança, Bragança, Portugal <http://esa.ipb.pt/bivalves/>
- March 11 – 15, 2013** -- **FMCS 8th Biennial Symposium, Guntersville State Park, Alabama Theme: [to be determined]**

Contributed Articles

The following articles have been contributed by FMCS members and others with interest in freshwater mollusks. These contributions are incorporated into Ellipsaria without peer review and with minimal editing. The opinions expressed are those of the authors.

Report of the Fifth Annual Ohio River Valley Unified Malacologist Meeting (OVUM), Thomas More College Center for Ohio River Research and Education, California, Kentucky, October 01, 2011

Contributed by **Meghann Vincie King** and **Dr. Timothy Pearce**

In attendance: Charles Acosta, Francisco Borrero, Mariah Clements, Zsuzsanna Cooke, Joe Darpel, John Ferner, Clara Folb, John Hageman, Nick King, Meghann Vincie King, Ronald Lange, Olivia Lantry, Steve Lilly, Christopher Lorentz, Christopher Owen, Megan Paustian, Timothy Pearce, Warren Pryor, Lori Schroeder, Jeff Schroeder, Amsula Stone, Alexandria Wright.

The Ohio River Valley Unified Malacologists met for their fifth year at the Thomas More College Center for Ohio River Research and Education (TMC CORRE), also known as the TMC Biological Field Station, located on the Ohio River in California, Kentucky, across the river from Cincinnati. There were 22 total in attendance and nine mollusk presentations given. The meeting began with a welcome and background talk of the field station by Dr. Chris Lorentz, a Thomas More College biology professor and director of the TMC CORRE. Dr. Timothy Pearce then described OVUM and its origin. Several talks regarding snails or slugs included the following:

- Dr. Pearce talked about whether wetlands are good habitat for land snails,
- Dr. Francisco Borrero spoke about the ecology of two common species of snails in tropical forest understory habitat in southern Costa Rica,
- Dr. Megan Paustian discussed invasive terrestrial slugs and their worldwide spread, specifically how it related to her Encyclopedia of Life project, and
- Jeff and Lori Schroeder presented a video of snail research completed in the Bernheim Research Forest in Clermont, Kentucky.
- Dr. Charles Acosta brought marine experience to the meeting with his talk on modeling population dynamics of the queen conch *Strombus gigas* under heavy fishing pressure in Belize.

The remaining talks related to freshwater mussels, including the following:

- Dr. Warren Pryor presented his studies on temperatures in a mussel habitat located in Crooked Lake, Indiana,
- Mariah Clements discussed her masters research on the projected effect of photoperiod on the metabolic rate in *Pygandon grandis*,
- Meghann Vincie King presented her masters research on development of a suitable diet for rearing captive endangered juvenile oyster mussels *Epioblasma capsaeformis*, and
- Nick King displayed and described his photo documentation of a natural fish host infestation by *Epioblasma capsaeformis*.

After the meeting, five participants took a tour of the mollusk collections at the Cincinnati Museum Center led by Dr. Borrero. Dr. Warren Pryor expressed his interest in hosting OVUM 2012, hence the meeting will be held next fall at the University of St. Francis in Fort Wayne, Indiana.

A New Species Location Record in Sussex County Delaware

F. Matthew Blaine, 908 West Street, Laurel, Delaware 19956-1932

There have been few surveys of naiades (Bivalvia: Unionidae) in Sussex County, Delaware. The last major survey which included Sussex County was by Clement L. Counts, III, Thomas S. Handwerker, and Roman V. Jesien (Counts, et al., 1991). In that report, several stations in Sussex County, Delaware

are cited. I have been monitoring several of the stations over the past few years in an attempt to record all of the gastropods and bivalves extant in Sussex County, Delaware. Recently, I have found one new species sighting. I found *Anodonta cataracta* Say, 1817 at a new location near Counts, Handwerker, and Jesien's Meadow Branch station #31.

Description of the study area

Horseys Pond is a 46.3 acre freshwater lake at the head of Meadow Branch. The lake is separated from Meadow Branch by a dam just south of state Route 24 and Laurel, Sussex County, Delaware. Water flowing from the dam enters Meadow Branch and immediately flows underneath Route 24. Meadow Branch empties into the Nanticoke River and eventually into Chesapeake Bay.

The lake has a maximum historical depth of 12 feet immediately in front of the dam and is Delaware's deepest pond. Its mean depth is 5 feet. Meadow Branch was dammed by early settlers to harness waterpower for sawmills and gristmills. Records in 1816 show that a gristmill and sawmill were operating at the dam site and continued in operation there until 1920. In 1959, the pond was emptied while contractors removed brush stumps and trees. Beginning in the early 1980s, the Delaware Department of Natural Resources has tried to control the non-native plant hydrilla and a filamentous alga *Lyngbya* in the lake. Several methods have been used, including draining the lake, herbicide applications, and a mechanical weed harvester.

Methods

A review of the available literature was conducted. Periodic trips to various stations on Horseys Pond have been conducted over the past years. The Horseys Pond stations include the boat ramp area, state fishing access areas, and the area immediately around the dam. Until recently, no shells whatsoever have been seen in the water or on the shoreline at any of these stations.

On August 1, 2011, I found one valve of a *Corbicula* on the shore close to the dam. On August 12, 2011, I returned with a long-handled hand dredge and sampled the fishing area and the dam area. Hurricane Irene had preceded this sampling and the heavy rain associated with the hurricane had caused high volume water flow out of the lake through the dam gates. At the dam site, I collected *Corbicula*, and 7 whole single valves with attached broken opposing valves of *Anodonta cataracta* Say, 1817. The species was identified as *A. cataracta* by direct physical comparison with *A. cataracta* specimens in my collection which have previously been corroborated by Dr. Arthur E. Bogan. The exact location of the station where the shells were found is N 38°32.780, W 75°34.844.



Figure 1. The spillway separating Horseys Pond from Meadow Branch, looking toward the pond



Figure 2. Horseys Pond, Laurel, Sussex County, Delaware.

Results

One new species of naiad was found at Horseys Pond, Laurel, Delaware. The new species reported at this location is *Anodonta cataracta* Say 1817. The total number of *A. cataracta* collected was 7 single valves, each with part of the adjoining valve attached.

A number of *Corbicula* were also collected. The total for three collecting trips was eleven articulated valves and three single valves.

Acknowledgements

I would like to thank Dr. Arthur E. Bogan for his encouragement over the years and for his support. I would like to thank Dona Blaine for proof reading, being a constant companion, and tolerating my varied interests. And I would like to thank Alan Gettleman for continuously stoking my interests in naiades.



Figure 3. *Anodonta cataracta* and *Corbicula* from Horseys Pond

Literature Cited

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- Williams, J.D, Bogan, A.E., and Garner, J.T. 2008. *Freshwater Mussels of Alabama & the Mobile Basin in Georgia, Mississippi & Tennessee*: p. 633

A 2011 Mussel Translocation from the Fox River County K Bridge, Eureka, Winnebago County, Wisconsin

Marian E Havlik, Malacological Consultants, La Crosse, WI 54601-6609

We recovered 1397 live mussels representing 17 species from the Fox River, Eureka, Winnebago County, Wisconsin, during September 2011. The mean density of live mussels was 0.7/m². Mussels were concentrated under the bridge, in the deeper areas of the river along the east side. The substrate was cobble-rock-mud, especially near the east shoreline. Dead (empty) mussel shells were found throughout the bridge area. About 26.8% of the live mussels were *Amblema plicata* (Say 1817). Various ages and size classes were evidence of modest to excellent reproduction among nearly all species found in the area. Only two mussel species were represented by empty shells indicating that the mussel fauna in this area of the Fox River has remained nearly stable for some time.

The mussels found included 157 *Tritogonia verrucosa* (Rafinesque 1820), a Wisconsin Threatened Species. These individuals were uniquely numbered on both valves, measured for length and height, and most were externally aged. They ranged from 71 to 131 mm in length, and from 5 to 23 years of age. This section of the Fox River appears to have the one of the greatest known numbers of *Tritogonia verrucosa* in the state of Wisconsin. In addition to *T. verrucosa*, one *Lasmigona costata* (Rafinesque 1820), was also translocated.

Listed mussels were kept in bags in the river, or in pails of frequently changed water, and returned by hand to the river substrate at the translocation site at the end of each day. After processing, all mussels were returned to the translocation site in the Fox River, 300 m upstream of County K Bridge, Eureka, WI, along the "west" shore (left descending bank). Live common mussels were also hash-marked on both lower valves, and returned to the river from the surface shortly after they were collected.

Sexual Dimorphism in Fawnsfoot Species (*Truncilla* spp.)

Robert G. Howells, BioStudies, 160 Bearskin Trail, Kerrville, Texas; biostudies@hctc.net

Texas is home to all four species in the genus *Truncilla*, including Deertoe (*T. truncata*) and all three fawnsfoot species (Howells et al. 1996, 1997; Howells 2010a). Among these, Fawnsfoot (*T. donaciformis*) occurs in eastern Texas from the San Jacinto and Trinity drainages north and east through the Neches-Angelina, Sabine, and Red rivers, then throughout much of the Central U.S. (Fig. 1). Mexican Fawnsfoot (*T. cognata*) is endemic to the Rio Grande drainage of Texas and Mexico (Fig. 2) (Howells 2010b). Texas Fawnsfoot (*T. macrodon*) is endemic to the Brazos and Colorado drainages of Central Texas (Fig. 3) (Howells 2010c).

All three fawnsfoot species have historically been uncommon to quite rare in Texas waters. In part, because of this rarity, many early workers had limited familiarity with the variation in morphology of each and their respective distributions. As a result, there are number of old records reporting Texas Fawnsfoot in eastern Texas waters and Fawnsfoot in Central Texas. Some more-recent authors have mistakenly repeated these errors in identification and distribution. Indeed, distribution appears to be a fairly confident way to distinguish these morphologically similar species. Perhaps the only exception is some presumptive Fawnsfoot specimens from the upper Trinity River that are conchologically similar to Texas Fawnsfoot, but have not been subjected to biochemical genetic confirmation. Other specimens from the Trinity River are consistent with typical Fawnsfoot specimens from other waters.

Fawnsfoot is slightly sexually dimorphic. Most descriptive guides to unionids that include Fawnsfoot generally do not address sexual dimorphism. Watters et al. (2009) noted “sexual dimorphism of the shell is not at all pronounced and is most noticeable from the less elongate female profile and slightly angled ventral margin.” Shown here (Fig. 1) are Fawnsfoot specimens from Texas and other locations within its range with presumptive males above and females below. Both Mexican Fawnsfoot from the Rio Grande (Fig. 2) and Texas Fawnsfoot from the Brazos River (Fig. 3) also appear to show similar sexual dimorphism.

Until four or five years ago, fewer than about 200 Texas Fawnsfoot specimens had been reported (Howells et al. 1997; Randklev et al. 2010; Howells 2010c) and even fewer Mexican Fawnsfoot specimens were known (Howells 2010b). Among these, very few were alive when collected (Howells 2010b, c). Texas Fawnsfoot has been found alive at several locations in recent years (Burlakova and Karatayev 2010; C.R. Randklev, pers. comm.; J.A.M. Bergmann, pers. comm.) and a number of additional Mexican Fawnsfoot specimens have been discovered in the Rio Grande (Burlakova and Karatayev 2010; T.D. Miller, pers. comm.). However, no soft tissue examination has been reported to confirm presumptive sexual dimorphism in their shells in any of the fawnsfoot species in Texas waters.

Texas Parks and Wildlife Department recently listed Texas and Mexican fawnsfoots as legally threatened and U.S. Fish and Wildlife Service is currently considering listing both as well. These actions have made both species “hot button” topics for study, including reproductive and culture projects. Because of their rarity, as specimens become available, efforts need to be directed to obtaining as much relevant information as possible from each, including confirmation of sexual dimorphism.

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Figure 1. Fawnfoot (*Truncilla donaciformis*). Presumptive males are shown above, females below.



Figure 2. Mexican Fawnsfoot (*Truncilla cognata*) from the Rio Grande River.



Figure 3. Texas Fawnsfoot (*Truncilla macrodon*) from the Brazos River.

Mantle Flap Variation in Texas Fatmucket (*Lampsilis bracteata*)

R.G. Howells¹, C.R. Randklev², and M.S. Johnson²

¹ BioStudies, Kerrville, Texas, bobhowells@hctc.net ; ²Texas A&M University Institute of Renewable Natural Resources, College Station, Texas, crandklev@ag.tamu.edu

Texas Fatmucket (*Lampsilis bracteata*) is endemic to the Colorado and Guadalupe-San Antonio drainages of the Edwards Plateau and Texas Hill Country in Central Texas (Howells et al. 1996; Howells 2010a, b). Other reports from the lower Guadalupe River coastal plain, central Brazos River, and eastern Texas waters are based on misidentified Louisiana Fatmucket (*L. hydiana*). Historically, Texas Fatmucket has been limited in both distribution and abundance and has been reduced to a small number of particularly small populations in recent decades. Reproductive biology of the species was largely unstudied until Texas Parks and Wildlife Department (TPWD) began work with the species in 1992 (Howells 1997, 2000) and, more recently, by Texas A&M University Institute of Renewable Natural Resources in 2011.

Prior to TPWD's decision to terminate research on mussel reproductive biology in 1997 and 1998, mantle displays of specimens from three locations were photographed at Heart of the Hills Fisheries Science Center (HOH), Ingram, Texas. Video footage was obtained of Texas Fatmucket females from Elm Creek, a Colorado River tributary at the northwestern limit of its range, Runnels County, and from Spring Creek, a tributary of the Concho River that feeds into the central Colorado River, Tom Green County. Additionally, 35-mm slides and prints were made of a female from the Guadalupe River, Kerr County, by RGH. These media were damaged by smoke and heat during a fire at HOH (thereby reducing the quality of those images shown here). In 2011, CRR and MSJ photographed females from a fourth population in the upper San Saba River, Menard County, and the Llano River, Llano County. All four had distinctive mantle flaps, including:

Elm Creek, Runnels County (Figure 1) – Mantle flaps are very minnow-like being elongate with well defined eyespots, lateral lines, and moderate-sized “fins”, and colors of black, white, and gray. This population was dramatically reduced in 1999 and 2000 by flooding, drought, and over-collecting. Despite these pressures, stragglers are believed to persist.

Guadalupe River, Kerr County (Figure 2) – Female's lures from the upper Guadalupe River are similar to those from Elm Creek, but their lures are more brown and tan in color. This population was nearly eliminated during a construction project in 1998 and other subsequent construction activities. None have been found alive since 2005; however, nearly 100 shells and valves were found during drought-related dewatering in 2011.

Spring Creek, Tom Green County (Figure 3) – A female from this population had a dramatically enlarged mantle flap resembling a ragged mitten or surgical glove. The lure included a particularly enlarged “dorsal fin”, and was generally white in color with only a suggestion of an eyespot. This creek dried completely in 1999 and 2000, and subsequent surveys failed to find any live mussels at this location. This population is likely extinct.

San Saba River, Menard County (Figure 4) – These females have mantle flaps colored light charcoal gray and expanded posteriorly on the lure (posterior-ventrally on the mussel) with only a small, poorly defined eyespot. This population has continued to persist since its discovery in 1997. However, when examined in 2011, silt accumulation and upstream development were noted.

Llano River, Llano County, Texas (Figure 5) – A single female from this site produced a partially extended mantle flap that appeared uniformly dark and may be similar to those from the San Saba River, but a full display has yet to be observed.

Among the other extant populations currently known, mantle flap displays have not been reported or observed to date of females in the Onion Creek (Colorado drainage), Travis County, and Threadgill (Llano drainage) and Live Oak (Pedernales drainage) creeks, Gillespie County, Texas. A female from the Live Oak Creek population with a mantle flap that appeared to have been bitten off extended the remaining nub and vigorously wiggled it during aquarium observation. Another Live Oak Creek female had well-defined black and white eye spots, but never displayed a mantle flap.

Another species, Wavyrayed Lampmussel (*Lampsilis fasciola*), also produces females with several distinctive mantle flap forms. At least three such morphs occur in Ohio and two forms are known from the Paint Rock River, Alabama, and Williams et al. (2008) and Watters et al. (2009) questioned whether this represented a single variable species or a complex of sibling species. However, Zanatta et al. (2007)

reported mantle displays of seven populations could not be distinguished genetically with molecular variation. To date, Texas Fatmucket populations have not been subjected to biochemical genetic analysis relative to mantle flap forms. Although TPWD now lists Texas Fatmucket as legally threatened and U.S. Fish and Wildlife Service is currently considering listing as well, this species is declining so rapidly that the taxonomic status of some populations may never to be known.

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Figure 1. Texas Fatmucket (*Lampsilis bracteata*) from Elm Creek (Colorado River tributary), Runnels County, Texas.

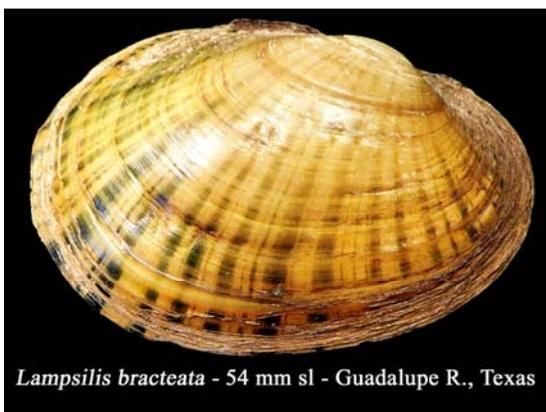


Figure 2. Texas Fatmucket (*Lampsilis bracteata*) from the upper Guadalupe River, Kerr County, Texas.

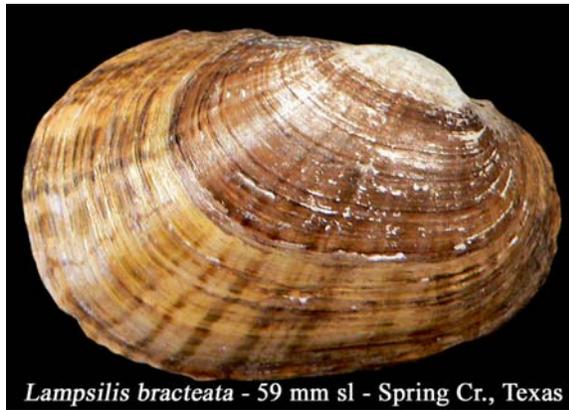


Figure 3. Texas Fatmucket (*Lampsilis bracteata*) from Spring Creek (> Concho River > Colorado River), Tom Green County, Texas. Note male positioned in front of the displaying female.



Figure 4. Texas Fatmucket (*Lampsilis bracteata*) from the upper San Saba River (> Colorado River), Menard County, Texas.



Figure 5. Texas Fatmucket (*Lampsilis bracteata*) from the Llano River (> Colorado River), Llano County, Texas.

**First account of a living population of False Spike, *Quadrula mitchelli*
(Bivalvia: Unionidae), in the Guadalupe River, Texas.**

Charles R. Randklev^{1*}, Matthew S. Johnson¹, Eric T. Tsakiris¹, Susan Rogers Oetker², Kevin J. Roe³, John L. Harris⁴, Stephen McMurray⁵, Clint Robertson⁶, Julie Groce¹ and Neal Wilkins¹

¹Institute of Renewable Natural Resources, Texas A&M University; ²U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office; ³Department of Natural Resource Ecology & Management, Iowa State University; ⁴Department of Biological Sciences, Arkansas State University; ⁵Missouri Department of Conservation, Resource Science Division; ⁶Texas Parks and Wildlife, Inland Fisheries Division

* Correspondent: crandklev@ag.tamu.edu

Quadrula mitchelli (Simpson 1895), false spike, is a rare central- and west-Texas endemic unionid mussel species that is considered state threatened and is under review for protection under the Endangered Species Act (USFWS 2009). Until recently, the only evidence that this species was not extinct came from a recent collection of a fresh-dead individual from the San Saba River (Randklev et al. in review). The causal factors for this species' decline likely stem from human modification of streams and rivers combined with record droughts and floods in the late 1970s and early 1980s (Howells 2010). Other than locality records, basic life history, reproductive biology, ecology and habitat requirements for this species are unknown (Howells 2010). Without these basic data, it is impossible to determine what specific causal factors precipitated the decline of this species or to develop management plans to facilitate its recovery.

During a fall 2011 survey, a small population of *Q. mitchelli* was discovered in the Guadalupe River near Gonzales, Texas. In total, 7 individuals were collected during two different sampling periods. Juveniles were not observed at the site, but given our sampling methodology (timed tactile and visual searches), their presence cannot be ruled out. All of the individuals collected are consistent with taxonomic descriptions provided by Howells et al. (1996). Other rare Texas endemic species were collected at the same locality, including the Golden Orb, *Quadrula aurea* (Lea 1859), and Texas pimpleback, *Quadrula petrina* (Gould 1855). These species are listed as state threatened in Texas and are candidates for protection under the Endangered Species Act (USFWS 2011).

The site where these individuals were collected is characterized by steep banks with a small riparian buffer. The adjacent land uses are a golf course and range land. Water velocity and depth were not measured, but appeared to be lower than normal (based on water depth in relation to the tops of undercut banks) because of the ongoing drought. *Quadrula mitchelli* was collected primarily from an upstream run in gravel and mud substrate. Water depth at this locality was less than 30 cm. A single individual was found at the head of a riffle, partially buried in gravel and sand. Foot swabs were used to sample genetic material that will be analyzed at a later date by James D. Williams (Florida Museum of Natural History) and Nathan A. Johnson (USGS, Southeast Ecological Science Center); information gathered from this effort with help resolve whether this species should remain in the genus *Quadrula*.

Our finding represents the only known population for this species in Texas and the first record of live specimens in over 30 years (Howells 2010). Because of this, a more thorough study of this reach of the Guadalupe River and its tributaries,



Figure 1. Guadalupe River where live *Quadrula mitchelli* were collected.

such as the San Marcos River, by experienced surveyors is needed to determine the extent of its distribution within this drainage. Additionally, locating a surviving population of *Q. mitchelli* creates the potential to study the species' basic life history, reproductive biology, and habitat requirements. Finally, this find and others (e.g., Randklev et al. 2010; Randklev et al. in review) serve as a reminder that while the general distribution of unionids in Texas is known, the distribution for threatened species within a given drainage is poorly understood.



Figure 2. Live *Quadrula mitchelli* collected from the Guadalupe River.



Figure 3. A live individual of *Quadrula mitchelli* collected from the Guadalupe River.

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Additional Information Concerning the Conquest of Europe by the Invasive Chinese Pond Mussel *Sinanodonta woodiana*. 26. News from Croatia, the Czech Republic, Germany, and Romania

Henk K. Mienis, National Collections of Natural History, Dept. Zoology, Tel Aviv University, IL-69978 Tel Aviv, Israel, and National Natural History Collections, Berman Building, Hebrew University, IL-91904 Jerusalem, Israel mienis@netzer.org.il

The Chinese Pond mussel: *Sinanodonta woodiana* (Lea, 1834), continuous its invasion of Europe. Numerous new records have been published from Croatia and a single one from Germany. Scientists in the Czech Republic have studied the role of native and invasive fish species as hosts for the glochidia of this mussel species, while in Romania they made a study of its genetics.

Croatia

From 2007 until 2011, fieldwork was carried out by Lajtner & Crnčan (2011) in aquatic biotopes throughout Croatia. The Chinese Pond mussel turned up almost everywhere in the eastern part of the country and seemed to spread rapidly also in the western Croatia. Altogether, they recorded it from 54 localities which included both flowing and standing waters.

The Czech Republic

In the Czech Republic, native and invasive fish species were checked for their potential role as hosts for the parasitic stage (glochidium) of *Sinanodonta woodiana* (Douba et al., 2011). All eight fish species: *Pseudorasbora parva*, *Carassius gibelio*, *Cyprinus carpio*, *Leuciscus cephalus*, *Rhodeus amarus*, *Gobio gobio*, *Barbus barbus* and *Rutilus rutilus*, turned out to be highly suitable hosts. Since the Chinese Pond mussel seems to be a broad host generalist, we may expect that it may increase the speed and the range of its invasion, which of course will have possible consequences on the native freshwater mollusc fauna especially the Unionid mussels among them.

Germany

Bössneck & Klingelhöfer (2011) reported the Chinese Pond mussel for the first time from Thüringia. It was located in a small isolated fish pond near Vacha in the district Wartburgkreis.

Romania

Twenty specimens of the Chinese Pond mussel collected in the Prut River near Vădeni, Rumania, were used in a genetic study. All loci turned out to be highly polymorphic. The number of alleles per locus ranged from 7 to 14 and the observed heterozygosity from 0.650 to 0.950. According to the authors, these loci should prove useful to study the species population genetics which could help to infer important aspects of the invasion process.

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On the Sudden Establishment of (Semi-) Aquatic Molluscs in the Formerumerwiel, Terschelling, the Netherlands

Henk K. Mienis, The Steinhardt National Collections of Natural History, Department of Zoology, Tel Aviv University, IL-69978 Tel Aviv, Israel mienis@netzer.org.il

A large part of the coastal areas of the Netherlands lies below sea level. Already in historical times, huge dikes have been built to keep the waters out. In spite of these efforts, often the force of the water has proven to be stronger than those human built barriers. Dikes collapsed and often flooded vast areas. Places where such floods took place are still recognizable in the field because, at the landside of such restored dikes, often a lake or pool is present which was created by the in-rushing waters.

Depending on where you happen to be in the Netherlands, such pools are called in Dutch: 'kolk', 'waal' or 'wiel'. Geographic names containing such words are easily found on local maps. This is also the case on Terschelling, one in a row of islands to the north of the Netherlands which are separated from the mainland by the Wadden Sea. While the northern, North Sea, side of Terschelling is protected by dunes, the low built-up area along the southern, Wadden Sea, side is demarcated by a huge dike for some 12 km running from West-Terschelling to Oosterend.

Collapses of dikes have also taken place on Terschelling and such floods have usually created round pools on the landside of the dike. Until the end of the sixties, six pools (called 'wiel' on Terschelling) were present behind the Waddensea dike. These were from west to east: Ponswiel, a pool without name near Seeryp, Formerumerwiel, Round Wiel, Westerwiel, and Oosterwiel. A review of the (semi-) aquatic molluscs ever found in those pools has been published by Mienis (2007). Although 16 species have been reported from these pools, the number of species occurring in a single pool ranged from zero to 13 and were collected or reported between 1956 and 2005.

Three pools: the Round Wiel, Westerwiel, and Oosterwiel, don't exist anymore since 1968, when they brought the dike at Delta Height by strongly reinforcing the dike, while only a tiny part of the pool near Seeryp has remained, now situated on private property. In other words, only two pools have remained unaltered: the Ponswiel, harbouring 9 species, and the Formerumerwiel, which until 2005 was devoid of any mollusc life.

The Formerumerwiel dates from 1717. The lack of any mollusc in it is related to the fact that it is a brackish water biotope. The groundwater below the pool is highly influenced by seepage from the Waddensea. Plants growing around the pool (*Aster tripolium*, *Scirpus maritimus*, and *Scirpus lacustris tabernaemontani*) are characteristic for such a biotope, while the brackish water prawn *Palaemonetes varians* is quite commonly encountered in the water.

When my review of the mollusc fauna of those pools on Terschelling was in print, I managed to locate, on 5 October 2007, the first population of a mollusc in the northwest corner of the Formerumerwiel: *Potamopyrgus antipodarum* (Gray, 1843), a well established invasive species originating from New Zealand, on Terschelling (Mienis, 2008a). It occurred in a dense stand of *Phragmites australis*. Interestingly, I looked in vain for it among *Phragmites* at other places in the pool. One year later, on 22 September 2008, I confirmed its presence at the same spot (Mienis, 2010). The presence of *Potamopyrgus antipodarum* in the Formerumerpool did not come as a surprise since it was already known from numerous other brackish biotopes in the Netherlands in general and Terschelling in particular.

On 27 September 2010, I sampled another part of the pool with a dense stand of *Phragmites*. The water was of a very poor quality and looked more like a green soup but, nevertheless, I found several specimens of another gastropod: *Radix balthica* (Linnaeus, 1758) (Mienis, 2011). No specimens of *Potamopyrgus* were found; however, I did not check the original place where I had found it in 2007 and 2008.

This year, I visited the Formerumerwiel on 4 October 2011. I immediately found on the eastern bank of the pool a specimen of the amphibious land snail *Oxyloma elegans* (Risso, 1826). The east side of the pool is the only part where *Phragmites* is not growing (Figure 1). At the old *Potamopyrgus* site in the northwest corner of the pool, I found to my surprise not only that species but also extremely large numbers of *Stagnicola palustris* (Müller, 1774), fewer specimens of *Planorbis planorbis* (Linnaeus, 1758), and a single specimen of *Haitia acuta* (Draparnaud, 1805). The latter has to be considered an invasive species originating from North America, which has suddenly turned up at various sites on Terschelling (Mienis, 2005 & 2008b).

According to these data, six species (semi-) aquatic gastropods are now known from the Formerumerwiel:

Family	Species	Year of appearance
Hydrobiidae	<i>Potamopyrgus antpodarum</i>	2007
Lymnaeidae	<i>Stagnicola palustris</i>	2011
	<i>Radix balthica</i>	2010
Physidae	<i>Haitia acuta</i>	2011
Planorbidae	<i>Planorbis planorbis</i>	2011
Succineidae	<i>Oxyloma elegans</i>	2011

How can we explain the sudden appearance of (semi-) aquatic molluscs in the Formerumerwiel? The only thing I can think of it is that the water of the pool is slowly changing from brackish to freshwater. The summer of 2011 was rather wet and may have reduced the salinity of the water. The future will show whether these snails succeed in establishing permanent populations in the Formerumerwiel.



Figure 1. A view of the Formerumerwiel, Terschelling, the Netherlands, seen from the southeast corner.

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Further data concerning the (semi-)aquatic mollusc fauna of the Ponswiel, Terschelling, the Netherlands

Henk K. Mienis, The Steinhardt National Collections of Natural History, Department of Zoology, Tel Aviv University, IL-69978 Tel Aviv, Israel mienis@netzer.org.il

The Ponswiel, a corruption of the name Pontswiel, since it was named after the Pont brothers (van Dieren, 1980), is a pool resulting from a collapse of a former sea-dike west of Seeryp on the island Terschelling, Friesland, the Netherlands. The collapse of the dike occurred most probably already in the 16th Century. At the moment, the pool is situated inland due to the fact that the Polder Nieuwland, also known as Strieper-, Stryper- or Seeryperpolder, was been reclaimed between the old sea-dike and the current Waddensea-dike in the 16th Century (Schoorl, 2000).

The Ponswiel is connected with various ditches and contains freshwater. Along its banks grows not only *Phragmites* and *Scirpus*, but also *Butomus umbellatus*. The latter is a good indicator that we are not dealing here with a pool containing brackish water. Fish species living in this pool are at least *Anguilla anguilla*, *Pungitius pungitius* and *Gasterosteus aculeatus*. In addition fishermen have introduced among others *Rutilus rutilus* and *Esox lucius* in the pool (Zwart, 1985).

Beekman & Polman (1989) were the first who mentioned freshwater molluscs from the Ponswiel. Their records and the unpublished observations by A. Tulp in 1989 and H.K. Mienis in 2005 have been summarized by Mienis (2007). According to those data at least nine species have been collected during the period 1967-2005.

During my annual visits to Terschelling in the autumns of 2006, 2007 and 2008, I have continued my brief searches for freshwater molluscs and amphibious land snails in the Ponswiel. This has resulted in four additional records: *Galba truncatula*, *Segmentina nitida*, *Oxyloma elegans* and *Succinea putris*. This means that 13 species of (semi-) aquatic molluscs have now been reported from the Ponswiel (Table 1).

Table 1: List of (semi-) aquatic gastropods collected so far in the Ponswiel, Terschelling, Friesland, the Netherlands.

Taxon	Collector & dates			
	1967-2005 (Mienis, 2007)	H.K. Mienis 02.10.2006	H.K. Mienis 02.10.2007	H.K. Mienis 24.09.2008
<i>Valvata cristata</i>	+	-	-	-
<i>Physa fontinalis</i>	+	+	+	+
<i>Galba truncatula</i>	-	-	+	-
<i>Lymnaea stagnalis</i>	+	+	+	+
<i>Radix balthica</i>	+	+	+	+
<i>Stagnicila palustris</i>	+	-	+	+
<i>Anisus vortex</i>	+	+	+	+
<i>Gyraulus albus</i>	+	+	+	+
<i>Gyraulus crista</i>	+	-	-	-
<i>Planorbarius corneus</i>	+	+	+	-
<i>Segmentina nitida</i>	-	-	+	-
<i>Oxyloma elegans</i>	-	+	-	-
<i>Succinea putris</i>	-	+	-	-
Total (N=13)	9	8	9	6

Galba truncatula is an amphibious freshwater snail and is well known as an intermediate host of the liver fluke *Fasciola hepatica*. Since sheep are frequently grazing in meadows or on the dike south of the pool, the population of *Galba truncatula* may serve as a source for the transmission of liver flukes to the sheep.

Both *Oxyloma elegans* and *Succinea putris* are amphibious land snails, which were collected by the author from the emerging aquatic vegetation in the pool.

Striking is the complete absence of any freshwater mussel species, this in spite of the fact that species belonging to the genus *Pisidium* are quite regularly encountered in a large variety of aquatic biotopes on Terschelling (van Leeuwen & Kuiper, 2010).

A regular investigation of the mollusc fauna of the Ponswiel is important not only from the historic point of view but also from a conservational one. Although the "wiels" on Terschelling i.e. the pools caused by dike collapses, lack the status of nature reserves, they form unique biotopes for aquatic plant- and animal life on the island Terschelling.

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About *Eupera klappenbachi* Mansur & Veitenheimer, 1975, a Very Little Native Freshwater Clam (Sphaeriidae) in Santa Catarina State, Central Southern Brazil

A. Ignacio Agudo-Padrón, Project "Avulsos Malacológicos – AM", Caixa Postal (P. O. Box) 010, 88010-970 Centro, Florianópolis, Santa Catarina - SC, Brasil, ignacioagudo@gmail.com
<http://noticias-malacologicas-am.webnode.pt>

Before the first half of 2001, nothing was reported in the technical literature available about freshwater bivalve mollusks from the State of Santa Catarina, SC, in the Central Southern Brazil (Agudo 2002, Agudo-Padrón 2008: 148). But later, in September/October 2001, together with three naiad species [*Anodontites trapesialis* (Lamarck, 1819), *Leila blainvilleana* (Lea, 1834) – see Agudo 2007 -- and *Mycetopoda legumen* (Martens, 1888) -- see Agudo 2002], the very little native clam *Eupera klappenbachi* Mansur and Veitenheimer, 1975, in the family Sphaeriidae, became the first freshwater bivalve confirmed by our research in the geographical territory of the State, specifically in the Central Atlantic Slope of the "Serra do Tabuleiro Ecological State Park" region (Agudo-Padrón & Bleicker 2009: 10; Agudo-Padrón 2008: 168). These animals were found in an eutrophic sandbank channel (Agudo-Padrón 2011: 20), where they occurred occasionally among the roots of floating aquatic plants *Pistia stratiotes* (water lettuce) in the course of collecting freshwater gastropods, in September 16, 2001. They were small in length (approx. 0.5 cm. = 5 mm.), the shell valves had brown spots (Figure 1), and were very active, setting up the walls of the glass container that contained it (Figure 2).

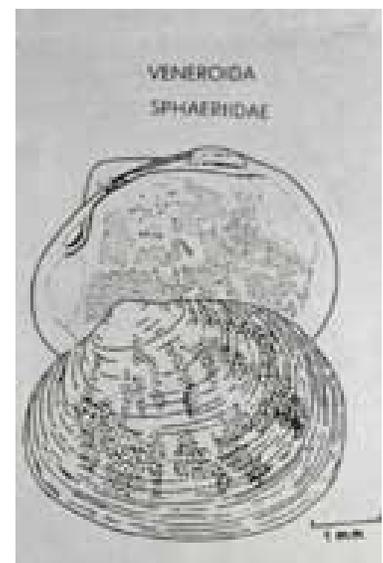


Figure 1.- Drawing of the little clam *Eupera klappenbachi* (from: Mansur et al 1987)

Subsequent random sampling was conducted in the same locality on October 6-7 and 12, 2001, in the roots of floating plant *Pistia stratiotes* anchored in muddy substrate of banks with the help of a rectangular screen (Figure 3). As a result, another 130 specimens were obtained (also kept alive in glass container with a diet of commercial food for aquarium fish (Tetramin), previously pulverized and diluted in distilled water), proving to be very actives (Mansur & Veitenheimer 1975: 31) (Figure 2) and presenting a range of measurements between 2.5 to 7.0 mm, as follows: 7.0 mm - 2, 6.5 mm - 3, 6.0 mm - 12, 5.5 mm - 13, 5.0 mm (including the first specimen obtained) 30, 4.5 mm - 24, 4.0 mm - 26, 3.5 mm - 12, 3.0 mm - 6, and 2.5 mm - 2. These data reveal that these small freshwater shells typically range between 3.5 and 6.0 mm, information that agrees with those originally described for that species (Mansur & Veitenheimer 1975: 27-30).

The habitat where these small bivalves were collected (Figure 3) is a ditch with substrate of mud and organic detritus, populated with floating plants *Pistia stratiotes*, besides *Vaucher longicaulis* (a green filamentous algae), *Hydrocotyle ranunculoides*, *Scirpus californicus* and *Typha domingensis* in the margins. Animal life includes the fishes *Phalloceros caudimaculatus* and *Hoplerythrinus unitaeniatus*, pulmonates aquatic snails *Biomphalaria tenagophila* (d'Orbigny, 1835), *Aplexa marmorata* Guilding, 1828 and *Lymnaea columella* Say, 1817, amphipod crustaceans *Gammarus neglectus*, brachyuran freshwater crabs *Trichodactylus fluviatilis*, and various aquatic insects, typical in these environments (Agudo-Padrón 2011).



Figure 2. – *Eupera klappenbachi* in a glass container. Photo: A. I. Agudo-Padrón, Project AM



Figure 3.- The habitat in which *Eupera klappenbachi* specimens were found and the screen used to locate them. Photos: A. I. Agudo-Padrón, Project AM

Today, six species of these tiny native freshwater clams are known in Santa Catarina's State, including two genera, two subfamilies and one family (Agudo-Padrón 2008: 168-169, 2009c: 9). From Brazil and South America, including the Brazilian southern States of Paraná, PR (Agudo 2008: 11; Agudo-Padrón 2009a: 6, 2010: 11-12) and Rio Grande do Sul, RS (Agudo-Padrón 2009b: 10), Ituarte and Mansur (1993), Mansur and Ituarte (1999), Simone (2006: 299-305) and Mansur *et al* (2008: 228) together related a total of 31 species of Sphaeriidae, including five genera and two subfamilies.

Finally, as indicated by Ituarte (1994: 2), the genus *Eupera* is a biogeographical interest group within the freshwater mollusc fauna, given its almost exclusive representation in the Ethiopian and Neotropical regions, represented in South America by more than a dozen species (Simone 2006: 302-304).

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A New Emerging Scientific Continental Malacological Collection and the Research with Mollusk Fauna in the North Metropolitan Region of the “Great Porto Alegre”, RS, Southernmost Brazil

A. Ignacio Agudo-Padrón, Project “Avulsos Malacológicos – AM,” Caixa Postal (P. O. Box) 010, 88010-970 Centro, Florianópolis, Santa Catarina - SC, Brasil ignacioagudo@gmail.com
<http://noticias-malacologicas-am.webnode.pt>

The mollusk fauna survey of a region is important in several respects, such as zoological, biogeographic, archaeological, paleontological, agricultural, food resource and, fundamentally, ecological conservation, as well as of health care in its capacity as vectors of disease to humans (medical & veterinary). In addition, scientific biological collections (molluscs included) are fundamental in the study of biodiversity in various fields of basic and applied research, which is extremely important when being correct and responsible driving and conservation (Bibow 1997; Farias 2000; Saraiva et al 2006).

Parallel to our research work, scoring 15 full years of modest uninterrupted and systematic activity, since the year 2008 we have actively engaged in the construction and systematic organization of a new emerging continental malacological collection housed in the Museum of Natural Sciences (Museu de Ciências Naturais da Universidade - MCNU), Lutheran University of Brazil, located in the southernmost region in the Rio Grande do Sul State, RS (Agudo-Padrón 2007, Agudo-Padrón & Oliveira 2008, Agudo-Padrón 2009 a, Agudo-Padrón *et al* 2009, Agudo-Padrón 2011 b) (Figure 1). This museum provides new space for the promotion of technical study, knowledge, and the necessary and urgent conservation of our threatened freshwater and land molluscs.



Figure 1.- Location of the Municipal District of “Canoas” (red color) in the Rio Grande do Sul State, southernmost Brazil (left), headquarters of the Museum of Natural Sciences of the Lutheran University of Brazil – ULBRA (center and right). Photos: Paulo Lenhard, Project AM

Through May 2011, the scientific collection of continental mollusks deposited in the MCNU (Figure 2) includes a total of 405 preserved specimens (69 bivalves and 336 gastropods), representing 39 species belonging to 14 freshwater forms (four Gastropoda and 10 Bivalvia), distributed in eight families and 10 genera; and 25 land Gastropoda forms, in their turn distributed among 12 families and 19 genera (Agudo-Padrón *et al* 2011).

Prior to this effort, the annals of MCNU indicated the existence of "some 5,000 different shells," coming from the coast of the States of Rio Grande do Sul (RS) and Santa Catarina (SC), and some fossils of bivalves and gastropods available in the sector of Paleontology, prevailing in a general lack of obvious sensitive Malacological collection housed in it, and a total lack of organization, maintenance, and encouragement for their study (Figures 2 and 3).

The specimens are cataloged as well as final origin confirmed, with specific geographic locations belonging to the Municipalities in the States of Rio Grande do Sul (with 64 lots - 49 Gastropoda & 15 Bivalvia) and Santa Catarina (Gastropoda with 11 lots). Each related species is presented accompanied by the following minimum information: MCNU lot, location of origin, date of collection, collector(s), and specimens contained in the consignment. The 75 lots that make up the collection (35 in alcohol, involving the soft tissues of 79 Gastropoda and two Bivalvia, and 40 in dry - 27 shells of Gastropoda and 13 Bivalvia) are listed in a file digitally organized in taxonomic order to the species level, recorded in the general catalog order entry in the collection. This collection includes the species *Milax gagates*

(Draparnaud, 1801) and *Milax valentianus* Férussac, 1821, european representatives of exotic slug Family Milacidae Ellis, 1926, whose occurrence in Brazil had never before been seen (Agudo-Padrón 2008 a-b, 2009 b; Agudo-Padrón & Lenhard 2010, Agudo-Padrón 2011 a). The collection is further enhanced by such information specific photographic and 33 regional technical reports spawned.



Figure 2.- General aspects of the emerging continental malacological scientific collection of the MCNU. Photos: A. I. Agudo-Padrón, Project AM



Figure 3.- Endangered native freshwater mussel specimens of *Leila blainvilleana* (Lea, 1835) in the scientific continental malacological collection of the MCNU. Photos: A. I. Agudo-Padrón, Project AM

Currently in Brazil, there are about 1,600 registered marine species of mollusks (Ribeiro-Costa and Marinoni 2006: 81), and at least 1,105 continental forms, terrestrial and freshwater, including native and exotic species (Simone 2006:3), of which at least 493 to date are known from the State of Rio Grande do Sul, in the southernmost of the country (Agudo-Padrón 2011 c). These numbers, however, are considered weak and under estimates by experts. Still, regional land and freshwater/ limnic mollusks are generally known by the high degree of endemism and is the group of animals that currently has the largest number of endangered species in the world (Mansur *et al* 2003:50; Heydrich 2007:250).

North Metropolitan Region Mollusk Fauna of the “Great Porto Alegre”, Rio Grande do Sul, and the Species Represented in the MCNU Continental Malacological Collection (*)

SYSTEMATIC SPECIES LIST (Total of 73 representatives)

Class GASTROPODA

(48 species – 26 limnic, 1 amphibian, and 21 terrestrial)

Subclass Prosobranchia / Caenogastropoda

Family Ampullariidae

Asolene platae (Maton, 1809)

Pomacea canaliculata (Lamarck, 1819) (Figure 4)*

Pomacea bridgesii (Reeve, 1856)*



Figure 4.- Freshwater native snail specimens *Pomacea canaliculata* (Lamarck, 1819) in the scientific collection of the MCNU. Photos: Paulo Lenhard/ Agudo-Padrón, Project AM

Family Hydrobiidae*Heleobia* sp*Littoridina cuzcoensis* (Pilsbry, 1911)**Subclass Gymnophila****Family Veronicellidae***Belocaulus angustipes* (Heynemann, 1885)*Belocaulus willibaldoi* Ohlweiler, Mota & Gomes, 2009**Phyllocaulis soleiformis* (d'Orbigny, 1835)**Phyllocaulis tuberculosus* (Martens, 1868)*Phyllocaulis variegatus* (Semper, 1885)***Subclass Pulmonata****Family Chiliniidae***Chilina fluminea* (d'Orbigny, 1835)**Family Physidae***Aplexa* (*Stenophysa*) *marmorata* (Guilding, 1828)*Physa acuta* (= *cubensis*) Draparnaud, 1805**Family Lymnaeidae***Lymnaea* (= *Pseudosuccinea*) *columella* Say, 1817*Lymnaea viatrix* (d'Orbigny, 1835)

In the Northern Municipal District of "Eldourado do Sul," this species is regional vector agent of the veterinarian/ human tropical parasitic disease "Fascioliasis" (Oliveira 2007)

Family Ancyliidae*Burnupia ingae* Lanzer, 1991*Ferrisia gentilis* Lanzer, 1991*Gundlachia ticaga* (Marcus & Marcus, 1962)*Hebetancylus* (= *Gundlachia*) *moriciandi* (d'Orbigny, 1837)*Uncancylus* (= *Gundlachia*) *concentricus* (d'Orbigny, 1835)***Family Planorbidae***Antillorbis nordestensis* (Lucena, 1954)*Biomphalaria glabrata* Say, 1818

In the Northern Municipal District of "Esteio," this species is regional vector agent of the human tropical parasitic disease "Schistosomiasis" (Sena *et al* 2001)

Biomphalaria oligoza Paraense, 1975*Biomphalaria peregrina* (d'Orbigny, 1835)*Biomphalaria tenagophila tenagophila* (d'Orbigny, 1835)*Biomphalaria tenagophila guaibensis* Paraense, 1984*Drepanotrema anatinum* (d'Orbigny, 1935)*Drepanotrema depressissimus* (Moricand, 1839)*Drepanotrema heloicum* (d'Orbigny, 1835)*Drepanotrema kermatoides* (d'Orbigny, 1835)*Drepanotrema lucidum* (Pfeiffer, 1839)**Family Succineidae***Omalonyx convexus* (Heynemann, 1868)**Succinea meridionalis* (d'Orbigny, 1846)***Family Milacidae***Milax gagates* (Draparnaud, 1801)**Milax valentianus* Férussac, 1821*

Family Limacidae

Limacus (= *Limax*) *flavus* (Linnaeus, 1758)*
Limax maximus Linnaeus, 1758*

Family Agriolimacidae

Deroceras laeve (Müller, 1774)

Family Philomicidae

Meghimatium pictum (Stoliczka, 1873) (= *Pallifera* sp)*

Family Bulimulidae

Bulimulus angustus Weyrauch, 1966*
Bulimulus tenuissimus (d'Orbigny, 1835)*
Drymaeus acervatus (Pilsbry, 1895)*

Family Megalobulimidae

Megalobulimus abbreviatus (Bequaert, 1948) (Figure 5A)*

Family Subulinidae

Rumina decollata (Linnaeus, 1758)*
Subulina octona (Bruguière, 1792)*

Family Helicidae

Helix (*Cornu*) *aspersa* Müller, 1774*

Family Bradybaenidae

Bradybaena similaris (Férussac, 1821)*
 Família SYSTROPIIDAE
Prohappia besckei (Dunker, 1847)*

Class BIVALVIA

(25 species – 16 limnic mussels/ naiads and 9 freshwater clams)

Order Unionoida**Family Hyriidae**

Castalia martensi (Ihering, 1891)
Diplodon delodontus (Lamarck, 1819)*
Diplodon multistriatus (Lea, 1834)*
Rhipidodonta charruana (d'Orbigny, 1835)*
Rhipidodonta grata (Lea, 1866)*

Family Mycetopodidae

Anodontites elongatus (Swainson, 1823)*
Anodontites obtusus (Spix, 1927)
Anodontites patagonicus (Lamarck, 1819) (Figure 5C and D live and shells)*
Anodontites tenebricosus (Lea, 1834)
Anodontites trapesialis (Lamarck, 1819) (Figure 5B - left)*
Anodontites trapezeus (Spix, 1827)
Leila blainvilleana (Lea, 1835) (Figures 3 and 5B - right)*
 Additional specimens of the “EEA/ IRGA”, Cachoeirinha Municipal District (Agudo-Padrón & Oliveira 2008), were deposited by us in the bivalve collection of the FZBRS Museum of Natural Sciences, Porto Alegre City = MCN-CMOB 39455
Monocondylaea corrientesensis d'Orbigny, 1835
Monocondylaea minuana d'Orbigny, 1835
Mycetopoda legumen (Martens, 1888)*

Order Veneroida

Family Corbiculidae

Cyanocyclus (= *Neocorbicula*) *limosa* (Maton, 1809)

Corbicula fluminea (Müller, 1774)*

Corbicula largillierti (Philippi, 1844)

Family Sphaeridae

Eupera klappenbachi Mansur & Veitenheimer, 1975

Pisidium forense Meier-Brook, 1967

Pisidium globulus Clessin, 1888

Pisidium sp

Pisidium sterkianum Pilsbry, 1897

Sphaerium sp

Order Mytiloida

Family Mytilidae

Limnoperna fortunei (Dunker, 1857)



A



B



C



D

Figure 5.- Some examples of the regional continental mollusks research in the MCNU. **A** -- *Megalobulimus abbreviatus* (Bequaert, 1948); **B** – left -- *Anodontites trapesialis* (Lamarck, 1819), right -- *Leila blainvilleana* (Lea, 1835); **C** (live) and **D** (shells) -- *Anodontites patagonicus* (Lamarck, 1819). Photos: Paulo Lenhard, Project AM

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About the Threatened Freshwater Mollusk Fauna of the Itajaí-Açu River Basin Valley, Santa Catarina's State, SC, Central Southern Brazil

A. Ignacio Agudo-Padrón, Project “Avulsos Malacológicos – AM,” Caixa Postal (P. O. Box) 010, 88010-970 Centro, Florianópolis, Santa Catarina - SC, Brasil ignacioagudo@gmail.com
<http://noticias-malacologicas-am.webnode.pt>

The subtropical valley of the Itajaí-Açu river basin, in the Atlantic Slope Forest domain of central southern Brazil, is the largest Atlantic drainage basin of the Santa Catarina State, SC (Agudo-Padrón 2008 b: 82) (Figures 1 and 2). The study of mollusk biodiversity in this section of the state it is urgent (Figures 3 - 7), in view of the rapidly changing natural environments, due to human activities and the rapid process of invasion by exotic species (Agudo-Padrón 2008 b).

Emerging results revealed until now a total of several species of continental mollusks, freshwater and terrestrial, in this peculiar region (Agudo-Padrón 2008 a-b, 2011 a-f). Notably, within these taxa, some freshwater forms, encountered in shells deposits (Figure 3), are new records for the state (Agudo-Padrón & Bleicker 2011).

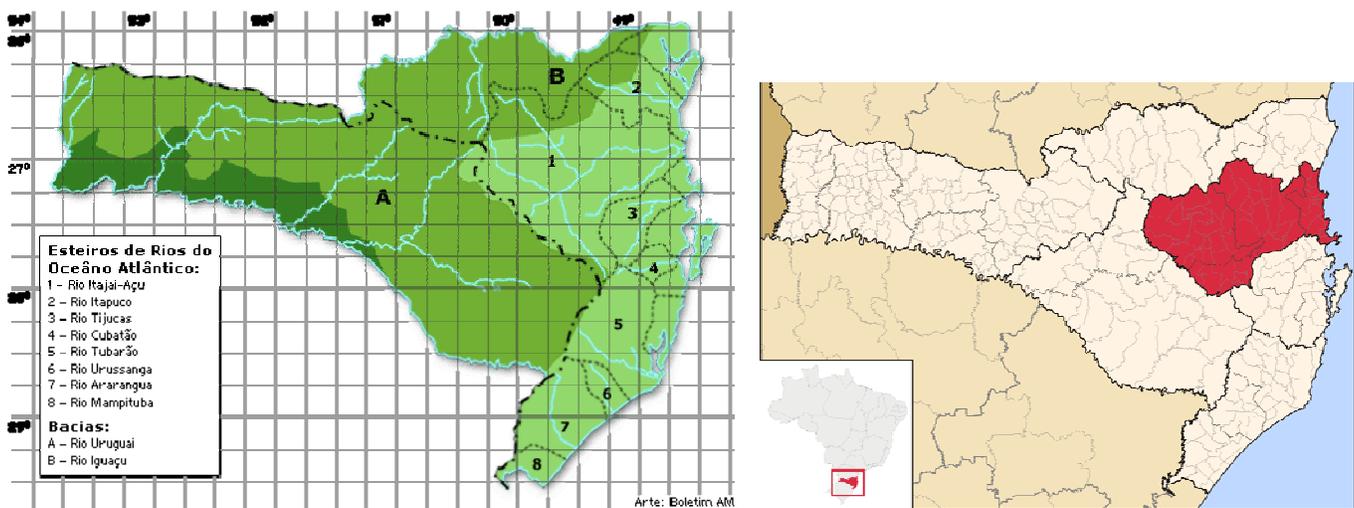


Figure 1.- Hydrographic composition of Santa Catarina State, SC, Brazil (left), and the Itajaí-Açu river basin (red color on right), the largest Atlantic drainage basin in the state.

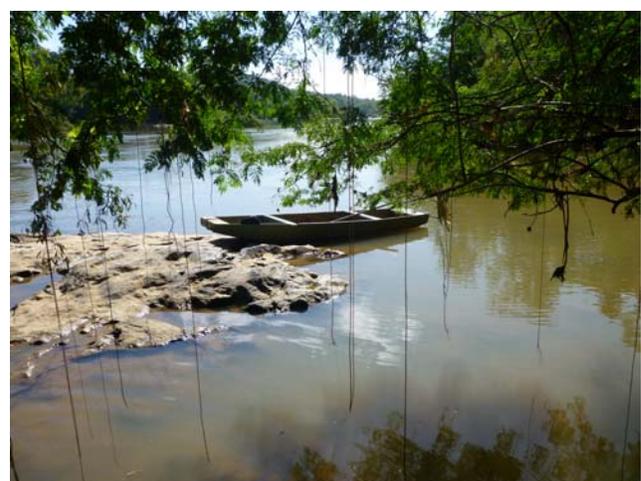


Figure 2.- Some general views of the Itajaí-Açu river basin valley region. All photographs in this article were taken by A. I. Agudo-Padrón, Project AM



Figure 3.- Shelling in riversides of the Itajaí-Açu river basin valley region.



Figure 4.- Native freshwater snails *Aylacostoma* sp (CMOUPF 0451) and its habitat in the Itajaí-Açu middle river basin valley. CMOUPF = Passo Fundo University (UPF) Mollusk Collection, RS, Brazil = Augusto Ruschi Zoobothanical Museum (MUZAR)



Figure 5.- Little freshwater native snails *Potamolithus catharinae* Pilsbry, 1911 (CMOUPF 0445, 0449, 0452) and its habitat in the Itajaí-Açu middle river basin valley.



Figure 6.- Freshwater native snails *Chilina globosa* Frauenfeld, 1881 (CMOUPF 0440, 0441, 0446, 0450) and its habitat in the Itajaí-Açu middle river basin valley.



Figure 7.- Native freshwater mussels/ naiads *Diplodon aethiops* (Lea, 1860) = *Rhipidodonta charruana* (d'Orbigny, 1835) (CMOUPF 0447, 0453, 0463) (left), exotic asian clams *Corbicula largillierti* (Phillippi, 1844) (CMOUPF 0439, 0442, 0443, 0444, 0464) (right) and their habitats (below) in the Itajaí-Açu middle river basin valley.

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Evaluative Summary of the Santa Catarina's State Mollusk Fauna, Central Southern Brazil, After 15 Years of Research

A. Ignacio Agudo-Padrón, Project "Avulsos Malacológicos – AM," Caixa Postal (P. O. Box) 010, 88010-970 Centro, Florianópolis, Santa Catarina - SC, Brasil ignacioagudo@gmail.com
<http://noticias-malacologicas-am.webnode.pt>

The study of biodiversity in the State of Santa Catarina, the smallest portion (central) of the geo-spatial southern Brazil region (Agudo(-Padrón) and Bleicker 2006:8; Agudo(-Padrón) 2007; Agudo-Padrón 2009 b:3), is urgent in view of the rapidly changing natural environments due to human activities and the rapid process of invasion by exotic species. Based on available estimates in the contribution of Simone (2006: 3), relative to the totality of continental malacological species estimated for the vast Brazilian territory, the Santa Catarina is today home of 185 specific forms, among them 68 limnic/ freshwater – 42 gastropods and 26 bivalves – and 117 terrestrial (Agudo-Padrón 2011 b, d, j; Agudo-Padrón and Bleicker 2011).

Regional freshwater and land mollusks are generally known by the high degree of endemism and is the group of animals that currently has the largest number of endangered species in the world (Mansur *et al* 2003: 50; Heydrich 2007: 250).

In general, after completing 15 years of specific studies, it is clear that knowledge of the diversity of this continental limnic and terrestrial invertebrates is still incomplete in the State (Agudo-Padrón 2010 b, 2011 f-h). By way of example, only in the course of the last two years of sustained systematic research, reference and field (2009-2011), the molluscan fauna occurring within the geographical territory of Santa Catarina had a significant increase of 87 species incorporated into the its general

inventory, among them 24 continental (13 limnic/ freshwater - 3 Bivalvia and Gastropoda 10 - and 11 terrestrial) and 63 marine forms (1 Polyplacophora, 41 Gastropoda, Bivalvia 7, 14 Cephalopoda) (Garcia *et al* 2008; Agudo-Padrón 2011 b, j; Agudo-Padrón & Bleicker 2011; Almeida & Figueira 2011; CdB 2011; Souza *et al* 2011).

Of all the regional mollusks (100%) so registered (857 forms) (Table 1), 22% (185 forms) are well known continental species for the territory (68 limnic/freshwater (8%) - 42 gastropods and 26 bivalves - and 117 (14%) terrestrial). The remaining 78% corresponds to the 672 marine species (11 Polyplacophora, 398 Gastropoda, 10 Scaphopoda, 230 Bivalvia, 23 Cephalopoda).

Table 1.- Total species of marine and continental (limnic/freshwater and terrestrial) mollusks occurring in Santa Catarina State, Central Southern Brazil, based on data available to the author as of Setember 2011

Santa Catarina Mollusks	
<u>Major Haritats</u>	<u>Number of Species</u>
Marine/Estuarine Mollusks	
Polyplacophora	11
Gastropoda	398
Scaphopoda	10
Bivalvia	230
Cephalopoda	<u>23</u>
Subtotal:	672
Continental Mollusks	
Terrestrial Gastropoda	117
Freshwater Gastropoda	42
Freshwater Bivalvia	<u>26</u>
Subtotal:	185
General Total:	857

As regards territorial coverage, the region of strands and Atlantic Slope, predominant area of the natural "Tropical Rain Forest" or "Tropical Atlantic Forest," is the environment with more continental species so far recorded in the State: 98 species (87 Gastropoda and 11 Bivalvia), followed by West region, accompanying the Upper Uruguay River Basin: 62 species (43 Gastropoda and 19 Bivalvia) by "Subtropical Forest" of the same name, and the Highlands of the Santa Catarina Plateau: 30 species (26 Gastropoda and Bivalvia 4) (Agudo-Padrón 2008: 150) (Fig. 1B).

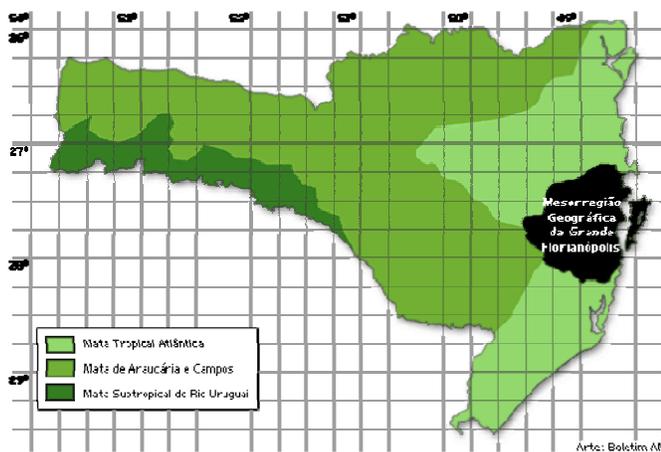
In the case of the freshwater Bivalvia, the highest occurrences of species corresponds to the Upper Uruguay River in the western region of the State (19 species), followed by records obtained in the Atlantic Slope (11 species), undisputed sway of Gastropoda (Figure 1C). In both cases, the region of the Highlands, area of "Araucaria Forest and Fields" (Figure 1E), presents smaller numbers, with particularly low occurrence of representatives Bivalvia (4 species) in relation to Gastropoda (26 species). There is misinformation and a lack of studies on the region of the Iguazu River Basin in the North sector of the Plateau (Agudo-Padrón 2008 b: 150).

Still, the specific location of "Nova Teutônia", Seara Municipal District in the West Region, Upper Uruguay River Basin (Figure 1C), presents itself as the geographic location having the largest number of records contained in the literature (46 species: 43 Gastropoda and three Bivalvia) (Agudo-Padrón 2011e).



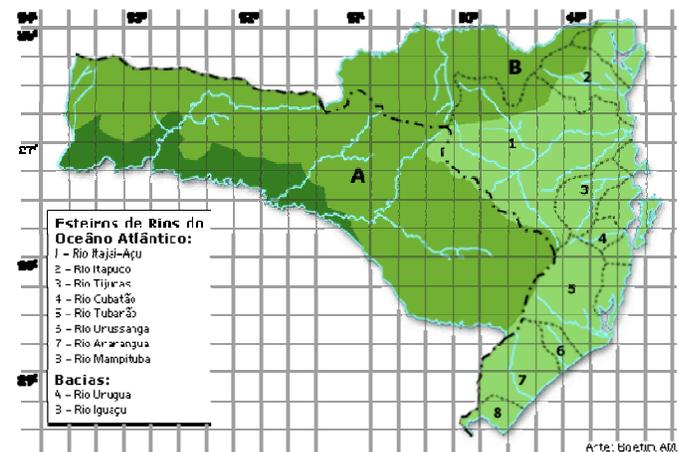
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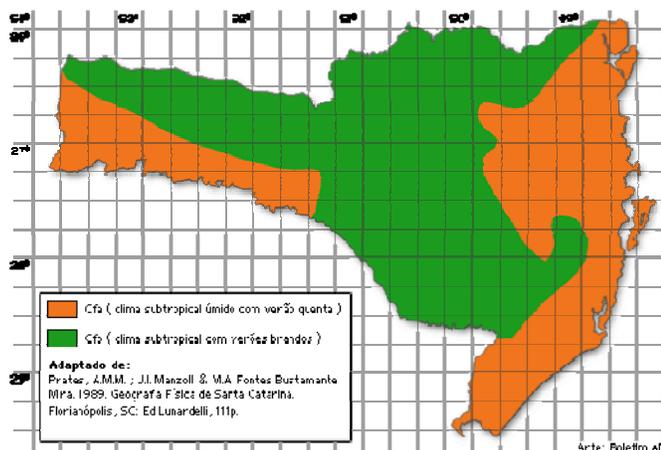
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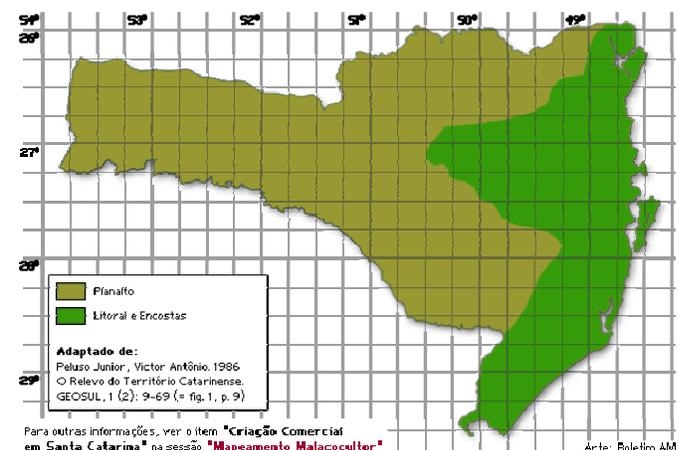
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C



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D



Arte: Boletim AM

E

Figure 1.- Geographical localization of the Santa Catarina State, in the context of the Southern Brazil region (A); Botanical formations and Capital territory of the State (B); Hydrographic basins (C); Climatic regions (D); and Basic geomorphological relief (E).

Limnic/freshwater Species Situation:

As appreciation of Buckup (2011), the Uruguay River Basin stands out regionally once again, which according to initial surveys already made, was found to be one of the "hotspots" of the world. It is the river with the greatest biodiversity of mollusks in Latin America (Figure 1C). Based on the IUCN "Restricted Distribution" criterion, a total of 54 nominal species, including 31 terrestrial gastropods, 15 freshwater gastropods and eight limnic bivalves (Figure 2), were considered strong candidates as threatened taxa (Agudo-Padrón 2009 a, 2010 a, 2011 i).

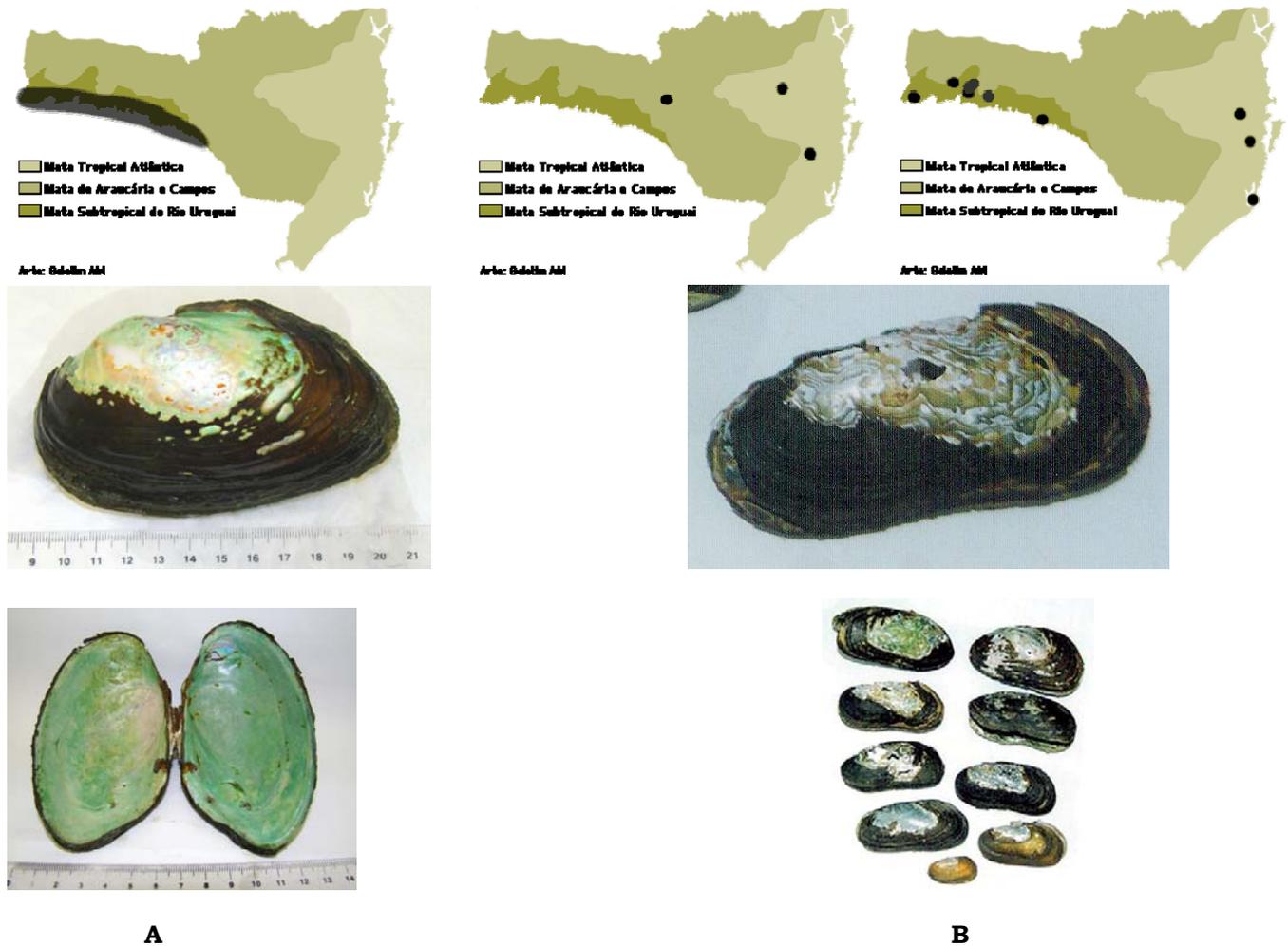


Figure 2.- Some freshwater mussel/naiad species endangered in Santa Catarina State: *Anodontites patagonicus* (Lamarck, 1819) (A) and *Anodontites tenebricosus* (Lea, 1834) geographical variations (B). Photos & Maps: Paulo Lenhard/ Agudo-Padrón, Project AM

About native limnic bivalves, current knowledge is sparse, estimated at 20% of the knowledge of the group in Brazil (Mansur & Pereira 2006; Simone 2006: 249-305; Mansur *et al* 2008; Agudo-Padrón 2011 f) (Figure 3), reflecting the absence of sampling in various regions.

As Buckup (2011), the order Unionoidea (Subclass Paleoheterodonta) is especially interesting for its ancient origin (Gondwanic) and high degree of endemism, a unique life cycle that begins with a parasitic larval stage in fish that serve as vehicle dispersion (at a later stage colonize the benthic sediment where they develop and reproduce themselves, living for long periods of life - more than 100 years), and are globally threatened – in the Neotropical region are 172 known species (Simone 2006 - part). In the Brazilian National List of Endangered Species, published in 2004, 22 species of this group are listed, 12 of them are registered in Santa Catarina (Agudo-Padrón 2010 a, 2011 i).

Reportedly, however, in the available literature (Froehlich s/d) the following (sic):

"... knowledge of the fauna of freshwater mollusks in South America is limited, and many studies have only descriptions or lists of wildlife species, resulting in systematic obscure patterns --- (Agudo-Padrón 2011 f) --- (the systematic of the mollusks is largely based on the shell; particularly the freshwater mussels/ naiads is provided of conservative structure, so that different species are sometimes very similar, with indistinguishable shells), a situation that impedes the search for these animals due to the difficulty of identification. Still, widely distributed species may differ in their shells --- (Figure 2B) ---, perhaps in response to different environmental conditions, have been described as different species --- (Simone 2006, Mansur & Pereira 2006) --- in many cases were not supported by a study of the morphology of soft parts ...".

According to Buckup (2011), in the order Veneroidea, the family Sphaeriidae also has a high degree of endemism, species are exclusively benthic, and good environmental indicators. The family is in need of taxonomic revision (Simone 2006, Mansur & Pereira 2006, Mansur *et al* 2008). Little is known about the diversity of this group in the State, and new species are still being described (Mansur *et al* 2008).

In particular, knowledge of the invader limnic bivalves is a major concern, with five species recorded for the inland waters of the state (two freshwater asian clams and three gastropods) (Agudo-Padrón 2008 a, 2008 c: 86, 2011 c-d), since they all cause serious damage to the environment, and choke away by the fauna of native bivalves, and other exotic forms corresponds both terrestrial detected, with 11 species so far recognized (Agudo-Padrón 2011 d).

As goals for extending knowledge of limnic species recommended greater sampling effort in higher streams of the Plateau, the river basins of Uruguay and Iguaçú, as well as coastal lagoons and riparian forests (Agudo-Padrón 2011 g, h, i) (Figure 1C).

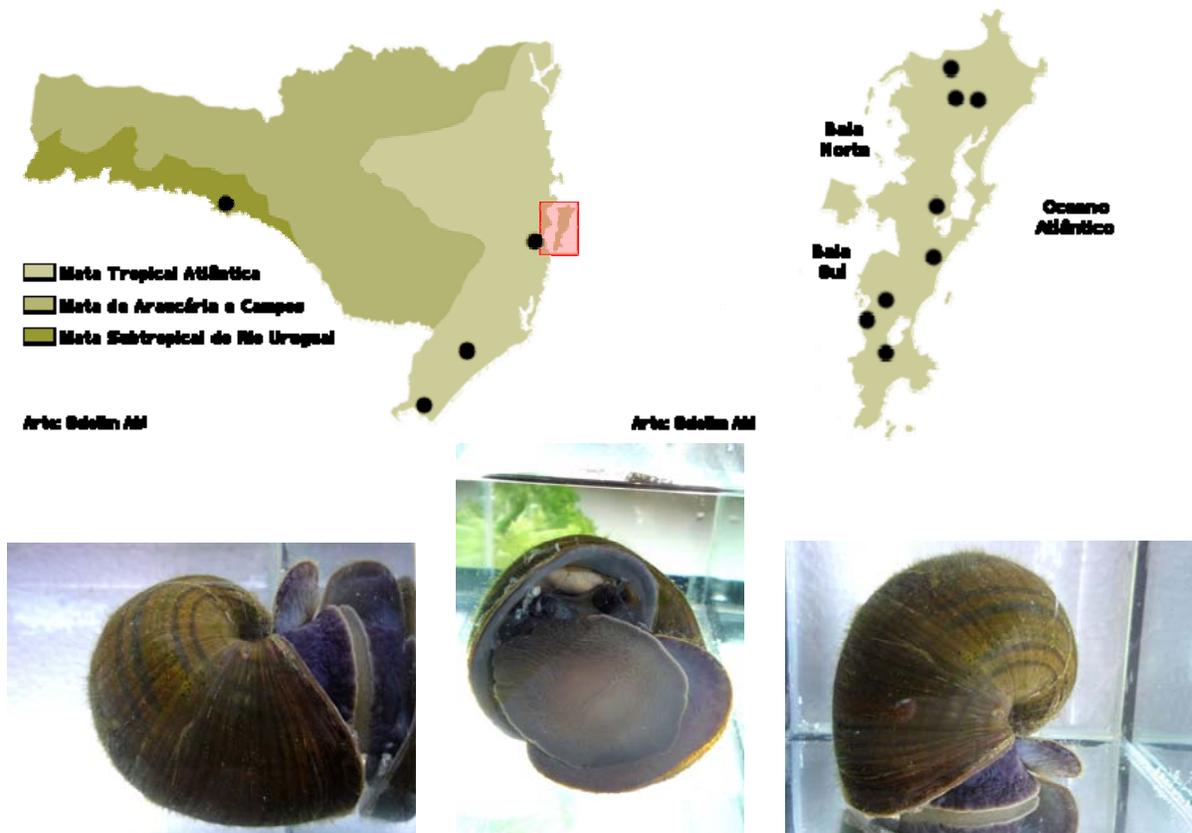


Figure 3.- Freshwater snails *Pomacea canaliculata* (Lamarck, 1804), the best known limnic gastropod in Santa Catarina's State territory. Photos & Maps: Paulo Lenhard/ Agudo-Padrón, Project AM

Terrestrial Species Situation:

The continental land snails are represented in Santa Catarina by 106 native and 11 exotic gastropods, distributed in 25 families (Agudo-Padrón 2008 b, 2011 j). This number, however, is an underestimate because there are many areas of the State that were not sufficiently sampled (Agudo-Padrón 2008 b: 150), and the invasive African land snail *Achatina (Lissachatina) fulica* (Bowdich, 1822) profiles today as the best studied species in the State (Agudo-Padrón 2008 b: 158, 2011 j) (Figure 4).

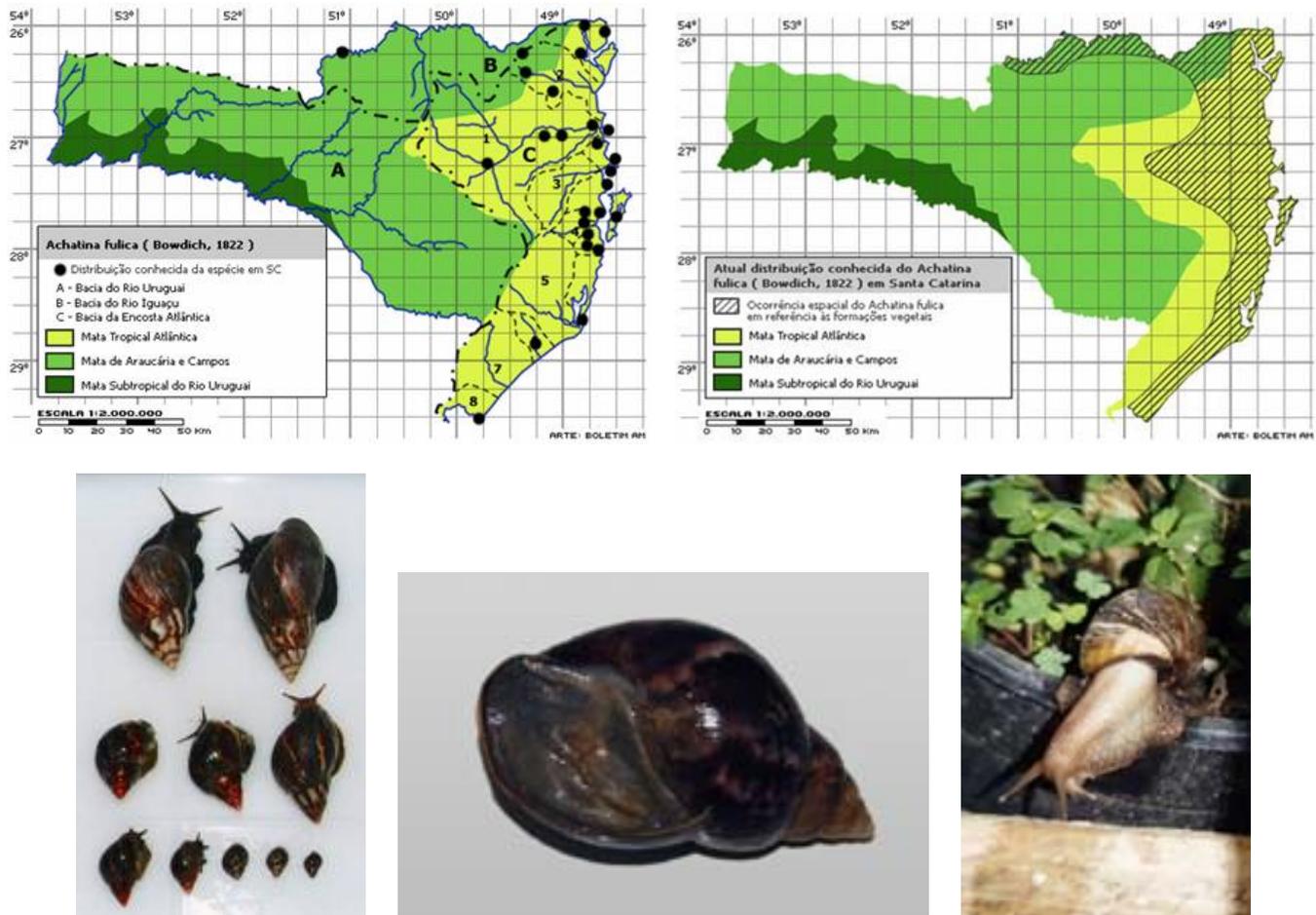


Figure 4.- *Achatina (Lissachatina) fulica* (Bowdich, 1822) and its known distribution in Santa Catarina State. Photos & Maps: A. I. Agudo-Padrón, Project AM

More study of all taxonomic groups is needed. Of the 25 families that occur in Santa Catarina, and as reported by Buckup (2011) in the neighboring State of Rio Grande do Sul, only the native slugs Veronicellidae Gray, 1840 (Figure 5) has completed revisions. Six species of terrestrial mollusks are listed among the elements of Endangered Wildlife of Brazil occurring in SC in the categories Vulnerable, Endangered and Not Established (Agudo-Padrón 2011 i). This number should be even higher, given the intense anthropogenic pressure on natural ecosystems in the State, a situation aggravated in recent years for true "public terrorist campaigns" carried out since the year 2003 at national level through the media pro "eradicate *Achatina (Lissachatina) fulica* of the environment" at the hands of lay people, terrified and technically unprepared, and as a reflection and consequence of the undesirable increase/acceleration in the extinction of native gastropods representatives of the families Bulimulidea Tryon, 1896, Strophochilidae Thiele, 1926, and Megalobulimidae Leme, 1973, many of them rare, endemic and little-understood scientifically (Agudo-Padrón 2011 k).

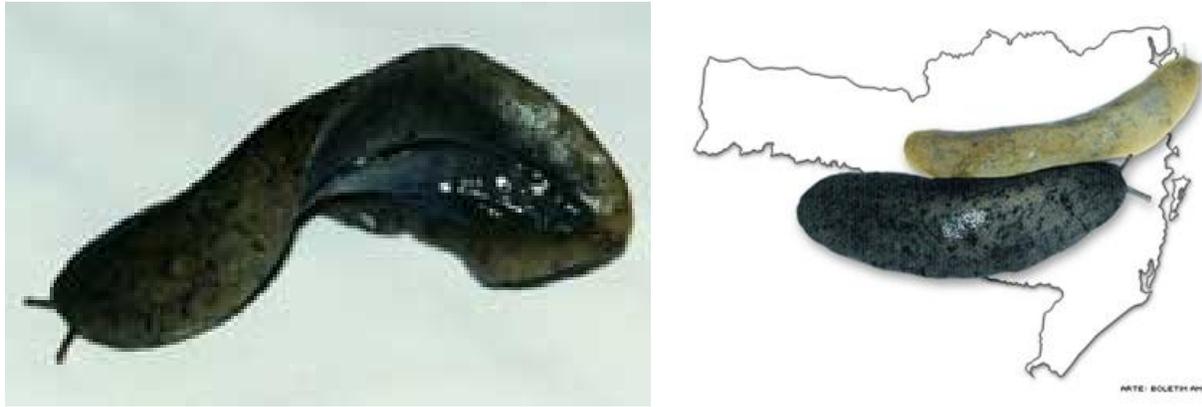


Figure 5.- Native slugs Veronicellidae, only the families present in Santa Catarina, with revisions completed. Photos: A. I. Agudo-Padrón, Project AM

With regard to the scanty knowledge of the terrestrial mollusks of the State, the biggest problems are the scarcity of population studies (Agudo-Padrón 2011 a, h) and the “epidemic” lack of taxonomists in research institutions (Agudo-Padrón 2011 g, i), the consequent difficulty of training new human resources, and the existence of sub-sampled areas in the State, such as the North and even the highlands of Plateau (Agudo-Padrón 2008: 150) (Figure 1).

Marine/Estuarine Species Situation:

The estimate of the knowledge of marine mollusks, including four recognized exotic species of bivalves (Agudo-Padrón 2011 d), is as previously reported in the range of 78%, much better than for continental forms (22%), terrestrial and limnic/freshwater (Agudo-Padrón and Bleicker 2009, 2011 j).

Other Conclusive Considerations:

With regard to species of immediate anthropic interest occurring in Santa Catarina State we have the following:

- Ten forms have the potential for culture use/consumption (two exotic terrestrial gastropods; and eight marine - two exotic and five natives bivalves, and one Cephalopoda) (Agudo-Padrón & Bleicker 2009: 5).
- At least 18 forms are of interest for their medical and veterinarian sanitary vector condition of emerging diseases in humans and animals (11 native gastropods - five limnic and six terrestrial, as well as seven exotic - one limnic and six terrestrial) (Agudo-Padrón 2006, 2007, 2008 a, 2011 c). and finally,
- Twenty-six other forms are considered harmful pests of various kinds (12 exotics – eight terrestrial gastropods, two limnic bivalves, and two marine caribbean bivalves – macrofouling in marine farms; and 14 native forms – six terrestrial gastropods, two limnic gastropods, four marine gastropods, one freshwater bivalve/naiad (Figure 6) and at least one marine bivalve – wooden puncher).

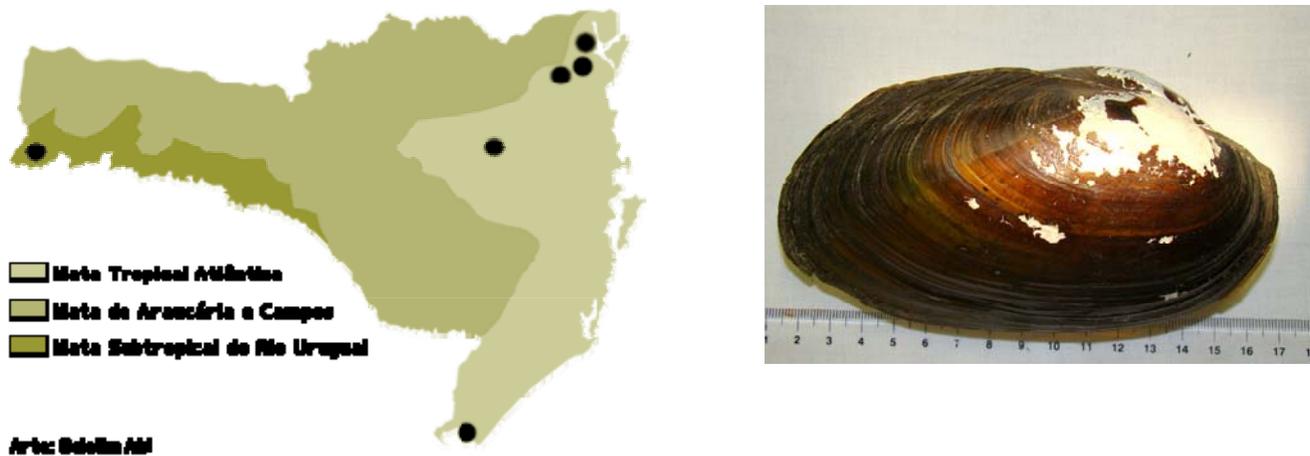


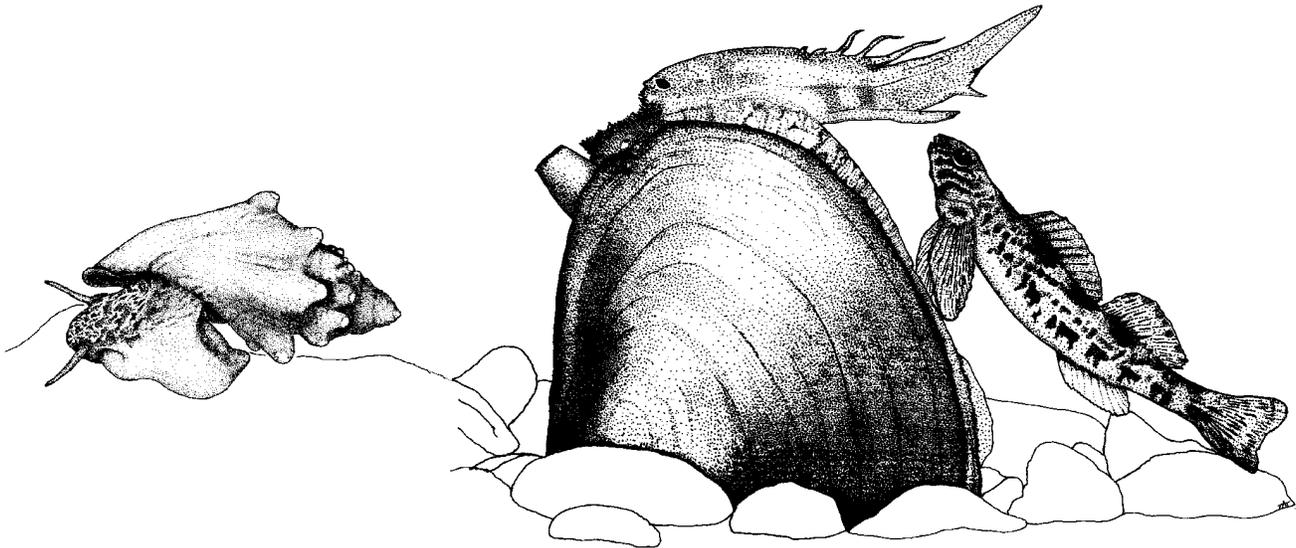
Figure 6.- Giant native naiad *Anodontites trapesialis* (Lamarck, 1819), a severe pest in regional fish farms. Photos & Maps: Paulo Lenhard/ Agudo-Padrón, Project AM

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FMCS Officers

President

Caryn Vaughn
Oklahoma Biological Survey
University of Oklahoma
111 E. Chesapeake Street
Norman, OK 73019
405-325-4034
cvaughn@ou.edu

President Elect

Patricia Morrison
U.S. Fish and Wildlife Service
Ohio River Islands NWR
3982 Waverly Road
Williamstown, WV 26187
304-375-2923 x 124
patricia_morrison@fws.gov

Secretary

Greg Zimmerman
EnviroScience, Inc.
6751 A-1 Taylor Road
Blacklick, OH 43004
615-866-8540
gzimmerman@enviroscienceinc.com

Treasurer

Heidi L. Dunn
Ecological Specialists Inc.
1417 Hoff Industrial Park
O'Fallon, Mo 63366
636-281-1982; Fax: -0973
Hdunn@ecologicalspecialists.com

Past President

W. Gregory Cope
North Carolina State University
Dept. of Environ. & Molecular Toxicology
Box 7633
Raleigh, NC 27695-7633
919-515-5296; Fax -7196
greg_cope@ncsu.edu

Ellipsaria is posted on the FMCS web site quarterly: early in March, June, September, and December. This newsletter routinely includes Society news, abstracts, job postings, meeting notices, publication announcements, informal articles about ongoing research, and comments on current issues affecting freshwater mollusks. Contributions may be submitted at any time but are due by the 15th of the month before each issue is posted. Anyone may submit material for inclusion in *Ellipsaria*; however, only current dues-paying members of FMCS can access it on-line. Information for possible inclusion in *Ellipsaria* should be submitted via e-mail to the editor, John Jenkinson, at jjjenkinson@hotmail.com.

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If you are interested in participating in committee activities, please contact one of the appropriate chairs.

Awards

W. Gregory Cope
North Carolina State University
greg_cope@ncsu.edu

Teresa Newton
Upper Midwest Environ. Science Center
tnewton@usgs.gov

Emy Monroe
University of South Dakota
emy.monroe@usd.edu

Environmental Quality & Affairs

Steve McMurray
Missouri Dept. of Conservation
stephen.mcmurray@mdc.mo.gov

Braven Beaty
The Nature Conservancy
bbeaty@tnc.org

Gastropod Status and Distribution

Jeff Garner
Al. Division of Wildlife and Fw. Fisheries
bleufer@aol.com

Jeremy Tiemann
Illinois Natural History Survey
jtiemann@illinois.edu

Genetics

David J. Berg
Miami University
bergdj@MUOhio.edu

Curt Elderkin
The College of New Jersey
elderkin@tcnj.edu

Guidelines and Techniques

Nevin Welte
Pennsylvania Fish & Boat Commission
c-nwelte@state.pa.us

Rita Vilella Bumgardner
Harpers Ferry, West Virginia
rbumgardner17@comcast.net

Information Exchange

G. Thomas Watters
OSU Museum of Biological Diversity
Watters.1@osu.edu

John Jenkinson
Clinton, Tennessee
jjjenkinson@hotmail.com

Mussel Status and Distribution

Arthur E. Bogan
N.C. State Museum of Natural Sciences
arthur.bogan@ncdenr.gov

John L. Harris
Arkansas State University
omibob1@gmail.com

Nominations

Leroy Koch
U.S. Fish and Wildlife Service
leroy_koch@fws.gov

Outreach

Andy Roberts
U.S. Fish and Wildlife Service
andy_roberts@fws.gov

Tom Jones
Marshall University
jonest@marshall.edu

Megan Bradley
Missouri State University
mebrad11@vt.edu

Propagation, Restoration, & Introduction

Rachel Mair
White Sulphur Spr. Nat. Fish Hatchery
Rachel_Mair@fws.gov

Christopher Owen
Kentucky State University
musseldoc@gmail.com

Symposium

Patricia Morrison
U.S. Fish and Wildlife Service
patricia_morrison@fws.gov

Parting Shot



Interior of the right valve of an *Amblema plicata* shell showing its repair after an injury [Milwaukee Public Museum (MPM) Mollusk # 4447.] This shell is part of the Bunde & Upmeyer collection, at least part of which was deposited at MPM before 1902 [Chadwick, G. H. 1906. Notes on Wisconsin Mollusca. Bulletin of Wisconsin Natural History Society, 4(3):69]. Bunde & Upmeyer was a leading Milwaukee jewelry store and jewelry maker that was in business from the 1880s to the 1950s. They were among the first to recognize the jewelry value of the large number of freshwater pearls being found during the button shell harvest that started in the 1890s (Washburn, H. E. *American Pearls*. 1908. The Ann Arbor Press, page 6). An article in the Spring 2012 issue of the Wisconsin Magazine of History will focus on the jewelry aspects of the button shell harvest. Photograph by Joan Jass, MPM.

If you would like to contribute a freshwater mollusk-related photograph for use as a **Parting Shot** in *Ellipsaria*, e-mail the picture, caption, and photo credit to jjjenkinson@hotmail.com.

