



Newsletter of the Freshwater Mollusk Conservation Society
 Volume 13 – Number 2
 June 2011

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President’s Message

Challenges and Goals

I am honored to be President of FMCS and represent such a talented and dedicated group of professionals and students. Past President Greg Cope has left big shoes to fill and I appreciate all of his hard work and accomplishments, as well as that of the Executive Board and Committee Chairs.

As all of us know, conserving freshwater mollusks is a challenging enterprise, particularly in the current economic and political environment. I think one way to accomplish this is by demonstrating to policy makers, managers, and others the important ecosystem services (such as water filtration, nutrient recycling and sequestration, and habitat for other organisms) that are provided by freshwater mollusks. In some cases, we now have the data we need to start putting dollar amounts on the services provided by mollusks. In other cases, more research is needed. Some agencies are already supporting mussel restoration for the purpose of water quality improvement, and this support will directly or indirectly help all freshwater taxa. Danielle Kreeger and Daniel Spooner will be heading up a new ad hoc committee examining these issues and determining what FMCS as a society can do to promote these efforts.

Two of the largest threats facing freshwater mollusks are interrelated changes in environmental flows and climate. Our 2012 workshop, "Environmental Flows, Climate Change and Freshwater Mollusks," will bring together experts on these topics in

Athens, GA next April. We are anticipating a two-day workshop to be held at the Holiday Inn near the University of Georgia campus. More details will be forthcoming.

Other goals I hope to accomplish as President include stewarding a revision of the National Strategy, facilitating more interaction with and between regional mollusk conservation groups, and working towards more graduate student involvement. I am looking forward to seeing our journal, *Walkerana: The Journal of the Freshwater Mollusk Conservation Society*, come out and encourage you to submit your work there.

It is going to be a busy two years. I look forward to working with all of you.

Caryn Vaughn

Society News

Meeting Minutes, FMCS Spring 2011 Board Meeting Seelbach Hilton, Louisville, KY, April 11, 2011

Call to Order - Greg Cope

Attendees:

Greg Cope - President

Caryn Vaughn – President -Elect

Heidi Dunn - Treasurer

Greg Zimmerman – Secretary

Steve Ahlstedt

David Berg

Art Bogan

Tony Brady

Janet Clayton

Kevin Cummings

Catherine Gatenby

Leroy Koch

Chuck Howard

John Jenkinson

Paul Johnson

Rachel Mair

Monte McGregor

Steve McMurray

Emy Monroe

Patty Morrison

Teresa Newton

Andy Roberts

Jeremy Tiemann

Tom Watters

Jim Williams

Call to Order

Motion to approve the minutes of the September 2010 Board meeting in Powder Valley, Missouri made by Paul Johnson, second, Greg Z, motion carried and approved.

Treasurer's Report - Heidi Dunn

2010 net income expenses, 31,000, 34,000 total assets 160K. Possibility of a lifetime membership was discussed ~\$500. Full detailed report was made available (presented on page 5).

Secretary's Report – Greg Zimmerman

Working with Chris Mayer, Heidi Dunn, Sophie Binder, and others to web-enable the new FMCS website, journal, and membership has been quite a task. In particular, trying to get the membership list to sync with the treasurer's records, balancing books, etc. Many duplicates where people forgot their passwords or changed emails, then re-registered. There are limitations with the Wild Apricot software but it seems to be a good value for the price, despite many glitches.

Committee Reports

2011 Symposium - Monte McGregor

214 registered for the conference so far. Committee meetings – 2nd floor Tuesday and Wednesday. Those meeting rooms are available all day long. Poster sessions – next to food, posters up by noon on Tuesday so will be available for judges before session. Cost for the speaker was free, but FMCS should

consider giving an honorarium; speaker will have books for sale. Also, there is a hospitality suite on 9th floor. Thursday schedule – after business meeting is done, main meeting is over. Friday field trips: rivers are very high, some field trips may be cancelled.

Awards Committee – Emy Monroe

16 students applied for student travel, 6-7 awards given. New platform and poster evaluation forms have been developed that are 1 page, less subjective, and based on AFS and others. There will be 4 judges for each presentation.

Outreach

Nothing to report.

Information Exchange

Walkerana – Tom Watters

The journal is ready to go; needs manuscripts. Conservation, systematics, toxicology, freshwater snails, and reproduction. BioOne status? Consensus was to wait until a couple of journal volumes come out before we apply w/ BioOne. To get ISI status we must be publishing for a certain period of time and not be late. PDFs of word files? Kevin Cummings suggested MS Word for ease.

Heidi – institutional rate for larger distribution, access our journal through EBSCO – indexing service would generate revenue. Kevin suggested keeping revenue small to prevent being dropped.

Editorial – AFS model? 3y model for associate editors. Tom says retroactive? (Pause for laughter), a 4y term for associate editors, 8y term for editors was decided. No vote required.

Submissions through website, meeting w/ webmaster Sophie Binder, improve look/feel of website Thursday afternoon after the luncheon.

Back issues? – most printed copies are being held by Kevin. Get rid of them? Fire sale? Scan the old journals. OCR searchable? Kevin to price out OCR scan. #2 may be out of print. Three complete sets for the auction.

Ellipsaria – John Jenkinson

All agreed first online issue looked good. Discussion: Should *Ellipsaria* be in 2-column format? 2 Columns may limit web usability, so go to single column format. Triannual unionid reports are available online along with all back issues of *Ellipsaria*. We will ensure that the new web site links for these were retained and are operational. *Ellipsaria* back issues (very few copies – no full sets) are being transferred to John.

Environmental Quality and Affairs – Steve McMurray

Committee has worked on 7 letters for comment, SMCRA, spectaclecase, sheepnose. We only missed one deadline for comment letters. Ryan Evans is stepping down as co-chair. Commenting on ammonia criteria was a monumental and excellent Society-wide effort. Now will be preparing to comment on Marcellus shale gas drilling and the recent approval by WV to apply the brine solution to roads in winter – by putting it on roads they only have to test for 5 contaminants. Water withdrawals associated with gas drilling are a serious concern for stream flows necessary for survival of mollusks and fish. Working topic for Committee meeting WQ&A. All gave thanks to Ryan for his service.

Gastropod Status and Distribution - Paul Johnson

AFS will put the gastropod list up on their website. There is a need for someone young and computer-savvy to take up the cause.

Mussel Status and Distribution -- Art Bogan

Mussel ID App for iPhone / computers. Exploring a computer-aided key for mussels which can be exported as an external file. First need is a list of unionid taxa by state, then use 3-15 characters that define each species. The key will have internal and external characters and figures. Another need will be good photos. Kevin C. and J. Williams noted to be careful of auto-georeferencing features. Many points are inaccurate.

Genetics – David Berg

Working on “best practice” one page technical papers: one on type specimens in review, one on voucher

specimens in planning. Heidi: Could we post something on web site for swabbing materials for genetic analysis? Art/Steve A. But also need voucher specimen. There are some sequences on GenBank that are NOT unionids and, without the voucher specimen (in addition to a swab), you cannot check for accuracy.

Guideline and Techniques – Janet Clayton and Chuck Howard

Both Chuck and Janet are stepping down this year; nominations for a new chair will be requested at the committee meeting. Past mussel surveyor certification efforts were unsuccessful largely due to legal issues. Hard for FMCS to grasp without money and staff / legal support. Issue should come from local/regional level and be education-based. During workshops in off years, the local FMCS groups should be emphasized.

Jim Williams and Art Bogan to come up w/ standardization of photographing shells, possibly to be published in Walkerana. Art says there is a definition of each structure, paleontology, Linnaean classification to tribal level.

Propagation / Restoration – Rachel Mair

Committee is working on developing online database for mussel translocations. Greg Z. said to keep it as simple as uploading a file for now until more advanced system can be implemented – but make FMCS the clearinghouse for translocation records. Apparently a system was designed in the past that was never implemented that may be suitable. Also, committee is still working on the list of mussel and snail propagation labs and the species they have worked with so that this can be posted to the new web site.

New/Continuing Business

Standing Symposium Committee

In the past, the committee has been ephemeral; staffed for each specific event and then disappears, leaving next group in the dark. We should move to a more continuous operation. Chair of symposium committee will be President-Elect; local symposium chairs will always serve on following committee, and EXCOM members will all serve on this committee.

Procedures Manual

Greg Cope has drafted up a FMCS procedures manual, which all agreed was badly needed. This manual will document existing practices, cover what dates things are due by, new members, etc. and get it posted on the web. Steve McMurray agreed to assist with this effort.

2012 Workshop

Timing – spring would be better for everyone as opposed to fall, as in last year. Potential Topics: Catherine Gatenby/Rachael Muir – mussel and environmental flows/climate change; Rebecca Winteringer – mussel ID joint meeting w/ NABS at upcoming Louisville meeting. U. of Georgia meeting on environmental flows / climate change is likely. WQ on health of mollusks and researchers? Altering flows / climate change? Caryn Vaughn to look into it. Will look at meeting that includes altering flows.

2013 Symposium

Guntersville State Park, Paul Johnson. Members can fly into Huntsville, AL. Shuttles can be provided for fly-ins. It was noted that Triannual AFS – fish culture meeting was held there March 29-April 1. Paul will present a teaser for the Guntersville State Park meeting during the business meeting.

FMCS Teaming with Regional Mollusk Meetings?

Many regional mussel meetings are happening but not getting tied in with FMCS. We would like to bring these groups into FMCS and try to offer incentives. Establish an ad-hoc committee for FMCS state representation. How many individual groups are meeting out there? Should one of the organizers always be an FMCS member? Offer the groups ~\$100 to sponsor food/beverages in return for a 1-page report in Ellipsaria?

Action item / Ad hoc committee – regional workshop vs. national

FMCS Facebook page

An FMCS Facebook page has been established. Right now only a few people can edit to prevent spam but we are working on getting more information up on the web. (see article on page 10)

AFS Mollusk Valuation

Southwick Associates Book update – Are values too low? Need more guidance for costs / mussels. What about AFS? It is codified into many states. Also need values for lost functional, economic values.

Committees

We need to make committee chairs/co-chairs more active and give them a way to communicate with each other via the website. Wild Apricot can do this to some extent but the risk of too many administrators may not be a good idea for web integrity.

National Strategy

FMCS needs to get people together around this topic – 1-day workshop was suggested. This needs a leader, possibly a good charge for the new committee chair. Emerging contaminants and other new threats need to be incorporated into revised version. Possibly refocus on this issue after a fall board meeting?

Midwest Fish and Wildlife Conference <http://www.midwest2011.org/>

Scott Gretich - Iowa / Jeremy Tiemann – noted 9 of 12 states that represent the Midwest will be there. URMCC gave sponsorship and contributed some money for speakers to get there. Steve Ahlstedt proposed giving \$1000 to conference to support FMCS members presenting and participating in the special mollusk symposium, motion carried.

US FWS Landscape Conservation Cooperative -- Catherine Gatenby

Identify science needs for resources at the landscape level. Should the Tennessee / Cumberland be divided up or not? Catherine drafted up a letter to be reviewed and potentially signed by the new FMCS President — will be evaluated by the Environmental Quality and Affairs Committee.

Motion to adjourn by Steve McMurray 2nd by Heidi Dunn

Treasurers Report

Heidi Dunn

In 2010, income was primarily from memberships and the 2010 workshop. Due to sponsorship, the workshop netted \$4597.29. Memberships were changed from a one year to two year format; however, it will likely take a few years to get everyone on the same schedule. A few people also registered for the 2011 symposium in 2010. Other income included interest (\$407.82) and miscellaneous sales of hats, t-shirts, and items left over from previous workshops and symposia (\$130.00). A few volumes of archived Walkerana were also sold. Total 2010 income \$34,140.32

2010 expenses included costs for the workshop (\$15575.21), webpage (\$2237.79), newsletters (\$6347.32), credit card/paypal fees (\$1453.54), donation to Frieda Schilling memorial (\$100), bank charges (\$7), costs for set up of Walkerana (\$5250), and annual registration fee (\$40). Total 2010 expenses \$31,010.86 Net income for 2010 \$3,129.46

Thus far in 2011, income has primarily been from memberships (\$17,115) and symposium registration (\$68,865). Other income is from interest (\$70.21), rewards on our check card (\$43.42), and a donation for 2010 workshop that came in late (\$500). Total income to date for 2011 \$86,643.63

Expenses include shipping a few items (\$4.75), webpage expenses (\$2835.97), credit card and paypal fees (\$1636.60). We also received some money back on our credit card account (-\$22.80). Total expenses to date for 2011 \$4,454.52. Net income to date \$82,189.11. However, no expenses for symposium have been paid yet.

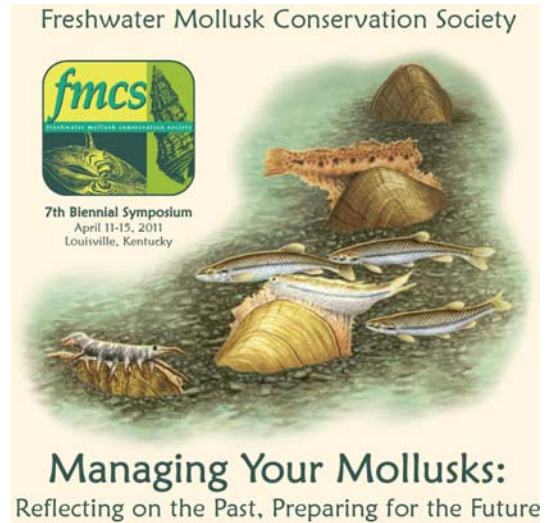
Total assets to date = \$167,833.78. Profit loss reports and a balance sheet are available.

Web page membership and conference registration is now operating. There were some glitches that have been fixed. We continue to find ways to make errors, and are dealing with them as best we can.

Louisville Meeting Statistics

In spite of a potential shutdown of the Federal government (which was avoided at the last minute), the 7th Biennial Symposium of the Freshwater Mollusk Conservation Society was held as planned from April 11 – 15 at the Seelbach Hilton Louisville in Louisville, Kentucky. The meeting was attended by 233 participants who saw 50 posters and 92 platform presentations. About half of the attendees (119) were returning regular members; the rest were students and new members. Although not all the financial details are settled as of yet, the society gained about \$2,000 (not including the proceeds from the auction) above the costs of this meeting.

This year's coordinators (Leroy Koch and Monte McGregor) would like to thank all of the volunteers for helping at the meeting. Suggestions for improving future meetings should be directed to Patricia Morrison, Chairman of the Symposium Committee.



General Meeting Minutes Seelbach Hilton, Louisville, KY, April 14, 2011

President Greg Cope welcomed all members to the Business Meeting and reviewed the many activities that FMCS has conducted over the past two years. Greg Cope also introduced Sophie Binder as the new webmaster for FMCS. Heidi Dunn presented a summary of the Treasurer's report, and Monte McGregor presented an overview on the Kentucky symposium. President Cope then presided over a vote on the three changes to the FMCS by-laws that were described in the December 2010 issue of *Ellipsaria*. The motion to approve those changes was passed by the membership. Leroy Koch announced that Patricia Morrison had been elected President Elect, and that Heidi Dunn (Treasurer) and Greg Zimmerman (Secretary) had been re-elected.

The Awards Committee announced the recipients of the student travel awards, presented awards for outstanding student platform and poster presentations, and introduced the presenters for three professional awards (see Awards Committee article on page 7). Former Present Steve Ahlstedt received an award from the U.S. Fish and Wildlife Service (see article on page 9).

Paul Johnson presented an overview of the facilities at Guntersville State Park in northern Alabama, where our 2013 Symposium will be held.

President Cope then passed the horns of power to Caryn Vaughn, the new FMCS President. President Vaughn thanked Past President Cope for his service and previewed her goals for the next two years (see Presidents Message, on page 1). She also indicated that the 2012 Workshop will be held in Athens Georgia, where the focus on environmental flows and climate change (see Upcoming Meetings entry on page 12). Finally, outgoing President Cope received a special gift of Kentucky Bourbon for his work as FMCS President.



Incoming FMCS President Caryn Vaughn (L) receives the "Horns of Office" from Past President Greg Cope (R)

Members Recognized with Awards at the 2011 Symposium

Submitted by Teresa Newton, Emy Monroe, and Greg Cope

Student Travel Awards

The Awards committee announced and solicited applications for student travel awards to assist students in attending the biennial symposium. Similar to 2009, travel awards were made in the form of pre-paid rooms at the symposium hotel. A total of 16 students applied for travel awards and, based on the allotted funds for all awards from the society and the cost of rooms, 7 student awards were presented. The following students were selected: Dan Allen (University of Oklahoma), Wesley Daniel (Louisiana State University), Andrew Gascho Landis (Auburn University), Renae Greiner (North Carolina State University), Kentaro Inoue (Miami University), Philip Mathias (Central Michigan University), and Nathan Whelan (University of Alabama Tuscaloosa).

Best Student Platform and Poster Awards

A total of 36 student presentations required judging at the 2011 symposium (19 platform and 17 poster). Each student was judged by 4 separate judges, which meant that 38 FMCS members volunteered to get the job done! The awards committee thanks every member who helped us judge student presentations; we could not present these awards without you.

The best platform paper award went to Renae Greiner of North Carolina State University (co-authors J. Levine, C. Osborne, T. Kwak, A. Bogan, and D. Buchwalter) for her talk entitled, "Shredding insects' potential contribution to freshwater mussel nutrition". The honorable mention platform award went to Wesley Daniel of Louisiana State University (co-authors K. M. Brown, M. Kaller, and W. Kelso) for his talk entitled, "Modeling the distribution and diversity of southeast Louisiana freshwater mussels".



Renae Greiner (L) receiving her Best Student Platform Award from Emy Monroe.



The best poster award went to Megan Bradley (L) of Missouri State (co-authors M. C. Barnhart, B. R. Bosman, and A. L. Cravens) for her poster entitled, "Innovations in the propagation of freshwater mussels (Unionidae)." The honorable mention poster award went to Kentaro Inoue, Arkansas State University (co-authors D. M. Hayes, J. L. Harris, and A. D. Christian) for his poster entitled, "Phylogenetic and morphometric analyses reveal phenotypic plasticity in freshwater mussels: synonymy of *Villosa arkansasensis* and *Obovaria jacksoniana*". Congratulations to all the fine student presentations at this year's symposium!

The awards committee noted several students presented more than one platform paper or poster at this symposium, which is great to see, but adds to the judging burden for members. In the future, we will request that students select only one presentation for judging at the meeting when they submit their abstracts. In addition, the presentation selected by the students should be on original or new research they are conducting as an independent undergraduate project or for a graduate degree.

The new judging forms implemented for the 2011 symposium were helpful to the Awards committee when it was time to determine the recipients. However, the Awards committee will be soliciting feedback on the new forms from judges participating in both 2009 and 2011.

Professional Awards

The Awards committee solicited nominations and applications from the membership for professional awards to be presented at the biennial symposium. We received one nomination for the Meritorious Service Award and two nominations for Lifetime Achievement Awards. At the 2011 FMCS Symposium in Louisville, Rita Vilella Bumgardner was presented with the Meritorious Service Award for her diligent efforts on behalf of the Society. Drs. Chris Barnhart and Jim Williams were each presented with Lifetime Achievement awards for over 20 years of dedicated service to the conservation of freshwater mollusks.

Rita Vilella Bumgardner served as an officer on the FMCS board of directors from 1998 to 2005. She was elected secretary in 1999 and re-elected several times, serving FMCS officially until 2005. As a board member and an elected officer, she was involved in drafting, reviewing, and revising the constitution and bylaws, setting membership dues, establish membership categories, and disseminating a record of the meeting minutes to the membership. She was an active member of the Techniques and Guidelines Committee. She served on the technical advisory committee that reviewed the manual on mussel valuation that was published as a special publication of the AFS in 2003. Rita actively participated in developing the National Strategy for Conservation of Freshwater Mussels and co-sponsored a 2002 workshop held at the FWS National Conservation Training Center.



Rita Vilella Bumgardner (C) receives her Meritorious Service Award from Heidi Dunn (L) and Janet Clayton (R).

Dr. Jim Williams has worked at the forefront of aquatic conservation for over 40 years and spent much of his career as a Biologist with the U.S. Geological Survey in Gainesville, Florida. He has made seminal contributions on the life history, taxonomy, biogeography, and conservation of both North American freshwater fishes and mussels. He has authored or co-authored over 80 research publications and co-authored or edited 10 books. Early in his career, he listed and described critical habitat for over 30 species. He also published multiple descriptions of both native fishes (16 species) and mussels (3 species). He worked with the American Fisheries Society (AFS) to complete the first ever Conservation Status Assessment of North American freshwater mussels. Dr. Williams initiated

conversations with the AFS to publish the nomenclature for native mussels as part of a committee for The Scientific and Common Names of Aquatic Invertebrates of the US and Canada. More recently, he spearheaded a 25-year effort and, with Dr. Art Bogan and Jeff Garner, wrote the "*Freshwater Mussels of Alabama and the Mobile Basin*" — a comprehensive study of this region's mussel fauna. The recently retired Dr. Williams is currently rumored to be working on a project to document Florida's freshwater mussel diversity!!



Jim Williams (C) was presented his Lifetime Achievement Award by (L to R) Nate Johnson, Jeff Garner, Art Bogan, Bob Butler, and Paul Johnson.



Chris Barnhart at the Baltimore Meeting in 2009 (because he wasn't able to come to Louisville)

Since 1991, Dr. Chris Barnhart has been a Professor of Biology at Missouri State University, where he has passionately and tirelessly pursued research on the life history, ecology, physiology, and propagation of freshwater mussels. He is nationally known for his contribution to the conservation of freshwater mussels and has collaborated with many different wildlife agencies, universities, and research centers over the years. He has authored or co-authored over 70 papers and technical reports. He is perhaps best known to FMCS members for his efforts to develop propagation and rearing methods for early life stages and for documenting amazing reproductive behaviors for dozens of species. Culture techniques pioneered by Dr. Barnhart are now being used at numerous hatcheries and universities across the U.S. These techniques have revolutionized mussel culture and have made artificial propagation a viable recovery option for many species. In addition, his outstanding pictures and digital film clips of rarely seen mussel behavior and lure displays have caught the attention of many members of the general public.

FMCS Auction – Many Thanks for Making it a Big Success!

The 2011 auction was a great success; we earned \$4,826 for student awards! Thanks to ALL for your generous donations, and for purchasing auction items and raffle tickets! We had an amazing assortment of items, ranging from classic mollusk literature to art, photography, jewelry, food and drink, 'one of a kind' items, and, of course, the slug, and the baby doll head monument!

A SUPER big thanks to Steve Ahlstedt, *auctioneer extraordinaire*, and others who helped make it happen: Teresa Newton, Kevin Roe, Lisie Kitchel, Heidi Dunn, and all the folks who sold tickets and schlepped items.

We will be needing more of the same for the meeting at Gunterville, so start thinking now of what you would like to make or donate, and keep an eye out for those 'rare and unusual' finds.

Once again THANKS to everyone, without you it would not be possible, and the students would not receive the financial assistance they so very much appreciate! - *the Auction Team*

Ahlstedt Receives U.S. Fish and Wildlife Service Award

At the 2011 FMCS Symposium, Steve Ahlstedt (Left in picture) was presented with the National Cross-Regional Recovery Champion Award by Regions 4 and 5 of the U.S. Fish and Wildlife Service. Stephanie Chance (C) and Roberta Hylton (R) presented the award to Steve for his efforts in promoting freshwater mollusk recovery. Over the past 30 years, Steve has assisted with mollusk recovery efforts in at least nine Eastern US states and has written Recovery Plans for 14 federally listed mussel species. These projects have involved the coordination of several non-governmental, state, and



federal agencies, including: The Nature Conservancy, Virginia Polytechnic Institute and State University, Alabama Department of Conservation and Natural Resources, Kentucky Department of Fish and Wildlife Resources, Tennessee Wildlife Resources Agency, Virginia Department of Game and Inland Fisheries, National Park Service, Office of Surface Mining Reclamation and Enforcement, Tennessee Valley Authority, and U.S. Fish and Wildlife Service.

One of Steve's greatest strengths is his ability to tell a good story and raise public awareness for freshwater mussels. He has been a strong "voice" for both the mussel fauna and the rivers they call home. His leadership and outgoing personality have made all who meet him a friend of mussels; and he has encouraged and guided many others in their work to conserve and protect these unique natural resources.

Meeting Photographs

All of the photographs of the Louisville Meeting included in this issue of *Ellipsaria* were taken by Mark Hove, Macalester College. This year, as in the past, Mark's pictures have captured the faces and feelings of our members as we work together and celebrate. Thanks, once again, Mark !

Announcements

FMCS Website

We're in the process of updating and improving the FMCS website following lots of input at the Louisville meeting. We welcome new ideas and material to keep both the mollusk and society stories moving forward. If you have anything you'd like to include on the website, or you find any broken links please send the information to Megan Bradley, mebrad11@vt.edu, or Andy Roberts, Andy_Roberts@fws.gov.

Triannual Unionid Report Now Available Online

The Triannual Unionid Report (TUR), compiled by Dick Biggins in the Asheville Field Office, U.S. Fish and Wildlife Service, included a total of 19 issues that were published from May 1993 through March 2000. It served to ". . . expedite the exchange of information . . . [about] unionid conservation . . ." by distributing sets of submitted articles three times a year to interested mussel biologists and others. In many ways, this very informal newsletter helped draw together the variety of people interested in understanding and protecting freshwater mollusks, and who would form the FMCS (in 1998). Once the Society was up and publishing *Ellipsaria*, Dick stopped distributing the TUR and encouraged all former contributors to start submitting their input to this newsletter.

Regardless of the informal and unedited format, the issues of TUR contain useful information and data, some of which has been cited in peer-reviewed publications. For this reason, FMCS has made PDF versions of all 19 issues of TUR available on the *Ellipsaria* page of our web site. The specific address for the TUR material is: http://molluskconservation.org/MServices_TUnionidreport.html.

Follow FMCS on Facebook!

FMCS has a Facebook page (search for "Freshwater Mollusk Conservation Society") to increase our communication and web presence. Check us out and "Like" our page!

If you are not yet receiving posts from Freshwater Mollusk Conservation Society in your News Feed, it is probably due to the News Feed settings of your page.

To add Freshwater Mollusk Conservation Society to your News Feed:

1. When you are on your Most Recent News Feed view, click “Most Recent” to expand a drop-down menu.
2. Select “Edit Options”.
3. A list of your people, Pages, and apps will appear in a pop-up box. Click “x” next to each one you would like to remove from the list. Removing a profile from your “Hidden” list means that posts from that person or Page can appear in your News Feed.
4. Click “Save”.

Input Needed for the Host-Mussel Database at The Ohio State University

For over nine years (and over 9,000 hits later), the host-mussel database at Ohio State has filled a resource need to the freshwater malacological community. But it's time for a make-over and we need your help. Under the excuse of “I can't be everywhere,” some references are being missed. If you know of published host-mussel associations that are not in the OSU database, please send them along and they will be included. Send at least the full citation and we'll track it down. Authors who have published associations are asked to notify us as well. Finally, let us know what else you would like to see on the database.

G. Thomas Watters Watters.1@osu.edu <http://www.biosci.ohio-state.edu/~molluscs/OSUM2/>

Recent Publications

- Crail, T.D., R.A. Krebs, and D.T. Zanatta. 2011. Unionid mussels from nearshore zones of Lake Erie. *Journal of Great Lakes Research*. 37:199-202.
- Galbraith, H.S., K.M. Wozney, C.M. Smith, D.T. Zanatta, and C.C. Wilson. 2011. Characterization of microsatellite loci in the freshwater mussel *Lasmigona costata* (Bivalvia: Unionoida). *Conservation Genetics Resources*. 3: 9-11.
- Schwalb, A. N., M. S. Poos, and J. D. Ackerman. 2011. Movement of logperch: Implications for dispersal of endangered snuffbox mussels via its obligate host fish. *Aquatic Sciences* 73: 223-231.
- Schwalb, A. N., M. S. Poos, K. Cottenie, and J. D. Ackerman. 2011. Dispersal limitation of unionid mussels and implications for their conservation. *Freshwater Biology*. DOI: 10.1111/j.1365-2427.2011.02587.x
- Zanatta, D.T. and C.C. Wilson. 2011. Testing congruency of geographic and genetic population structure for a freshwater mussel (Bivalvia: Unionoida) and its host fish. *Biological Journal of the Linnean Society*. 102:669-685.
- Zanatta, D.T. and D.A. Woolnough. 2011. Confirmation of *Obovaria olivaria*, Hickorynut mussels (Bivalvia: Unionidae), in the Mississagi River, Ontario Canada. *Northeastern Naturalist*. 18(1):1-6.
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Upcoming Meetings

July 23 – 28, 2011 – Annual Meeting, American Malacological Society, Duquesne University, Pittsburgh, PA, USA
<http://www.malacological.org/meetings>

November 13 – 17, 2011 – 32nd North American Annual Meeting, Society of Environmental Toxicology and Chemistry (SETAC) Hynes Convention Center, Boston, MA, USA. Theme: *Navigating Environmental Challenges: Historical Lessons Guiding Future Directions* <http://boston.setac.org/>

November 28 – December 2, 2011 – International Congress for Conservation Biology, Christchurch NZ Theme: *Engaging Society in Conservation*. <http://www.conbio.org/Activities/Meetings/2011/index>

April 2012 -- FMCS Workshop Holiday Inn, Athens Georgia Theme: "*Environmental Flows, Climate Change and Freshwater Mollusks*"

May 20 – 26, 2012 -- North American Benthological Society Annual Meeting, Marriott Louisville Downtown, Louisville, Kentucky Theme: [to be determined] <http://www.benthos.org/Annual-Meeting/Future-Meetings.aspx>

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 only minimal editing. The opinions expressed are those of the authors.

2011 Interior Highlands Mollusk Conservation Meeting

Submitted by Steve McMurray, Missouri Department of Conservation

On March 2 – 3, 2011, 58 people attended the Interior Highlands Mollusk Conservation Meeting. The meeting was held at the U.S. Fish and Wildlife Service's Neosho National Fish Hatchery in Neosho, Missouri, and was hosted by the U.S. Fish and Wildlife Service and the Missouri Department of Conservation. Most attendees were from Interior Highlands states (AR, KS, MO, OK), but a few travelled from as far away as North Carolina and Iowa to attend. In addition to the 16 papers that were presented, attendees were given a tour of Neosho National Fish Hatchery by David Hendrix, Hatchery Manager. The hatchery's volunteer group even provided us with food during our breaks. It was decided to continue the meetings, with the 2012 meeting to be held in Arkansas. The group will also begin using an existing website for announcements and other items of interest::

<http://unionid.missouristate.edu/IHMCC> .



Attendees of the 2011 Interior Highlands Mollusk Conservation Meeting in front of the new Visitors Center at Neosho National Fish Hatchery

Abstracts from the 2011 Interior Highlands Meeting

HISTORICAL CHANGES IN THE OCCURRENCE AND DISTRIBUTION OF FRESHWATER MUSSELS IN KANSAS

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The surface waters of eastern and central Kansas once supported an impressive variety of native freshwater mussels, but a widespread decline in species richness accompanied the urban, industrial, and agricultural development of this region. Statewide mussel surveys implemented during the past two decades have shed new light on the scope and severity of this decline. Of the 48 mussel species originally known from Kansas, six are now extirpated, one lacks reproductively viable populations (i.e., faces imminent extirpation), and 38 others have suffered evident range regressions or a widespread thinning of former populations. Soil erosion and stream siltation, other forms of water and sediment pollution, physical habitat degradation, stream flow attenuation, and declines in the native fishes serving as biological hosts for larval mussels all have contributed to these changes. Dams and other impediments to fish migration now hinder the reestablishment of mussel colonies following prolonged droughts and catastrophic water pollution events. Some mussel populations in this region display unique morphological, developmental, and genetic attributes, implying their continued attrition may lead to the eventual loss of distinctive forms or subspecies.

CONSERVATION AND MANAGEMENT OF MUSSELS IN MISSOURI

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With over 45% of the fauna considered Species of Conservation Concern, native freshwater mussels rank 2nd only to crayfish as the most endangered faunal group in the state. Threats to freshwater mussels in Missouri include loss of habitat due to the construction of dams and other alterations of natural waterways, decreases in water quality, and invasive species. The *Missouri Mussel Conservation and Management Plan*, completed in April 2008, described four goals for the conservation of mussels in Missouri: 1) Implement the conservation and management actions necessary to restore, protect, and use Missouri's mussel fauna; 2) Evaluate conservation actions through integrated monitoring of the status, distribution, diversity, and fitness of Missouri's mussels, and relevant aspects of habitat and water quality; 3) Increase awareness of conservation needs for Missouri's mussel fauna; and 4) Advance our knowledge of mussel biology and ecology through research. There are a number of conservation initiatives underway in Missouri, including faunal surveys to document species distributions, research into artificial propagation methods, population genetics research, research into the effects of hydropower facilities and heavy metal contamination, ecotoxicological research to document the effects of contaminants on the various life stages of freshwater mussels and provide for more stringent water quality criteria, and working with private landowners to protect mussel habitats. Current research and management efforts in Missouri will be highlighted.

UNIONOIDA (MOLLUSCA: MARGARITIFERIDAE, UNIONIDAE) IN ARKANSAS, THIRD STATUS REVIEW

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We analyzed stream inventories, phylogeographic studies, community and population estimates, life history and reproductive biology research, and suitable habitat investigations conducted from 1997-2008, as well as the Arkansas Natural Heritage Commission mussel database, to update the conservation status for all native freshwater unionoid bivalves thought to occur in Arkansas. Prior to this study, Harris et al. (1997) reviewed the distribution and status of 75 freshwater mussel species considered native to Arkansas and ranked 22 species as endangered, threatened or special concern. We now recognize 85 mussel taxa in Arkansas; however, some of those have yet to be described or their nomenclature remains in a state of flux. The previous inclusion of *Fusconaia subrotunda* (Lea 1831) and *Obovaria subrotunda* (Rafinesque 1820) in the Arkansas native mussel fauna was based on misidentifications. Within the Arkansas mussel fauna, 19 species (22%) are now considered Endangered, 5 species (6%) are ranked as Threatened, 20 species (24%) are of Special Concern, and unfortunately, 1 species has probably been extirpated.

TESTING EFFECTS OF AGE ON LARVAL VIABILITY, METAMORPHOSIS, AND JUVENILE CONDITION IN FRESHWATER MUSSELS

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Freshwater mussels are the most threatened animals in the US. Seventy species are federally endangered. We are propagating mussels for population restoration and for toxicology research. Mussel larvae are brooded for months within the female, and then are briefly parasitic on fish where they metamorphose to the juvenile stage. One important question is whether older larvae and juveniles that develop from older larvae are as healthy as younger larvae and juveniles. We tested old and young larvae of mussels by placing them on host fish, recovering the juveniles, and then observing duration of survival of juveniles. We inoculated 36 largemouth bass with larvae from six females. Three females had 5-mo old larvae, and three had 18-mo old larvae. We determined the proportion of attached larvae that metamorphosed, and then observed the survival of juveniles during starvation, as a measure of their condition. Older larvae were equally able to attach to the host, but were significantly less likely to successfully metamorphose ($p=0.016$, T-test). The time to 50% mortality (LT50) of starved juveniles was 25.5 days and was similar for juveniles from old and young larvae. These data suggest that older larvae are suitable for propagation and toxicology research.

INCREASE OF UNIONID MUSSEL POPULATIONS IN THE VERDIGRIS RIVER, KANSAS, FROM 1991 TO 2010

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Periodic quantitative surveys to monitor populations of freshwater mussels (Unionidae) were conducted at eight sites in the Verdigris River, KS during 1991, 1997, 2003 and 2009-2010. Over 14,000 mussels were sampled in these surveys. Twenty-two species were collected, including several on the Kansas rare-species lists. Overall mussel abundance increased from 1991-2003, then stabilized from 2003-2010. Abundance of nine species (*Cyprogenia aberti*, *Fusconaia flava*, *Pleurobema sintoxia*, *Ptychobranchnus occidentalis*, *Quadrula metanevra*, *Quadrula nodulata*, *Quadrula pustulosa*, *Tritogonia verrucosa*, and *Truncilla donaciformis*) increased significantly. This positive trend in unionid abundance could be due to various factors that have improved habitat quality of this reach of river. This improvement in habitat quality, coupled with low spring/summer flows, allowed a dramatic population increase that appears to have peaked for several species in 2003.

AN ASSESSMENT OF FRESHWATER MUSSEL POPULATIONS AND HEAVY METAL SEDIMENT CONTAMINATION IN THE LEAD MINING-IMPACTED BIG RIVER, MISSOURI

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An assessment was conducted to determine the downstream extent of heavy metal contamination of sediment; to determine distribution, diversity, and abundance of freshwater mussels; and to evaluate the relationship between heavy metal concentrations in sediment and mussel community characteristics in the lead mining-impacted Big River, Missouri. Sediments exceeded Probable Effects Concentrations for over 180 river km downstream of mining for Pb, and for approximately 80 km downstream of mining for Zn and Cd. Mussel species richness and CPUE and mussel sediment toxicity data showed broad-based negative associations with metals in sediments. Species richness was also significantly lower at sites below mining areas compared to past data. Further, mean mussel densities at 6 sites downstream of mining areas ranged from 0 to 0.4 individuals/m², significantly lower ($p < 0.0001$) than average densities at 2 reference sites (1.9 and 9.1 individuals/m²). These mussel community data indicate that mussel populations in a reach extending 159 km downstream from mining inputs are impacted from heavy metal contaminated sediment in the Big River.

RESIDUAL EFFECTS OF LEAD AND ZINC MINING ON FRESHWATER MUSSELS IN THE SPRING RIVER BASIN

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This study evaluated the lingering effects of historical Pb and Zn mining operations on freshwater mussels in the Spring River Basin (Kansas, Missouri, and Oklahoma, USA). Visual/tactile mussel surveys were performed in 23 stream reaches distributed throughout the basin and above and below former mining sites. Quantitative surveys were conducted in the Spring River at one upstream reference location and one downstream location. Concentrations of selected metals in the soft tissues of mussels and Asian clams (*Corbicula fluminea*) were evaluated at most survey sites. Additional metal analyses were performed on fluvial sediment samples and on surface water samples obtained during base flow and peak flow synoptic surveys.

Sites on the Spring River immediately upstream of heavily mined areas supported at least 21–25 species of mussels, whereas sites near the lower terminus of the river yielded evidence of 6–8 extant species. Between the upper and lower quantitative survey sites, mean mussel and clam densities declined by 88% and 97%, respectively. Tributary reaches below heavily mined areas lacked evident bivalve communities and contained concentrations of Cd, Pb, and Zn that continually or sporadically exceeded hardness-dependent water quality criteria and consensus-based sediment quality guidelines. In less contaminated stream reaches supporting bivalves, concentrations of Cd, Pb, and Zn in mussels and clams were correlated spatially with the concentrations of these metals occurring in fluvial sediment ($0.50 \leq \tau \leq 0.64$, $p \leq 0.03$). In non-headwater perennial stream reaches, sediment Cd, Pb, and Zn levels also were related inversely to mussel taxa richness ($-0.80 \leq \tau \leq -0.64$, $p \leq 0.004$).

Overall, streams draining heavily mined areas exhibited depauperate (or fully extirpated) mussel assemblages and correspondingly elevated concentrations of Cd, Pb, and Zn in water, sediment, and bivalve tissue. Other measured environmental chemistry parameters, and physical habitat conditions evaluated at the stream reach scale, demonstrated little general relationship to the degraded status of these assemblages. We conclude that pollution attributable to former mining operations continues to adversely influence environmental quality and impede the recovery of mussel communities in a large portion of the Spring River Basin.

EVALUATION OF MUSSEL SENSITIVITY TO METALS OR AMMONIA IN WATER OR SEDIMENT TOXICITY TESTS

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Methods have been established by the American Society for Testing and Materials (ASTM) for conducting water-only toxicity tests with early life stages of freshwater mussels. Results of our acute (4-d) and chronic (28-d) toxicity tests conducted following these methods demonstrated that a variety of species of mussels were relatively sensitive to ammonia and metals including copper, cadmium, zinc, and lead compared to other freshwater organisms, and current US Environmental Protection Agency (USEPA) ambient water quality criteria for ammonia, copper, or zinc may not be adequately protective of mussels. The ASTM and USEPA have also established methods for conducting whole-sediment toxicity tests with a variety of freshwater organisms including amphipods, midge, mayflies, and oligochaetes. However, limited studies have evaluated the bioavailability of contaminants in whole-sediment samples to mussels. The ASTM and USEPA methods were adapted by our laboratory to conduct whole-sediment toxicity tests starting with about 2-month-old mussels. Results of 28-d exposures of mussel to field-collected sediments contaminated with metals, polycyclic aromatic hydrocarbons, or polychlorinated biphenyls indicate that mussels were typically equally or more sensitive compared to other commonly tested species such as the amphipod *Hyalella azteca* and the midge *Chironomus dilutus*. Moreover, strong concordance has been observed between our laboratory sediment toxicity tests conducted with mussels and results of field surveys of mussels from contaminated sites. Hence, including mussels in the assessment of the bioavailability of contaminants in water or in sediment provides complementary toxicity information relative to more commonly tested species.

MUSSEL RESTORATION IN THE LOWER OSAGE RIVER

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The Lower Osage River Protection and Enhancement Program was established by AmerenUE, the Missouri Department of Conservation, and the U.S. Fish and Wildlife Service as part of a Settlement Agreement filed with the Federal Energy Regulatory Commission. This agreement was written into AmerenUE's new project license issued by FERC in 2007, for the operation of Bagnell Dam. New license articles included major enhancements for the lower Osage River including improved minimum flows, dissolved oxygen, flow ramp-down rates, fish protection measures at the dam, fish propagation funding, erosion control and mussel propagation / monitoring and habitat restoration to occur within the 80 miles below Bagnell Dam (Lake of the Ozarks). The LORPEP is to continue to implement adaptive management actions to improve aquatic habitat, protect and enhance aquatic resources, and reduce adverse affects of project operation and historical elements specifically to the federally endangered Pink Mucket (*Lampsilis abrupta*) and Scaleshell (*Leptodea leptodon*) mussels in the lower Osage River.

GENETIC ANALYSIS OF THE FEDERALLY ENDANGERED WINGED MAPLELEAF MUSSEL TO AID PROPOSED RE-INTRODUCTION EFFORTS.

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The winged mapleleaf, *Quadrula fragosa*, historically occurred in the Mississippi, Tennessee, Ohio, and Cumberland river drainages, but has suffered severe population and range reductions. When the species was federally listed as endangered, its range was thought to have been reduced to a stretch of the St. Croix River between northwestern Wisconsin and east-central Minnesota. Recently, additional *Q. fragosa* populations were discovered at sites in Arkansas, Missouri, and Oklahoma. Subsequently, a plan was proposed to re-introduce *Q. fragosa* into portions of its historic range through propagation efforts using the St. Croix *Q. fragosa* as the source population. Genetic analysis of the St. Croix River *Q. fragosa* was undertaken to better establish the genetic diversity of this population. Fifty-two samples were collected using a non-destructive method for DNA extraction, and were screened for 20 microsatellite loci. Various population parameters were estimated from the genotypic data including effective population size and relatedness between sampled individuals.

LONGITUDINAL PROFILE OF AMMONIA CONCENTRATIONS IN PARAFLUVIAL FLOW ON THE BUFFALO NATIONAL RIVER

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Freshwater mussels are of conservation concern in the Buffalo National River. Mussels live imbedded in river sediment and are known to be highly sensitive to ammonia, a common water pollutant that results from both natural and man-made influences. During the summer of 2010, water samples were collected from two sites,

Saunders' Field, and Cedar Creek. At both sites, four samples were collected from a longitudinal path through the gravel bar and a fifth was collected from the surface water just below the gravel bar. Samples were collected by driving a hollow 12 inch pipe into the gravel bar and drawing the water into a syringe to prevent diffusion of unionized ammonia into the atmosphere. At Saunders' Field, which is located near the middle of the river, the mean concentration of total ammonia were 0.173, 0.484, 0.752, 0.276, 0.127 mg/L for samples 1, 2, 3, 4, and Surface, respectively. Likewise, the mean unionized ammonia concentrations for the five locations moving downstream were 0.007, 0.014, 0.018, 0.009, and 0.002 mg/L, respectively. At Cedar Creek, the last access point before the Lower Wilderness, the mean total ammonia concentrations were 0.183, 0.313, 0.853, 0.670, and 0.218 mg/L for samples 1, 2, 3, 4, and Surface, respectively. The equivalent unionized ammonia concentrations were 0.029, 0.011, 0.019, 0.020, and 0.003 mg/L moving downstream. Concentrations in the gravel bar exceed Water Quality Criterion for total ammonia for chronic exposure, however, once the water from the parafluvial flow meets the surface flow, the concentrations decreases significantly. This indicates that while parafluvial flows do seem to potentially detrimental to freshwater mussels; it likely only affects mussels at the very edge of the river along the gravel bar. However, a follow-up study looking at ammonia concentrations below the surface water in the hyporheic flow should be considered as this water probably more closely is linking to freshwater mussels.

BYSSUS PRODUCTION IN FRESHWATER MUSSELS (UNIONOIDEA)

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Although byssus production in the Unionidae has been reported in the literature for over 100 years, the function, mechanism of production, and phylogenetic distribution of byssus in Unionidae are poorly known. 56 species have been observed to produce it, representing 4 of the 6 tribes of Unionids. The roles of age and size in byssus production is difficult to pinpoint, with juvenile *Lampsilis rafinesqueana* up to 27.19 mm maintaining threads and many other species producing them only briefly. 70-80% of newly transformed *L. rafinesqueana*, *L. siliquioidea*, and *L. abrupta* show evidence of byssus versus 30% of newly transformed *Fusconaia ebena*. In further experiments there also appears to be a difference in byssus production dependent on the species present and their number with mean byssus production varying from zero for a lone *Ligumia recta*, to 1.8 for a mix of 6 *Lampsilis siliquioidea* and 6 *L. recta*, to 5 for twelve *L. recta*. Further experiments examining the impact of the presence of conspecifics are underway. Many questions regarding byssus production remain unanswered, but its significance in the life history of juveniles is likely great and warrants further inquiry.

HIODON HOST FOUND FOR EBONYSHELL (*FUSCONAIA EBENA*) AND WASHBOARD (*MEGALONAIAS NERVOSA*) MUSSELS

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Ebonyshell and Washboard mussels (*Fusconaia ebena*, *Megaloniais nervosa*) once dominated large rivers within the Mississippi River and Gulf of Mexico drainages. However, the ebonyshell is listed at some level of endangerment in seven states and is likely extirpated from Iowa, while the washboard is in decline in several portions of its former range. Overharvest during the pearl-button rush of the late 1800's and early 1900's, habitat degradation through intensive land use, water pollution, flow manipulation and river navigation infrastructure contribute to these species' decline. Specifically, lock and dam systems have disrupted the migratory habits of skipjack herring (*Alosa chrysochloris*), previously the only documented larval host for ebonyshell. Washboard suffer lack of recruitment for less precise reasons and are capable of metamorphosing on a number of fish hosts. Recently, goldeye (*Hiodon alosoides*) have successfully metamorphosed juvenile ebonyshell and washboard in lab trials, challenging old assumptions about extirpation, and providing conservationists new avenues for population restoration. Ongoing research focuses on documenting life history traits, additional fish host identification and reproductive characteristics necessary for improved conservation of these commercially and ecologically valuable natural resources.

OCCURRENCE AND HABITAT REQUIREMENTS OF THE DELTA HYDROBE (*PROBYTHINELLA EMARGINATA*) IN CEDAR CREEK

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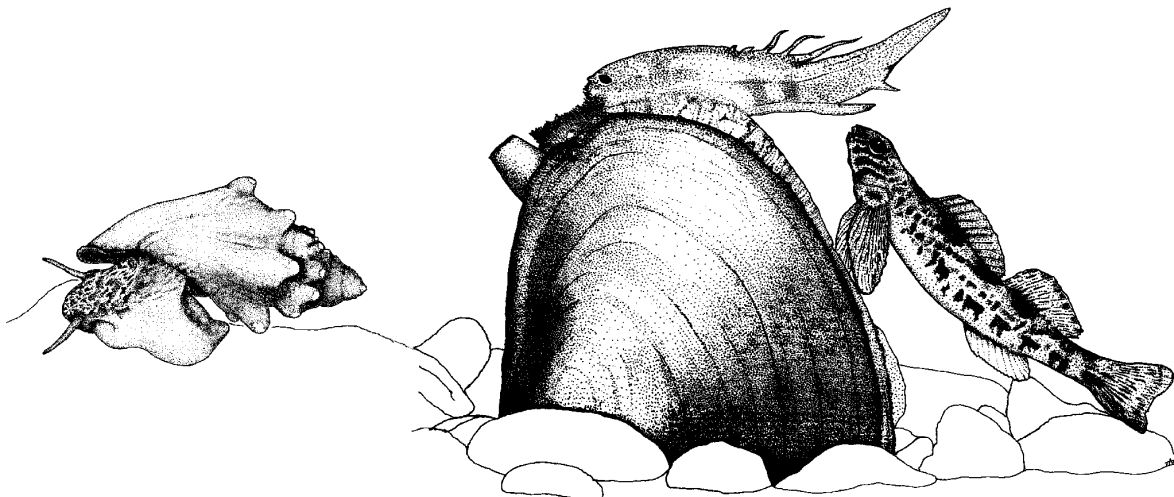
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The status of many aquatic gastropods in North America is not well understood. Many are exposed to similar threats to that of aquatic bivalves and other sensitive aquatic macroinvertebrates. To better understand the status of aquatic gastropods, research highlighting the distributions, habitat specificity, and population size of these organisms must be collected. This baseline information is imperative to the conservation of these sensitive species. We surveyed 14 sites on Cedar Creek, a pristine stream located in the flint hills of Kansas, in an effort to delineate the occurrence, distribution, and habitat preference of the delta hydrobe (*Probythinella emarginata*) through quantitative means. The delta hydrobe was the most abundant valve collected. Only two valves were live of the 604 delta hydrobe valves collected. The delta hydrobe demonstrated a positive association with downstream habitats of fine gravel substrates and increased salinity. Dead valves are not generally used to determine habitat specificity as instream processes might selectively distribute valves independent of habitat preference. Two aquatic snails representing high values of live valves were used to test whether or not dead valves of the delta hydrobe would be useful in determining live valve habitat specificity. This information is inconclusive. The delta hydrobe is located in downstream habitats that seem to be associated with an increased abundance of spring habitats. Six springs have been located in these areas. These habitats, as well as streams in adjacent basins, must be surveyed in the future to accurately describe the habitat association and distribution of the delta hydrobe as a means to better assess its conservation status in Kansas.

GENETIC STRUCTURE AND INTRASPECIFIC PHYLOGEOGRAPHY OF THE SHEEPNOSE MUSSEL (*PLETHOBASUS CYPHYUS*).

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Genotypes for 16 microsatellite loci and mitochondrial haplotypes for the NADH dehydrogenase gene were used to infer population structure and test hypotheses concerning gene flow across eight populations of the sheepnose mussel (*Plethobasus cyphus*), a candidate species for listing by the USFWS. Genetic data collected for ~100 indicate that extant populations appear to be genetically isolated from each other, with very few shared alleles or haplotypes. The microsatellite data reveals a pattern consistent with isolation by distances, whereas the mitochondrial data do not. A test of the individual populations for evidence of the occurrence of genetic bottleneck indicates that only a single population (Wisconsin River) was consistent with this hypothesis; however, the sample size for this population was small and could have resulted in erroneous conclusion. The conservation implications from this study are that each of these populations should be managed as independent entities for purposes of captive rearing and propagation until evidence indicates a particular population may benefit from the introduction of novel genetic information.



**A Mussel Translocation from the Wolf River,
New London, Waupaca County, Wisconsin, June 2010**

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We recovered 1134 live mussels representing 21 species from the Pearl Street Bridge, Wolf River, New London, Waupaca County, WI, June 2010 (Table 1). The total included 104 *Tritogonia verrucosa* (Rafinesque 1820), a Wisconsin Threatened Species (numbered on both valves, measured, and externally aged). A few other rare mussels were similarly processed. Common mussels were hash-marked on both valves. This area of the Wolf River appears to have one of the largest known numbers of *T. verrucosa* in Wisconsin ranging from 80 - 168 mm in length, and 5 - 19 years of age (Figure 1). *Alasmidonta marginata* Say 1819, *Lasmigona costata* (Rafinesque 1820), and *L. compressa* (Lea 1829), were also found. *Utterbackia imbecillis* (Say, 1829), was represented by an empty shell.

After processing, all living mussels were returned to the Wolf River about 300 m upstream of the Pearl Street Bridge, just east of the Outagamie County, WI, line. Common mussels were returned to the river from the surface shortly after they were collected. Listed mussels were kept in bags in the river, and returned by hand to the substrate at the end of each day. Various size classes were evidence of modest to excellent reproduction among nearly all species. The number of species in this area of the Wolf River has remained nearly constant since the 1990's, although the species distribution varies from place to place. Mussels were concentrated under the bridge in deeper areas of the river. Both river shorelines were built up to nearly the water's edge. The substrate was cobble-rock, especially near the south shoreline. The bottom downstream of the bridge, and north of the existing pier, were more silt and sand, with fewer live mussels.

	Species	Total	%
1	<i>Utterbackia imbecillis</i>	FD	--
2	<i>Pyganodon grandis</i>	15	1.3
3	<i>Strophitus undulatus</i>	4	0.4
4	<i>Alasmidonta marginata</i>	4	0.4
5	<i>Lasmigona costata</i>	21	1.9
6	<i>Lasmigona compressa</i>	5	0.4
7 T	<i>Tritogonia verrucosa</i>	104	9.1
8	<i>Quadrula quadrula</i>	3	0.3
9	<i>Quadrula pustulosa</i>	99	8.7
10	<i>Amblema plicata</i>	14	1.2
11	<i>Fusconaia flava</i>	11	1.0

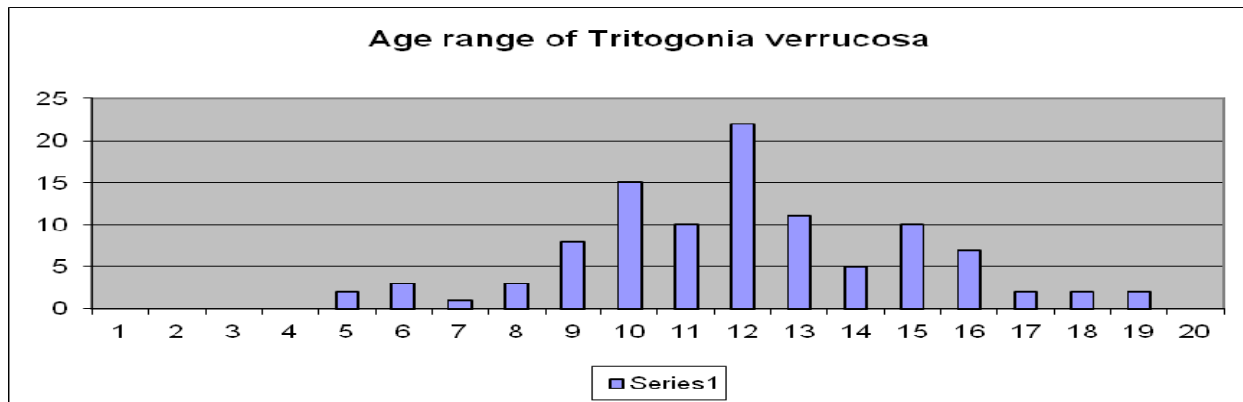
	Species	Total	%
12	<i>Pleurobema sintoxia</i>	8	0.7
13	<i>Elliptio dilatata</i>	79	7.0
14	<i>Obliquaria reflexa</i>	5	0.4
15	<i>Actinonaias carinata</i>	677	59.7
16	<i>Obovaria olivaria</i>	3	0.3
17	<i>Truncilla truncata</i>	4	0.4
18	<i>Leptodea fragilis</i>	13	1.1
19	<i>Potamilus alatus</i>	30	2.6
20	<i>Ligumia recta</i>	6	0.5
21	<i>Lampsilis siliquoidea</i>	9	0.8
22	<i>Lampsilis cardium</i>	21	1.9
	Total:	1134	100
	<i>Dreissena</i> sp.	~10	

Table 1. Mussel results from the translocation work conducted at the Pearl Street Bridge, Wolf River, New London, Waupaca County, Wisconsin, June 2010

Bolded mussel species = Wisconsin Threatened Species (T) and Species of Special Concern (SC)

FD = dead only

Figure 1. Age ranges of *Tritogonia verrucosa* translocated from the Pearl Street Bridge, Wolf River, New London, Waupaca County, Wisconsin, June 2010.



X axis = ages in years; Y axis = number of individuals

Freshwater Mollusc Additions to Inventory of Santa Catarina’s State, SC, Southern Brazil Region, With Brief Comments About Some Little-known Continental Forms

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Despite to the constant in the recent malacological literature (Agudo-Padrón & Bleicker 2011: 20), one native little freshwater gastropod – limnic/ estuarine - form included in the continental species inventory, until now had escaped our attention, increasing to 185 the number of forms so verified, specifically based in the regional contribution of Veitenheimer-Mendes & Lopes-Pitoni (1995):

Class GASTROPODA

Subclass PROSOBRANCHIA / CAENOGASTROPODA

Family HYDROBIIDAE

***Littoridina davis* (Silva & Thomé, 1985)**

Originally cited under the synonymic status *Heleobia davis* Silva & Thomé, 1985 for the southeastern coastal ecosystems - lagoons and rivers – in the Atlantic Slope region of the State (Veitenheimer-Mendes & Lopes-Pitoni 1995: 431) (Fig. 1). Ovate-conic species conveniently illustrated in the Brazilian monographic contribution of Simone (2006: 90-Fig. 232)

Figure 1.- Geographical localization habitat (red color) of *Littoridina davis* (Silva & Thomé, 1985) in southern coastal limnic/ estuarine ecosystems (Agudo-Padrón & Bleicker 2009 b: 5), Santa Catarina State territory



Other highlighted, but very little known, continental freshwater and terrestrial mollusc forms of this Brazilian territory are as follows:

Class GASTROPODA

Subclass PROSOBRANCHIA / CAENOGASTROPODA
Family HYDROBIIDAE

Potamolithus catharinae Pilsbry, 1911

Little trochiform native freshwater species with occurrence in the “Itajaí-Açú River Basin Valley”, in the “Blumenau Municipal District” (Fig. 2), northeastern Atlantic Slope of the State, among other locations. Cited by Agudo-Padrón (2008: 152, 2011 b) and illustrated in the Brazilian monograph malacological contribution of Simone (2006: 85-Fig. 214).



Figure 2.- *Potamolithus catharinae* Pilsbry, 1911 specimens, typical little species of “flowing waters - rapids”, and geographical location habitat of “Itajaí-Açú river basin valley” (red color), Santa Catarina State (Photo: Agudo-Padrón)

Family AMPULLARIIDAE

Pomacea lineata (Spix, 1827)

Native freshwater “apple snail” species with restricted occurrence in the “Lages Municipal District”, State Plateau (Fig. 3). Cited by Agudo-Padrón (2008: 151, 2010 a: 32) and illustrated in the Brazilian monograph malacological contribution of Simone (2006: 54-Fig. 89).



Figure 3.- *Pomacea lineata* (Spix, 1827) specimen and geographical location habitat of “Lages Municipal District” (red color), Santa Catarina State (Photo: Agudo-Padrón)

***Pomacea sordida* Swainson, 1823**

Native freshwater “apple snail” species with occurrence in the “Itajaí-Açú River Basin Valley”, “Blumenau Municipal District”, northeastern Atlantic Slope of the State (Fig. 4), among others few restricted localities. Cited by Agudo-Padrón (2008: 151, 2011 a) and illustrated in the Brazilian monograph malacological contribution of Simone (2006: 54-Fig. 89).



Figure 4.- *Pomacea sordida* Swainson, 1823 specimens and geographical location habitat of “Itajaí-Açú river basin valley” (red color), Santa Catarina State (Photo: Agudo-Padrón)

Subclass GYMNOPHILA

Family VERONICELLIDAE

***Phyllocaulis boraceiensis* Thomé, 1972**

Native terrestrial species of giant slug, the largest of the Americas. Very rare in the State territory, with occurrence only known in restricted localities (Agudo-Padrón 2008:153; Agudo-Padrón & Bleicker 2011:24-25) (Fig. 5). Illustrated in the Brazilian malacological contributions of Simone (2006: 95-Fig. 263 a-b) and Thomé *et al* (2006:52- Fig. 31).



Figure 5.- Native giant slug *Phyllocaulis boraceiensis* Thomé, 1972 of "Capoeiras", continental metropolitan region of the “Great Florianópolis” (red color) immediate neighbor to the “Santa Catarina Island” (Agudo-Padrón 2010 b: 15-Fig. 3), SC State (Photo: Agudo-Padrón)

Subclass PULMONATA
Family CHILINIDAE

***Chilina globosa* Frauenfeld, 1881**

Neritiform native freshwater species, typical of “flowing waters, rapids with boulders and waterfalls in slop areas”, with occurrence in the “Itajaí-Açú River Basin Valley”, “Blumenau Municipal District”, northeastern Atlantic Slope of the State (Fig. 6), among others very few restricted localities. Cited by Agudo-Padrón (2008:154) and illustrated in the Brazilian malacological contribution of Simone (2006:98-Fig. 285).



Figure 6.- *Chilina globosa* Frauenfeld, 1881 specimens and geographical location habitat (red color) of “Itajaí-Açú river basin valley”, Santa Catarina State (Photo: Agudo-Padrón)

Family ODONTOSTOMIDAE

***Macrodonates thielei* Pilsbry, 1930**

Native tree forest snail with restricted occurrence known only in two localities of the Extreme West region of Santa Catarina (“São João do Oeste” and “Itapiranga” Municipal Districts), domains of riverine (ciliar) tropical damp forest in the Uruguay river basin (Fig. 7). Cited by Agudo-Padrón (2010 b:11, 12-Fig. 1.a) and illustrated in the Brazilian monograph malacological contribution of Simone (2006:164-Fig. 562).



Figure 7.- *Macrodonates thielei* Pilsbry, 1930 – specimen deposited in the Museum of Science and Technology PUCRS (MCP 09234), Porto Alegre, RS – and geographical location habitat (red color) in “Sede Capela, Itapiranga Municipal District”, Extreme West of Santa Catarina State (Photo: Agudo-Padrón)

Class BIVALVIA

Order UNIONOIDA

Family HYRIIDAE

***Diplodon aethiops* (Lea, 1860)**

Native freshwater mussel naiad, typical of flowing waters - rapids and sandy bottom between rocks, with occurrence in the "Itajaí-Açú River Basin Valley", "Blumenau Municipal District", northeastern Atlantic Slope of the State (Fig. 8), among others similar localities in the State. Controversial species, cited/ illustrated by Simone (2006:267-Figs. 986 a-b) and Agudo-Padrón (2008:167, 2011 a) under the taxonomic status ***Rhipidodonta charruana* (d'Orbigny, 1835)**, unlike Mansur & Pereira (2006:1128, 1131-Fig. 2), based mainly on the parasitic "gloquidium" larvae form of the species, that prefer to maintain the validity of your original name.



Figure 8.- *Diplodon aethiops* (Lea, 1860) = *Rhipidodonta charruana* (d'Orbigny, 1835) specimens (shells) and geographical location habitat (red color) of "Itajaí-Açú river basin valley", Santa Catarina State (Photo: Agudo-Padrón)

Finally, other little known native continental species of molluscs to the State, however, may be conferred on regional literature (Agudo-Padrón & Bleicker 2009 a: 10-11; Agudo-Padrón 2010 a: 35-36).

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Invasive Infestation of Freshwater Snail *Melanoidea tuberculatus* (Müller, 1774) in the North Section of Santa Catarina's State, Southern Brazil Region: New Geographical Record

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Currently 44 specific exotic forms of molluscs have been reported from Brazil, and the afro-asiatic limnic gastropod *Melanoidea tuberculatus* (Müller, 1774), representative of the family Thiariidae, is one of them (Agudo-Padrón & Lenhard 2010: 37, 39), still appearing to occur among the species of the Santa Catarina's State - SC (Agudo & Bleicker 2006: 6; Agudo-Padrón 2008 a: 152; Agudo-Padrón 2008 b, 2009), the smallest geographical portion of the Southern Brazil region.

The present report characterizes the four confirmed occurrence/ geographical records of this exotic freshwater snail in the State (Agudo-Padrón 2008 b: 16-Fig. 1) and, in addition, the first territorial verification of a remarkable invasive infestation, in the North Atlantic Slope section.

On May 06 2011, one lot of 47 specimens (random sample) of *Melanoidea tuberculatus* (Müller, 1774) was examined by us, featuring shell lengths between 7.0 mm and 24.0 mm (measurements obtained with caliper), coming from disabled fish pond with muddy bottom and creek that run on small farm located in the Municipal District of "Jaraguá do Sul" (Fig. 1). This material was opportune collected and sent to us by the landowner, Mr. Jairo S. Muller, in May 04 2011. The specimens were preserved in liquid and deposited (witness material) in the scientific malacology collection of the Museum of Natural Science crowded in Lutheran University of Brazil - ULBRA, Canoas city, RS (MCNU - C055).



Figure 1.- Jaraguá do Sul Municipal District (red color), in the context of the Northern Santa Catarina's State territory, Southern Brazil (left), and specimens collected in the region (right). Photo: A. I. Agudo-Padrón

As informed by the collector in focus, the highest concentrations these aquatic snails is found in muddy streams of the water bodies infested. This very peculiar situation has been observed by us in the field at other locations of the Southern Brazil region (Agudo-Padrón 2010: 10, 11-Fig.1), and also recently reported in the

literature for other locations in Brazil, by example Miyahira *et al* (2010: 31-Fig. 2).

As far as is their knowledge, *Melanoides tuberculatus* (Müller, 1774) does not represent a direct threat to the farmed fish or that occur in rivers, lakes and reservoirs, every time it is a herbivore/detritivore with viviparous reproduction. However it is rather a species potentially able to change/destabilize severely the native benthic communities inhabiting the substrate of habitats colonized by it (Santos & Eskinazi-Sant'Anna 2010).

Work immediately with two (2) viable hypotheses that explain the reason for its admission and occurrence in that location:

A.- Purposely Introduction “Not Reported” by Regional Health Authorities

Have been widely used worldwide as a biological control agent of the disease "Schistosomiasis", they have on native aquatic snails *Biomphalaria* spp. their vectors. Supposedly, *M. tuberculatus* can reduce populations of the latter, intermediate hosts of the parasitic worm *Schistosoma mansoni*, but , that the latter have been questioned by some authors, by example Giovanelli *et al* (2002).

It is worth noting that, coincidentally, just the Municipal District of "Jaraguá do Sul" is one of the few regions of SC with registered prevalence of this terrible disease (Agudo-Padrón 2007), with the main native regional vector *Biomphalaria t. tenagophila* (d'Orbigny, 1835) (Agudo-Padrón 2008 a: 156).

B.- Commercial Transport of “Cultivated Shrimp” as Vector of Introduction and Dispersal

Studies also indicate that *M. tuberculatus* acts as an intermediate host of trematode parasite worms of the respiratory system in humans, the species *Paragonimus westermani* (Kerbert, 1878), responsible for the serious parasitic disease "Paragonimiasis" (potential to occur in SC), which involves in its natural cycle several species of crabs and “shrimps” used for culinary consumption, which represents a potentially serious threat to public health (Agudo-Padrón 2008 b).

Again, just the Municipal District of “Jaraguá do Sul” found in the commercial land transportation route of “farmed shrimp” that comes from the brazilian Northeast and reaches the region capital of “Great Florianópolis”, confirmed dispersion agent vector in the State of this and other aquatic snail species, natives and/ or exotics (Agudo-Padrón 2009).

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Additional Information Concerning the Conquest of Europe by the Invasive Chinese Pond Mussel *Sinanodonta woodiana*. 24. News from the Czech and Slovak Republics, Poland and Sweden

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Already for quite some time, Polish malacologists are providing much background information concerning a large variety of aspects dealing with the presence of the invasive Chinese Pond Mussel *Sinanodonta woodiana* (Lea, 1834) in Poland. The 18th volume of "Folia Malacologica," published in 2010, forms a good example of it. Additional information is provided concerning the presence of this exotic species in the Czech and Slovak Republics, while in Sweden mussels were found which look like the exotic Chinese Pond Mussel but turned out to belong to the native *Anodonta cygnea*.

Czech and Slovak Republics

The distribution of *Sinanodonta woodiana* in the Czech and Slovak Republics has recently been reviewed by Horsák et al. (2010). Slowly but steadily this invasive mussel is expanding its range in both countries. Good pictures are given of an adult specimen and of the umbral region of it.

Poland

Ożgo et al. (2011) described the presence of the Chinese Pond Mussel in a dammed up tributary of the Lupawa River near Czarny Młyn, which serves as a buffer zone of the Słowiński National Park. Contrary to most other localities of this invasive mussel species in Poland, this locality is not influenced by cooling waters of power plants. The shallow water and the dark muddy bottom in that aquatic biotope are most probably the cause of a natural increase of the water temperature during the summers. The large specimens collected in October 2009 showed 10 well developed annual growth lines and the mean length of the mussels turned out to be 172 mm. Since the surveyed water body was once part of a fish pond complex, the exotic mussels reached most probably the area by stocking those former ponds with fish, which were infected with glochidia of *Sinanodonta woodiana*.

In two articles dealing with the characteristics of mitochondrial DNA of Unionid bivalves Soroka (2010a-b) dealt also with the invasive Chinese Pond Mussel. Polish specimens identified on morphological grounds as belonging to the latter turned out to be genetically more similar to *Anadonta arcaeformis* (Heude, 1877), usually classified as *Sinanodonta (Anemina) arcaeformis*, than to Asian specimens of *Sinanodonta woodiana* (Soroka, 2010a). In the second paper, Soroka (2011b) compared the complete sequences of maternally inherited mitochondrial genomes of the exotic Chinese Pond Mussel with that of the local *Unio pictorum* (Linnaeus, 1758).

Sweden

Kyrkander & Örnberg (2010) studied the supposed presence of *Sinanodonta woodiana* in Kårtyllasjön, Sweden. Although they found some shells which are morphologically very close to the Chinese Pond Mussel, they turned out to be local morphs of *Anodonta cygnea* (Linnaeus, 1758).

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On the Further Spread of *Pyrgophorus* in Israel

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Recently an alien *Pyrgophorus* species, Fam. Cochliopidae, has been reported living at three different localities in the Tanninim River basin (=Crocodyle River) in Israel (Mienis et al., 2011). No explanation could be found as to how this American species reached that area in Israel although at least in the Tanninim River the invasive aquatic weed *Pistia stratiotis* was seen floating on the water. In the wake of the above finds, Dr. Dana Milstein of the Israel Nature Reserves and National Parks Protection Authority carried out some further fieldwork in the surroundings of Kibbutz Ma'agan Michael, situated near the estuary of the Tanninim River.

On 3 March 2011 she sampled the Difla, a swampy area situated between the commercial fish pond of Ma'agan Michael and the dunes running parallel the Eastern Mediterranean coastline. In the past, the Difla received water from the Dalia River, due to poor drainage of that river in the Mediterranean Sea, and by groundwater which created vents on the swamp's bottom. During the Tanninim River Campus held in 1986 the Difla swamp was an unspoiled area containing crystal clear water and inhabited by at least nine different species of molluscs. The presence of large numbers of the amphibious *Phytia myosotis* (Draparnaud, 1801), Fam. Ellobiidae, on its banks showed that we were dealing with a brackish water swamp.

However when Dana Milstein sampled the southern part of the Difla swamp 25 years after the Tanninim Campus, the water looked like a huge bowl of pea soup: it had a greenish colour and there was no visibility at all. The deterioration of the water quality is without doubt directly connected with the release of large amounts of highly eutrophic water from the nearby fish ponds in the Difla. The only molluscs found in this highly polluted water turned out to belong to the recently introduced *Pyrgophorus* species!

During an outing of staff associated with the National Collections of Natural History of the Tel Aviv University to Sede Eliyyahu on 5 April 2011, the author took the opportunity to take a handful of detritus from a canal running along the road. This canal consists of two compartments: one channel carrying clear slightly brackish water, the other channel carrying murky water i.e. effluents from the numerous nearby fishponds. The sample was taken from the brackish water channel. It turned out to contain among others *Theodoxus michonii* (Bourguignat, 1852), *Thiara scabra* (Müller, 1774), *Melanooides tuberculata* (Müller, 1774), *Pyrgophorus* species and *Corbicula fluminalis* (Müller, 1774).

Sede Eliyyahu and the canal described above are situated in a completely different zoogeographic area of Israel. While the Tanninim River basin forms part of the Mediterranean coastal area of Israel, Sede Eliyyahu and its surroundings are part of the Emeq HaMayanot, connected with the Jordan River basin. However they have several things in common: brackish water, although of completely different sources and composition, is present in both areas, and aquaculture in the form of fishponds where both local and exotic fish species and similar aquatic plants are being grown on a rather intensive and large scale. Most probably, material infected with *Pyrgophorus* arrived in this way in Israel.

This is most unfortunate, not only from the pure zoological point of view: the dwindling native freshwater mollusc fauna has to cope with another invasive species, but probably also from the medical point of view: *Pyrgophorus* species are known intermediate hosts of trematodes which have as secondary and tertiary hosts respectively fish and fish-eating bird species (Scholz et al., 1996).

New records of *Pyrgophorus* from Israel

ISRAEL: Difla, southern part, leg. D. Milstein, 3 March 2011 (TAU MO 72842/8); Canal along the road opposite Sede Eliyyahu, brackish water channel, leg. H.K. Mienis, 5 April 2011 (TAU MO 72854/17).

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A Further Note on the Conquest of Israel by the Invasive Tropical Gastropod *Thiara scabra*

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The tropical freshwater gastropod *Thiara scabra* (Müller, 1774), Fam. Thiaridae, was found for the first time in Israel in 2006 (Mienis, 2008). Since then, this highly invasive species has been reported from numerous springs and streams in Emeq Bet Shean, now renamed Emeq HaMayanot (Valley of the Springs) and the Sea of Galilee (Mienis, 2008, 2009, 2010a-b, Mienis, Krotman & Harlev, 2009, Mienis & Mienis, 2008a-b and Roll, Dayan, Simberloff & Mienis, 2009). All of the localities reported so far from Israel were situated in the Jordan River Basin (including the Sea of Galilee) or in a river basin i.e. the Valley of the Springs, which is a tributary of the Lower Jordan River.

Recently, *Thiara scabra* has been found in a completely different watershed: the coastal rivers along the Mediterranean coast of Israel. My colleague Dr. Frida Ben-Ami of the Tel Aviv University (TAU) and some of her students collected it in the Tanninim River (=Crocodile River) Nature Reserve on 23rd of December 2010 (TAU MO 72079), while Dr. Dana Milstein of the Israel Nature Reserves and National Parks Protection Authority (INRNPPA) brought me a sample from 'Enot Afeq forming the springs of the Na'aman River south of Akko, where she had collected it on 7th March 2011 (TAU MO 72840).

There is no clue how this species reached both coastal rivers. However, it may be pointed out that *Thiara scabra* managed to invade the National Water Carrier, which carries water from the Sea of Galilee (=the Kinneret) initially westwards to the Eshkol Reservoir near Bet Netofa and from there southwards to most parts of Israel. During emergency situations, water from the National Water Carrier can be released at various points along its way southwards, however, none of them seem to be directly connected to either the Na'aman or the Tanninim River.

The presence of *Thiara scabra* in the watersheds of the Jordan Valley and the coastal streams, and its settlement in the National Water Carrier, may have not only a disastrous effect on the already dwindling local mollusc fauna, but may also cause problems among other aquatic animals like fish or their predators, since *Thiara scabra* is a known intermediate host of numerous parasites.



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I would like to thank Dr. Frida Ben-Ami (TAU) and Dr. Dana Milstein (INRNPPA) for permanently lodging their mollusc samples in the National Collections of Natural History of the Tel Aviv University. Likewise I would like to thank my colleague Oz Rittner for the excellent photograph of *Thiara scabra*.

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2010 Freshwater Mollusk Bibliography

Compiled by Kevin S. Cummings
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This bibliography lists papers dealing with freshwater mollusks that have been published up to and including 2010 that have not appeared in previous FMCS bibliographies. The citations are split into five groups for the convenience of researchers: Unionoida, Sphaeriidae, Corbiculidae, Dreissenidae & other bivalves, and Gastropoda. Papers which list taxa from more than one of the above categories are included in each pertinent category. A web searchable database of over 20,000 references on freshwater mollusks (including all previous FMCS bibliographies on freshwater mollusks) can be found at: <http://ellipse.inhs.uiuc.edu:591/mollusk/biblio.html>

To insure that papers are cited correctly, researchers are encouraged to send pdf's or reprints to: Kevin S. Cummings, Illinois Natural History Survey, 607 E. Peabody Dr., Champaign, Illinois 61820. email: ksc@inhs.illinois.edu

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SPHAERIIDAE (FINGERNAIL AND PILL CLAMS)

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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 aquatic 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.

MSWord is optimal for text documents but the editor may be able to convert other formats. Graphics should be in MSExcel, PhotoShop, TIF, GIF, BMP, or EPS format; again, the editor may be able to translate other formats. Please limit the length of informal articles to one page of text. Note that submissions are not peer reviewed but are checked for clarity and appropriateness for this newsletter. Feel free to contact the editor with any questions about possible submissions or transmission concerns.

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Parting Shot



A silty horn snail (*Pleurocera canaliculata*) welcomes a new neighbor -- one of 200 tagged fanshells (*Cyprogenia stegaria*) placed at Muskingum Island, within the Ohio River Islands National Wildlife Refuge. As part of recovery actions for the federal endangered fanshell, representatives from West Virginia, Kentucky, and Ohio collaborated with the U.S. Fish and Wildlife Service in September 2010 to take 600 animals from the Licking River (KY), tag them, and augment populations in the Kanawha River (WV), Ohio River (WV), and Muskingum River (OH). Photo Credit: Janet Clayton, WVDNR

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.

