



Newsletter of the Freshwater Mollusk Conservation Society
Volume 17 – Number 1 **March 2015**

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Pictured (L-R) are Applied Ecology Department Head Harry Daniels, current Distinguished Professor JoAnn Burkholder, and the two newest NCSU College of Agriculture and Life Sciences Distinguished Professors: Ken Pollock and Greg Cope.

Distinguished Professor !

A recent FMCS President, active Committee Co-chairman, and Co-editor of our journal has been named a William Neal Reynolds Distinguished Professor in the North Carolina State University (NCSU) College of Agriculture and Life Sciences. These endowed professorships recognize “great scholars, great teachers, great scientists, and great interpreters.”

William Neal Reynolds established the endowment creating the Distinguished Professorships in 1950. The endowment enables the College to strengthen teaching, research, and extension programs in the various fields

of agriculture, and to lift rural living standards in North Carolina.

“Dr. Greg Cope’s work in toxicology research, teaching, and extension have led to major advances in the science, conservation, and management of endangered freshwater fauna; strengthened national environmental policy with benefit to all Americans; and major progress in agromedicine and health and safety protection of farmworkers across the state, nation, and world. He directs the single largest university program worldwide that is dedicated to understanding and mitigating the effects of toxic pollutants on sentinel imperiled freshwater mussels and fish. His research team’s contributions have been highlighted by scientific societies and by a wide array of state and federal resource agencies. He has published over 120 scholarly papers, books, and book chapters associated with his research and extension programs, and has mentored 25 graduate students and served on another 30 graduate committees. Under his leadership as Coordinator of the North Carolina Agromedicine Institute, agromedicine programs have substantially improved the occupational health safety of rural populations involved in agriculture, forestry, and fisheries. Dr. Cope exemplifies the highest level of excellence as a scholar, scientist, teacher, and interpreter, and also has an outstanding record of service to his college, university, state, and country.”

We congratulate Greg on this significant and well-deserved honor.

Society News

“The Next Cohort” – Moving Forward

Patricia Morrison, President

As the time for our next Symposium approaches, we begin another busy year of freshwater mollusk conservation. I hope to see all of you in a few weeks at our joint meeting with the Upper Mississippi River Conservation Committee in St. Charles, Missouri (see article starting on Page 9) ! During that meeting, our Society will install new and extremely capable leadership as our new officers begin their terms. I am sure you join me in welcoming Teresa Newton as our next President – she has served as President Elect for the past two years and is already extremely active and leading us into the future. Stepping up as our next President Elect is Heidi Dunn – the indefatigable, longest serving FMCS officer! Our new Secretary is Janet Clayton, who will manage all the correspondence and records of the Society – she better bring a big truck for the hand-off! And our new Treasurer is Emily Grossman, who is already learning the ropes from our outgoing Treasurer, Heidi Dunn.

Several items discussed during the Fall 2014 Board Meeting (see minutes starting on Page 3) will involve changes for the better. For example, our journal is evolving and adapting to new environments. In the near future, it will be transitioning to a new manuscript management system with Allen Press. Henceforth, the publication will be known as *Journal of the Freshwater Mollusk Conservation Society*, and all issues will be open access. Please remember to submit your articles for publication in *our* journal.

Change is good, and we are handing off the reins to a very capable leadership team. Our elected officers, together with the Committee chairs, are the backbone of the Society, and they help set the priorities for our initiatives. Once the Revised National Strategy for the Conservation of Freshwater Mollusks is adopted [a complete draft will be unveiled very soon], the Board will take a look at how the Society is structured (for example, are the committee names and focus well organized) to meet the current and future needs of the fauna as we move forward? If not, how do we re-focus ourselves?

Stay active and involved. We are all part of the “next cohort” as we move forward together.

Fall 2014 FMCS Board Meeting (Conference Call)
December 9, 2014

Call to Order, Roll Call for Attendance, and Declaration of Quorum – Patty Morrison

Attendees:

Patty Morrison	John Harris	Steve McMurray
Heidi Dunn	Art Bogan	Christopher Owen
John Jenkinson	Tom Watters	Becca Winterringer
Braven Beaty	Greg Cope	Joe Bartmess (financial consultant)
Caryn Vaughn	Nathan Whelan	
Jeremy Tiemann	Hua Dan	
Megan Bradley	Greg Zimmerman	(Missing: Guidelines and Techniques)
Teresa Newton	Emy Monroe	

Approval of the April 23, 2014 Maine Board Meeting Minutes (published in June 2014 *Ellipsaria*) Meeting Minutes Approved

Treasurer's Report – Heidi Dunn (full report is on Page 6)
Regional meetings have been a success. Overall, FMCS is doing well.

Secretary's Report – Greg Zimmerman

- We currently have 827 members, some of whom (~20%) are lapsed but this is still a significant increase over last year's report (727 members in December 2013), so the membership continues to grow.
- Updates were made to the Secretary's duties section of the Procedures Manual.
- Supported various committees and members with email announcements through the website app.
- Currently working to compile a list of past FMCS Committee chairs to compliment the list of past FMCS board members already compiled by Teresa Newton.

Committee Reports

Symposium – Teresa Newton

2015 – St. Charles, Missouri --Heidi Dunn/ Steve McMurray

- Board Meeting 5-7 Sunday, Mixer 7-9
- Board room reserved all week – open for committees to use
- Mussel Status and Distribution room will also be largely available
- Still looking for Sponsorships
- Getting T-shirts, gifts – vests for board members – using standard FMCS logo.
- Still looking for speakers for presentation on science in large rivers
- Joint session – landscape ecology
- Session overviews – looking to the past – Greg Cope and Teresa identified speakers for the first presentation in a session to give an overview of advances made in the past 25 years; 4 topic areas were chosen: Water quality, Relocation, Status of mollusks, and Propagation and Culture
- 14 abstracts, 11 platform and 3 posters in so far. Get your abstracts in ASAP
- Propagation Workshop Megan Bradley. Workshop needs rooms for 70. Chris Owen gave synopsis

2016 Workshop (Genetics Theme) Megan Bradley. Workshop needs rooms for 70. There was a week available in February at NCTC (Shepherdstown, WV), worries about weather issues with mountains. Board and others suggested looking at other venues.

2017 Symposium - Investigate Texas location, taking other proposals. Neil Ford was interested in forming a team and hosting. Becca Winterringer / Greg Z. will investigate Cleveland.

Awards – Teresa Newton (full report on Page 7)

- Student Travel Awards - We had 30 applicants for 8 awards in 2013. In 2015, there are funds available for 9 awards.
- For 2015 and all future Symposia, students giving more than one presentation will be judged on only one presentation and they need to pick the one to be judged. Also, we need to round up judges.
- Professional Award Nomination Packages are due at the end of December.

Nominations – Elections Voting! Request was made to send out an email to the voting link after New Years – a one liner.

Outreach – Megan Bradley

Primarily work has been on improvements and updates to the website.

Gastropod Status and Distribution – Nathan Whelan and Jeremy Tieman

Work has been completed on populating the website page.

Names lists – Want to move link to names with a photo and put in common searchable terms. (see full report on Page 7)

Techniques and Guidelines – Nevin Welte and Janet Clayton – No report.

Environmental Quality and Affairs – Steve McMurray and Braven Beaty

Working on a few letters, not much to report.

Genetics – Curt Elderkin and David Berg

No report during meeting; report circulated soon thereafter (see Page 7).

Information Exchange

Ellipsaria (John Jenkinson)

The newsletter continues to be posted on schedule. Nothing new or unusual to report. The Board praised John for his work and efforts.

Walkerana – Tom Watters and Greg Cope

- Vol. 17 Issue #2 has been posted on our website.
- We have investigated three systems to improve distribution and allow for better editorial tools for our journal. Propose to transition the production management of our journal to Allen Press and their software called Allen PeerTrack. That company is highly recommended because they specialize in small- and medium-sized journals. Working with Allen Press also should simplify becoming part of BioOne. (full report starting on Page 7)

A motion was made by Greg Cope to contract with Allen Press, move the journal to open access, and change the name to the “*Journal of the Freshwater Mollusk Conservation Society*”. Motion carries.

Mussel Status and Distribution – Art Bogan and John Harris (full report on Page 8)

- Mussel ID App - the App is scheduled for a Beta version at St. Charles meeting and then request for comments. Stumbling block at the moment is adequate, high quality photographs.
- Mussel Atlas has suffered somewhat due to manpower. Committee will put out a call for photos for needed species.

Propagation, Restoration, and Reintroduction

Christopher Owen gave a brief oral update and submitted a written report (see Page 8). Discussion was on the upcoming Workshop at the Symposium.

Old Business

Revision of National Strategy – Teresa Newton and Patty Morrison

Identified 10 issues, group meeting every 2 weeks via telecon. Progress includes:

- 5 done, 4 draft, 1 in progress
- Ready by March symposium.
- Overview
- Success stories
- Conservation and management
- Opportunities

Procedures Manual

The Procedures Manual is now UP on the website! Thanks to all who contributed. The Past President is now tasked to update the Procedures Manual every 5 years.

NiSource Mitigation Panel

John Jenkinson is representing FMCS on this U.S. Fish and Wildlife Service-approved Habitat Mitigation Panel. When John has travel expenses associated with the meetings of this Panel, FMCS will file his claims for reimbursement with NiSource.

New Business

Long-term Investment Strategies – Joseph Bartmess.

Heidi Dunn brought Joseph in to potentially help with money, investment as we grow, providing funding for special projects, etc. He has been advising his church’s endowment committee. Some potential options include designating investment earnings to specific areas (student awards, etc.). FMCS could accept money from bequests, start an endowment, etc. Bylaws don’t seem to restrict use. Interest rates are low right now in standard savings accounts. EXCOM will look into investment strategy – exploratory. Joe will prepare a proposal to present at the St. Charles Board Meeting.

AFS Fish and Mussel Kill Document – Patty Morrison

Need to add snails; eventually move this issue to a subcommittee. Patty will represent FMCS during the AFS Pollution Committee telecom meeting in January.

Ammonia Criteria Implementation

Heidi Dunn was invited to represent FMCS at a recent meeting in Washington, DC. sponsored by Great Lakes Environment Center, Water Environment Research Foundation, National Association of Clean Water Agencies, Association of Clean Water Administrators, Water Environment Research Foundation, and Water Environment Federation. The meeting was attended by public utility representatives, state agencies, U.S. EAP, and consultants. Dave Smith also attended. The purpose of this meeting was to identify ways to economically implement the new ammonia standard, identify tasks that need to be accomplished, and studies that may need to be conducted to determine best practical means of compliance particularly by small communities without financial means to upgrade. Heidi will write a meeting summary for the next issue of *Ellipsaria* (starting on Page 12).

Haas Letter

Heidi received a letter from Jeremiah Haas, asking FMCS to serve as escrow agent for funds guaranteeing performance of Quad Cities Nuclear Station obligations under an Incidental Take Permit. FMCS would account for the fund annually and would be able to spend the interest. After deliberation, the Board decided we did not want to wade into managing mitigation funds at this time. Heidi will draft a response back to Mr. Haas.

Motion to adjourn, all in favor, motion carries.

**Committee Reports Submitted to Support the
December 9, 2014, Board Meeting**

Treasurer’s Report– Heidi Dunn -- Income and expenses through Nov 30, 2014

Income

Donations	\$100.00 (Tom Keevin)
Interest	82.60
Memberships	7,560.00
T-shirts, hats, posters, mugs	10.00
Maine Workshop	14,065.00
2015 Symposium	<u>1,025.00</u>

Total income **\$22,842.00**

Expenses

Regional meetings	\$200.00
Webpage	4,140.00
Walkerana	2,062.50
Shipping	4.00 (stamps, shipped a mug)
Miscellaneous	675.01 (ammonia travel, rewards, tax prep)
Bank fees	29.00
Credit card fees	648.28
Pay pal fees	352.85
2014 workshop expenses	7,453.87 (net on workshop \$6,611.13)
2015 symposium expenses	<u>6,060.00</u> (deposit)

Total Expenses **\$21,625.51**

Net thru Nov 30, 2014 \$1,217.09

Total in checking/savings/PayPal/petty cash **\$101,315.25**

Awards Committee – Teresa Newton

The Awards Committee submitted a call for nominations for the 2015 FMCS Professional Awards in the September issue of *Ellipsaria*. To be considered, all nominations and the supporting documentation packages must be submitted by January 16, 2015.

The Awards Committee also submitted a call for Student Travel Awards to attend the 2015 FMCS symposium in the September issue of *Ellipsaria*. We anticipate that up to 9 awards will be made for the 2015 symposium. A complete application package must be submitted by January 15, 2015.

Awards Committee members are working with the 2015 Symposium Organizing Committee to insure that student presentations are held early in the symposium and to arrange for judging of student platform and poster presentations. An email requesting judges will be sent out in early 2015.

Gastropod Status and Distribution Committee – Nathan Whelan and Jeremy Tieman

The gastropod part of the FMCS website is slowly being populated with content and updated. For the first time, there is actually content on the gastropod pages. Some issues with formatting/typos will be fixed before the end of the year.

Paul Johnson, John Harris, Jim Williams, and I are working on specific procedures for the mussel and gastropod names sub-committee meeting(s) during the symposium in March. I know Paul really wants to update/modify common names for freshwater snails so genus names are no longer in common names. I hope the common names aspect of the committee is relatively uncontroversial. Scientific names on the “official” FMCS lists may be a bit more controversial, but the procedures for the actual meetings of this committee and updating the lists will mostly follow what AFS does for fish. This is where Jim Williams’s experience should help. The starting points for both lists will be the Johnson et al. (2013) gastropod list and the Williams et al. (in review) mussel list from *Fisheries* as discussed in previous meetings.

Tentatively, the names subcommittee will meet during the St Charles Meeting instead of a day or two early to have the highest attendance possible of people who are interested. There has been talk about both the mussel and gastropod groups meeting at the same time, and I’d like to hear thoughts about that.

Genetics Committee Report – Curt Elderkin, David Berg, Emy Monroe, and Kevin Roe

The Genetics Committee submitted a request to have a Workshop for 2016 regarding conservation genetics of freshwater mussels. The request was approved by the FMCS Board and we moved forward to reserve the proper venue. We contacted the National Conservation Training Center (NCTC) requesting three days for a conference of ~125 attendees. The NCTC staff has offered February 16 – 19, 2016 as a date for the Workshop. During this time, we would have full access to teaching rooms and hotel space on site.

The Genetics Committee will meet at the 2015 FMCS Symposium to decide on details for the schedule, format, and invited speakers for the Workshop.

Information Exchange Committee – Walkerana-JFMCS – Greg Cope and Tom Watters

Due to some website inflexibilities with the journal’s pages and other associated issues with manuscript submission and file maintenance, the Co-Editors of the Journal have investigated other options for Journal management. As indicated at the Spring 2014 Board Meeting in Portland, Maine, several established publishers were contacted and additional information was gathered. It was determined that Allen Press was the potential best fit and had the right package for our needs. A webinar with Allen Press was held on August 21, 2014 for the FMCS EXCOM and Journal Co-Editors to learn more about their services and costs. Consensus after the webinar was that FMCS should transition the management and production of the Journal to Allen Press. Therefore, the Co-Editors and FMCS EXCOM unanimously recommend that the Journal be transitioned to Allen Press as soon as practical. After initial

set-up, the costs for Allen Press will be very similar to those under the current scenario for producing two issues per year.

In addition, during this transition to Allen Press, the Co-Editors recommend that the Journal move to full open access and the Journal name be changed from *Walkerana-The Journal of the Freshwater Mollusk Conservation Society* to *Journal of the Freshwater Mollusk Conservation Society*. A major benefit of the transition to Allen Press is its association with BioOne. We will be able to apply to become part of the BioOne Journal package holdings for distribution and marketing to major libraries worldwide. Because BioOne was created out of Allen Press, there will be little or no additional costs for this service.

Mussel Status and Distribution Committee – Arthur E. Bogan and John L. Harris

1. **J. D. Williams et al. AFS Conservation assessment of freshwater mussels of US, Canada and Mexico.** This is a revision of the Williams et al. (1993) first edition. The manuscript has been submitted to AFS - *Fisheries* and is under review. Publication is likely late summer 2015.
2. **Development of Mussel ID App** – Susan Oetker. Progress continues on development of the mussel identification app. We have acquired useable photographs for 206 of 300 taxa addressed in the app, and the team continues to search for high quality photos to complete the North American set. The development team completed the attributes database for all taxa, and these will be used as the basis for the app to "identify" mussels. The development team participated in a webinar in late November to review the latest version of the app, and the app is on schedule for presentation to the FMCS membership at St. Charles in March 2015.
3. **Atlas of Freshwater Mussels of North America.** Currently, 134 of the approximately 365 taxa addressed in the Atlas have volunteer authors for species accounts. We have received 13 first draft accounts as of December 5, 2014. Distribution data for most of these accounts is still being acquired.
4. **Mussel Scientific and Common Names Subcommittee.** Paul Johnson and Jim Williams are drafting guidelines for the mussel and gastropod names subcommittees. We expect those guidelines to be circulated for comment to the Board and subcommittee members in early 2015. A joint meeting of the subcommittees is planned for St. Charles in March to discuss and finalize guidelines.

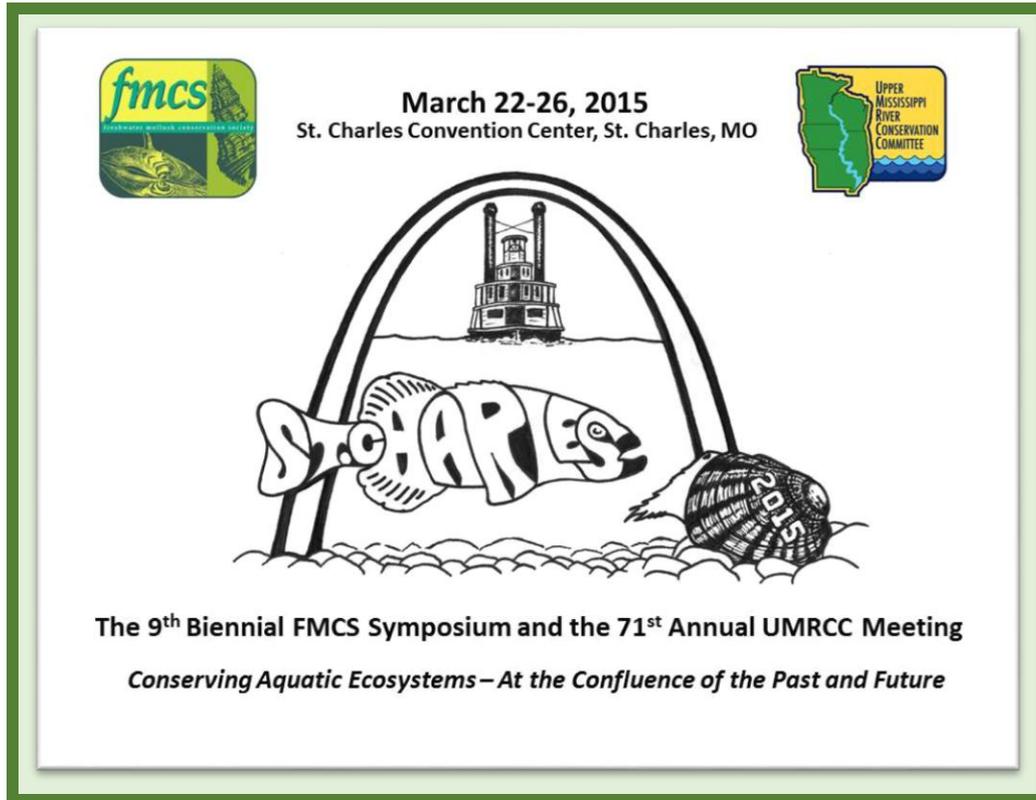
Propagation, Restoration, and Re-Introduction Committee – Christopher Owen and Dan Hua

The Propagation Committee has successfully updated the facilities database and it now contains the past and current efforts of 17 participating hatcheries. Data included are species, methods used and grow out status. Additionally, we modified the database to include basic information on the management of species. Participating hatcheries submitted records detailing if a species had been manipulated (moved, propagated, etc.) and whether management efforts were relocations or propagation, augmentations or reintroductions, included HCU8 code for broodstock source and destination of managed species, and, of course, species and year. This database was not intended to be a complete repository of all management data, as it violated many agencies data sharing agreements, but rather serve as a basic outline of what is being done and where, so that researchers and/or policy makers can access some basic information and know whom to contact for more information. The next goal for the database is to get it uploaded to the FMCS website so there is easy access for members and hopefully a more streamlined platform for updating the database.

We are coordinating a workshop on propagation methods to be held the day before the symposium in St. Charles. Megan Bradley is serving as our representative to Steve McMurray for planning and executing the workshop. Thus far, the outline of the workshop is finalized, speakers are lined up, and costs have been submitted. Please contact Megan directly (megan.bradley@dgif.virginia.gov) with any questions or requests.

Additionally, we are still working with the Genetics Committee towards developing a best practices and guidelines for managing mussel species. This will hopefully address genetic concerns and offer management agencies a model for minimizing genetic risks as they progress with increased species conservation and management.

Conserving Aquatic Ecosystems – At the Confluence of the Past and Future



The 9th Biennial FMCS Symposium and the 71st Annual UMRCC Meeting will be jointly held on March 22-26, 2015, at the St. Charles Convention Center, St. Charles, Missouri (<http://www.stcharlesconventioncenter.com>). The program has been finalized and posted on the FMCS meeting website (http://molluskconservation.org/2015Symposium/2015_FMCS-Symposium.html). To celebrate the history of FMCS, we have invited speakers to talk on four important topics. These talks will examine the history of these subjects and create a vision for the future of our activities.

Status, Trends, and Monitoring of Molluscan Resources:

- ★ Paul Johnson *et al.* will present “**Update to the Conservation Status of Freshwater Gastropods of Canada and the United States**”
- ★ Jim Williams *et al.* will present “**Conservation Status of North American Freshwater Mussels**”

Contaminants and Ecotoxicology:

- ★ Greg Cope *et al.* will present “**Advances in Molluscan Toxicology over the Past 25 Years: the Importance of People, Places, and Perspectives**”

Relocation & Reintroduction:

- ★ Greg Cope *et al.* will present “**An Evaluation of Mussel Relocation as a Conservation Strategy: 25 Years Revisited**”

Propagation:

- ★ Chris Barnhart and Monte McGregor will present “**100 Years of Mussel Propagation: What Have We Learned and Where Are We Going?**”

St. Charles, Missouri, founded in 1765 as *Les Petites Côtes*, "The Little Hills", by Louis Blanchette, a French-Canadian fur trader, is the third oldest city west of the Mississippi River, was the first state capital of Missouri, and was the last "civilized stop" on the Lewis and Clark *Corps of Discovery*. Much of the heritage of St. Charles has been preserved in downtown and along historic Main Street where there are plenty of shops, eateries, and bars. The hotel offers free shuttle service to historic Main Street. You can find out more about St. Charles at <http://www.historicstcharles.com/>. For exercise buffs, the Katy Trail State Park, the nation's longest rails-to-trails project, runs along the Missouri River and has a trailhead near the hotel (<http://mostateparks.com/park/katy-trail-state-park>).

There are several other parks and attractions within an hour drive of St. Charles, so there will be plenty to do before or after the meeting. Just 25 minutes away is downtown St. Louis with the Arch, riverfront, and historic Laclede's Landing. At Forest Park, the site of the 1904 World's Fair, discover the world-renowned St. Louis Zoo, Art Museum, Science Center, and Missouri History Museum. Stroll around the world-class Missouri Botanical Garden. Visit unique neighborhoods, such as Soulard's historic farmer's market, the Central West End's boutiques/antiques, and the funky, fun Delmar Loop.

Lodging is still available at the Embassy Suites St. Louis – St. Charles/Hotel & Spa, which is directly adjacent to the convention center. Lodging consists of a two-room suite with separate living and sleeping areas. Depending upon availability, the hotel may still honor the reduced rate of \$118/night for 1-2 people and \$128/night for 3-4 people (+ tax), which includes a complimentary full breakfast and evening reception including adult beverages (Yes, complimentary as in FREE...). Reservations can be made by phone (636-946-5544) or online at http://embassysuites.hilton.com/en/es/groups/personalized/S/STLEMES-FMC-20150321/index.jhtml?WT.mc_id=POG. Make sure to mention the Group Name **FMCS/UMRCC** and Group Code **FMCS**.

YOU CAN STILL REGISTER

Still haven't registered? You can still register online until March 13, 2015. After that, we will only accept walk-up registration at the Convention Center. To register online, go to http://molluskconservation.org/2015Symposium/2015_FMCS-Symposium.html. Registration rates will include most meals, breaks, and 2-year **membership dues for FMCS** if registering for the full joint meeting or just the FMCS portion as a non-member.

2015 Joint Meeting Registration Rates

Late Registration (February 14 - March 13, 2015)

Full Joint Meeting (Sunday FMCS Mixer – Thursday UMRCC Banquet)

FMCS Member	\$500
FMCS Student Member	\$400
Non Member (includes 2-year FMCS membership)	\$580
Student Non Member(includes 2-year FMCS membership)	\$440

FMCS Only (Sunday FMCS Mixer – Wednesday Night Auction)

FMCS Member	\$400
FMCS Student Member	\$300
Non Member (includes 2-year FMCS membership)	\$480
Student Non Member(includes 2-year FMCS membership)	\$340

CALLING ALL STUDENTS!!

The Program Committee is still in need of Student Volunteers to help with lights, A/V, and registration during the meeting. In exchange for a few hours' work at the meeting, Student Volunteers will receive cold, hard CASH. That's right, bucks, dough, moolah, cheddar, smackers. If you're interested, please contact Daelyn Woolnough (wooln1d@cmich.edu) or Susan Oetker (susan_oetker@fws.gov) before registering for the meeting.

Auction Items Needed!:

Don't forget to bring your items for the auction! We will have our annual auction at the March, 2015 FMCS symposium and joint meeting with the UMRCC. Money generated during the auction helps to fund travel and scholarships for students attending. Please consider bringing the following items for auction: books, scientific journals, antiques, carvings, pictures, paintings, pottery, jewelry, hunting, fishing, boating, and camping equipment. Quality oddball-quirky "river booty" would be great! Please bring items to the Symposium where there will be a designated area for storage. If you have questions please contact Steve Ahlstedt (bigshelldaddy@bellsouth.net, 865.776.9510) or Lisie Kitchel (Lisie.Kitchel@Wisconsin.gov). If you need to ship large items, contact Steve McMurray (Stephen.McMurray@mdc.mo.gov) or Heidi Dunn (hdunn@ecologicalspecialists.com).

Sponsorships:

We are also still seeking Sponsorships for the Joint Meeting.

All Sponsor Contributions Include Recognition in the Joint Meeting Program

Sponsorship Levels		
River	>\$1000	One Complimentary Registration, Logo on Website Registration Page
Stream	\$500-\$1000	One Registration Reduced by 25%, Logo Displayed at the Welcome Mixer, Logo on Website Registration Page
Eddy	\$100-\$499	Logo on Website Registration Page
Mussel	<\$100	Recognition in the Workshop Program

To Sponsor the Joint Meeting, please go to: <http://www.fmcs.onefireplace.org/page-1748504>

Send Us Your Photos!!:

New for this Symposium, we'd like to run a PowerPoint presentation during the mixers, etc., showing FMCS and UMRCC members doing their thing. So, send your field photos, lab photos, etc., to show off your work or having fun! Send photos to Heidi Dunn (hdunn@ecologicalspecialists.com)

We look forward to seeing you in St. Charles!! If you have any questions about this meeting, please contact Steve McMurray (Stephen.McMurray@mdc.mo.gov) or Heidi Dunn (hdunn@ecologicalspecialists.com).

Ammonia Criteria Implementation Stakeholders Meeting

Heidi L. Dunn, Ecological Specialists, Inc.

In August 2013, the Environmental Protection Agency published new ambient water quality criteria for ammonia reflecting the latest scientific knowledge on the levels of ammonia that are needed to protect sensitive freshwater aquatic species. The new criteria are numerically lower (more stringent) than previous criteria. The criteria levels are based largely on protection of unionid mussels, which are native to most fresh waters throughout the United States, and are considered an important taxonomic group in healthy aquatic communities.

I was invited to attend a stakeholders meeting in Washington DC last October to assist a panel of regulators and utilities with understanding freshwater mussel issues arising from the new ammonia criteria. The meeting was sponsored by: Water Environment Research Foundation, National Association of Clean Water Agencies, Association of Clean Water Administrators, Water Environment Research Foundation, and Water Environment Federation. Attendees included public utility representatives from Denver, Colorado, Los Angeles County, California, Virginia Beach, Virginia, Northeast Ohio, and Northern Kentucky; state water quality regulators from Utah, Illinois, Iowa, Kansas; U.S. Environmental Protection Agency (USEPA) staff from Region 5, Health and Ecological Criteria Division, Water Permits Division/Office of Wastewater Management, Standards and Health Protection Division, and Office of Science & Technology; mussel representatives Heidi Dunn and David Smith; and consultants from Clyde Wilber (Virginia), Geosyntec Consultants (Michigan), and Environ (Tennessee).

The purpose of the meeting was to identify ways to economically implement the new ammonia standard, and identify tasks that need to be accomplished and studies that may need to be conducted to determine best practical means of compliance, particularly by small communities without financial means to upgrade. Following opening remarks, USEPA provided an overview of the new criteria and implementation guidance documents that are available. Municipal and industrial dischargers presented their concerns with compliance. State regulators presented options for implementation approaches issues specific to ammonia in freshwater. I presented an overview of freshwater mussel biology, habitat, and sampling techniques.

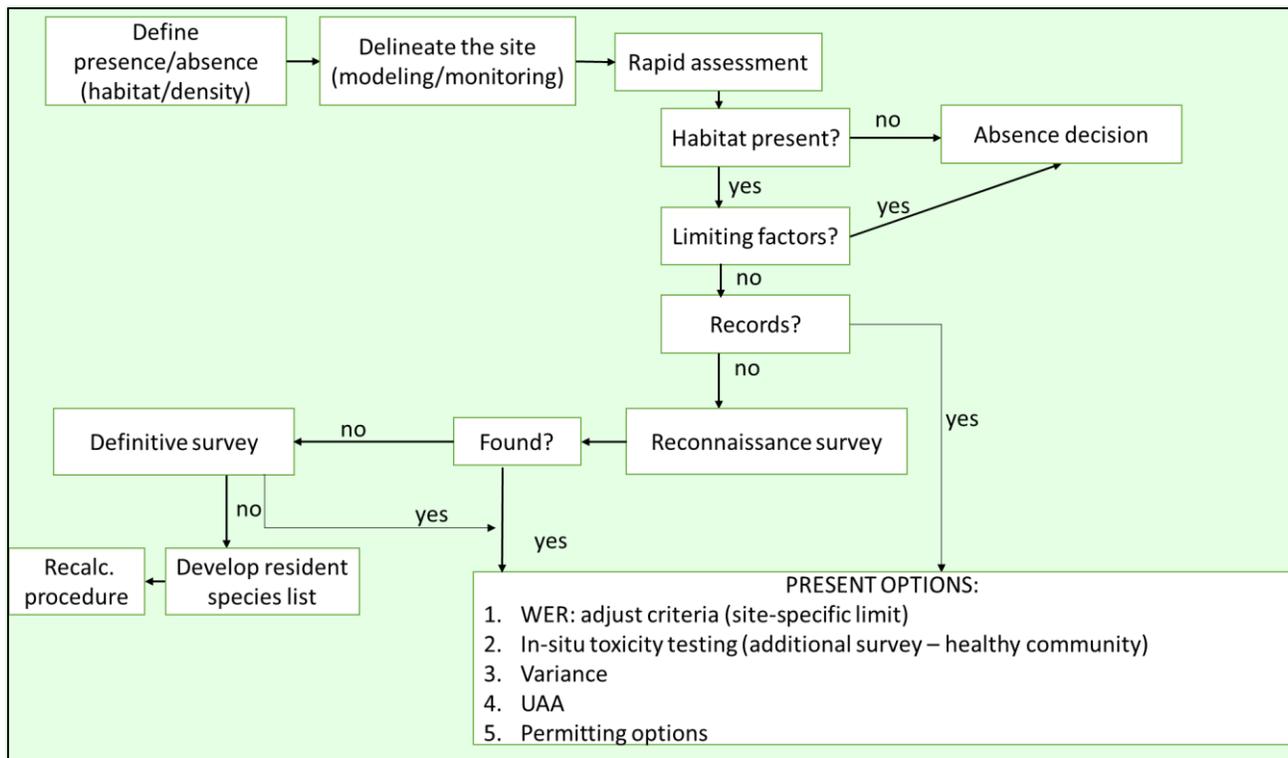
We discussed the presence/absence of mussels and how difficult it would be to prove absence. We discussed the need to use probability of detection, but then talked about the considerable effort required for actual absence. How the definition of “site” and “absence” differs in different parts of the country due to differences in species, density, species composition, and habitat types was discussed. Snails kept coming up briefly, and how they would probably be ubiquitous. The definition of a “site” was discussed at length. Again, this would probably need to be assessed on a case-by-case basis or at least on a regional/state basis. At the end of the day, most agreed the presence/absence mode of avoiding the criteria was probably not practical. They all also agreed that meeting the criteria was the right thing to do, but just not practical at this point in time. Flexibility in the criteria using mixing zones, variances, and UAAs were also discussed. Variances will apply to many small communities in rural areas, but they will eventually have to figure out how to meet criteria. Stochastic permitting was also discussed. Placing discharges in poor habitat such as headwaters, or poor habitat areas of rivers/streams and ensuring criteria are met before water reaches any “good habitat” was considered as a possibility that might apply in some instances. Regulators very concerned with small discharges in rural areas. They do not want to have to evaluate and come up with solutions for thousands of facilities on an individual basis. USEPA and others were also concerned as to how USFWS will apply Section 7 consultation to this process.

Many additional questions were raised, including:

- What about areas where mussel communities exist within non-compliance areas?

- No effect on the indigenous biological shellfish community is used for 316(a) demonstrations. Where would this fit into the regulatory process for ammonia criteria?
- What about the water effect ratio? Are the lab tests reflecting field conditions?

A decision tree (presented below) was developed to assist regulators in determining a course of action. Local conservation agency mussel biologists and U.S. Fish and Wildlife Service biologists would need to be consulted to determine specific guidelines for each state on “presence/absence” decisions and “site” definitions. GLEC is compiling meeting notes/proceedings; however, this is still in progress. A meeting summary will be presented at the upcoming FMCS/UMRCC symposium with the hope of generating discussions of these issues among mussel biologists, particularly those in regulatory positions.



Regional Meetings

FMCS Regional Mollusk Meeting Assistance Award Program

As described in the December 2012 issue of *Ellipsaria*, the FMCS has established a Regional Mollusk Meeting Assistance Award Program to facilitate regional mollusk meetings that address local and regional concerns with freshwater mollusk conservation and management. Our interest in assisting with these meetings is to bring people together who work with freshwater mollusks to exchange information on how to conserve and protect this faunal group. These meetings are often attended by a variety of individuals, including agency personnel, academia, private citizens, scientists, and others, some of whom may not be

FMCS members. Therefore, a secondary goal of this program is to increase the awareness of, and membership in, FMCS among individuals in these groups. Support is provided via a cash award of \$100 to the regional group to help defray the costs (e.g., meeting room rental, speaker travel, break refreshments, etc.) associated with holding their meeting. It is anticipated that about 15-20 awards will be made in a given calendar year.

The complete program description and application form may be obtained from the Awards Committee website at http://www.molluskconservation.org/Mservices_awards.html. One copy of the completed application must be received by the Chair of the Awards Committee at least two months prior to the Regional Mollusk Meeting to allow for application and payment processing.

2015 Chesapeake Bay Freshwater Mussel Workgroup Meeting

The annual Chesapeake Bay Freshwater Mussel Workgroup convened at the FWS office in Annapolis, Maryland, on January 29th, 2015. The meeting was attended in person by 23 people and via web conferencing by at least 17 people who represented state and federal resource agencies, river basin commissions, non-profit organizations, and academia. The topics included the range-wide status assessment of *Alasmidonta varicosa*, mussel propagation at Harrison Lake National Hatchery, proliferation of zebra mussel into the Chesapeake Bay, mussel relocation in Maryland, ecohydrology and habitat optima of *A. heterodon*, using bivalves in STEM learning, American eel restoration activities and pheromone research, and updates on potential ESA listings of regional species. Following presentations, there was a brief discussion on the current status of the unionid fauna and state inventory and monitoring plans. Financial assistance for this regional meeting was graciously provided by FMCS through the Awards Committee and supported afternoon refreshments for attendees. Presentations, with permission of the authors, are shared on a password-protected share point web site.

Barry Wicklow presentation on range-wide *Alasmidonta varicosa* status assessment:

- Heat scheme to grade status by state specific HUC maps
- Many poor viability and data deficient HUCs, recent and rapid declines
- Widespread in upper Susquehanna, but declining and becoming vulnerable to stochastic events.
- Some viable populations in western Susq., many spares and unviable populations throughout rest of drainage. Potomac drainage is predominantly HUCs of questionable viability.
- Some of the best ranked populations are within National Scenic Rivers

Rachel Mair presentation on Harrison Lake:

- Transferred to Harrison Lake from White Sulphur Springs
- Evaluating survival and efficacy of basket grow out system and others
- Used eels to propagate *Elliptio complanata* and *E. congaraea*, largemouth bass for *Ligumia nasuta*
- Summary of drop off totals over 6 year period. Hatchery has increased production in species and numbers. Presented survival rates by culture system.
- In 2014, released 50,000 seven species and six rivers
- Scaling down numbers and shifting focus towards new, rare species for hatchery

Matt Ashton presentation on mussel projects of the Maryland Biological Stream Survey

- Proliferation of zebra mussel into the Upper Chesapeake Bay
- Collaborator in EPA Region 3 e-DNA study for rare aquatic species
- Conducted first relocation in Maryland waters with Natural Heritage Program.
- Pore water chemistry characterization in agricultural stream with recent *Alasmidonta heterodon* decline.

Julie Devers presentation on American eel restoration in the Susquehanna River

- Update on ongoing project to pass eels beyond Conowingo dam. Will eel reintroduction lead to young *E. complanata*?

- Experimental stocking of eels into two creeks and other stocking throughout the basin since 2008. Monitor fish and mussels over time.
- Eels are growing and dispersing rapidly from stocking sites.
- May be seeing evidence of young *E. complanata* already in Pine Creek.

Carrie Blakeslee presentation on attractants and repellents of American eel in lab study

- Glass eels significantly attracted to washings of elvers, but not elver to elver.
- Ongoing work with other attractants, varied concentrations, and other life stages.

Heather Galbraith presentation on *A. heterodon* ecohydrology optima

- Is temperature an important variable in population dynamics?
- They seem to prefer cooler water in a lab experiment.
- Groundwater inputs create thermal gradients that seem to be *A. heterodon* refugia.
- Physiological optima of mussels and hosts along a temperature gradient.

Jeff Cole Ecohydrological drivers of mussel density.

- Hydrodynamic model joined to quantitative survey data to look at variability within space and over time in relation to mussel density.
- Recent flow history seems to be a stronger associate with density than flow events further back in time.
- Do specific events drive these patterns? Do these patterns hold across other variables? Is this model transferable to other rivers? What other data available?

Sarah McCrae presentation on Mid-Atlantic species in North Carolina

- Critical habitat petition for *A. heterodon* from CBD, Raleigh is lead.
- Propagation in North Carolina for Atlantic slope mussels, potentially tied to major transportation project with potential impacts to *A. heterodon*.
- *Fusconaia masoni* propagation, species status assessment in response to ESA listing petition. Working to fill in data gaps ahead of potential listing.
- Successful in vitro *E. lanceolata* propagation at NCSU, another petitioned species by CBD. Potential areas identified for augmentations.

Dan Berlin and **Selena Garber** presentation on bivalves and STEM science

- Use bivalves to investigate environmental issues; do manmade structures affect native and non-native estuarine bivalve populations?
- Many variables affecting the quantity and quality of data
- Asian clam abundance variable, might be trending downward

Jim Cummins presentation on Potomac River survey efforts

- Incorporate SAV and mussels to EPA NRSA biologic community data and collect better data in low flow area.
- Interested in a community level metric for the river.
- Mussel absence in upper reaches, low diversity and density with the exception of downstream Dam No 5.

Mike Everhart update on West Virginia Department of Natural Resources activities

- Scheduled to revisit Cacapon long-term monitoring site, set up sites on Back Creek, re-visit Patterson Creek sites.
- Would like to get back into the Potomac drainage but focused on Ohio.

For more information about the meeting, contact Matt Ashton at matthew.ashton@marylnd.gov or (410) 260-8604.

Ohio River Valley Ecosystem Team (ORVET) Mussel Group Meeting

OSU Museum of Biodiversity, Columbus, Ohio, October 21-22, 2014.

Mike Miller, ORBCRE. Update on the West Milton dam removal, on the Great Miami River in Ohio. Mussel rescue and relocation starts Oct 28 – Nov 5, Cody Fleece at Stantec is coordinating. Funding is a big hurdle for many dam removals, such as the dams on the West Fork in West Virginia and the Green River in Kentucky. Proposal to remove a dam on the Red River in Logan County, funding secured with grants.

URS, Becca Winterringer – using Ohio survey form and protocols a lot this year. Great Lakes and Ohio River, ODOT related projects.

Andy Johnson, Corps Engineers. Large mussel survey contracted this year to Chad, for future maintenance dredging needs. Multiple sites surveyed on the Ohio and Kanawha Rivers. Tried to do beneficial use site at Neal Island with ORINWR, it won't happen this year but will be modified for next year with fuller consideration of all options for dike site, height, fill elevations, etc.

Jeremy Tiemann, ILNHS – 1200 clubs and etr in Vermillion basin, total ~4000 re-introduced so far. All PIT tagged. Don't find many dead shells. Approx. 50-60% detected on monitoring. Two dams coming out in the system, re-connecting these streams to the Wabash. Governor of Illinois has dam removal initiative with funding.

Brant Fisher, Indiana. Tippicanoe River has 2 reservoirs, Norway and Oakdale. Dried up parts of the Tippi in 2012, stranded lots of mussels. Trying to get run-of-the-river guidelines. Big recreation lakes, do not want to release water for mussels. There are 5 listed species in that reach. USFWS and IDNR started a mussel stewardship campaign, assessing local knowledge of the fauna in their rivers. They will do an initial survey, then outreach and education, then survey folks again. They are open to ideas on how to reach out to the public. Snuffbox augmentation underway, caged logperch and awaiting results. Two dams removed on the Eel River, with ORBFHP money. Fish passage being planned for the third dam.

Tom Watters, Ohio – As of this year, they have moved 10,000 northern riffleshell (nrs) and 2,000 clubshell into Darby Creek. They are in the Metropark system, under protection. Some have moved downstream with high water events. Received funding for in-vitro work, with the Zoo.

Greg Zimmerman, Enviroscience – small ODOT projects, Muskingum River, Lake Erie, Big Darby and Little Darby, re-surveying historic sites. Live clubshell and rabbitsfoot.

Steve Ahlstedt, Killbuck Creek, 8th year working there. 10 caged females, 3 gravid, 1 to Tom and 2 to Monte. Held females in Little Darby for the season, till flows drop. Only 2 females left now. Back out a few weeks ago, found 26 catspaws! Tagged and put most back. Many young ones, 15 – 21 mm long. There had been a *Corbicula* die-off there a few years back. Now there are 8 females in a cage for next spring. [12 left alive from 2013 WSS propagation in KY now.] Found snuffbox too. And lots of other common juvenile mussels. Recent bump up of juveniles!

Pennsylvania – Nevin Welte. New species in Dashields pool, QP and Trit. Dunkard Creek case will be moving forward again. Jordan – 4 salvages in FC, Alleg, Conewango. Most went to West Virginia. Some to Ohio for host fish. Keeping some for Pennsylvania rivers ! Conewango, Shenango River, nrs and clubshell, 900 so far.

Hydropower person being sought for FWS office, mussel restoration is a goal.

Round goby found in Lake LeBoef, no detections in French Creek yet, they eat a lot of darters and sculpin. Endangered mussels have been found in LeBoef Creek.

Lora Zimmerman – Pennsylvania Field Office did field study on chlorides from brine discharge on nrs juveniles in silos in the upper Allegheny River below Warren. It is toxic. Publication coming out, EPA is working on standards, as are the states. Traditional lab studies may not be long enough for chronic exposure determinations. Wellsboro USGS doing some longer term studies in lab. Continuous monitoring

instruments could be very useful, and not too expensive. ORSANCO - 250 is the drinking water standard on the Ohio River, not protective of aquatic life necessarily.

Janet Clayton, West Virginia DNR. WV folks still are working up monitoring data for sites on the Kanawha, New, Greenbrier, Elk, Hackers Creek. Elk River at Sutton – temp loggers showed drops of 20 C after high flow events. No recruitment of mussels was detected. Corps agreed to change operations in 2010. This year showed no improvement, rather, some fresh dead mortality. Mostly amblemas. There is a timber treating plant below the dam, possible culprit?? Corps will be looking for dead shells immediately below the dam. Fish surveys underway there too. Elk River Queen Shoals is restoration site for both nrs and rayed bean. There has been some otter predation locally. Many mussels from the PA projects go here! Lower Elk spill in January. No detectable mussel impacts. Plus transects on the Kanawha River too. But good data was collected.

Hackers Creek – last clubshell population that existed in the Mon basin. This site was set up 10 years ago, hard to find live amblemas, but clubshell were there. There was likely a mine blow out. Showed the long term decline of the mussel fauna there, but clubshell still hanging on. Middle Island Creek, Meathouse Fork still has a few clubshell but not genetically viable (too few individuals) so augmentation from Allegheny River sources is possible. Per Meredith Bartron.

Lots of endangered species restoration ongoing, fanshells in Kanawha and Ohio River – doing great!!! Working with PA on nrs and clubshells. Added 3 sites on the Ohio River and Kanawha Falls. Clubshell are now at MI Creek at Falls Mills, Buckley Island, LK, Greenup and Muskingum Island. No mortality. Used PIT tag reader in deep water. Some Blennerhassett Island muckets from the head of the island had moved down to lower island. Part of 1000 adults moved there and stocked juveniles there this year.

First stocked juvenile *L. abrupta* recovered from Muskingum Island (there are now 650 there).

Dunkard Creek, in Miracle Run coal mine impoundment had dam breach last month. Conductivity 1500 at upper site, 10,000 at the mouth. This is upstream of the Dunkard Creek restoration sites, looked OK now but need to go back and look again, given what we know about delayed mortality. Inoculated and released fish for 2 years now.

Kentucky Nature Preserves – Mike Compton, searching with Cumberland papershell, above the falls, found 6 of 16 historic populations, 1 new. Cond 150-225 in these areas. Red River dam removal. *P. clava* work away from Greensburg major populations. *V. ortmanni* status review underway. Some other surveys with Steve Ahlstedt and Bob Butler. Other surveys in the Green River: collected 1 fresh dead ring pink, and 16 *Cumberlandia monodonta*!! Fish host still unknown.

Chad Lewis – Green River, Pool 4 (dam has breached) has hundreds of *C. monodontas*. Rock ledges and riffles. Worked up into 17miles of the pool, 10 sites, many young mussels. Lower Barren River, similar habitat but no *Cumberlandia* ?? They are gravid in March/April. 30 are in cages now, ready to work with next year. May try lamprey as host. Chad working with *P. cooperianus* looking in the mainstem Ohio River, found 15, aggregated them together in one area. If you have good habitat, also find sheepnose. Seeing a lot of expansion of *P. capax* in the Ohio, Green, Tennessee, Clarks, Tradewater. Stockpiled some for propagation, noticed some increase in mortality lately.

Thomas More College has begun to build capability to hold big river mussels. Flow through systems in place, ready soon for mussels.

Jeff Thomas – ORBFHP meeting coming up in Pittsburgh next week. ORSANCO finished surveys this year in 4 pools, electrofishing and macro-invertebrates. Still want to add mussels regularly. Triennial review for pollution control standards. Ammonia, TDS, chlorides, sulfates. Mussels will be considered. Jeff is the lead, aquatic life standards. Mainstem Ohio River data were compiled up to 2000, nothing since then. They would like to know where the mussels are, and the existence of toxicity studies.

Chuck Howard – TVA. New CEO onboard, new environmental stewardship focus. Project on the Elk River in Tennessee, some recent recruitment evident after modifications of operations.

Discussion of detectability of mussels, those that we think are so rare, but somehow they manage to hang on and occasionally pop up in larger numbers. What do we really know about these? Is it effort, time of year, etc.?

Upper Ohio River Basin protocol discussion, being used in WV, PA, OH, MI. PA has a variety of protocols that are industry based, like dredging, and Allegheny River requires Smith et al. 2001. Possible discrepancy in OH/WV buffers and survey areas? Will check them. Issues and concerns, Phase II in big rivers, using the formula. Species richness curves are required for Phase I surveys in Group 2. Can always add transects in between the "trigger" transects to increase effort. Add more effort in the concentration areas. Or do cells directly around those trigger spots. Is there a need to add a quantitative component? Finds smaller species and individuals. May change the relative abundance, but it is very inefficient. Put more detail into justification section after Phase I trigger met. Can we ultimately define a threshold community diversity, by system, that correlates with listed species occurrence?? Probably can be done with recent data. Best to spread out sampling over the entire site of interest, hitting multiple habitats.

May be a need for a Mussel Fact Sheet for developers, applicants, permittees. What they may have to deal with. The Corps regulatory folks could use this tool. Like the Indiana bat sheet. The Midwest FWS Mussel fact sheet could be a template.

Ways to get applicants to evaluate alternatives early on in the process, not just after the triggers are met. Clarify in the guidance, avoid and minimize should always be done. Use some type of scoping project ahead of time, to look for least impact areas. Then hone in on areas of most interest? Conference call early next year to tweak protocol.

Emily Imhoff – Thomas More College.

New mussel conservation center at Old Lock and Dam 35 on the Ohio River, above Cincinnati. FWS and KY funding. Work to be done for KY, OH, and WV. Flow through Ohio River water system. Also do education and outreach there. Can also run as a closed system at times. Ready to accept adult mussels soon. System capacity? Probably hundreds of adults, 600 gallons in the system, 250 gallon tanks.

Monte McGregor, Kentucky DFWR

Facility in Frankfort, plus Minor Clark Hatchery. New labs, greenhouse, fish and mussel holding, in vitro culture. KY working with surrounding states to recovery endangered species to historic range. Restoration is the goal!! Re-introducing nrs, clubshell to Licking River, augmenting pink mucket in the Green. Tagging with glitter. Goal = 10 reproducing pops in the Green. Purple catspaw restoration. 12 of 13 juveniles from 2013 are alive and growing. Plus new ones from 2014, now have 30 growing. Also got nrs juveniles and clubshell from WSS for growout. They are doing well, very few lost. KY is willing to give 100-200 fanshells per site for new re-introduction projects. Lots of new projects underway. Comparison of in vitro vs in vivo juveniles for toxicity testing. Large scale silo and cage studies, assessing water pollution.

John Spaeth, ESI Cincinnati. Duke Energy had a diesel spill this summer: hugged OH shoreline. They had potential impact zone 15 km. Used OH mussel protocol, 167 transects down the reach, 35 days, 4 to 8 personnel. Good survey information along this reach now. Got 48 live sheepsnose in the survey area, spread throughout. Will have data for next year. > 20,000 mussels, 30 live species. Many beds identified. No evidence of die off. Very little fresh dead. Some *P. alatus* collected for toxicity testing too.

Patty Morrison, USFWS, Ohio River Islands NWR. Review of 2013 CRI project accomplishments, and possible future plans for another CRI proposal. Topics and species?? Possible focus on eDNA application to mussel conservation and recovery. Suggestion of possibly holding a theme centered meeting next year, with genetics folks from USGS, Northeast Fisheries Center, etc.

Bob Butler. Petition to list >400 aquatics a few years back. *O. subrotunda*, *F. subrotunda*, *T. lividus*, *P. rubrum* in the ORVE. Williams et al update submitted for publication. 74% imperilment rate. *L. abrupta*

5-year review done. Recovery Plan needs to be updated to add propagation. Threats are hard to control. KY Mussel Atlas in development. FL freshwater mussel book is now out in print, get your soon. Maybe need to work on upper Ohio River Basin-wide Propagation and Re-introduction Plan. TN/Cumberland group has this for their basin. This group is the core group that would do this. Dr. Christopher Owen has template for a propagation, stocking, and translocation database.

Next year's meeting !! **Week of October 19 – 23, 2014.** KY, OH, IN, WV possibilities (Falls of the Ohio, IN refuges, WVU) stay away from extremes of the ecosystem? There is a Bass Pro Shop, in Cincinnati and Clarksville, IN, with meeting rooms.

A sub-group of attendees stayed to discuss the plans for the proposed Allegheny River, Hunter Station bridge mussel relocation project.

Upcoming Meetings

March 22 – 26, 2015 – National Shellfisheries Association 107th Annual Meeting, Monterey, California, Theme: [yet to be announced] <http://www.shellfish.org/annual-meeting> .

March 22 – 27, 2015 – FMCS Symposium/Joint meeting with the Upper Mississippi River Conservation Committee, St. Charles, Missouri. Theme: “*Conserving Aquatic Ecosystems – At the Confluence of the Past and Future.*” <http://molluskconservation.org/Events.html>

April 28 – 30, 2015 – Flow 2015 – Protecting Rivers and Lakes in the Face of Uncertainty, Third International Conference on Instream Flows, Red Lion Hotel, Portland, Oregon
www.instreamflowcouncil.org/flow-2015

May 17 – 21, 2015 – Society for Freshwater Science Annual Meeting, Wisconsin Center, Milwaukee, Wisconsin. Theme: “*Our Freshwater Futures.*” <http://sfsannualmeeting.org>

August 2 – 6, 2015 – International Congress for Conservation Biology, Montpellier, France
<http://www.conbio.org/conferences/about-scb-meetings/past-iccbs>

August 28 – 31, 2015 – American Malacological Society 81st Annual Meeting, University of Michigan Biological Station, Pellston, Michigan
<http://www.malacological.org/meetings/2015/AMS%202015%20Michigan%20ad.pdf>

October 4 – 8, 2015 – Second International Meeting on Biology and Conservation of Freshwater Bivalves, Buffalo, New York, USA <http://greatlakescenter.buffalostate.edu/>

November 24 – 26, 2015 – 2nd International Seminar; Rearing of unionoid mussels, Centre Culturel Château de Clervaux (Castle Clervaux) L-9712, Clervaux, Luxembourg <http://www.unio.lu>

Spring, 2016 – FMCS Genetics Workshop, [specific dates and location under review]



Contributed Articles

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

Snuffbox (*Epioblasma triquetra*) Metamorphose on Naturally Infested Logperch

Grace Van Susteren and **Mark Hove**, Univ. of Minnesota (UMN), St. Paul, 55108; mark_hove@umn.edu
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Dan Hornbach, Macalester College, St. Paul, MN, 55105

The snuffbox (*Epioblasma triquetra* (Rafinesque, 1820)) was recently placed on the U.S. list of federally endangered species (USFWS 2012). Conservation efforts are frequently improved with knowledge of a species life history. Laboratory research has shown that percids (especially logperch, *Percina caprodes*), cottids, and fundulids, are potential snuffbox hosts (Hill 1986, Sherman 1993, Yeager and Saylor 1995, Hillegass and Hove 1997, Barnhart *et al.*, 1998, Jones and Neves 2000, Hove *et al.*, 2003, Watters *et al.*, 2005). Combining potential host research with evidence that snuffbox naturally infest logperch would show this fish is a natural host. The purpose of this study was to identify snuffbox-like juvenile mussels recovered from naturally infested logperch to determine if logperch is a natural host for *E. triquetra*.

We used standard methods to collect and identify juvenile mussels from naturally infested logperch (Hove *et al.*, 2012). During 2004 and 2014, we collected fish from the St. Croix River (Chisago County, Minnesota) and held them in aquaria. Periodic checks of the aquaria revealed freshly-released juvenile mussels, which were photographed using scanning electron microscopy (SEM). We used SEM to measure glochidia from known mussel species and created a database of glochidia shell dimensions for five species similar in size to *E. triquetra* (Hornbach 2001, Watters *et al.*, 2009) (Table 1). We used these data to develop a discriminant function to differentiate among species. (This function correctly identified species approximately 90% of the time). We then applied this discriminant function to the juveniles collected from wild caught logperch. This analysis generated a $\geq 95\%$ prediction probability that 34 juveniles collected from logperch were *E. triquetra* (Table 2).

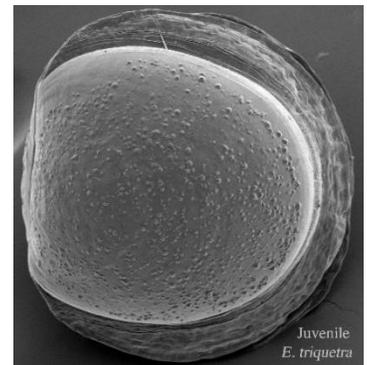


Table 1. Glochidial shell dimensions of St. Croix River (S) and Kohlman Creek (K) mussels. Shell dimensions with different column superscripts were significantly different ($P < 0.05$).

Species	Height \pm 1 std dev (μ)	Length \pm 1 std dev (μ)	Hinge length (μ)
<i>Obliquaria reflexa</i> (S)	256 \pm 6 ^a	250 \pm 7 ^a	146 \pm 6 ^{a,b}
<i>Amblema plicata</i> (S)	234 \pm 8 ^b	216 \pm 6 ^b	141 \pm 5 ^c
<i>Elliptio dilatata</i> (S)	231 \pm 12 ^b	221 \pm 8 ^b	149 \pm 5 ^a
<i>Epioblasma triquetra</i> (S)	206 \pm 4 ^c	204 \pm 4 ^c	143 \pm 5 ^{b,c}
<i>Toxolasma parvus</i> (K)	200 \pm 11 ^c	181 \pm 10 ^d	104 \pm 6 ^d

Table 2. Juvenile mussels recovered from naturally infested logperch.

Logperch collection date	Mean height \pm 1 std dev (μ)	Mean length \pm 1 std dev (μ)	Mean hinge length \pm 1 std dev (μ)	Discriminant analysis prediction probability
June 2004	203 \pm 4	200 \pm 4	136 \pm 4	<i>E. triquetra</i> (98 \pm 3%) (34 juveniles)
June 2004	209	201	132	<i>E. triquetra</i> (87%), <i>A. plicata</i> (12%)
June 2004	212	206	138	<i>E. triquetra</i> (82%), <i>A. plicata</i> (12%)
July-Aug 2014	211	193	133	<i>E. triquetra</i> (95%)
July-Aug 2014	215	192	132	<i>E. triquetra</i> (84%), <i>A. plicata</i> (15%)
July-Aug 2014	215	207	143	<i>E. triquetra</i> (77%), <i>E. dilatata</i> (13%)

These results show that the logperch is a natural host for *Epioblasma triquetra*, confirming laboratory studies. Logperch occur throughout the St. Croix River (Fago 1986), and snuffbox live downstream of the St. Croix Falls dam (Hornbach 2001). Snuffbox have a rather distinctive subelliptical glochidial shell outline, and discriminant analyses generated high prediction probabilities for most unknown juveniles identifying them as *E. triquetra*.

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***Quadrula nodulata* in the Upper St. Anthony Falls Pool, Mississippi River**

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Quadrula nodulata (Rafinesque, 1820) is widely distributed but uncommon throughout much of the Upper Mississippi River, though it can be locally abundant. This species was historically rare in Minnesota, and was listed as endangered in Minnesota in 1996 (MNDNR, 2015). A more recent study found *Q. nodulata* in varying abundance from the Twin Cities to Pool 3, suggesting that the species may be recovering in this reach of the Mississippi River (Kelner and Davis, 2002; MNDNR, 2015). The listing status of *Q. nodulata* was subsequently downgraded from endangered to threatened in 2013. *Quadrula nodulata* was collected recently in moderate abundance in upper Pool 1 (Mile 851.5; ESI, 2013), but had not been previously reported above Pool 1.

Two live *Q. nodulata* were collected in an October 2014 mussel survey in the Upper St. Anthony Falls Pool at river mile 855 (ESI, 2014). The survey was conducted on behalf of the Minneapolis Park and Recreation Board for development of the Hall's Island Project and was coordinated by Barr Engineering. Both the left and right descending banks were included in the survey. Survey methods followed the Minnesota Freshwater Mussel Survey and Relocation Protocol (MNDNR and USFWS, 2013); the survey areas were divided into cells and each cell was searched qualitatively for mussels. The survey yielded a total of 192 live mussels of 12 species. Among these were two *Q. nodulata*: an adult (58 mm long, 7 years old – below, left) and a juvenile (24 mm long, 4 years old – below, right). These individuals were identified as *Q. nodulata* based on their round shell shape, greenish-tan periostracum, two rows of pustules, no sulcus, and no green ray on the umbo.



Although the majority of unionids collected during this survey were found within 50 m of the banks, where substrate was more stable, both *Q. nodulata* were collected >50 m from the bank in loose sand. In addition to the live individuals, a weathered *Q. nodulata* shell was collected. That shell was retained as a voucher and will be deposited in the Illinois Natural History Survey Mollusk Collection.

Although *Q. nodulata* was previously known to occur in the Mississippi River as far upstream as Pool 1, this is the first record of *Q. nodulata*, living or dead, from the Upper St. Anthony Falls Pool. The new record of *Q. nodulata* in the Upper St. Anthony Falls Pool, as well as the first live record of this species in the St. Croix River in 2014 (Hove et al., 2014), suggest that *Q. nodulata* may be expanding its range in Minnesota. This is a significant find for Minnesota, and may be of particular interest in light of the planned closure of the Upper St. Anthony Falls lock in 2015.

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Freshwater Molluscs of African Origin, Which Inhabited the Pelusiac Branch of the Nile River and the Eastern Canal in North Sinai, Egypt, and the Possible Role of these Ancient Water Bodies in the Settlement of Species of Nilotic Origin in Israel

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In spite of the information, which has been published concerning the Pelusiac Branch of the Nile River and the Eastern Canal (Sneh & Weissbrod, 1973; Sneh, Weissbrod & Perath, 1975; Sneh et al., 1986; Moshier, 2002), the freshwater mollusc fauna of these ancient waterways has remained virtually unknown. The archaeological North Sinai Survey (NSS) carried out by Prof. E. Oren (Ben-Gurion University of the Negev, Beersheva) has revealed at least 52 sites containing freshwater mollusc material of African origin. Most of the shells collected by the NSS-campaign were of fairly large specimens belonging to the gastropod genera *Pila* and *Lanistes* and the mussel genera *Chambardia* and *Mutela*. During the extraction of the grey sandy-mud from the large gastropods, however, numerous smaller freshwater molluscs were obtained. These mud-filled shells showed that the large freshwater snails were not leftovers of food, but remains of the autochthonous freshwater mollusc communities inhabiting either the eastern Pelusiac Branch of the Nile or the Eastern Canal. Most of these freshwater molluscs are therefore of more zoogeographical than archaeological importance (Mienis, 1998).

A full report dealing with the excavated sites and the recovered faunal elements, not only molluscs but also vertebrates, will be published in the near future by Liora Kolska Horwitz, Omri Lernau and Henk K. Mienis. Here I will briefly discuss the freshwater molluscs of African origin which were recovered during the excavations carried out by Prof. Eliezer Oren.

Systematic list of autochthonous freshwater molluscs of African origin collected during the archaeological North Sinai Survey carried out by Prof. E. Oren

During the excavations carried out by Prof. Oren and his team remains were collected of at least 16 different species of gastropods (11) and bivalves (5) in the Pelusiac Branch or the man-made Eastern Canal in North Sinai, Egypt.

GASTROPODA

Family Viviparidae

Bellamyia unicolor (Olivier, 1804)

Family Ampullariidae

Pila ovata (Olivier, 1804)*Lanistes bolteni* (Röding, 1798) [Syn. *L. carinatus* (Olivier, 1804)]

Family Valvatidae

Valvata nilotica Jickeli, 1874

Family Bithyniidae

Gabbiella senaariensis (Küster, 1852)

Family Thiaridae

Melanoides tuberculata (Müller, 1774)

Family Pleuroceridae

Cleopatra bulimoides (Olivier, 1804)

Family Planorbidae

Afrogyrus coretus (de Blainville, 1826)*Gyraulus ehrenbergi* (Beck, 1837)*Gyraulus costulatus* Kruass, 1848)*Bulinus truncatus* (Audouin, 1826)**BIVALVIA**

Family Etheriidae

Etheria elliptica Lamarck, 1807

Family Iridinidae

Chambardia rubens arcata (Cailliaud, 1823)*Chambardia wahlbergi hartmanni* (von Martens, 1866)*Mutela dubia nilotica* (Cailliaud, 1823)

Family Corbiculidae

Corbicula consobrina (Cailliaud, 1827)

These 16 species are all typical Nilotic species of African origin (van Damme, 1984; Schütt, 1988; Sattmann & Kinzelbach, 1988) and represent probably only a part of all the freshwater species which were living once in the Pelusiac Branch or the Eastern Canal. The question is whether North Sinai functioned also as a kind of stepping stone for Nilotic species to reach Israel.

At least during two different periods, the area which is now called Israel was invaded by molluscs of African origin. During the Miocene/Pliocene, African freshwater molluscs invaded the area by means of the Syrian-African Rift Valley: *Bellamyia* aff. *unicolor*; *Radix natalensis* Krauss, 1848 and *Pisidium pirothi* Jickeli, 1881 (Tchernov, 1988a & b; Schütt & Ortal, 1993). Of these three species, only *R. natalensis* is still living in Israel. It is not clear, however, whether it survived until today or it reached this area in the Southern Levant during a second wave of Nilotic species which managed to settle into the coastal streams during one or more glacial periods when the level of the Mediterranean dropped so drastically (during the last Glacial 120 m!) that the Nile Delta and the estuaries of the southern coastal rivers were connected with each other.

During such periods *Cleopatra bulimoides*, *Biomphalaria alexandrina* (Ehrenberg, 1831), *Bulinus truncatus* (Audouin, 1826), *Gyraulus ehrenbergi* and *Corbicula consobrina* managed to move to the Southern Levant (Tchernov, 1988b; Mienis, 2003). Most of these species were still living in the coastal rivers in the early fifties of the 20th Century, but since then, *Cleopatra* and *Biomphalaria* have become extinct due to the ever increasing pollution of these rivers (Mienis & Ortal, 1994).

I don't rule out the possibility that *Bulinus truncatus* could have reached aquatic biotopes in the Southern Levant from the Pelusiac Branch or the Eastern Canal in North Sinai by aerial distribution i.e. while hiding among the feathers of wading birds, since up till now it is one of the most characteristic species occurring in isolated temporary rain-pools. Unfortunately, such occurrences are indeed temporary and it is impossible to pin point the zoological history of them in Israel. However, we must not rule out the possibility that some of the large freshwater mussels (*Chambardia* and *Mutela*), which have

been imported intensively to the Levant since early human history (Reese, Mienis & Woodward, 1986), had their origin in the waterways of Northern Sinai, when they were still living there, and not in the Nile proper.

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A First Find of the S.E.-Asian *Filopaludina martensi* in a Pond in a Public Park in Kefar-Sava, Israel

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The gastropod *Filopaludina (Siamopaludina) martensi* (Frauenfeld, 1865), Family Viviparidae, is restricted in its distribution to South East Asia, more particularly to Central and South Thailand and Malaysia (Brandt, 1974). It has recently been recorded as an introduced species from Singapore (Tan, Chan & Clements, 2012).

Since 2005, temporary workers from Thailand has attempted to smuggle live *Filopaludina martensi* and other edible freshwater molluscs into Israel in order to grow them for food. On several occasions, such attempts were intercepted by inspectors of the Plant Protection and Inspection Services (PPIS), Ministry of Agriculture, stationed at Ben-Gurion Airport (Mienis, 2006a-b; Vaisman & Mienis, 2011, 2012, 2014 & 2015; Mienis, Vaisman & Rittner, 2013). In spite of the excellent work carried out by the PPIS-inspectors at Ben-Gurion Airport, we wrote in one of our first reports (Mienis, 2006a) that we did not rule out the possibility that from time-to-time they failed in avoiding the importation of unwanted freshwater molluscs from Thailand into Israel.

On 11 February 2014, we found among others living specimens of *Filopaludina martensi*, *Pomacea maculata* Perry, 1810 and *Radix luteola* (Lamarck, 1822) in a Tel Mond nursery mainly dealing in tropical freshwater fish. Although the owner told us that he was not interested in snails, three aquariums full of many different sizes of Apple snails were up for sale (Mienis & Rittner, 2015). Among the people working in the nursery were several temporary workers from Thailand!

On 29 December 2014, we visited an extensive pond system in a public garden near Yad Lebanim in Kefar Sava. The two upper ponds were fairly recently built and equipped with plants and fish by a gardener in Nordiyya who acquired the aquatic material from the above mentioned nursery in Tel Mond. Five species of snails were found in the upper ponds: *Filopaludina martensi*, *Pomacea maculata*, *Physella gyrina* (Say, 1821), *Planorbella duryi* (Wetherby, 1879) and *Radix luteola*, all exotic species. For *Filopaludina martensi* it was the first time that it had been found in a pond in a public garden.

Unfortunately, the connection between smuggling attempts of temporary labourers arriving from Thailand and the appearance of their smuggled ware (freshwater snails) in a nursery and in a public pond seems to have become a reality. The question is when will we see the first specimens of *Filopaludina martensi* in a natural aquatic habitat in Israel?



Figure 1: *Filopaludina* (*Siamopaludina*) *martensi* (Frauenfeld, 1865) a S.E.-Asian species discovered in a public pond in Kefar Sava, Israel. Photograph by Oz Rittner

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First Geographical Record of the Native Limnic Apple Snail *Pomacea lineata* (Spix, 1827) for Criciúma Municipal District, South Atlantic Slope Section of Santa Catarina State/ SC, Southern Brazil

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Giving continuity to the regional survey, and based on recent literature review and the examination of samples obtained in the course of fieldwork, the present contribution adds the geographical record of one more continental mollusk for the Municipal District of “Criciúma”, in the southern region of Santa Catarina State (Figure 1).

On January 28, 2015, the second author obtained six dry shells of native gastropod species Ampullariidae *Pomacea lineata* (Spix, 1827) (Figure 2) in a rural area named “Sitio do Bépe” (Bépe Site), in the “Quarta-linha” (Fourth-line) of Criciúma. The shells had been gathered by local residents in a "cattle grazing area" flooded during the rainy season, being sighted still at the ground the typical "color pink eggs" produced by the species. This site is a farm with large cattle pastures that is likely to be used for urban development in the future (Figure 3). Previously, *Pomacea lineata* had been reported only from the Highlands region of Santa Catarina territory (Agudo-Padrón 2014), specifically the Lages Municipal District (Agudo-Padrón 2008:151).



Figure 1. The Municipal District of Criciúma (red color) in the geographical context of Santa Catarina/ SC State



Figure 2. *Pomacea lineata* (Spix, 1827) from Criciúma, Santa Catarina State/ SC.
Photographs by Jefferson Souza da Luz, Project AM

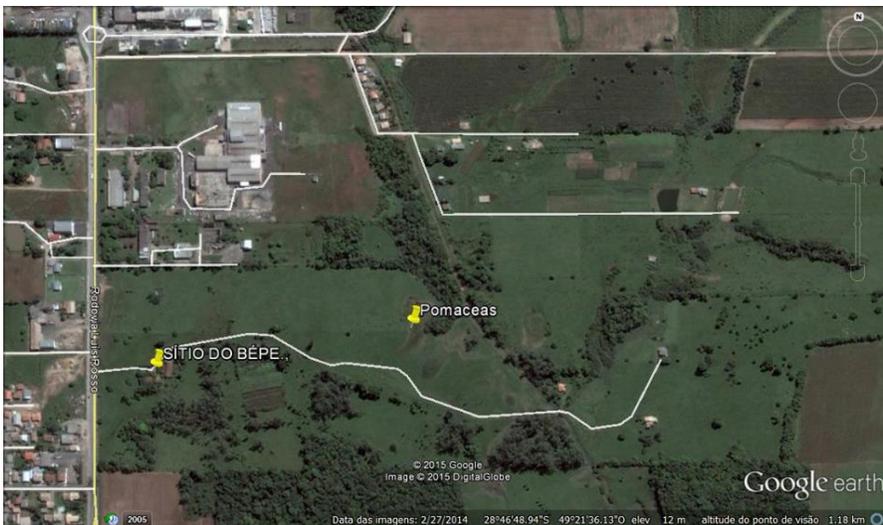


Figure 3. Specific locality in the rural area of Criciúma, Santa Catarina State/ SC where the *Pomacea lineata* shells were collected.

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The Registered Mollusks on the “Brazilian Official List 2014 of Endangered Species”: A Preliminary Approach

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The most recent new Official List of Brazilian Fauna Threatened Extinction - Version 2014 <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies.html?limitstart=0>>, only includes a total of 23 species of mollusks, including six marine forms, eight terrestrial forms, and nine freshwater/ limnic forms, this last of our special interest. Seven of these species there are currently verified in the Santa Catarina's State/ SC territory (Figure 1), including two marine (1 Bivalvia & 1 Gastropoda) and five freshwater/ limnic (2 Bivalvia & 3 Gastropoda), this last previously included in the most recent regional systematic inventory of known continental forms (Agudo-Padrón 2014).

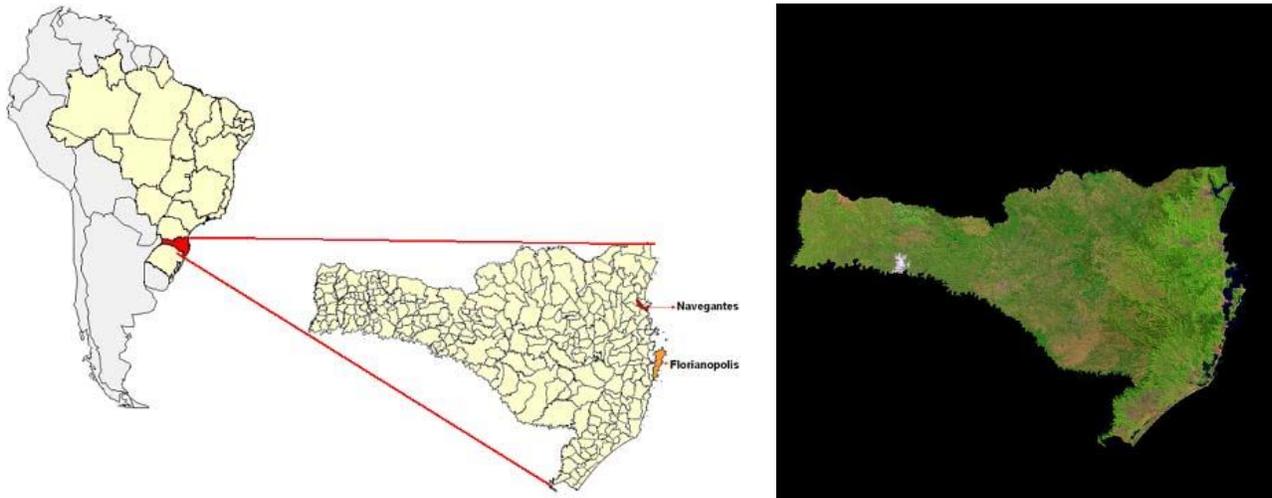


Figure 1. Outline map of South America showing the state-level divisions in Brazil (left) and the State of Santa Catarina/ SC (center and right).

MARINE MOLLUSKS (1 BIVALVIA & 5 GASTROPODA)

- *Eustrombus goliath* (Schröter, 1805) <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5781-especie-5781.html>>
- *Euvola ziczac* (Linnaeus, 1758)* <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5771-especie-5771.html>>
- *Lobatus costatus* (Gmelin, 1791) <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5782-especie-5782.html>>
- *Olivancillaria contortuplicata* (Reeve, 1850)* <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5784-especie-5784.html>>
- *Olivancillaria teaguei* Klappenbach, 1964 <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5785-especie-5785.html>>
- *Petalconchus myrakeenae* Absalão & Rios, 1987 <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5786-especie-5786.html>>

LAND MOLLUSKS (1 SLUG & 7 SNAILS)

- *Gonyostomus insularis* Leme, 1974 <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5909-especie-5909.html>>
- *Hypselartemon alveus* (Dunker, 1845) <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5910-especie-5910.html>>
- *Macrodonates dautzenbergianus* Pilsbry, 1898 <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5911-especie-5911.html>>

- *Megalobulimus cardosoi* (Morretes, 1952) <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5912-especie-5912.html> >
- *Phyllocaulis renschi* Thomé, 1965 <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5913-especie-5913.html> >
- *Succinea lopesi* Lanzieri, 1966 <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5914-especie-5914.html> >
- *Thaumastus lundi* Pena, Salgado & Coelho, 2005 <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5915-especie-5915.html> >
- *Tomigerus (Digerus) gibberulus* (Burrow, 1815) <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5916-especie-5916.html> >

FRESHWATER MOLLUSKS (2 BIVALVIA & 7 GASTROPODA)

- *Diplodon (Rhipidodonta) koseritzi* (Clessin, 1888) * <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5770-especie-5770.html> >
- *Lymnaea rupestris* Paraense, 1982* <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5783-especie-5783.html> >
- *Mycetopoda legumen* (Martens, 1888) * (Figure 2) <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5772-especie-5772.html> >

Figure 2. *Mycetopoda legumen* (Martens, 1888)



- *Physa marmorata* Guilding, 1828* (Figure 3) <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5787-especie-5787.html> >



Figure 3. *Physa marmorata* Guilding, 1828

- *Plesiophysa dolichomastix* Paraense, 2002 <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5788-especie-5788.html> >
- *Pomacea sordida* (Swainson, 1823) * (Figure 4) <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5789-especie-5789.html> >

Figure 4. *Pomacea sordida*
(Swainson, 1823)



- *Potamolithus karsticus* Simone & Moracchioli, 1994 <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5790-especie-5790.html> >
- *Potamolithus troglobius* Simone & Miracchioli, 1994 <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5791-especie-5791.html> >
- *Spiripockia punctata* Simone, 2012 <<http://www.icmbio.gov.br/portal/biodiversidade/fauna-brasileira/lista-de-especies/5792-especie-5792.html> >

* Species with verified occurrences in Santa Catarina State/ SC

The large geographical size of Brazil and its diversity of environments and ecosystems suggest the existence of a huge diversity of continental mollusks, most of which is still unknown to science. The most recent available estimates speak of 700 terrestrial species and 373 freshwater forms, 956 gastropods and 117 bivalves (Simone 2006:3).

Conclusively, the size and content of the “official malacological list” clearly demonstrates that the urgent and necessary knowledge about the situation of your conservation unfortunately still persists unchanged today: ... worryingly "stagnant and deficient".

The research and knowledge of the conservation situation of Brazilian mollusk biodiversity is necessary in view of the rapidly changing natural environments due to human activities and parallel rapid process of invasion by exotic species. Urgently needed depth studies on their population biology and reproductive cycles in addition to ecological research of middle and long term, among other no less relevant.

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Ellipsaria is posted on the FMCS web site quarterly: around the first of March, June, September, and December. This newsletter routinely includes Society news, abstracts, job postings, meeting notices, publication announcements, informal articles about ongoing research, and comments on current issues affecting freshwater mollusks. Anyone may submit material for inclusion in *Ellipsaria*; however, only current dues-paying members of FMCS can access the two most recent issues. Older issues are accessible to anyone. Information for possible inclusion in *Ellipsaria* should be submitted via e-mail to the editor, John Jenkinson, at jjjenkinson@hotmail.com.

Contributions may be submitted at any time but are due by the 15th of the month before each issue is posted. MSWord is optimal for text documents but the editor may be able to convert other formats. Graphics should be in a form that can be manipulated using PhotoShop. Please limit the length of informal articles to about one page of text. Note that submissions are not peer reviewed but are checked for clarity and appropriateness for this freshwater mollusk newsletter. Feel free to contact the editor with questions about possible submissions or transmission concerns.

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

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Parting Shot



One component of the logo for the joint FMCS/Upper Mississippi River Conservation Committee (UMRCC) meeting in St Charles is a River Rat. The River Rat is a UMRCC symbol of experience and expertise in the Mississippi River. In 1986, Tom Boland approached UMRCC Coordinator Jerry Rasmussen with the idea of some sort of award to recognize dedicated, long-term members. Jerry proposed River Rat Awards to the Executive Board that year and the Board unanimously supported it. The Board also agreed that it couldn't just start as if 1986 was "year one" for such recognitions, so they used the list of registrants at past Annual Meetings to compile member credits for these recognitions. That policy continues to this day. To get a credit, you have to pay the registration fee and attend the UMRCC Annual Meeting. The original River Rat artwork, done by one of the top artists on the Missouri Department of Conservation publications staff, covered the 5-, 10-, 15-, and 20-year River Rat Awards. Later, artwork was added for the 25-, 30-, 35-, and 40-year River Rat Awards.

During its 72-year history, UMRCC members have accomplished incredible tasks to keep the upper Mississippi River one of the world's most valued resources. Because of this hard work and determination, the River Rat Awards are cherished by the recipients and all true River Rats display them in prominent places. Several FMCS members are proud to be River Rat awardees.



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