



Newsletter of the Freshwater Mollusk Conservation Society

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2012 Workshop	1
Society News	3
Announcements	3
Job Postings	4
Upcoming Meetings	5
Contributed Articles	6
FMCS Officers	25
FMCS Committees	26
Parting Shot	27

Speakers and Titles Set for April Workshop

The planning committee is in the final stages of arranging for our 2012 Workshop to be held on Thursday and Friday, April 19 and 20 in Athens, Georgia. As indicated in previous articles, this workshop will focus on three topics related to mussel conservation and management: Environmental Flows, Climate Change, and Ecological Services. Invited speakers will give talks about each of these topics and participate in open discussions with workshop attendees. Students will present and discuss posters relevant to these topics during an evening reception on the 19th.

The entire first day of this Workshop will be devoted to talks and discussions dealing with multiple aspects of environmental flows, ranging from how to determine environmental flow requirements of mussels to getting such requirements implemented in policy and management activities. The following talks are scheduled to be presented during this daylong session on Thursday:

- **How Much Water Does a Healthy Mollusk Need? Considerations When Developing Environmental Flows for Mollusk Conservation**
Andy Casper, U.S. Environmental Protection Agency, and Jim Gore, University of Tampa
- **The Environmental Flow Management Conundrum**
Mary Freeman, U.S. Geological Survey
- **Developing The Framework for a Multi-Jurisdictional Authority to Manage Environmental Flows**
Laurie Fowler, University of Georgia School of Law
- **Establishing Environmental Flows in Texas**
Kevin Mayes, Texas Parks & Wildlife

- **Managing River Flows for Mussels (and Everything Else)**
Darran Crabtree and Colin Apse, The Nature Conservancy.
- **In Search of Environmental Flows for Endangered Species: The Apalachicola River Experience**
Karen Herrington and Jerry Ziewitz, U.S. Fish and Wildlife Service
- **Estimation of Mussel Population Response to Hydrologic Alteration in the Apalachicola, Chattahoochee, and Flint River Basin**
Colin Shea, James Peterson, Jason Wisniewski and Rhett Jackson, Tennessee Technological University, U.S. Geological Survey, Georgia Department of Natural Resources, and University of Georgia.
- **Habitat Constraints Controlling Population Persistence of Freshwater Mussels: A Case Study on the Upper Delaware River** Heather Galbraith and Kelly Maloney, U.S. Geological Survey
- **Non-Lethal Assessment of Drought-Related Stress in Mussels**
Robert Bringolf, Andrea Fritts and James Peterson, University of Georgia and U.S. Geological Survey

The morning session on Friday will focus on the effects of climate change on freshwater mussels and new federal and state partnerships that are guiding much of the research and funding opportunities in this area. The talks scheduled for this session are:

- **Department of Interior Climate Science Centers: Adapting to Climate Change Impacts**
Damian Shea, U.S. Geological Survey
- **Hydrologic Modeling to Understand Climate Change Impacts on Stream Flow**
Jerad Bales, U.S. Geological Survey
- **Breaking Traditional Barriers to Model Climate Change and Land Use Impacts on Freshwater Mussels** Thomas Kwak, Greg Cope, Teresa Newton, Jerad Bales, Joseph Dario, Ashton Drew, Tamara Pandolfo, Jennifer Archambault, Alissa Ganser, Ryan Heise, Robert Nichols, Tom Augspurger, and Byron Karns, U.S. Geological Survey, North Carolina State University, U.S. Fish and Wildlife Service, North Carolina Wildlife Resources Commission, and U.S. National Park Service

The afternoon session on Friday will focus on ecological services provided by freshwater mussels and how we can begin to assign economic value to these services. The following talks are scheduled for this session:

- **A Framework for Ecological and Economic Valuation of Ecosystem Services: Challenges, Progress, and a Renewed Case for Conservation**
Daniel Spooner, Teresa Newton, and Steven Zigler, U.S. Geological Survey
- **Ecosystem Service Valuations in Aquatic Systems: Not So Cut and Dry**
Adam Riggsbee, Riverbank Ecosystems
- **Oyster Restoration and Ecosystem Services**
Speaker to be determined
- **Drought Reduces Ecosystem Services Provided by Freshwater Mussels**
Caryn Vaughn, Carla Atkinson, Adam Riggsbee, and Daniel Spooner, University of Oklahoma, Riverbank Ecosystems, and U.S. Geological Survey

Early registration for this Workshop ends on March 19. Late registration extends through the second day of the Workshop. The registration fee includes breaks, lunch on Thursday, and a social Thursday evening. Go to <http://www.molluskconservation.org/Events.html> to register. A block of rooms for the Workshop is available at the Holiday Inn, 197 E. Broad Street, Athens, Georgia, at the government rate of \$91 per night. In addition, there are numerous other hotels in the vicinity.

Society News

Spring 2012 FMCS Board Meeting

The FMCS elected officers and Committee Chairs will hold their Spring 2012 Board Meeting on Wednesday, April 18, the day before the start of our Workshop. This meeting will occur in the Holiday Inn, Athens, Georgia, from 3 – 6 pm. All society members and guests are welcome to attend.

Outreach Committee Wants You !

“We’re looking for highly motivated and skilled personnel to develop...” Oops - wrong ad. Actually, the FMCS Outreach Committee is looking for input from anyone who’s interested in bringing together freshwater mollusks and people -- under positive circumstances. If you have a little time to offer, we need more hands and ideas to find ways to improve our tools for education and awareness. Please consider getting involved; if you haven’t been a member of the committee in the past, please contact Megan (see below).

We’ve also been talking about, and working on, selecting new display boards for the society. If you’ve used the old boards or have any thoughts about things you’d like to see on the new ones, please contact Megan Bradley at: mebrad11@vt.edu.

Announcements

Southeast Atlantic Slope Mollusk Biennial Meeting

North Carolina recently hosted the 3rd biennial Southeast Atlantic Slope Mollusk meeting in Raleigh on January 11 and 12. There were 56 participants from Virginia, North Carolina, South Carolina, and Georgia, representing nine state agencies, two federal agencies, two universities, three nonprofit organizations, and three private companies. In addition to general updates, several topical presentations were given including the mega petition to the U.S. Fish and Wildlife Service, ecological flows, strategic habitat conservation, and an update on propagation efforts throughout the region. Anyone interested in notes from this meeting should contact Judy Ratcliffe (judith.ratcliffe@ncdenr.gov).

Submitted by: Angie Rodgers, NC Natural Heritage Program

Search for Types of Freshwater Mollusks in the Historic Invertebrate Collection in Geneva, Switzerland.

Arthur E. Bogan¹, Jeffrey T. Garner² and Yves Finet³

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²Mussel biologist, Dept. of Conservation and Natural Resources, 350 County Road 275, Florence, AL 35633 bleufer@aol.com

³Invertebrates: Malacology, Muséum d'histoire naturelle de la Ville de Genève, 1 Route de Malagnou Geneva, CH-1208 Switzerland Yves.Finet@ville-ge.ch

Jeff Garner and Arthur Bogan recently spent two weeks in October and November, 2011, visiting the Muséum d'histoire naturelle de la Ville de Genève searching their freshwater gastropod collection for type specimens of species originally described in the family Melaniidae. The museum’s mollusk collection contains a large number of freshwater gastropod lots assembled by early nineteenth

century naturalists including J.B.P.A. Lamarck (1744-1829), A.L. Brot (1821-1896) and M.E Moricand (1779-1854) and some of their collections were subsequently donated to the museum. These naturalists were in communication with early naturalists working in the United States and actively exchanged specimens.

Jeff Garner and Paul Johnson, both in the Alabama Department of Conservation and Natural Resources; Ellen Strong, Smithsonian Institution; and Arthur Bogan, North Carolina State Museum of Natural Sciences, are compiling original species descriptions and type localities to create a catalog of type specimen photographs (original specimens used in describing each species), for the freshwater gastropod family Pleuroceridae [subsequently split from the Melaniidae]. There are approximately 800 species described in this family, which is restricted to lakes, creeks and rivers of the eastern United States and four species in Mexico. Today, the genus *Gyrotoma* Shuttleworth, 1845, with 6 species, along with another 40 species in the family, are all presumed extinct. These taxa have been lost primarily due to habitat modification such as pollution and damming of rivers, inundating their riffle and shoal habitats. Museum collections are important repositories of historical collections that document the former distribution and occurrence of species. Those collections also contain the specimens used by authors to describe new species and document the range of their variation.

During our two week visit at the Museum in Geneva, we identified 78 lots containing 386 specimens that are type or probable types from 12 authors including: J.B.P.A. Lamarck [1], John G. Anthony [46], R. Ellsworth Call [1], Timothy A. Conrad [3], Calvin Goodrich [2], A.A. Gould describing species for John Anthony [3], Samuel S. Haldeman [2], Isaac Lea [2], Lovell Reeve [1], Thomas Say [5], Robert J. Shuttleworth [1] and Albert G. Wetherby [11]. All but Lamarck were naturalists who described new gastropod species assigned to the Pleuroceridae from eastern North America. Twenty five types were identified in the Brot collection and 1 in the Lamarck collection. The remaining 52 lots of type specimens were found in the systematic collection or in the unsorted lots from the Moricand collection at the end of the family Melaniidae.

The freshwater bivalve collections also were briefly examined and found to include several lots of species of the North American genus *Epioblasma* that are today extinct. Fifteen lots from the Moricand collection were observed to have originated from the interior of the United States, obtained from the early 19th century naturalist Thomas Say. Most of Thomas Say's specimens have been lost and those remaining in museum collections are very scarce.

Museum systematic collections represent a treasure trove of information on the history of species and their distributions. Old collections such as those of Lamarck, Brot and Moricand found in the Muséum d'histoire naturelle de la Ville de Genève often contain important and overlooked original type specimens and specimens of now extinct species.

Our work in US museums has been facilitated with U.S. Fish and Wildlife Service Section 6 funds to the State of Alabama. We were awarded a grant by the Muséum d'histoire naturelle de la Ville de Genève to help defray the costs of this trip.

Job Postings

Freshwater Mussel Biologist

Ecological Specialists, Inc. currently has an opening for a freshwater mussel biologist (permanent position) to assist with mussel sampling and data analysis in the Ohio River and Mississippi River basins. Position may include fieldwork throughout the Midwest, proposal preparation, project management, supervision of field crews, equipment maintenance, data analysis, and report preparation.

Requirements for malacologist position:

- Masters degree in biology, aquatic ecology, fisheries, or related field or Bachelors degree and at least two years of field experience
- Knowledge of Ohio and Mississippi River unionid fauna
- Computer experience with spreadsheets, databases, word processing, graphics, statistics
- Ability to prepare professional quality reports
- Willingness to travel

Useful skills:

- Diving certification
- Boat operation and maintenance skills
- Knowledge of Midwestern fish and benthic invertebrates
- GPS/GIS
- Consulting experience

Salary and Benefits:

- Competitive salary depending on experience
- Health Insurance
- SIMPLE savings/retirement plan
- Paid vacations and holidays
- Professional development time (e.g., conferences, research, training)
- Flexible hours
- Opportunity to travel throughout the Midwest collecting unionids

Start date: May 1 (estimate)

Please send resume by April 15 to:

Heidi L. Dunn, Ecological Specialists, Inc., 1417 Hoff Industrial Drive, O'Fallon, MO 63366-1959
 Fax: 636-281-0973 E-mail: HDunn@EcologicalSpecialists.com

Upcoming Meetings

April 10 -- 11, 2012 -- Interior Highlands Mollusk Conservation Meeting. Buffalo National River, Harrison, AR. Call For Abstracts Due by March 9, 2012. For further information contact Shawn Hodges Shawn.Hodges@nps.gov. Please RSVP even if you are not presenting.

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”.** (<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>

June 16 – 21, 2012 -- The American Malacological Society 2012 annual meeting, in the Philadelphia, Pennsylvania area. Scientific sessions of interest to FMCS members include “Magnitude of Molluscan Diversity, the known and the unknown”, and “North American Mollusk Conservation”. <http://www.malacological.org/meetings/index.php>

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/>

November 11 – 15, 2012 -- Society of Environmental Toxicology and Chemistry (SETAC) 33rd North American Annual Meeting, Long Beach, California Theme: “*Catching the Next Wave: Advancing Science through Innovation and Collaboration*” <http://longbeach.setac.org/>

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.

Meeting of the Chesapeake Bay Freshwater Mussel Workgroup

The Chesapeake Bay freshwater mussel workgroup met at the Chesapeake Bay Field Office in Annapolis, Maryland on January 19, 2012. This was the group's fourth annual meeting, but the first officially as the Chesapeake Bay workgroup. Past meetings were held for those working in Maryland or in close proximity. Thirty-one participants attended the meeting this year, up from 20 the previous year. Of the 31 people in attendance, 12 participated by web ex and telephone, making it our greenest meeting to date. Thanks to the U.S. Fish and Wildlife Service, Maryland Fishery Resources Office for hosting the meeting.

The morning and early afternoon consisted of short presentations, listed below. The remainder of the afternoon was reserved for open dialogue on pressing issues to mussel management and conservation in the watershed. In addition, there were short discussions about collaborative field efforts and grant proposals. Presentations, with author permission, and meeting minutes will be shared with the participants. Information on how to access and view meeting materials can be requested from Julie (Julie_Devers@fws.gov) or Matt Ashton (mashton@dnr.state.md.us).

Presentations

Matt Ashton (Maryland Department of Natural Resources – MBSS) – Update of Maryland Biological Stream Survey mussel work: environmental flows, environmental conditions of *Alasmidonta varicosa* and *Ligumia subviridis* streams, and morphological techniques to distinguish between *Lampsilis cariosa* and *Lampsilis cardium* in the Potomac.

Tom Dickinson (Catena Group) - Catena Group Recent & Future Chesapeake Watershed Mussel Surveys in Virginia.

Jim McCann (Maryland Department of Natural Resources – Heritage) - Freshwater mussel survey on the Casselman River and status update for *Alasmidonta heterodon* in Maryland.

Heather Galbraith (USGS – Northern Appalachian Laboratory) - Physiological Tolerance and Behavioral Preferences of Freshwater Mussels: Consequences for Mussel Biodiversity in a Changing Environment.

Julie Devers (USFWS – Maryland Fishery Resources Office) - Experimental Stocking of American Eels in the Susquehanna River.

Beth Meyer (Pennsylvania Natural Heritage Program) – Susquehanna River Basin Freshwater Mussel Surveys.

Brian Watson (Virginia Department of Game and Inland Fisheries) - Atlantic Slope Freshwater Mussel Propagation in Virginia.

Rachel Mair (USFWS – White Sulphur Springs National Fish Hatchery) – James spiny mussel propagation efforts at White Sulphur Springs National Fish Hatchery and South Fork Potts status survey.

Dan Spooner (USGS – Northern Appalachian Laboratory) – Ecological and economic valuation of ecosystem services associated with of host-affiliate relationships.

Angela Padeletti (Delaware Bay Estuary Program) - Restoring bivalves to increase natural capital: a watershed-wide approach.

Open Discussion – moderated by Julie Devers (USFWS)

- Hatchery Production Potential and Investment for Chesapeake Bay mussels
- Potential effects of Marcellus Shale gas exploration/extraction on freshwater mussels
- Status of status reviews for species in decline: *L. subviridis* and *A. varicosa*
- Coordination of inter-jurisdictional survey efforts and regional grant opportunities

New Record for *Simpsonaias ambigua* in the Ohio River Mainstem in West Virginia

Patricia Morrison, U.S. Fish and Wildlife Service, Ohio River Islands National Wildlife Refuge

While conducting surveys for freshwater mussels in the Ohio River just above Marietta, Ohio, our refuge dive team located 9 live *Simpsonaias ambigua* (and spotted a mudpuppy swimming away from the scene). The first individual was found under a small flat rock with other young native mussels, in water 10 feet deep. We brought it up to the surface to photograph and measure. The specimen was 35 mm long, and approximately 6 years old (Figure 1). When we dived back down to return it to its home, we found a larger rock nearby and, under it, were (you guessed it) eight more *S. ambigua*. The mussel community in the area is quite diverse, comprised of 17 species and includes *Cyprogenia stegaria* and *Plethobasus cyphus*.



Figure 1. One of nine live *Simpsonaias ambigua* collected in the Ohio River. Photo by Patricia Morrison.

Mite DNA in Mantle Clips

Robert A. Krebs, Brian D. Allen, and Na'Tasha M. Evans

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Gene sequencing as a tool for the conservation of freshwater mussels is finally taking off, although the majority of studies are systematic in nature, rather than investigations of populations, for which many samples are required. One limitation for population-scale studies is harm to mussels. Several low-impact options are available, however, notably mantle clips (Berg et al., 2005), use of a swab rubbed across the mantle and foot (Henley et al., 2006), and even grinding fresh shells (Geisti et al., 2008). While each of these approaches progressively decreases risk to live individuals, DNA yields decline. For that reason, mantle clipping has remained the most commonly used non-lethal sampling protocol.

We discovered a caveat to sampling DNA via mantle clips. Parasitic or commensal organisms associated with unionid mussels may occasionally contaminate genetic samples taken from along the margins of individuals. Following DNA extraction from two *Pyganodon grandis* individuals for which a mantle-clip was taken during surveys throughout the Lake Erie-Lake St. Claire watersheds, a non-

unionid fragment of the mitochondrial CO1 gene was amplified (Accession numbers JQ425161-JQ425162). While these sequences barely aligned with the known haplotypes from *P. grandis*, a blast search in GenBank tentatively identified them as coming from *Unionicola* mites. Mites are symbionts with mussels, and are likely to be very common. Gangloff et al. (2008) reported all 29 *Pyganodon grandis* from a tributary of the Tallapoosa River, Alabama, possessed both unionicolid mites and aspidogastroid trematodes.

While the frequency of obtaining a non-mussel sequence from a mantle clip is not high, at about 1%, that number suggests to us that others have occasionally obtained DNA of parasites and probably done nothing further with them. Water mites are currently placed in one genus, *Unionicola* Haldeman 1842 (Acari: Unionicolidae), which presently contains some 238 named species in 57 subgenera of which limited phylogenetic analysis suggests very deep divergence levels (Edwards et al., 2010). GenBank contains even fewer water mite sequences; a search on *Unionicola* gave just 97 (some of which are expanded sequences of the same species). For a perspective on how understudied this mite system is, no GenBank sequences were more than 83% similar to either of the two recently submitted sequences, which also differed at 94 of 645 base pairs (14.6%), although base pair variation generated just seven amino acid substitutions. Clearly, any new discoveries of *Unionicola* mites, even by accident, should be uploaded to the public domain to enable future work on the diversity of this less studied group, and potentially, investigations of a relationship between parasitic unionicolid mites and their unionid hosts (Edwards and Vidrine, 2006).

Acknowledgements: We thank Dale Edwards for suggestions to improve this note. This research was funded by the US FWS #30181AG152.

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Concho River Pearls

Robert G. Howells, BioStudies, Kerrville, Texas – bobhowells@hctc.net

An excellent discussion of both freshwater and marine pearls was provided in “Pearls: A Natural History” (Landman et al. 2001). However, this book overlooked a major pearl fishery in Texas, as did an earlier book by Kunz and Stevenson (1908). There were early pearl finds in the Atlantic States and later in the Mississippi River drainage and an early pearl rush at Caddo Lake on the Texas-Louisiana border (Blakely 1988). However, much interest in Texas has focused on the Tampico Pearlymussel (*Cyrtonaias tampicoensis*) and the unique colored pearls it produces. This particular unionid and its pearls were not only part of Texas history, but have contributed to a local fishery that continues to generate interest today.

Early Spanish explorers collected its pearls in the Concho River (Rio Conchos = river of shells) and established area missions that ultimately morphed into the city of San Angelo. Although lay interest

often focuses on the Concho River, Tampico Pearlymussel occurs from the Brazos River south and west into northeastern Mexico. This mussel evolved in rivers (there were no natural lakes in its range), but it often adapts well to reservoirs. However, ongoing drought conditions have no doubt dramatically reduced its numbers over the past few years.

Cyrtonaias typically has purple, pink, lavender, or orange nacre and produces pearls of these same colors. Local pearl hunters and jewelers still value colored “Concho River pearls” and often reject white pearls as undesirable. Pearls may be irregular baroques, covered pieces of broken hinge teeth, or classic pear or spherical shapes. Tampico Pearlymussel may produce pearls anywhere in its soft tissues or attached to the shell. Many hold free pearls at the posterior edge of the mantle (the specimen shown in Figure 1 has an area on the valve where one such pearl was located). More than one pearl hunter has opened a mussel while standing in the water and then bemoaned watching a pearl fall free and sink into the muddy water below... never to be seen again.

As human influence continues to impact Texas waters, especially in the face of severe drought conditions, the future of Tampico Pearlymussel, its pearls, and the fishery it has supported may be at risk.

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Kunz, G.F., and C.H. Stevenson. 1908. The book of the pearl: the history, art, science, and industry of the queen of the gems. The Century Company, New York (reprinted 1993 by Dover Books).
Landman, N.H., P.M. Mikkelsen, R. Bieler, and B. Bronson. 2001. Pearls: a natural history. American Museum, New York.



Figure 1. Tampico Pearlymussel (*Cyrtonaias tampicoensis*) from the Concho River drainage, Texas, and examples of natural pearls from central Texas. Purple color of the nacre and pearls often photographs poorly; actual examples are far more attractive than is evident in this picture.

Study to Document Mussel Diversity in Wyoming

Philip T. Mathias (Philip.Mathias@wyo.gov) and **Gordon P. Edwards, Jr.** (Gordon.Edwards@wyo.gov)
Wyoming Game and Fish Department; Casper Regional Office, 3030 Energy Lane, Casper, Wyoming

Wyoming is still in a discovery phase with regard to its native mussels. Seven species have been identified statewide (Cvancara, 2005), none of which have a protected status under the Endangered

Species Act, although western drainage species are beginning to receive attention from conservation groups. Starting in 2011, the Wyoming Game and Fish Department began systematic population surveys of native freshwater mussels. The focus has been on the drainages west of the continental divide where the California floater (*Anodonta californiensis*) and western pearlshell (*Margaritifera falcata*) are found. Perennial streams are being surveyed (visual and tactile searches) for native freshwater mussel presence/absence and catch per unit effort. Basic aquatic habitat information is also collected at each site (width, substrate composition, bank-full depth, etc.). Collected specimens were deposited in a voucher collection at the University of Colorado Museum of Natural History. Specimens were also collected and preserved for both genetic sampling and shell morphometric studies by Karen Mock at Utah State University.

The 2011 field sampling season focused on two major drainages in Wyoming: Bear River and Snake River. Twenty-four sites were sampled, eight of which had live mussels present. The Bear River and its tributaries had live California floaters and western pearlshells, while the Snake River only had live western pearlshells (Table 1). California floaters were found upstream of Woodruff Narrows Reservoir (Yellow Creek, 41.2784N, 110.9986W), which is the most upstream population known in the Bear River in Wyoming. Sites near Jackson were abundant with western pearlshells (Table 1); mussel beds were as populous as 500-800+ individuals with relatively few empty valves present (Figures 1 and 2).

Table 1. Sampled sites with live mussels present. Twenty-four sites were sampled during 2011, eight of which had live mussels present.

Date	Stream	Drainage	Abundance	Species	Latitude*	Longitude*
8/3/11	Bear River	Bear R.	10	CFM†	41.5083N	111.0064W
8/4/11	Mill Creek	Bear R.	2	WPM‡	41.0056N	110.8574W
8/8/11	Yellow Creek	Bear R.	1	CFM†	41.2784N	110.9986W
8/23/11	Bear River	Bear R.	2	CFM†	41.9268N	110.9906W
9/16/11	Smith's Fork Bear River	Bear R.	277	WPM‡	42.1423N	110.8854W
9/28/11	Snake River	Snake R.	638	WPM‡	44.1293N	110.6566W
10/1/11	Pole Cat Creek	Snake R.	537	WPM‡	44.1083N	110.6841W
10/25/11	N. Fk. Fisherman's Creek	Snake R.	828	WPM‡	43.1676N	110.2944W

*North American Datum, 1927

†California floater mussel (*Anodonta californiensis*)

‡Western pearlshell mussel (*Margaritifera falcata*)

In other work, Pinedale Regional Fisheries Biologist Pete Cavalli found live western pearlshells in the New Fork River (Green River drainage), which was previously believed not to contain native freshwater mussels. No native freshwater mussels were previously known from the entire Colorado River drainage upstream of the Little Colorado River in Arizona.

Acknowledgements: Joseph Bailey, Sarah Green, Travis Neebling, Diana Miller, Tracy Stephens, Rob Gipson, Pete Cavalli, Hilda Sexauer, Craig Amadio, Jessica Shulte, Amy Detta, and Katherine Weber. Funding provided by the Wyoming Game and Fish Department through the USFWS State Wildlife Grant Program.

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Figure 1. Mussel bed of western pearlshells (*Margaritifera falcata*) in the Snake River (44.1293N, 110.6566W), near the border of Yellowstone National Park.



Figure 2. Western pearlshell (*Margaritifera falcata*) in the Snake River (44.1293N, 110.6566W), near the border of Yellowstone National Park.

Review of the Invasion and Taxonomy of the Pagoda Tiara, *Plotia scabra* (Müller, 1774) (Gastropoda: Thiaridae).

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Freshwater gastropods are regularly being introduced around the world and include such pest species as *Pomacea canaliculata* (Lamarck, 1822), *Pomacea insularum* (d'Orbigny, 1835), *Melanooides tuberculata* (Müller, 1774), *Tarebia granifera* (Lamarck, 1822) and *Thiara scabra* (Müller, 1774).

Thiara scabra was reported from Mauritius, Réunion, and a few coastal localities near sea level in east Africa, living in rivers, creeks and ponds at elevations up to 600m (Brown 1994). Glaubrecht et al. (2009) provided a more detailed map of the species distribution from east Africa, Madagascar, India, Sri Lanka, Malaysia, Thailand, Sunda Islands, Philippines, Borneo, Celebes, Bismarck Archipelago, the Solomon Islands, the New Hebrides and Fiji, New Guinea, northern Australia (Figure 1).

During the last decade *Thiara scabra*, has been reported from the Emeq HaMayanot (Valley of the Springs) and the Sea of Galilee in Israel (Mienis 2008; Mienis and Mienis 2008; Mienis et al. 2009; Roll et al. 2009). More recently it has been discovered in two coastal rivers along the Mediterranean coast of Israel (Mienis 2011). It has been suggested that *Thiara scabra* was introduced into Israel through the aquarium trade or might have been imported on aquatic plants (Mienis and Mienis 2008; Roll et al. 2009). There is concern that this invasive and abundant species may have an adverse impact on the native aquatic fauna.

In 2006, *Thiara scabra* was collected for the first time in the United States from southern Florida, Martin County and again in April, 2007 from Palm Beach County, Florida (Thompson et al. 2009). Thompson et al. (2009) used the common name Pagoda Tiara as provided by Reeve (1860). The common name Rough Melania was used by Mienis and Mienis (2008).

Like most Thiaridae, *Thiara scabra* is host for a variety of trematodes that may affect the local aquatic and vertebrate fauna (e.g. Yanohara, 1995; Chontanarith and Wongsawad 2010; Jayawardena et al. 2010). The systematics of thiarid gastropods is undergoing revision and Glaubrecht et al. (2009) moved *Thiara scabra* to the genus *Plotia* Röding, 1798 with the new combination being *Plotia scabra*.

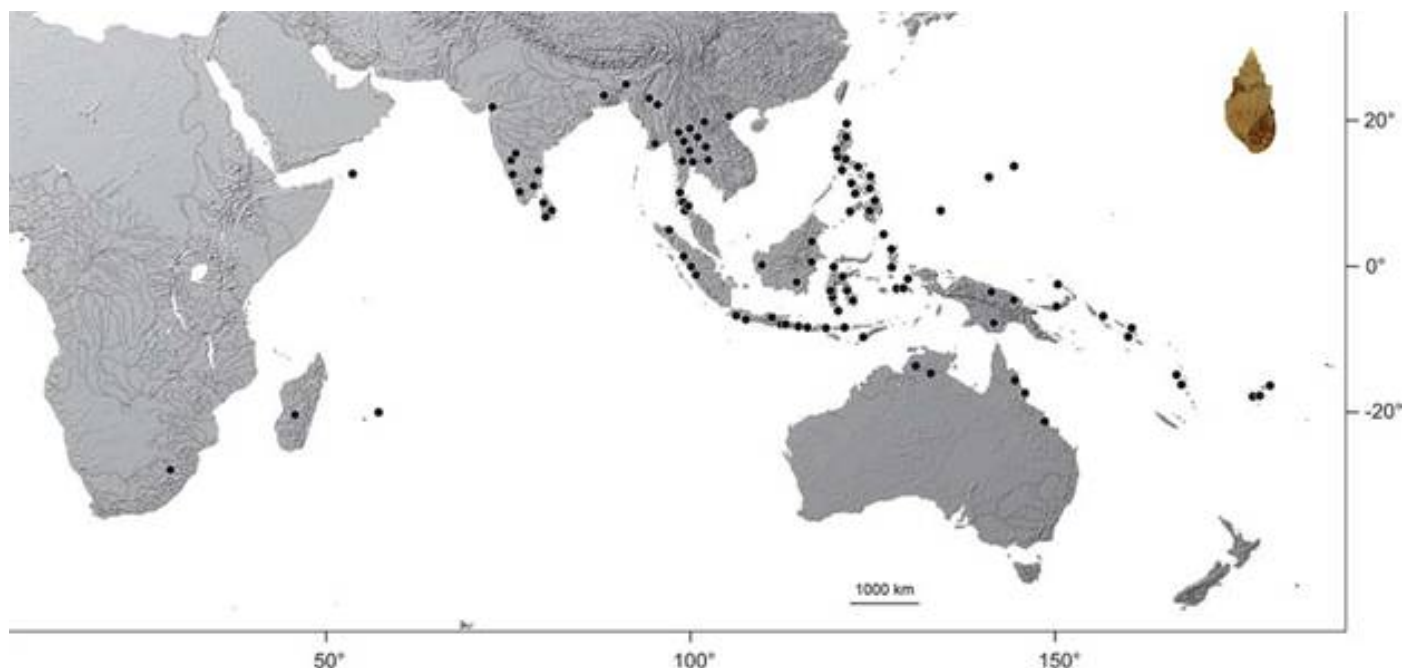


Figure 1. Distribution of *Plotia scabra* (O. F. Müller, 1774) from Glaubrecht et al. 2009. Reproduced with permission of the author.

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Trematodes in Ohio River *Quadrula pustulosa*

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Cooperators in an NRDA restoration project have been working for five years propagating common species to help replenish mussel beds in the Belleville Pool of the Ohio River. Propagation facilities include White Sulphur Springs National Fish Hatchery (NFH), Columbus Zoo/OSU Center for Mussel Conservation, Genoa NFH, and the West Virginia Division of Natural Resources. So far, seven common species have been successfully transformed, grown out to taggable size, and stocked. Many of these are short term brooders, which provide extra challenges in timing the collection of broodstock and infestation. Over the past three years of working with *Quadrula pustulosa*, multiple cooperators have noticed the tendency of some of the females to release numerous balls of trematodes in advance of any eggs or larvae; we have wondered why it is evident only in *Q. pustulosa* so far (even though many other species of mussels are collected as broodstock from the same locations at the same time), and if this apparent trematode parasitism affects the condition or reproductive capability of the *Q. pustulosa* even though juveniles have been successfully produced from these females. Figure 1 is a “through the microscope” photograph of a cluster of these trematodes, possibly of the genus *Bucephalus* ?? Has anyone else seen these ??



Figure 1. Through the microscope, disassociated balls of trematodes released from a female *Quadrula pustulosa* from the Ohio River.

Fecundity Estimation in Unionids

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Fecundity determination is a common element of fin-fish management. It typically involves counting ovarian eggs (particularly mature ovarian eggs) to estimate aspects of reproductive potential. Fecundity estimates have been applied less frequently in unionid life history studies; however, they may have relevance in malacology as well. Indeed, with revelations that some unionid eggs may never have been intended to hatch, counting and differentiation of glochidia and developing and non-developing eggs in gravid marsupia may be useful in estimating reproductive potential.

Various techniques that have been used for fin-fish ovaries can also be applied to gravid unionid marsupia. In the early years of Texas Parks and Wildlife Department's unionid research activities, methods usually associated with plankton counting procedures were also used successfully on mussels. These methods involving the use of Hensen-Stempel pipettes, Sedgwick-Rafter cells, and other tools were described in the Info-Mussel Newsletter back in 1994 (Howells 1994). During recent discussions

with university undergraduates, graduates, and instructors, it became apparent that many had no idea what these tools or techniques were. Accordingly, it seems appropriate to repeat this technique and describe associated equipment again here.

A gravid unionid gill is extracted from a sacrificed female and then macerated and shaken in a jar of water to disassociate all contents and structural tissues. The sample may then, optionally, be preserved in alcohol as well. The mixed sample is placed in a jar or beaker in a measured volume of water (1 liter volumes are often acceptable). A Hensen-Stempel pipette (Figure 1) resembles a hypodermic syringe without a needle. The internal plunger is fitted with an hour-glass shaped tip that holds exactly 1 ml (larger volume models are available, but usually not appropriate). This tip is extended, the mixture of water and tissue stirred, and the plunger withdrawn (manually or via spring) to obtain a 1-ml subsample. Stirring involves moving the pipette in a figure-eight motion with an up-and-down action as well to achieve a homogeneous mixture (never stir in a circular motion). Once extracted, the subsample is counted, then it should be returned to the mixture before repeating the process.

Counting of eggs and glochidia is often best accomplished with a Sedgwick-Rafter cell (Figure 2). This is a microscope slide fitted with metal or plastic sides and a thin glass slip-cover. It, too, holds 1 ml. Contents of the Hensen-Stempel pipette are released into the well on the Sedgwick-Rafter cell. Efforts need to be made to avoid trapping bubbles under the slip cover (thus reducing the volume of fluid present). This slide can be examined under a compound or dissecting microscope. It may be helpful to use a background grid to assist in counting. This cell and a compound microscope will be necessary for very small glochidia like those of *Leptodea fragilis*. Larger glochidia, like those of *Anodonta suborbiculata*, can sometimes be counted with a high-powered dissecting microscope and a counting wheel (Figure 3). Counting wheels consist of grooved wheels where the sample is placed, then turned under the viewing field during counting.



Figure 1. Hensen-Stempel pipettes are available in manual models (top) that must be pulled to obtain the sample or as spring-loaded models (bottom) that retract the sample automatically. The 1-ml size is typical, but larger styles are also available.



Figure 2. Sedgwick-Rafter cell used for counting plankton samples. This example holds 1 ml of sample.

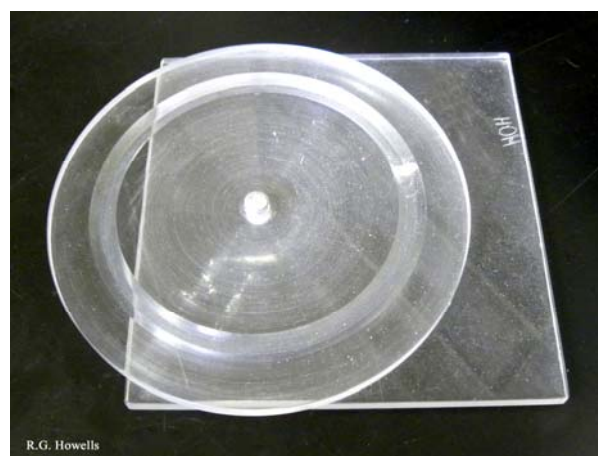


Figure 3. Plankton counting wheel that can be used for larger specimens.

When numbers of specimens are too high for easy counting, the sample volume can be increased. A Folsom plankton splitter (not shown) can also be used to half the sample one or more times to reduce the subsample size to easily countable numbers. Final counts can ultimately be extrapolated to produce total numbers for both gills of the female examined. The number of subsamples needed reflects the number of specimens in each and homogeneity of the mixture being sampled. Apply standard statistical techniques.

Numerous sources that discuss fecundity techniques in fin-fishes and others related to plankton processing methods can be consulted to provide further insight (e.g., Lind 1974).

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**Additional Information Concerning the Conquest of Europe
by the Invasive Chinese Pond Mussel *Sinanodonta woodiana*. 27.
News from Belgium, Moldova, and Poland**

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New information concerning the invasive Chinese Pond mussel *Sinanodonta woodiana* (Lea, 1834), Family Unionidae, in Europe appears regularly in a large variety of journals and reports. In this instalment, I present such records published in the past months in Belgium, Moldova, and Poland. In addition a photograph is presented from Bulgaria (Figure 1).

Belgium

A review of the expansion drift of exotic molluscs in rivers and standing waters in the area of Antwerp, during the past 20 years, has shown that *Sinanodonta woodiana* has not yet shown up in that part of Belgium, although it has been reported already from numerous ponds used for aquaculture, especially for growing carps, all over the country (Sablon & Vercauteren, 2011).

Moldova

Oxana Munjiu (2011) studied the mollusc fauna of Lake Belev in the Prut River basin, a tributary of the Danube. In 2008 The Chinese Pond mussel occurred in the lake at a density of 0.4 specimens/m², this increased to 1.4 specimens/m² in 2009. It is already playing a significant role in density (7%) and biomass (74% !) of the lake although it has established only fairly recently a viable population in the Lake Belev. In 2003, empty shells of it had been found also in Lake Manta which is likewise situated in the Prut River basin (Minjiu & Shubernetski, 2008).

Poland

Urbańska et al. (2012) describe what seems to be the oldest population of *Sinanodonta woodiana* in Poland. A valve collected in 1998 from a pond near Zgliniec between Lake Jezierzyckie and Lake Wojnowickie, containing waters of natural thermal conditions, turned out to be at least 7 years old. It was characterized by having an extremely thick shell. Compared to valves from other sites in Poland and neighbouring countries, it turned out to be closer in form and texture to specimens recorded from Hungary than those from the heated Konin Lakes in Poland. The list of references contains all the works dealing with records of the Chinese Pond mussel from Poland.

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Figure 1. A characteristic specimen of *Sinanodonta woodiana* from the Bulgarian part of the Danube. Photo: Prof. Hubanov

On the Presence of *Physella gyrina* in the Botanical Garden of Tel Aviv University and Elsewhere in Ramat Aviv, Israel

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The Tadpole physa *Physella gyrina* (Say, 1821), Family Physidae, is confined in its natural distribution to temperate and sub-Arctic North America (Taylor, 2003). Since *Physella gyrina* seems to belong to a group of aquatic gastropods often encountered in freshwater aquaria, it has been reported fairly recently from a number of European countries: Great-Britain, Ireland, the Netherlands, Germany, and Spain (Glöer, 2002; Anderson, 2005; Mienis, 2011) and from Israel in the Middle East (Mienis, 2003, 2004).

Taylor (2003) has pointed out the large range in diversity of shell morphology of the Tadpole physa. The shells may range from depressed globular to high slender, but usually all the shells in a single population show the same form. Most specimens we could study from Israel were rather small (<10mm), rather globular and the animals were coloured much darker with less numerous pale dots on the mantle than in the much more common *Haitia acuta* (Draparnaud, 1805). So far, *Physella gyrina* had been encountered mainly in the Botanical and Zoological Gardens of the Tel Aviv University in Ramat Aviv.

On 26 January 2012 we visited once more the Botanical Garden of the Tel Aviv University. The area called the "En Gedi oasis" consists of a rather wet sandstone wall covered mainly by ferns from which water is constantly dripping into a small basin. Excess water is carried away by means of a narrow channel of about 10 m length which empties into a large earthen pool. Usually, this pool is covered by a dense cover of *Lemna*, but at the time of our visit, the water level in the pool was not only extremely low but also the *Lemna* cover had been completely removed. The water was very clear and all

around the pool large congregations of the invasive Mimic pond snail *Pseudosuccinea columella* (Say, 1817) were present. These specimens were coloured very dark black, but here and there some slightly paler snails were crawling around. The latter turned out to be large specimens of *Physella gyrina* (Figures 1 and 2). They were all of the same size class (14-15 mm high), which means about 50% larger than any specimen of the Tadpole physa collected in Israel in the past. Most of the shells showed one or two paler thickenings towards the lip of the aperture. We have to admit that this new material is still considerably smaller than the maximum size (25 mm!) given for this species by Taylor (2003).



Figure 1: *Physella gyrina* (Say, 1823) from the large earthen pool at the end of the "En Gedi-area" in the Botanical Garden of the Tel Aviv University. (Photo: Oz Rittner)



Figure 2: *Physella gyrina* crawling in the "En Gedi" pool of the Botanical Garden, Tel Aviv University. (Photo: Oz Rittner)

On 14 February 2012, one of us (HKM) checked a cluster of eight artificial ponds along the southern side of Einstein Street, between Brodetsky Street and Namir Road, in Ramat Aviv, for the presence of aquatic molluscs. Only five species were found: the native *Melanoides tuberculata* (Müller, 1774) and four invasive species all of North-American origin: *Pseudosuccinea columella*, *Haitia acuta*, *Physella gyrina* and *Planorbella duryi*. Not all the species were present in the eight ponds. Two ponds had been stocked with exotic Koi carps and those ponds turned out to be devoid of any snails! The presence of *Physella gyrina* in these ponds can be explained by the fact that most of the aquatic plants present in the ponds were acquired from the Botanical Garden of the Tel Aviv University, which is situated at a distance of only some 500 m from the ponds in Einstein Street.

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Some Short Field Observations on Birds that Eat Freshwater Mollusks and their Prey in the Metropolitan Region of “Great Porto Alegre”, Southernmost Brazil

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As is common knowledge, many freshwater mollusks (snails and mussels/clams) are part of the diet of various elements of the vertebrate fauna occurring in a locality, among them swamp birds. Here in Brazil we find some interesting bird species whose nutrition is entirely based on this type of food, serving as “excellent bioindicators” to facilitate the knowledge of the faunal biodiversity of large or moderate aquatic mollusks that inhabit temporary ponds, marshes, wetlands, fish ponds and borders of rivers and streams.

In this sense, we have been observing for years in the Central North section of the “Great Porto Alegre Metropolitan region” (Agudo-Padrón 2009 a), specifically in the Canoas and Cachoeirinha Municipal Districts (Agudo-Padrón & Oliveira 2008; Agudo-Padrón 2009 b; Agudo-Padrón *et al* 2009, 2010; Agudo-Padrón 2011), two bird species occurring in swamp environments specializing in predation and consumption of freshwater mollusks:

- 1.- The “Snail Kite” -- *Rostrhamus sociabilis* ([Vieillot](#), 1817)



Also called “Gavião-caramujeiro”, is a bird of prey within the family Accipitridae, which also includes the eagles, hawks, and old world vultures. These birds are largely diurnal. The dark, deeply hooked beak is an adaptation to its diet. It flies slowly with its head facing downwards, looking for its main food, the large limnic apple snails of the family Ampullariidae. For this reason, it is considered a “molluscivore”. In the Metropolitan region of “Great Porto Alegre” (Agudo-Padrón 2009 a, 2011), their main food is the common aquatic snail *Pomacea canaliculata* (Lamarck, 1819).

2.- The "Limpkin" – *Aramus guarauna* (Linnaeus, 1766)

Also called "Carão", "Courlan" or "Crying bird", is placed in its own monotypic family, Aramidae, which is in turn placed with the crane and rail order Gruiformes. These birds are largely nocturnal and crepuscular. They forage primarily in shallow water and on floating vegetation. In "Canoas" Municipal District – Campus of the "Brazilian Lutheran University/ ULBRA," the diet of the Limpkin is dominated by common apple snails *Pomacea canaliculata* (Linnaeus, 1819). In the Municipal District of "Cachoeirinha" – Rice Experimental Station/ IRGA – their diet includes that species and the freshwater mussels naiads *Leila blainvilleana* (Lea, 1835) and *Anodontites trapesialis* (Lamarck, 1819), mainly (Agudo-Padrón *et al* 2009; Agudo-Padrón 2011).

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New Report of Local Freshwater Snails in the Environment Campus of the Lutheran University of Brazil - ULBRA, Canoas Municipal District, Rio Grande do Sul State, RS

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Through the month of October 2011, 11 species of Continental Gastropoda (6 exotic invaders & 5 natives) had been found on the Canoas Campus of the Lutheran University of Brazil – ULBRA (Agudo-Padrón & Lenhard 2009; Agudo-Padrón 2011), Canoas Municipal District (Figure 1), Rio Grande do Sul State - RS, consisting among related species so 1 native aquatic limnic/freshwater Ampullariidae snail, 2 native slugs Veronicellidae, 2 native terrestrial Pulmonata snails, 3 exotic Pulmonata slugs and 3 exotic terrestrial Pulmonata snails.



Figure 1. Canoas Municipal District in the geographical context of the Rio Grande do Sul State, RS, Southernmost Brazil region

On November 11, 2011, during field evaluation of predation and consequent accumulation of shells [46 specimens collected – Museu de Ciências e Tecnologia da PUCRS, Porto Alegre, RS, Brazil (MCP) 9269] on aquatic snails *Pomacea canaliculata* (Lamarck, 1804) (Figure 2) - with abundant presence of egg masses deposited on vegetation around the water (Figure 3) – in streams by molluscivore birds or bird-eating freshwater mollusks “Limpkin” – *Aramus guarauna* (Linnaeus, 1766) (see article in this issue), two new local species of little limnic native snails: *Biomphalaria tenagophila guaibensis* Paraense, 1984 (one specimen collected – MCP 9267) and *Drepanotrema cimex* (Moricand, 1839) (two specimens collected – MCP 9268), previously included in the statewide inventory of species (Agudo-Padrón 2009). These snails were obtained in the “flooded” area densely populated by subtropical aquatic plants (*Nymphaeoides indica* and, mainly, *Salvinia auriculata*, the latter forming dense floating mats) (Figure 4).



Figure 2.- Shells of aquatic snail *Pomacea canaliculata* predation by bird-eating snails *Aramus guarauna* (Linnaeus, 1766) Photo: A. Ignacio Agudo-Padrón, Project AM.



Figure 3.- Typical egg masses deposited by aquatic snails *Pomacea canaliculata*. Photos: A. Ignacio Agudo-Padrón, Project AM.



Figure 4.- Temporary lake (above) and streams teeming with aquatic plants (below) on the campus Canoas of the Lutheran University of Brazil – ULBRA Photos: A. Ignacio Agudo-Padrón, Project AM.

Representatives of the Family Planorbidae, these little spiral native snails raise to 13 the number of gastropod species known in the environment of the campus (Agudo-Padrón 2011), and three the number of aquatic forms (two Pulmonata and one Prosobranchia).

Finally, at the time of writing this short report, the control samples thus obtained are forwarded for deposit in foreign institutional scientific collection, each time for "unexpected technical incompetence" of the local Museum of Natural Sciences ULBRA (MCNU), the same could not be entered into your emergent malacological collection.

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Shelling in the "Daymán River Basin", Salto Department, Uruguay, Southern Cone of South America

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In February 02-03 2012, during a period of heavy rainfall, I performed a quick visit for limnic shelling in the "Termas del Daymán" region, Salto Department, Oriental Republic of Uruguay, Southern Cone of South America, specifically in the "Daymán River", a stream tributary on the left/ oriental bank of the Uruguay river basin, in your lower middle portion (Figure 1).



Figure 1.- Two views of the Daymán River and the bridge over this stream, Termas del Daymán region, Salto Department, Oriental Republic of Uruguay

The municipality is located in the Northwest and 498 km from Montevideo, the Uruguayan capital. It is opposite the Argentine city of "Concordia", in "Entre Rios" Province (Figure 2), and to the southern region and river basin of "Termas del Arapey" (Agudo-Padrón 2006, 2008), having the same regional geomorphological features: riversides composed by dark basaltic rocks shaped by the action of water, with rifts of the close rocky blocks at water levels, riverbed sand and provided with abundant tiny corners rolled.

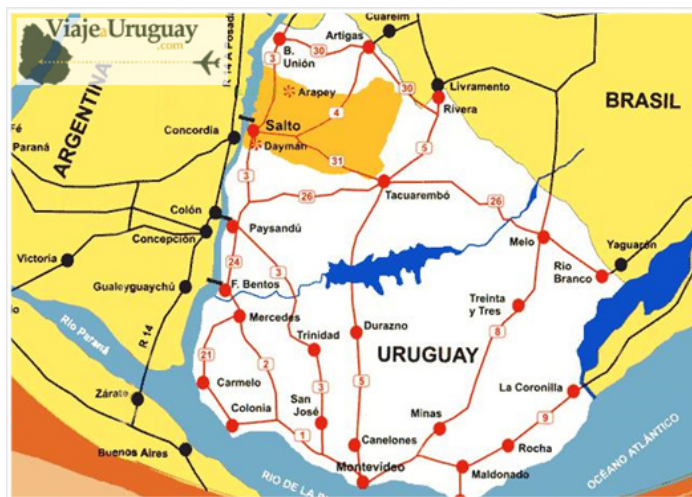


Figure 2.- Map of Uruguay including the “Salto Department” territory (orange). The shelling locality on the Daymán River was between Salto and Concordia, Argentina.

The mollusks observed on this opportunity (Figure 3) included the following 12 limnic forms (7 bivalves and 5 gastropods), determined in field with the help of Simone (2006):

I. Bivalves:

Exotic asian clams *Corbicula fluminea* (Müller, 1774) (Figure 3), and native limnic mussels/naiads *Castalia* sp, *Diplodon rhuacoicus* (d’Orbigny, 1835), *Diplodon wymanii* (Lea, 1860), *Mycetopoda legumen* (Martens, 1888), *Anodontites trapezeus* (Spix, 1827) and *Monocondylaea* sp, all previously cited in Campos and Calvo (2006), Scarabino and Mansur (2007), Clavijo (2009), and Clavijo *et al* (2010).

II. Gastropods:

Native snails, mainly *Pomacea canaliculata* (Lamarck, 1804) (Figure 3) (heavily predated by limnic snail-eating birds), *Felipponea iheringi* (Pilsbry, 1933), *Biomphalaria straminea* (Dunker, 1848), *Potamolithus* sp and *Drepanotrema* sp, all previously cited in Scarabino (2004) and Clavijo *et al* (2010).

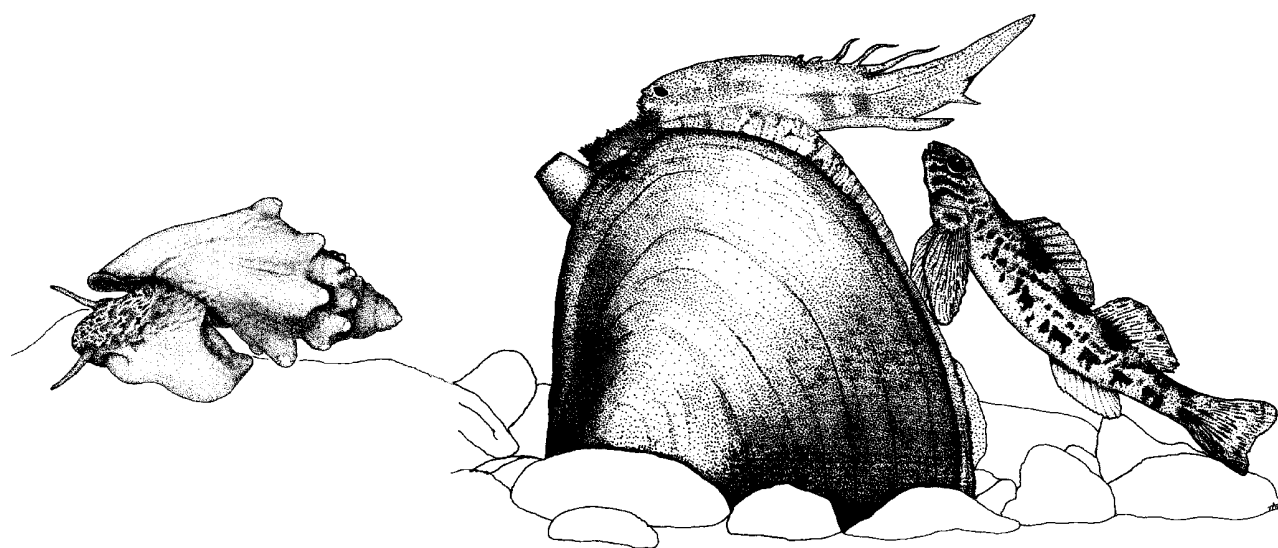
Finally, no terrestrial mollusks were sighted in the inspected area, or - oddly - the presence of the exotic invasive Asian golden mussel *Limnoperna fortunei* (Dunker, 1857), whose occurrence is registered for us in the territory of the Department of Salto (Agudo-Padrón 2006, 2008).



Figure 3.- Asian clam *Corbicula fluminea* and native snails *Pomacea canaliculata* shells of the Daymán River basin.

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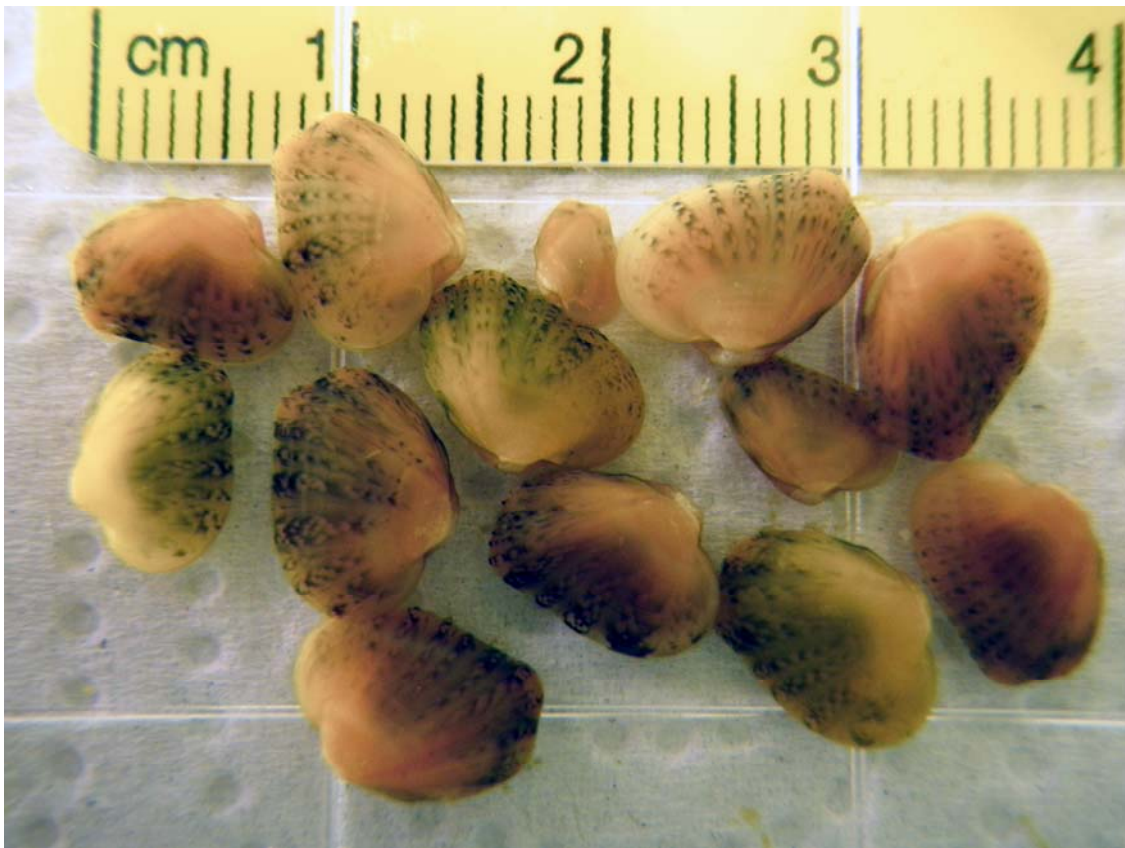
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Parting Shot



These juvenile dromedary pearlymussels (*Dromus dromas*) were raised at the Virginia Department of Game and Inland Fisheries' Aquatic Wildlife Conservation Center (AWCC) in Marion, Virginia. They dropped off their host fish (logperch, *Percina caprodes*) on June 1, 2010, and were almost 19 months old when this picture was taken on January 27, 2012. Their parents live in the Clinch River in Hancock, Tennessee. The present average length of these 13 yearling *D. dromas* living at the AWCC is 8.3 mm. Photograph by Amanda Duncan, AWCC

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.

