



Newsletter of the Freshwater Mollusk Conservation Society  
 Volume 14 – Number 4  
 December 2012

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**It's Time to Vote!**

**Caryn Vaughn**, FMCS President

It's time to elect new officers for our society and we are fortunate to have an excellent slate of candidates. Teresa Newton and Kevin Roe have graciously agreed to run for President Elect. Teresa is a founding member of the society who has chaired the awards committee and serves on the *Walkerana* editorial board. Kevin is also a longtime FMCS member who has served on multiple committees including chairing the Mussel Status and Distribution Committee. Both candidates are actively contributing to the conservation of freshwater mollusks through outstanding research and outreach. Both candidates would provide excellent leadership to our society.

Greg Zimmerman is running unopposed for a fourth term as FMCS Secretary. As the current FMCS President, I can attest to the fantastic job Greg has done. He keeps us organized and has greatly aided our ability to "go online." We need to re-elect him!

Heidi Dunn is a founding member of the society and has been our Treasurer since its inception. She has also served the society in many other capacities including organizing symposia and workshops and chairing the Guidelines and Techniques Committee. I can't think of anyone who has done more or is more dedicated to our society and its core mission than Heidi. It goes without saying that we need to re-elect Heidi.

Please take some time to read the statements from each of these four candidates (see below), then follow

the instructions on Page 5 to go to the on-line voting site. Voting only takes a minute but it shows your support for these candidates *and* for our society. Thank you for your active involvement in FMCS.

### Candidate for President Elect



**Teresa Newton**

I am humbled (and to be honest, a bit scared) to be considered for the position of President-elect of the Freshwater Mollusk Conservation Society. I have had the privilege of being one of the founding members of this Society (through its origins at the 1992 meeting in St. Louis, MO), I have been the co-chair or chair of the Awards Committee since 2007, and I have been a member of the editorial review board for *Walkerana* since 2011. It has been my privilege to serve the Society in these capacities, and if elected, I hope I can continue to serve the Society as President. I see this as an awesome opportunity!!

I first encountered native mussels when I attempted to wind surf in Jacksonville Reservoir in Mississippi as I began my Master's degree. As I kept falling off my board, I landed on these "hard rocks". After some investigation, as you can imagine, I discovered that the "hard rocks" were native mussels which simply blanketed the bottom of the reservoir. This event started a passion of mine that has

### Candidate for President Elect



**Kevin Roe**

I am originally from New York, where as a boy, I developed an interest in the natural world. It wasn't until I began my college education at the University of Georgia in 1983 and later in 1994 the University of Alabama, that I first became aware of freshwater mussels and started to study them. I have been actively involved in research on freshwater mollusks since 1994 and have been a member of FMCS since 1999 when I attended the first symposium in Chattanooga, Tennessee, as a graduate student.

I am currently a faculty member in the Department of Natural Resource Ecology and Management at Iowa State University, where I have continued my research on the evolution and conservation genetics of freshwater mussels and other aquatic organisms. My professional career has developed over the years as has our society and I cannot think of an organization that more completely encompasses my research interests and passions as well as FMCS. Our society includes a stimulating mix of

**(Newton, continued)**

continued for 25+ years. I continue to be totally excited about all the things we know about mollusks and all the unknowns yet to be discovered. This one fact keeps me totally motivated to continue to research these amazing animals!!

I received a B.S. in Biology and Conservation from Central Michigan University in 1981, a M.S. in Fisheries Biology from Tennessee Technological University in 1985, and a Ph.D. with a double major in Fisheries Biology and Toxicology from Iowa State University in 1990. My personal research interests lie in conserving and restoring freshwater mussel populations by understanding the suite of physical and chemical factors that influence their distribution and abundance, by quantifying the important roles that mussels play in river food webs, and by investigating how contaminants affect native mussel populations.

The Society has had incredible leadership over the past decade and has seen many recent accomplishments (e.g., a new journal, a new web page); it will be a hard act to follow!! However, if elected President, I will endeavor to uphold the core mission of the Society and to continue to move the Society forward to disseminate the incredible science performed by Society members.

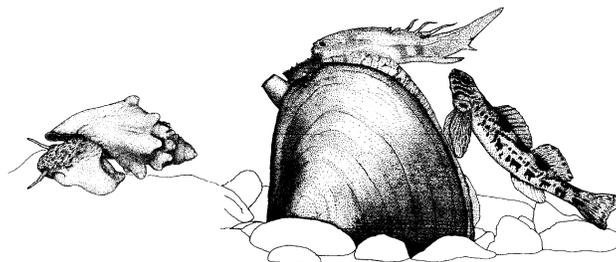
**(Roe, continued)**

individuals drawn from academia, and both the public and the private private sectors. It is this unique mix that has facilitated the exchange of information and has produced a number of successful collaborative projects.

Since I first joined FMCS, I have tried to be an active member of the society and have served on several committees including Mussel Status and Distribution and Genetics, and have served on the Board as chair of the Mussel Status and Distribution Committee.

At its inception, FMCS had several objectives and, these objectives are being met through the efforts of the membership, but freshwater mollusks will continue to face long-standing challenges to their survival, as well as newer emerging ones. In light of these challenges, it is important that the Society continue to recruit new members and foster research on freshwater mussels to meet these challenges.

If I am elected, I promise to pursue the objectives of the Society as stated in the by-laws to the best of my ability, including: Advocate freshwater mollusk conservation; Serve as a source and conduit of information on freshwater mollusks; Promote science-based management of freshwater mollusks; Promote and facilitate education about and awareness of freshwater mollusks and their importance to freshwater ecosystems; and Facilitate implementation of the *National Strategy for the Conservation of Native Freshwater Mollusks*.



### Candidate for Secretary



**Greg Zimmerman**

I am an Ohio native who was first introduced to freshwater mussels during my undergraduate years at Hiram College through Dr. Marty Huehner. For three summers, I helped Marty survey over 100 miles of Ohio's Grand River for mussels; after that I was hooked.

I graduated with a degree in Environmental Biology in 1996 and was hired shortly thereafter by EnviroScience in Cuyahoga Falls, Ohio to do fisheries work. Through my work at ES, I became involved in FMCS and the Ohio River Valley Ecosystem mollusk subgroup where I had the privilege of meeting many of the great folks that founded FMCS, most of whom are still working just as hard today. I have been with EnviroScience now for the past 17 years and the majority of my work involves freshwater mussels and commercial diving all over the country. While working, I received a graduate degree from Kent State University and my thesis looked at how freshwater mussels could affect substrate compaction and erosion, and GIS.

I truly believe FMCS is a very special and unique organization. I don't think you will find a more open, friendly, knowledgeable, eccentric, or dedicated

### Candidate for Treasurer



**Heidi Dunn**

I was first introduced into the world of freshwater mussels in 1979 while working for the USFWS. I have been working with this unique group of organisms ever since and am continually amazed at their adaptations. I received a BS from Purdue University in 1979, and my MS from Southern Illinois University at Edwardsville, IL in 1991. I have worked in environmental consulting since 1980, and founded Ecological Specialists, Inc. in 1990. As a consultant, I work with government, private industry, and regulatory agencies conducting inventories and impact analysis for freshwater mussels and other aquatic organisms.

I am one of the founding members of the Freshwater Mollusk Conservation Society and have been its Treasurer since its inception. As treasurer, I ensure the books are balanced, the bills are paid, and the taxes are filed, and assist with other FMCS activities as needed. I have assisted with most of the FMCS symposia and workshops, and was chair of the Habitat Workshop in 2007 and co-chair of the Fauna Identification Workshop in 2010. I was also chair of the Guidelines and Techniques Committee from 1999 through 2001. I have truly enjoyed working with

**(Zimmerman, continued)**

group of people under one banner. I am amazed by what we have accomplished in a relatively short time, and excited by what's to come. Here in Ohio, we have nearly lost two *Epioblasma* species in the last ten years and these advances cannot come at a more critical time.

I would like to continue working to coordinate the improvement of the following aspects of FMCS: 1) keep and expand our membership, 2) improve the efficiency of our membership database and dues management, 3) improve the on-line availability of FMCS documents, and 4) better organize and empower the FMCS committees with the tools they need to succeed. I think we have made significant improvements over the last two years and I would like that to continue.

**(Dunn, continued)**

the other officers, the Board of Directors, and society members. I hope you will give me the opportunity to continue working as Treasurer in 2013-2015.

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## Vote Now !

Now that you have read through the statements from the candidates, you need to vote for the officers of our Society. This link [▶ http://bit.ly/FMCS2013Ballot ◀](http://bit.ly/FMCS2013Ballot) will take you to the voting site. The voting site will be open through December 31, 2012. **Go vote now**, then come back and read the rest of this issue of *Ellipsaria*.

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## Society News

### Are You Coming to Guntersville ?

As indicated in preceding issue of *Ellipsaria*, the 8<sup>th</sup> Biennial FMCS Symposium will be held the week of March 10-14, 2013 at Lake Guntersville State Park, outside of Guntersville, Alabama. This will be a general symposium with presentations on a range of research and management topics in both oral and poster format. The meeting will be hosted by the Alabama Department of Conservation and Natural Resources.



Here is an abbreviated schedule for this Symposium:

### Sunday, March 10

1:00 p.m. Poster Session Set-Up  
 3:00 p.m. FMCS Executive Board Meeting  
 5:00 – 7:00 p.m. FMCS Committee Meetings  
 [Symposium, Outreach, Mussel Status and Distribution]  
 7:00 p.m. -- Guntersville Meeting Welcome

### Monday, March 11

8:00 a.m. – 5:00 p.m. Contributed Presentations  
 12:00 – 1:20 p.m. FMCS Committee Meetings  
 [Information Exchange, National Strategy, Genetics, Environmental Affairs]  
 6:00 p.m. -- Poster Session

### Tuesday, March 12

8:00 a.m. – 5:00 p.m. Contributed Presentations  
 12:00 – 1:20 p.m. FMCS Committee Meetings  
 [Awards, Propagation, Guidelines and Techniques, Gastropod Status and Distribution]  
 6:00 pm -- 8:00 p.m. Dinner and National Strategy Presentation  
 8:00 p.m. -- Auction

### Wednesday, March 13

8:00 a.m. – 5:00 p.m. Contributed Presentations  
 12:00 – 1:40 p.m. Business Lunch and Awards Presentation  
 6:00 p.m. -- Dinner (Top O' The River, in Guntersville)

### Thursday, March 14

Optional Day Trips

More details about this Symposium and the registration page can be found at:

[http://molluskconservation.org/2013Symposium/2013\\_FMCS\\_Symposium.html](http://molluskconservation.org/2013Symposium/2013_FMCS_Symposium.html)

## **LAST CALL ! ! Guntersville Abstracts Due by December 3, 2012**

This symposium will include both oral and poster presentations. Oral presentations will be limited to 20 minutes, including the question and answer period. Size of the poster presentations will be limited to four feet high by four feet wide. If you wish to bring a display unit, special arrangements can be made.

Abstracts for posters and oral presentations will be limited to 300 words. The title should appear in all caps and bold, and be followed by the author name(s), and affiliation(s). Please underline the name of the presenter. Abstracts, which should be written in Word utilizing Arial 11 point font, should include clearly stated objectives, brief methods, general results, and the basic conclusion. The **abstract submission deadline is December 3, 2012**. Submit abstracts on-line at: [fmcs2013symposium@gmail.com](mailto:fmcs2013symposium@gmail.com)

Example abstract from a previous FMCS symposium:

**ASSESSING THE HAZARDS OF CURRENT USE PESTICIDES TO EARLY LIFE STAGES OF NATIVE FRESHWATER MUSSELS.** Robert B. Bringolf<sup>1</sup>, LeRoy F. Humphries<sup>2</sup>, Peter R. Lazaro<sup>1</sup>, Chris Eads<sup>2</sup>, Chris Barnhart<sup>3</sup>, Damian Shea<sup>1</sup>, Jay F. Levine<sup>2</sup>, and W. Gregory Cope<sup>1</sup>. <sup>1</sup>Department of Environmental and Molecular Toxicology, North Carolina State University, Raleigh, NC 27695; <sup>2</sup>College of Veterinary Medicine, North Carolina State University, Raleigh, NC 27606; <sup>3</sup>Department of Biology, Missouri State University, Springfield, MO 65804.

Native freshwater mussels (family Unionidae) are among the most imperiled faunal groups in North America. Approximately 67% of the nearly 300 freshwater mussel species are considered vulnerable to extinction or already extinct. North Carolina has historically supported 56 species of mussels; however, 82% of those species are currently listed as endangered, threatened, or of special concern by the U.S. Fish and Wildlife Service and the State of North Carolina. Although numerous stressors have been implicated in the decline of freshwater mussels, the effects of pesticides on native mussels is largely unknown. Timing of pesticide application combined with the unique life history and reproductive strategy of mussels makes them susceptible to pesticide exposure. The objective of this study was to determine the hazards of pesticides to early life stages of freshwater mussels. We performed acute toxicity tests with glochidia (7 species) and juveniles (6 species) exposed to a suite of current use pesticides (atrazine, fipronil, pendimethalin, and permethrin) and a reference toxicant (NaCl). Our results indicate that these pesticides, at concentrations approaching water solubility, were not acutely toxic to the species of glochidia and juveniles tested. However, in a 21-d chronic toxicity test performed with 4-month old juvenile *Lampsilis siliquoidea* exposed to atrazine, the 14-d atrazine LC50 was 15.8 mg/L (95% confidence interval 12.0-19.5) and the 21-d atrazine LC50 was 4.3 mg/L (95% confidence interval 2.8-5.8). Effects on growth and genotoxicity (single-strand DNA breaks) were also determined in the chronic test. Our results indicate that the relative risk associated with acute exposure of early life stages of mussels to the current use pesticides tested singly is likely low; however, survival and genotoxicity results indicate that chronic exposure of juvenile mussels to atrazine may be impacting mussel populations and warrants further investigation, as does the assessment of pesticide mixtures.

**At the bottom of the abstract page, please type:**

1. The name, address, telephone, fax, and e-mail of the presenting author;
  2. Preference for Platform or Poster presentation and willingness (yes or no) to convert from one format to the other; and
  3. Whether the presenter is a Regular or a Student attendee
- Provided they meet eligibility requirements, all students submitting abstracts will be judged for the best student platform or poster presentations, unless otherwise indicated.
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**Student Travel Awards Still Available**

CALLING ALL STUDENTS - To facilitate your participation in the 8<sup>th</sup> Biennial Symposium, travel awards are being offered by the FMCS. Support is provided as Society-paid lodging accommodations for the duration of the meeting at Lake Gunter State Park. It is anticipated that eight awards will be made for the 2013 Symposium. A complete application package must be submitted by e-mail as a PDF file to Dr. Teresa Newton, FMCS Awards Committee, on or before **January 30, 2013**. For more information, application forms, and procedures, please see the Awards Committee web site at [http://molluskconservation.org/Mservices\\_awards.html](http://molluskconservation.org/Mservices_awards.html) or contact Teresa ([tnewton@usgs.gov](mailto:tnewton@usgs.gov), phone 608-781-6217).

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**Call for 2013 Professional Award Nominations**

Do you know someone who has made worthwhile contributions to mussel conservation or to the Society either by donating their professional time or expertise or through their scientific endeavors? Consider nominating them for one of the three FMCS Professional Awards. Nominations and supporting documentation are due on **December 31, 2012**. See the Awards Committee web site at [http://molluskconservation.org/Mservices\\_awards.html](http://molluskconservation.org/Mservices_awards.html) for more details. For more information, contact Greg Cope, [greg\\_cope@ncsu.edu](mailto:greg_cope@ncsu.edu) , 919-515-5296 or Teresa Newton, [tnewton@usgs.gov](mailto:tnewton@usgs.gov) , 608-781-6217.

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### Auction Items Needed

As is our custom, we will have an auction during our March, 2013 Symposium at Guntersville State Park. Money generated by the auction helps fund scholarships for students attending our meetings. Please consider bringing the following items we can auction: books, scientific journals, antiques, carvings, pictures, paintings, pottery, jewelry, hunting, fishing, boating, and camping equipment. Quality oddball-quirky "river booty" also would be great!

Please bring your auction items to the Symposium and contact Steve Ahlstedt, Teresa Newton, or Lisie Kitchel. If you have questions, contact Steve Ahlstedt by email: [bigshelldaddy@bellsouth.net](mailto:bigshelldaddy@bellsouth.net).

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### FMCS Fall 2012 Board Meeting, November 13, 3:00 – 5:00 p.m. EST, Thomas More College Biology Field Station, and via Conference Call

#### Call to Order and Roll Call for Attendance

Attendees: Caryn Vaughn, Patricia Morrison, Greg Cope, Greg Zimmerman, Heidi Dunn, Teresa Newton, Emy Monroe, Steve McMurray, Beaven Beaty, Kevin Cummings, Catherine Gatenby, Jeff Garner, Jeremy Tieman, Nevin Welte, John Jenkinson, John Harris, Rachel Mair, Chris Owen, Leroy Koch, Curt Elderkin, Mary McCann, Paul Johnson, Megan Bradley, Rob Krebs, Janet Clayton, Barb Douglas, and Steve Ahlstedt

**Motion for approval of last meeting minutes. Motion carried.**

#### Treasurer Report (as of 11-13-12) - Heidi Dunn

So far this year, we have income of:

- \$4.20 from checking account rewards
- \$248.97 interest
- \$7400 from memberships
- \$15,815 from the 2012 workshop
- \$2550 from 2013 symposium (8 early registrations, including one from Portugal)
- \$20 from sale of a 2000 symposium proceedings

Total income \$26,038.17

Expenses include:

- \$5000 for the mussel app
- \$14.04 shipping a set of *Walkerana* to Greg Cope
- \$2601.60 for the webpage maintenance
- \$2750 for *Walkerana* set-up
- \$35.00 for tax preparation (on-line fee if over \$100,000 in income)
- \$1010.29 Bank, cc, and PayPal fees
- \$460.64 for the workshop t shirts
- \$9620.24 workshop expenses

Total expenses \$21,491.81

Net income \$4,546.36

We have retained earnings of \$99,950.67

Total in the bank: \$104,497.03

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**Athens 2012 Workshop made money**

- \$15,815 income
- \$10,080.88 expenses in 2012
- \$500 expenses in 2011

Net Profit: \$5234.12

**Secretary Report – Greg Zimmerman**

The Wild Apricot web service has made the job of FMCS Secretary much easier than in the past; many tasks like tracking membership and keeping up with past-due members are now automated. Membership address and email changes are also self-service though there are some occasional bugs with duplicate emails / memberships. We have started to switch to HTML-format for announcements, which also had some glitches (user error!) but is more attractive with images and links to the FMCS Facebook page and website.

Our membership appears to be growing, though there is some ebb and flow with symposium years and students that join and then do not renew. At present, there are 447 active members and 8 Author / non-members. 191 members are overdue on dues and 150 have lapsed. I expect active membership will increase during this symposium year. A summary of the membership as of 11/21/12 is presented below.

Level	Total	Active	Renewal overdue	Lapsed	Pending			New in last	
					New	Renewal	Level change	7 days	30 days
Author-Non Member	<u>8</u>	<u>8</u>	-	-	-	-	-	-	<u>3</u>
Contributing	<u>7</u>	<u>6</u>	<u>1</u>	<u>1</u>	-	-	-	-	-
Lifetime	<u>10</u>	<u>10</u>	-	-	-	-	-	-	-
Paper Registr Members	-	-	-	-	-	-	-	-	-
Regular	<u>478</u>	<u>354</u>	<u>151</u>	<u>117</u>	<u>2</u>	<u>5</u>	-	-	<u>3</u>
Student	<u>110</u>	<u>77</u>	<u>39</u>	<u>32</u>	-	<u>1</u>	-	<u>1</u>	<u>3</u>
<b>Total</b>	<b><u>613</u></b>	<b><u>455</u></b>	<b><u>191</u></b>	<b><u>150</u></b>	<b><u>2</u></b>	<b><u>6</u></b>	-	<b><u>1</u></b>	<b><u>9</u></b>

**COMMITTEE REPORTS**

**Symposium Committee – Paul Johnson**

**March 10-14, 2013, Lake Guntersville State Park- Guntersville, Alabama**

For more information about this symposium, see the article on Page 5 or visit the web site: [http://molluskconservation.org/2013Symposium/2013\\_FMCS\\_Symposium.html](http://molluskconservation.org/2013Symposium/2013_FMCS_Symposium.html) The final meeting program should be posted on the FMCS Website by the end of January.

Other notes about this meeting:

- Food will be included with the symposium - (there is not much else near the park in terms of food).
- Committee meetings - We received correspondence that some members did not like overlapping committee meetings at last meeting. Caryn noted that members may need to plan on jumping between meetings for overlapping sessions. Paul noted than the committee meetings were spread out over three days to help reduce overlap. We just don't have a perfect solution to this dilemma.
- Continuing education credits – We discussed possibility of continuing education credits for FMCS meetings. Braven Beaty noted that there was a potential fee of \$20 to \$40 / per

person. This topic was moved to the business agenda to investigate potential opportunities.

### **Future Symposia and Workshops**

#### **2014 Workshop - New England – Mary McCann**

Proposed Topic: Mussel Considerations in Dam Removals. Likely Schedule end of April

1. Surveys and Relocations, including lessons learned
2. Regulatory Framework (including incidental take for (state) listed species
3. Dam Modification (Fish Passage, Flow and Temperature modification, etc.)

- Steve McMurray suggested that Mary look into getting a local speaker to increase interest.
- Also, Mary is looking at potential sites for visits. Weather at end of April may be marginal.
- Two potential sites are being investigated; one in Portland, Maine, and another on the coast about 1.5 hour north of Portland. Board members expressed interest in Portland because it was more accessible and would not require a rental car. Mary is looking at pricing.

#### **2015 Symposium – “Homecoming” in St. Louis – Steve McMurray and Heidi Dunn**

Steve and Heidi are still in the very early planning process, but there are a lot of options in St. Louis for venues.

#### **Awards Committee– Greg Cope, Teresa Newton, Emy Monroe**

Regional meetings assistance / award program is ready to go. See article on Page 13.

#### **Website – ([www.molluskconservation.org](http://www.molluskconservation.org))**

Sophie Binder, our web administrator was unable to make the call, but the following topics were discussed:

- For web changes, we can continue to have committee chairs contact Sophie directly. Using one point of contact for website changes deemed to be too complicated. Sophie has been working on going through the website and cleaning up links and buttons.
- Kevin Cummings proposed to add a button or title on the homepage that says “Publications” above Walkerana and Ellipsaria so that non-members will know where to find the journals / newsletters / etc. Group agreed.

#### **Information Exchange Committee**

##### ***Walkerana* – Tom Watters, Greg Cope, Wendell Haag**

- Manuscript procedures are working well. Eight manuscripts were published in the March 2012 issue (Volume 15, No. 1) and three manuscripts are in the final stages of production for Volume 15, No. 2.
- There is a problem with the website not sending out email notifications to the editorial board, and Wendell Haag and Greg Cope needed to be added to the email notification. Greg Zimmerman is working with Sophie and Marty Titchenell, EnviroScience’s IT guy to investigate (at time of the minutes release, issue appears to be associated with the migration of the website to a new server by our hosting service, the problem should be resolved soon).
- Back issues of Walkerana will be scanned for posting on the website.

##### ***Ellipsaria* – John Jenkinson**

- The December issue of *Ellipsaria* is on track. All agreed *Ellipsaria* under John’s direction looks great and he has done a great job maintaining deadlines.

- Greg Zimmerman asked John and the Board if FMCS should consider transferring *Ellipsaria* to HTML format? The concern is, based on looking at log-ins of members, that a low (~30%) percentage of the membership is reading the newsletter. Switching to HTML format would allow for direct emailing of *Ellipsaria*, including images in mobile and computer content, without logging into the FMCS website. A pdf file of the newsletter could then be saved on the site for log-in and past issues. We would need to investigate the logistics of converting to this format, is there a limit on page length, etc. Greg Cope expressed concern about switching formats so soon after developing the current process. Also, Heidi noted that we do not know what a good number is for the percentage of people who commonly read the newsletter in any format, and maybe 30% was a good number. It was asked if the newsletter could be sent directly as an attachment, but Greg Z. responded that to his knowledge, the web service could not send attachments. Greg Z will contact Sophie and see what the options are for HTML and the Wild Apricot newsletter template. Greg Z. will also try to track downloads to further refine the percentage of users accessing *Ellipsaria*. The newsletter format will stay the same until we have more information.
- *Ellipsaria* will conduct a survey in March to see what members like about the newsletter, what they want changed, etc.

**Environmental Quality and Affairs Committee-** Steve McMurray, Braven Beatty

- Recent proposed listings for the Rabbitsfoot and Slabside Pearlymussel.
- *Ellipsaria* will post announcement for Env. Quality

**Gastropod Status and Distribution Committee-** Jeremy Tiemann, Jeff Garner

- Gastropod conservation status paper is expected to be published in the February issue of Fisheries

**Genetics Committee** – not present / no report

**Guidelines and Techniques Committee-** Nevin Welte

The group has been working on two initiatives that are progressing:

- Developing guidelines for mussel surveyors (Tam Smith)
- Developing guidelines for handling mussels (Beth Meyers)

**Mussel Status and Distribution Committee-** John Harris

- No news on AFS update, Jim Williams anticipates that the Florida mussel book work to be done in December, then more time to devote to next tasks
- Mussel ID app has been main focus of Committee
  - Stan Martin has been developing the mussel ID app, progress and performance of the app has been “better than expected”.
  - App has been developed for both Apple and Android platforms.
  - App is basically a dichotomous key, with images
  - Beta version has been developed based on Clinch River subwatershed bivalve fauna and approximately 30 species.
  - Will be posted on FMCS website for beta testing

**Nominations Committee-** Leroy Koch

- Election announcement and Candidate statements will be in December *Ellipsaria*.
- Online voting for new officers will close the end of December.

- Eric Belt with Ecological Specialists has set up the web voting link.

#### **Outreach Committee** – Steve McMurray

FMCS presented a 1-day workshop to the Society for Freshwater Science (formerly NABS). See article on Page 14.

#### **Propagation, Restoration, and Introduction Committee-** Rachel Mair, Christopher Owen

- Database of mussel / mollusk propagation facilities is now complete, where should it be posted? Board decided that the list should be posted on the FMCS site.
- Mollusk propagation / translocation activity (# of mussels being raised, where they are being released, brood stock, etc.) web database is badly needed.
  - Dave Smith with USGS is interested in helping / looking for funding but does not want to administrate
  - Kevin C. – may help develop “strawman” database or base off existing templates / databases

#### **FMCS – AFS partnership** – Jeremy Tiemann

- New letter from AFS on new initiatives

#### **Revision of National Strategy** – Patty Morrison and Catherine Gatenby

- List of new issues w/ the national strategy was investigated in detail w/ EXCOM and additional members in Athens, GA workshop. New Issues:
  - International collaboration
  - Diseases
  - Policy enforcement
  - Geographic prioritization of areas and species
  - BMPs
- Four planned geographic-based webinars to be held in January. See article on Page 14.

### **OLD BUSINESS**

#### **FMCS Procedures Manual** – Steve McMurray , Greg Cope, and Heidi Dunn

Work in progress

### **NEW BUSINESS**

#### **Regional Mollusk Meeting Assistance Award Program** – Greg Cope

- All comments are in. Program will be implemented in January. See article on Page 13.

#### **Formation of *ad hoc* Committee on Scientific and Common**

##### **Names Checklist** – Paul Johnson

- Goal is to establish a common and scientific names committee for FMCS that will be responsible for maintain an official taxa checklists (mussels and gastropods) on the FMCS website. The FMCS committee would also regularly update taxa lists for the American Fisheries Society.
- With the pending publication of updated AFS conservation status reviews for gastropods and mussels, now is the time for FMCS to regularly make corrections to this list.
- Small group of 5-6 people will establish a process for maintaining these changes. Depending on the initial meetings separate committees (gastropod & mussels) may be formed to regularly review proposed changes. Paul Johnson will chair a small group for reviewing this process.

**Items for March 2013 Business Meeting**

- Look into obtaining CE credits and how we can sponsor approved meetings
- Obtain brief reports / minutes from region groups to improve communication
- Communicate that members can use the Environmental Quality and Affairs committee to tackle important issues.
- Small group to champion stocking / translocation fauna database
  - PRI committee to set goals and objectives / primary goal of March symposium comm. meeting
  - Update host database

**Board Meeting Adjourned.****FMCS Regional Mollusk Meeting Assistance Award Program**

In 2012, the Freshwater Mollusk Conservation Society (FMCS) established a Regional Mollusk Meeting Assistance Award 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 achieve a common goal of bringing 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 who are not yet members. Support is provided via a cash award of \$100 to the regional mollusk meeting group to help defray the costs (e.g., meeting room rental, speaker travel, break refreshments) associated with hosting their meeting. It is anticipated that about 15-20 awards will be made in a given calendar year.

**Eligibility Requirements and Limitations:** Any member of the Society in good standing who is on the organizing committee of a regional mollusk meeting is eligible to apply. Specifically, each applicant must:

- 1) be a current member of the Society or have paid their membership dues prior to submitting their application;
- 2) be willing to accept responsibility for, and utilize the funds for their stated purpose (see above);
- 3) submit a short summary report (one page or less) on the regional mollusk meeting, with a list of attendees and agenda, (and meeting minutes and presentation abstracts, if available) to the Awards Committee Chair and to the *Ellipsaria* Newsletter Editor within one month of completion of the meeting; and
- 4) be willing to promote the FMCS, and, specifically, its assistance in the partial sponsorship of the Regional Meeting, and encourage any non-FMCS attendees to join the FMCS.

NOTE: Failure to submit the mandatory summary report will result in ineligibility of that particular group for another Meeting Assistance Award for a subsequent two year period.

**Application Materials:** This program will begin in January 2013. The program description and application form may be obtained from the Awards Committee website at [http://www.molluskconservation.org/Mservices\\_awards.html](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. Failure to follow instructions or to fully complete the application form (MS Word or PDF) will invalidate the application.

Awards Committee: Greg Cope, Teresa Newton, Emy Monroe

## **Update on the National Strategy for the Conservation of Freshwater Mollusks**

Long-term members of this Society may remember that the precursor organization to FMCS developed a National Strategy for the Conservation of Freshwater Mussels in 1997 and that document was published in the Journal of Shellfish Research in 1998. The 1997 Strategy helped us, and a number of federal and state agencies, focus on important goals and actions that have improved our understanding of, and our ability to protect, freshwater mussels, snails, and the habitats in which they live.

Several years ago, FMCS members recognized that the National Strategy needed to be updated because some of its goals had been met and others should be refocused. Some also recognized that the Strategy should include snails as well as mussels. Over the past two years, the Ad-hoc Committee working on this project carefully reviewed the original Strategy document, developed an updated list of Issues and Goals, and, in April 2012, solicited input from the members of the FMCS Board.

In January 2103, you will receive a copy of the DRAFT National Strategy for the Conservation of Native Freshwater Mollusks, including an updated set of Issues and Goals. Also in January, we will be seeking your input on the specific “actions” needed to help agencies and individuals address the issues that the Strategy identifies. We plan to solicit this input through a series of four geographically-based webinars where participants can participate on the phone and also interact with the group on their computers. **The tentative dates for these four webinars are Tuesday, January 22, and Thursday, January 24, 2013 (both dates with morning and afternoon sessions).** We hope you will participate in one of these webinars, and you may call-in to more than one if enough phone lines are available. Specific information about the geographic areas, the webinar times, call-in numbers, and website link will be included in the early January e-mail accompanying your copy of the draft Strategy.

We expect to roll up the additions and revisions quickly, and to present a full draft of the revised Strategy to the Society at the 2013 Symposium in Alabama. Thank you in advance for your participation and support of the revised National Strategy for the Conservation of Freshwater Mollusks.

Ad-hoc Committee, National Strategy Revision  
Patricia Morrison, Rita Villella Bumgardner, and Catherine Gatenby

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## **Society for Freshwater Science 2012 Freshwater Mussel Workshop, “Freshwater Mussel Identification and Sampling Workshop: Freshwater Mussels of the Central United States**

Professional development workshops are typically offered as part of the annual meetings of The Society for Freshwater Science (SFS, formerly “NABS”). A session focused on taxonomy has long been a staple of these workshops. Initiated through the efforts of Rebecca Winterringer, several FMCS members were asked to lead a workshop on freshwater mussels based on the successful FMCS workshop held in St. Louis. Given the central location of the 2012 SFS meeting (Louisville, Kentucky) and having to condense the three day FMCS workshop into a single day, we focused on the mussel fauna of the central United States. Several FMCS members worked to make the workshop a success: Kevin Cummings, Heidi Dunn, John Harris, Steve McMurray, Josh Seagraves, and Tom Watters. The FMCS Executive Board granted permission to use materials from the St. Louis workshop.

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Presentations made during the 2012 SFS mussel workshop included:

- *Overview of Freshwater Mussel Identification*  
G. Thomas Watters, Ohio State University Museum of Biological Diversity
- *Interior Highlands/Mississippi Embayment Fauna*  
John L. Harris, Arkansas State University Museum of Zoology
- *Overview of Freshwater Mussel Sampling*  
Heidi Dunn, Ecological Specialists, Inc. &  
Dave Strayer, Cary Institute of Ecosystem Studies
- *Interior Basin Fauna*  
Kevin Cummings, Illinois Natural History Survey &  
Alison Price, Illinois Natural History Survey

The afternoon gave attendees time to work through keys and handle a variety of specimens brought from the collections of INHS, OSUMZ, and ASUMZ. Eighteen brave souls stuck with us the entire day and toughed their way through identifying several specimens. We received good comments from the attendees and -- be warned -- we've already been asked to do the workshop again at a future SFS Annual Meeting.



Most of the FMCS presenters at the 2012 SFS Mussel Identification Workshop.  
Photograph © M.J. Wetzel (INHS) & SFS

Submitted by: Stephen McMurray, Missouri Department of Conservation, Columbia, Missouri

## Regional Meetings

### **Tennessee Mussel Meeting, December 4 - 5, 2012**

Mark your calendars for December 4-5th for the annual Tennessee Mussel meeting to be held at Tennessee Tech University in the Nursing Building on the South end of campus (same as last year). Thanks To Dr. Jim Layzer and Kendal Moles for hosting us again this year. The meeting will begin at 1pm (cst) on the 4th and conclude at 12 noon (cst) on the 5th. We will continue our tradition of brief updates and informal presentations of ongoing or recently completed freshwater mollusk work.

## Chesapeake Bay Freshwater Mussel Workgroup Meeting January, 2013, Annapolis, Maryland.

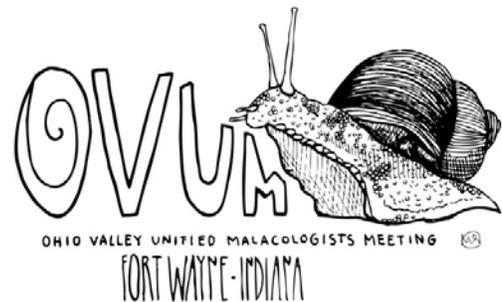
We will be holding the fourth meeting of the Chesapeake Bay Freshwater Mussel Workgroup at the U.S. Fish & Wildlife Service, in Annapolis, Maryland. Availability of the web conferencing equipment has given us the potential dates of **January 16<sup>th</sup> or 17<sup>th</sup>**, which is in tradition with the date of prior meetings. The meeting is open to anyone, but is primarily attended by resource agency biologists interested in and working on freshwater mussels in rivers and streams of the Bay. Teleconferencing and webcast capabilities will be available for those interested in participating, but cannot travel. We particularly encourage any students who might be interested or involved to attend to increase exposure to the issues mussels face in the region. Past presentations and topics of discussion included ecosystem services of mussels, inventories in the Susquehanna River basin, mussel propagation in Virginia, state updates on the status of imperiled species, FERC relicensing surveys, plus much more.

For more information, contact Julie Devers at [julie\\_devers@fws.gov](mailto:julie_devers@fws.gov) or Matt Ashton at [mashton@dnr.state.md.us](mailto:mashton@dnr.state.md.us). Further details are forthcoming via email, including a call for presentations, attendees, and those in need of conference capabilities. Information is primarily sent through a distribution list of past and interested attendees, but also be sent via the Unio list-serve.

## Meeting Summary – OVUM VI 6 October 2012 – Fort Wayne, Indiana

Hosts Warren Pryor ([wpryor@sf.edu](mailto:wpryor@sf.edu)) and Andrea Geyer ([ageyer@sf.edu](mailto:ageyer@sf.edu))

The Ohio Valley Unified Malacologists (OVUM) met on 6 October 2012 in the Achatz Hall of Science on the Campus of the University of Saint Francis (USF). Twenty people attended, representing institutions including the Middle Eel River Watershed Initiative; Arboretum and Research Forest in Clermont, Kentucky; Carnegie Museum; Fort Wayne Children's Zoo; Ohio State University; Manchester University; and USF. The titles of the presentations that were given are shown below, with the names of the presenter(s) indicated in **bold**:



- **G. Thomas Watters** Reintroducing the Northern Riffleshell to Ohio
- **G. Thomas Watters** Phylogenetics and Zoogeography of the Annulariidae
- **Alexandria Wright** & Warren Pryor Freshwater Mussel Respirometry Studies Performed on *Lampsilis* & *silquoidea* of Crooked Lake (Whitley County, Indiana)
- **Jessica Black** DNA Isolation and PCR of Mussel Tissue
- **Ariel Quickery** & **Elizabeth Lichtenwalter** Survey of Mussel Species along the Saint Mary's River
- David N. Karowe, Cameron Fletcher, Jenna Hetherington, Logan Schwarzman, Jamie Vaughan, Jesse Lewis, & **Timothy A. Pearce** Effect of Zebra Mussel Colonization upon Four Freshwater Snails
- **Megan E. Paustian** & Timothy A. Pearce The Slugs of Pennsylvania: Identification and Analysis of Species Distributions
- **Francisco J. Borrero** & Timothy A. Pearce Biogeographic and Ecological Studies in Megadiverse Hotspots in Northwestern South America

Tom Watters agreed to host OVUM VII next year at The Ohio State University in Columbus, Ohio, on a date yet to be determined. Molly Stronczek created the logo.

## Announcements

### National Conservation Training Center Offers Inaugural Conservation Biology of Freshwater Mussels Course

The U.S. Fish and Wildlife Service's National Conservation Training Center hosted students from across the country this past July for the inaugural Conservation Biology of Freshwater Mussels course. The week-long course utilized a variety of laboratory and field exercises to provide students with a broad overview of why mussels matter, why many mussels are endangered, and what tools are available for their study and conservation. Classroom lectures and laboratory exercises on unionid diversity, shell identification, anatomy, physiology, reproductive biology and captive culture were lead by Dr. Chris Barnhart. Dr. Barnhart is a Professor of Biology at Missouri State University whose research focuses on the conservation-related biology of freshwater mussels and the propagation of endangered species. The week also included guest lectures on Conservation Genetics of Freshwater Mussels by Dr. Jess Jones, Restoration Biologist for the U.S. Fish and Wildlife Services's Gloucester Field Office, stationed at Virginia Tech, and Section 7 consultation with freshwater mussels by Bob Anderson, Biologist for the U.S. Fish and Wildlife Service's Pennsylvania Field Office.

The field portion of the course included survey techniques, study design, data collection and analysis, translocation, habitat assessment, and long-term monitoring. This part of the course was led by Heidi Dunn, President of Ecological Specialists, Inc. who has been conducting unionid mussel studies and impact analysis throughout the Midwest for over 25 years. As part of the field exercise, the students and instructors teamed up with the Maryland Department of Natural Resources to set up a permanent monitoring station on the Potomac River near Clear Springs, Maryland. Future cohorts of the mussel course will continue to collect data from the Clear Springs site to monitor the health of the mussel bed over time.

Conservation Biology of Freshwater Mussels will be offered again at NCTC from June 17<sup>th</sup> through June 21<sup>st</sup>, 2013. If you are interested in attending, please contact Matthew Patterson at NCTC (304-876-7473, [matthew.patterson@fws.gov](mailto:matthew.patterson@fws.gov)).



Dr. Chris Barnhart (left) assists a student with mussel dissection. All dissections were performed on captive-reared mussels. (Photo: Matthew Patterson. USFWS)



Heidi Dunn (second from right) assists students with shell identification. (Photo.: Matthew Patterson, USFWS)

## EnviroScience, Inc, Opens Nashville Office



EnviroScience, Inc. (ES) has opened an office in Nashville, Tennessee, and has hired local employees with extensive mussel and fish survey, chemistry, and toxicity backgrounds. The new office will bring additional capabilities of ecological surveys, ecological damage assessments and HAZMAT cleanup solutions to the business. In addition, the office is expected to greatly expand EnviroScience's key business area of biological monitoring throughout the Southern United States. Mr. Dave Czayka, a biologist with ES since 2004, will be the manager of the Nashville Group. The Nashville Office is located at 1722 General George Patton Drive, Suite B100, Brentwood, Tennessee, phone 800-940-4025, email [dczayka@enviroscienceinc.com](mailto:dczayka@enviroscienceinc.com).

Nashville Group Manager Dave Czayka (R) and ES Vice President Greg Zimmerman (L) sorting through a time search of Apalachicola River mussels, including the federally endangered fat threeridge (*Amblema neisleri*), back in 2006.

## Upcoming Meetings

**March 10 – 14, 2013 -- FMCS 8<sup>th</sup> Biennial Symposium, Guntersville State Park, Guntersville, Alabama** [http://molluskconservation.org/2013Symposium/2013\\_FMCS\\_Symposium.html](http://molluskconservation.org/2013Symposium/2013_FMCS_Symposium.html)

**May 19 – 23, 2013** – Society for Freshwater Science Annual Meeting, Jacksonville, Florida Theme: *Energy production and aquatic biodiversity: Understanding the threats, planning for ecosystem management* <http://www.freshwater-science.org/Annual-Meeting.aspx>

**July 21 – 25, 2013** – Society for Conservation Biology 26<sup>th</sup> International Congress for Conservation Biology, Baltimore, Maryland Theme: *"Connecting systems, disciplines and stakeholders"* <http://www.conbio.org/mini-sites/iccb-2013>

**July 21 – 28, 2013** – The American Malacological Society will take part in the 2013 World Congress of Malacology to be held in the Azores. More information is available at: [http://www.malacological.org/meetings/wcm2013\\_circular1.pdf](http://www.malacological.org/meetings/wcm2013_circular1.pdf)

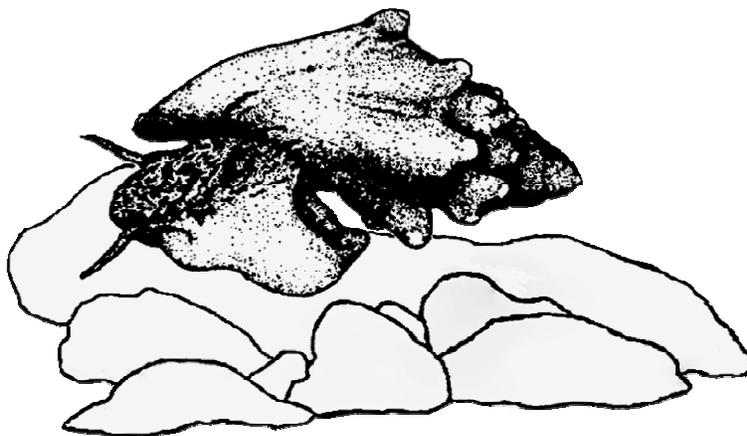
**November 17 – 21, 2013** -- Society of Environmental Toxicology and Chemistry (SETAC) 34<sup>rd</sup> North American Annual Meeting, Gaylord Opryland, Nashville, Tennessee, USA Theme to be determined <http://www.setac.org/?page=SETACMeetings>

## New Publication

Hinck JE, McMurray SE, Roberts AD, Barnhart MC, Ingersoll CG, Wang N, Augspurger T. 2012. Spatial and Temporal Trends of Freshwater Mussel Assemblages in the Meramec River Basin, Missouri, USA. *Journal of Fish and Wildlife Management* 3(2):319–331.

### Abstract

The Meramec River basin in east-central Missouri has one of the most diverse unionoid mussel faunas in the central United States with .40 species identified. Data were analyzed from historical surveys to test whether diversity and abundance of mussels in the Meramec River basin (Big, Bourbeuse, and Meramec rivers, representing .400 river miles) decreased between 1978 and 1997. We found that over 20 y, species richness and diversity decreased significantly in the Bourbeuse and Meramec rivers but not in the Big River. Most species were found at fewer sites and in lower numbers in 1997 than in 1978. Federally endangered species and Missouri Species of Conservation Concern with the most severe temporal declines were *Alasmidonta viridis*, *Arcidens confragosus*, *Elliptio crassidens*, *Epioblasma triquetra*, *Fusconaia ebena*, *Lampsilis abrupta*, *Lampsilis brittsi*, and *Simpsonaias ambigua*. Averaged across all species, mussels were generally being extirpated from historical sampling sites more rapidly than colonization was occurring. An exception was one reach of the Meramec River between river miles 28.4 and 59.5, where mussel abundance and diversity were greater than in other reaches and where colonization of Margaritiferidae, Lampsilini, and Quadrulini exceeded extirpation. The exact reasons mussel diversity and abundance have remained robust in this 30-mile reach is uncertain, but the reach is associated with increased gradients, few long pools, and vertical rock faces, all of which are preferable for mussels. Complete loss of mussel communities at eight sites (16%) with relatively diverse historical assemblages was attributed to physical habitat changes including bank erosion, unstable substrate, and sedimentation. Mussel conservation efforts, including restoring and protecting riparian habitats, limiting the effects of in-stream sand and gravel mining, monitoring and controlling invasive species, and protecting water quality, may be warranted in the Meramec River basin.



## Contributed Articles

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

### **Translocation of Freshwater Mussels for a Bank Stabilization and Rock Vein Construction Project in the Clinch River.**

**Steven A. Ahlstedt<sup>1</sup> and Donald W. Hubbs<sup>2</sup>.**

<sup>1</sup>P. O. Box 460, Norris, TN 37828.

<sup>2</sup>Tennessee Wildlife Resources Agency, Camden, TN 38320

The Clinch River at Kyles Ford, in Hancock County, Tennessee (Clinch River Mile 189.6), is known for its diversity of fish and mollusk species. Approximately 35 mussel species currently occur at Kyles Ford, many of which are Cumberlandian endemics, including 12 listed as federal endangered species. Continued streambank erosion behind an island on the left descending side of the river prompted the Tennessee Wildlife Resources Agency to propose stabilizing the banks and construct two rock veins that would dissipate energy and deflect high flows away from the shore. Concerns over the potential for downstream siltation or habitat disturbance from the in-water work prompted the removal of as many mussels as possible from the project area. Previous sampling in the area indicated that mussels occur in low numbers in this back channel; a large part of this channel is periodically exposed to drying during low flows and, during high flows, unconsolidated coal fines and silt gets blown through the back channel.

On October 25-26 and November 6-9, 2006, prior to any construction activity, quantitative and qualitative sampling was conducted in the back channel and along a 0.5m wide band along the main channel side of this island. The main channel side of the island was included out of concern that increased flows might affect mussels along that shore when the back channel was blocked off. Thirty 0.25m<sup>2</sup> quadrat samples (15 in the back channel and 15 along the main channel edge of the island) were collected by snorkelers. Substrate within each sampling frame was excavated to a depth of 20 cm in order to find buried mussels. This sampling provided estimates of existing population densities and a baseline for determining mussel re-colonization in the back channel during future monitoring.

Quantitative sampling in the back channel resulted in 8 individual mussels (five species) and



an average density estimate of 3.1 individuals per square meter (Table 1). Most of these mussels were found in the lower 50 meters of the back channel, closest to the downstream edge of the island. Quantitative sampling within 0.5 m on the main channel side of the island resulted in 31 mussels (eight species) and a density estimate of 8.3 individuals per square meter (Table 1). For comparative purposes, mussel densities across the river in prime habitat averaged 96m<sup>2</sup> and 74m<sup>2</sup> in 1999 and 2004, respectively (Ahlstedt et al., 2005).

Seventy-one person-hours were spent qualitatively collecting mussels in the back channel and along the main channel side of the island. The 865 mussels collected during this work (Table 1) resulted in a catch per unit effort of 12.1 mussels per person hour. This sampling consisted of repeated snorkeling and hand-digging in the substrate throughout each area. Repeated raking and washing of the substrate was effective in finding mussels not encountered during the snorkeling.

All mussels found were recorded by species on field data sheets and measured for total length using digital dial calipers. Most of the mussels were translocated to suitable habitat across the river while 211 of the *Ptychobranhus subtentum* specimens were moved to the Duck River in middle Tennessee as part of Tennessee Wildlife Resources Agency restoration efforts.

Table 1. Freshwater mussel species found in the Clinch River at Kyles Ford during quantitative (0.25m<sup>2</sup>) and qualitative sampling associated with this construction project in 2006. [E- endangered] [CE- candidate endangered].

Species	Quantative in Back Channel	Quantative on Main Channel	Qualitative Search	Total	Size Range (mm)
<i>Actinonaias ligamentina</i>	-	1	50	51	40-105
<i>Actinonaias pectorosa</i>	1	7	172	180	17-105
<i>Cyclonaias tuberculata</i>	-	1	6	7	44-72
<i>Cyprogenia stegaria</i> E	-	-	1	1	57
<i>Dromus dromas</i> E	1	-	1	2	49, 51
<i>Elliptio dilatata</i>	-	-	10	10	43-55
<i>Epioblasma brevidens</i> E	-	3	16	19	19-53
<i>Epioblasma capsaeformis</i> E	-	2	62	64	15-46
<i>Epioblasma triquetra</i> E	-	-	4	4	33-40
<i>Fusconaia cuneolus</i> E	-	1	2	3	38-47
<i>Fusconaia subrotunda</i>	-	-	1	1	42
<i>Hemistena lata</i> E	-	-	1	1	60
<i>Lampsilis fasciola</i>	-	-	24	24	22-68
<i>Lampsilis ovata</i>	-	-	7	7	69-82
<i>Lemiox rimosus</i> E	-	-	3	3	32-39
<i>Ligumia recta</i>	1	-	2	3	112-133
<i>Medionidus conradicus</i>	3	6	145	154	15-48
<i>Plethobasus cyphyus</i> E	-	-	3	3	53-82
<i>Pleurobema rubrum</i>	-	-	1	1	50
<i>Potamilus alatus</i>	-	-	1	1	105
<i>Ptychobranhus fasciolaris</i>	-	-	34	34	45-90
<i>Ptychobranhus subtentum</i> CE	2	10	300	312	14-95
<i>Quadrula cylindrica strigillata</i> E	-	-	9	9	65-91
<i>Quadrula pustulosa</i>	-	-	3	3	39-59
<i>Strophitus undulatus</i>	-	-	2	2	51, 63
<i>Villosa iris</i>	-	-	4	4	23-54
<i>Villosa vanuxemensis</i>	-	-	1	1	46
Total	8	31	865	904	14-133

During the actual construction work, every effort was made to minimize harm to the mussel fauna and the river. The back channel was completely sealed off from the main river with sand bags and, when that channel was drained, all the water was pumped away from the river, exposed to absorbent blocks that clay particles attach to, and directed through vegetation that further reduced turbidity. Hay was spread across all areas in the path of heavy equipment to reduce the effects of runoff and, at project completion, the stream banks were completely covered with hemp matting staked into the ground.

Although not part of the scope of work, 358 spiny riversnails, *Io fluviialis*, were collected during this project and translocated to habitat across the river. This large endemic snail prefers smooth bedrock where it grazes algae. The Clinch is one of only five rivers where this species remains, so it was prudent to move them out of harms way.

### Acknowledgements

We thank the following individuals for the excellent work done at Kyles Ford and for their assistance in finding mussels: Greg Babbit (Tennessee Stream Mitigation Program); Gary Moody (Jen-Hill Construction) and his construction crew; James and Robert Kiser, Mike Adams, and Nick Cammack with Stantec Consulting.

### Literature Cited

Ahlstedt, S. A., M. T. Fagg, R. S. Butler, and J. F. Connell. 2005. Long-term Trend Information for Freshwater Mussel Populations at Twelve Fixed-station Monitoring Sites in the Clinch and Powell Rivers of Eastern Tennessee and Southwestern Virginia, 1979-2004. Final Report. U.S. Fish and Wildlife Service, Cookeville, Tennessee. 42 pages

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## Changes in the Sunrise River over the Last 16 years

**Mark Hove, Jenny Liu, Diane Rubin, Forest Schenk, and Dan Hornbach**  
Macalester College, 1600 Grand Ave., St. Paul, MN 55105; [mark\\_hove@umn.edu](mailto:mark_hove@umn.edu)

The Sunrise River, a tributary to the St. Croix River, holds an important mussel assemblage to Minnesota. The Sunrise River holds nine state listed mussel species and possesses some of the most dense mussel beds known in the state (Davis and Miller 1996).

Qualitative and quantitative mussel community data were collected in 1996 and 2012 from three Sunrise River reaches: (1) C.R. 14 (2.2 km upstream of Kost Dam), (2) immediately below Kost Dam, and (3) C.R. 95 (2.5 km downstream of Kost Dam). 1996 and 2012 sampling locations were less than <400 m apart.

Over the past sixteen years mussel communities have changed in some respects and stayed the same in others (Table 1). Although sample sizes were sometimes small and time spent surveying was not exhaustive, there were a number of differences observed in the mussel communities between 1996 and 2012. Fewer mussels and mussel species were observed at C.R. 95 in 2012 compared to 1996. *Ellipsaria lineolata* and *Anodontooides ferussacianus* were not found in 2012 and *Lasmigona complanata* was not observed in 1996. *Fusconaia flava* was less commonly observed alive in 2012. The Sunrise River holds important mussel resources, which should be monitored to determine if trends in losses continue and need to be corrected.



Table 1. Mussels observed in the Sunrise River in 1996 and during this study. (L=live, D=dead)

Species	CR14		KostDam		CR95		Notes
	1996	2012	1996	2012	1996	2012	
<i>Actinonaias ligamentina</i>	L	L	L	L	L	L	No change
<i>Alasmidonta marginata</i>		L	L	L	L	D	New to CR 14 in 2012
<i>Amblema plicata</i>	L	L	L	L	L	L	No change
<i>Anodontoides ferussacianus</i>					L		Not observed in 2012
<i>Cyclonaias tuberculata</i>				D			Observed elsewhere in Sunrise in 1996
<i>Ellipsaria lineolata</i>					L		Not observed in 2012
<i>Elliptio dilatata</i>	L	L	L	L	L	D	Little change
<i>Fusconaia flava</i>	L	L	L	D	L	D	Less commonly observed alive in 2012
<i>Lampsilis cardium</i>	D	L	L	L	L	L	Little change
<i>Lampsilis siliquoidea</i>	L	L	L	L	L	D	Little change
<i>Lasmigona complanata</i>				L			Not observed in 1996
<i>Lasmigona compressa</i>	L			D		D	Variable
<i>Lasmigona costata</i>	L	L	L	L	L	L	No change
<i>Leptodea fragilis</i>			L	L	L		Not observed at CR 95 in 2012
<i>Ligumia recta</i>	D		L	L	L	L	Little change
<i>Pleurobema sintoxia</i>	L	L	L	L	L	D	Little change
<i>Potamilus alatus</i>			L	L	D		Little change
<i>Pyganodon grandis</i>	L		L	D	L		Less commonly observed in 2012
<i>Quadrula pustulosa</i>			L	L	D	D	No change
<i>Strophitus undulatus</i>	L	L	L	L	L		Not observed at CR 95 in 2012
<i>Toxolasma parvus</i>			L	L			No change
<i>Truncilla truncata</i>			L	L			No change
Ave mussel density (no./m <sup>2</sup> )		10	89	86	44	5	
Samples collected		25	5	25	8	25	

### Literature Cited

Davis, M. and S. E. Miller. 1996. A mussel survey of the Sunrise River. Report to the Minnesota Department of Natural Resources. St. Paul, Minnesota. 26 pp.

## 2012 Western Pearlshell (*Margaritifera falcata*) Mussel Translocation Project in the Blackfoot River Basin, Montana

David Stagliano (Montana Natural Heritage Program)  
1515 East Sixth Ave., Helena, MT 59620-1800 (<http://mtnhp.org>)

Montana's only trout stream mussel has disappeared from, or is declining in, 75% of its historically occupied watersheds across the state (Stagliano 2010). An outcome of this analysis was that the western pearlshell was listed as a Montana Species of Concern in 2008 and a U.S. Forest Service Region One Sensitive Species in 2011. As a conservation measure, we are attempting to establish and supplement pearlshell populations in three tributary streams of the Big Blackfoot River (Yes, of "River Runs Through It" fame). These streams have had extensive habitat restoration activities and have seen

the return of the mussel's native host fish, the westslope cutthroat trout. The donor population in the Clearwater River (same basin) is a dense population, rated A-viability by current Nature Serve standards (Hammerson et al. 2008).

Following unsuccessful efforts in 2010, largely due to stringent sterilization protocols imposed by the Fish Health Committee, we successfully completed our second translocation of 400 adult western pearlshell mussels into Monture (150 individuals), Pearson (100 individuals) and Grantier Spring (150 individuals) creeks on 9/11/2012. Two days post-transplant, there was 100% survival and all individuals in the groups (usually 50 per habitat unit) were visible and filtering (Figure 1). Revisiting the transplanted mussels one week post-transplant (9/18/2012) with water temperatures falling below 9°C, only ~75% were visible (many siphons were seen just barely above the substrate) (Figure 2); there was no evidence of predation or disturbance to presume they are missing or dead.



Figure 1. Western Papershell transplants in Monture Creek T2—Boulder for reference. Left photograph is on Transplant Day (9/11/2012); Right photograph is revisit on one week later (9/18/2012).



Figure 2. Western Papershell transplants in Grantier Spring Creek. Left is two days post transplant (9/13/2012); Right is revisit one week later (9/18/2012).

On 10/17/2012, the one month revisit, ~25% of the individuals were visible (again, just barely above the substrate). Water temperatures on the morning of the visit averaged 5.5 °C across the three streams. Thus, western pearlshells appear to begin their “overwintering” phase of inactivity as overnight water temperatures dip below 9°C.

We will continue to monitor our transplanted pearlshell mussel populations in the spring, pre- and post- run-off, and further report their long term results.

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## Growth Curves for *Margaritifera hembeli* from Shell Sectioning Similar to Mark and Recapture Estimates

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*Margaritifera hembeli* (Conrad), the Louisiana pearlshell, is a threatened unionid mussel limited to headwater streams in the Red River in Central Louisiana, USA (Johnson and Brown 1998). Pearlshells occur in high density beds in shallow riffles with stable substrates (Johnson and Brown 2000). Margaritiferids are the longest lived freshwater invertebrates (Comfort 1957, Hutchinson 1979), and the maximum lifespan of *M. hembeli* estimated through mark and recapture varied from 45 to 75 years (Johnson and Brown 1998). Although maximum size and lifespans varied among streams, size distributions were dominated by large individuals, as in other margaritiferids (Stober 1972, Bauer 1986). Here we compare growth and longevity using shell sectioning (Daniel 2012) to Johnson and Brown (1998) who estimated the age of 15 replicate mussels from three separate streams by the time required for growth by tagged individuals. We estimate the growth rate constant, age at maturity, maximum size and age reached.

Mussel growth and age were determined by counting annuli in the sectioned shell to estimate age (Neves and Moyer 1988, Rypel et al. 2008, Haag and Commens-Carson 2008). Shells (n = 47) of *M. hembeli* were from Moccasin Branch, LA. The dead shells were collected after a single, seasonal drying event in summer 2011. Shells were measured for maximum length (mm) before being cut with a slow-speed, diamond blade saw (South Bay Technology Inc., model 650). A 6” blade cut through the umbo giving a cross section of the shell. The sectioned valve was then sanded smooth with four grades (320, 600, 800, and 1500 grit) of sand paper and attached to a slide with clear epoxy. The valve was then re-sectioned with the same saw. The thin sectioned shell was re-sanded, and aged with a dissecting microscope (Leica MZ7<sup>5</sup>). By counting annuli of individuals differing in shell length, a growth curve can be plotted, allowing estimation of growth rates and longevity. Although there has been debate about whether annuli represent annual growth or reduced growth from disturbances (Rypel et al. 2008), Haag and Commens-Carson (2008) presented convincing evidence that mussels lay down annual growth lines. The von Bertalanffy growth function (Ricker 1958, Bartoo and Parker 1983) was used to model age to length relationships,

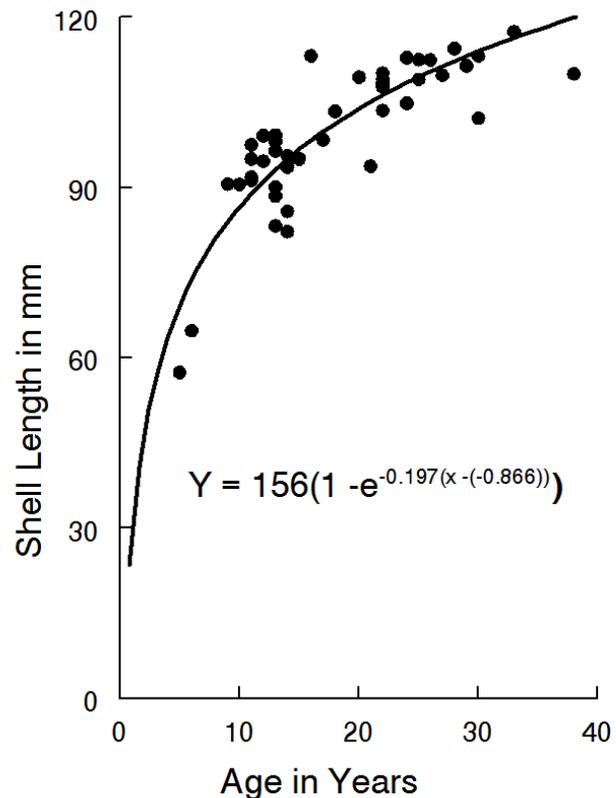
$$L(t) = L_{\infty} - (1 - e^{-k(t-t_0)}),$$

where the variables are t (age in years), t<sub>0</sub> (y-axis intercept), L<sub>∞</sub>, the maximum theoretical length reached, and k, a growth rate constant with units of reciprocal time (e.g. year<sup>-1</sup>). Age at maturity was estimated from the inflection points of the curves, because growth in unionids is rapid prior to sexual maturity and

decreases abruptly thereafter (McMahon 1991, Bauer and Wächtler 1994). Age at maturity was estimated from the point where a 45° tangent intersected the curve.

Ages ranged from 5 to 38 years, with our estimate of maximum age comparable to Johnson and Brown's (1998) based on mark and recapture methods. The maximum shell length was 117 mm, and age at maturity was approximately 5 years (Figure 1). The growth constant ( $k$ ) was 0.1969 ( $\text{year}^{-1}$ ), similar to other longer-lived species sampled in southern Louisiana (Daniel 2012). Our sampling did not represent the entire size range of all individuals, but the majority of our sectioned shells were larger individuals. Our results may thus not include the largest and oldest individuals, but do provide good estimates of the life history for this population.

Figure 1. Plot and best fit curve of the relationship between shell length and age based on thin sectioned shells of *Margaritifera hembeli* from Moccasin Branch, a tributary of the Red River in Central Louisiana, USA.



In summary, the thin shell technique produced similar life history results as Johnson and Brown's (1998) mark recapture estimates, but the thin shell technique also gave estimates the age at maturity and growth for the Moccasin Branch population of *M. hembelis*. The sectioning technique also eliminates any growth interference from repeatedly handling individuals to mark or recapture them.

#### Acknowledgments

Shells of *M. hembeli* were provided by Beau Gregory, Louisiana Department of Wildlife and Fisheries. We thank Wendell Haag for instructing us in sectioning techniques and age estimation.

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### **Occurrence of *Lasmigona complanata* (White Heelsplitter) in the Sulphur River, Texas**

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On September 10, 2012, during surveys for freshwater mussels on the Sulphur River, field technicians located the first individual of the white heelsplitter, *Lasmigona complanata*, reported from this east Texas river (Figure 1). The specimen was found just downstream from Wright-Patman Reservoir in a gravel/cobble and sandy substrate. It was alive and in very good condition when found. The unionid community at this location includes 13 species and is dominated by taxa that are known to tolerate fluctuating habitat conditions and sub-optimal substrates (e.g., *Lampsilis teres* and *Potamilus purpuratus*).

Historically, *L. complanata* ranged widely throughout central North America (Vidrine 1993), but reaches its southwestern limit in northeastern Texas where it is uncommon. In Texas, it is only known to occur naturally in Lake Texoma and the tributaries of the Red River downstream from there, with unsuccessful introductions in the Trinity River of Dallas-Fort Worth and the San Marcos River (Howells et.al. 1996; pers. comm.). It is not unexpected, therefore, to find *L. complanata* in the lower Sulphur River which joins the Red River downstream in Louisiana. It is interesting to note, however, that Vidrine (1993) has no recent records of *L. complanata* in Louisiana. Evidence for the existence of a rare Texas species such as the White Heelsplitter should be considered in regards to future alterations to the surrounding environment, including current plans to raise the height of Wright-Patman Reservoir.

Figure 1. Specimen of the White Heelsplitter, *Lasmigona complanata*, found just downstream from Wright-Patman Reservoir, Sulphur River, East Texas on September 10, 2012.



### Acknowledgements

I would like to thank Robert Howells for refining this note and the following individuals for continued support in the field: Lance Williams, P.h.D., Bryan Brown, Lalo Aguilar, Nate Marshall, and Kurt Felix. Surveys were funded by the U.S. Fish and Wildlife Service.

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## Mussel Mortality from a Toxic Spill in the Pearl River, Louisiana

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Unionid mussels are good bio-indicators of ecosystem health because of their relatively long life cycles, inability to detoxify contaminants (Van Hassel & Harris 2006, Grabarkiewicz & Davis 2008), and are used frequently in laboratory toxicity analyses (Naimo 1995). However, few studies have, in fact, looked at the response of unionids to actual riverine toxic chemical spills.

On August 9, 2011, the Temple-Inland pulp mill near Bogalusa, Louisiana, spilled between 80 and 100 million gallons of “black liquor” into the Pearl River. Black liquor is a mixture of strong bases used to separate lignins from pulp to produce paper, and the extracted lignin itself. The spill turned water visibly black, altered the pH, and reduced dissolved oxygen levels for a 50 mile stretch of the river.

In preliminary sampling of 12 sites after the spill, the Louisiana Department of Wildlife and Fisheries (LDWF, Brady et al. 2011) found 1,898 dead freshwater mussel shells along the shoreline, 99.4 % of which were the Fragile Papershell, *Leptodea fragilis* (Figure 1). This species has a fairly thin shell, and may, therefore, be over-represented in shoreline surveys of mortality because species with thicker shells may sink.

On August 18, 2011, after the water quality had improved, LDWF requested our help to survey the mussel assemblage in the river. Over three days, we qualitatively sampled seven sites on a stretch of the Pearl River between Bogalusa and the lower extreme of the spill, near Walkiah Bluff (Figure 2). Two snorkelers carefully hand searched sediments < 1 m depth for mussels. Earlier work had shown that

unionids in Coastal Plain rivers in Louisiana were found in these shallow littoral zones (Brown & Curole 1997, Brown & Banks 2001). All mussels encountered by the snorklers were identified to species, and noted whether they were alive or dead.



Figure 1. *Leptodea fragilis* washed ashore after the chemical spill in the West Pearl River. Photograph by Tony Brady, Natchitoches National Fish Hatchery, U.S. Fish and Wildlife Service

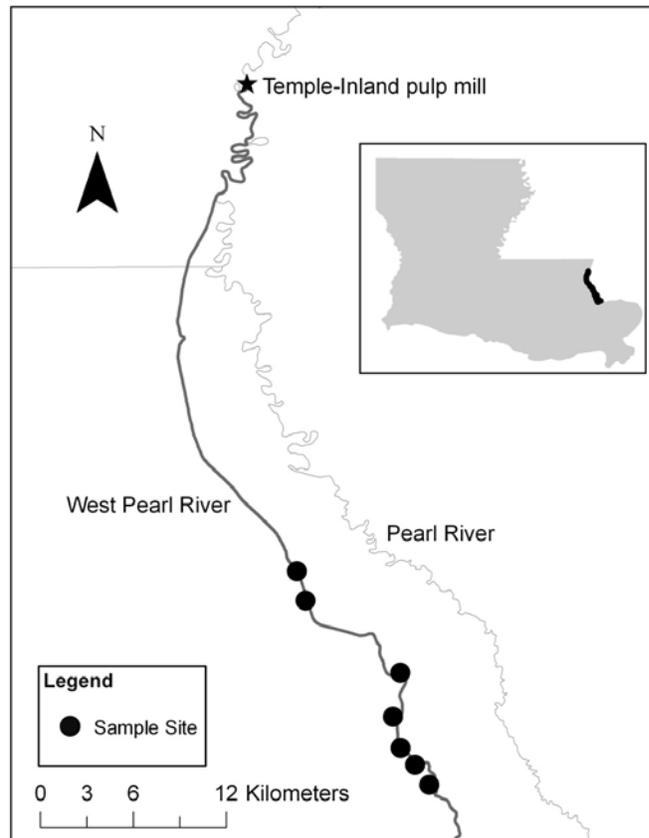


Figure2. Sampling sites on the West Pearl River, Louisiana, sampled during both studies.

A total of 19 species were collected at the seven sites (Table 1). Comparing mortality rates (e.g, the percent of individuals of each species that were collected dead), *Leptodea fragilis* had the highest mortality rate (79 %) and *Potamilus purpuratus* had the second highest (29.6%). The shells of these two species appeared particularly fresh dead, while shells of the other species probably represented mortality before the spill.

The leak undoubtedly included high concentrations of strong bases that elevated pH, and high concentrations of lignin which can create high biological oxygen demands as it decomposes. *L. fragilis* has a thin shell, perhaps explaining why it was differentially affected. A thick shell serves to isolate mussel tissues from ambient toxins (Kramer et al. 1989, Heinonen et al. 1997; however, *P. purpuratus* has a much thicker shell, and we are unaware why it would be affected more than the other thick-shelled species found during our survey. We have noticed a decrease in its relative abundance over time in the Pearl River (Brown et al. 2010).

Table 1. List of unionid mussels collected at seven sites in the Pearl River after a spill from a pulp mill. Species are listed by the total number of individuals collected, and the percentage of dead shells (% mortality) is also noted for each species.

<b>Unionid Species</b>	<b>Total Number Collected</b>	<b>% Mortality</b>
<i>Glebula rotundata</i>	823	0.7
<i>Leptodea fragilis</i>	246	78.9
<i>Lampsilis teres</i>	155	13.5
<i>Plectomerus dombeyanus</i>	79	0
<i>Potamilus purpuratus</i>	54	29.6
<i>Quadrula nobilis</i>	46	0
<i>Quadrula refulgens</i>	40	25.0
<i>Villosa lienosa</i>	36	8.3
<i>Lampsilis ornata</i>	26	3.8
<i>Obliquaria reflexa</i>	16	6.3
<i>Quadrula aplicata</i>	15	6.7
<i>Anodonta suborbiculata</i>	12	0
<i>Utterbackia imbecilis</i>	7	57.1
<i>Villosa vibex</i>	4	25.0
<i>Arcidens confragosus</i>	1	0
<i>Lampsilis claibornensis</i>	1	0
<i>Ligumia subrostrata</i>	1	0
<i>Toxolasma parvus</i>	1	0
<i>Uniomerus tetralasmus</i>	1	0

### Acknowledgements

We thank Tony Brady, of the for providing Figure 1, Cedric Doolittle, of the Baton Rouge Fish and Wildlife Conservation Office, and Gary Vitrano, of the Louisiana Department of Wildlife and Fisheries, for help in sampling.

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## **Freshwater Mussel (Bivalvia: Unionidae) Biodiversity in Sabine River Tributaries within the Sabine National Forest During Record Drought**

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The 65,078 hectare Sabine National Forest (SNF) is located in Shelby, San Augustine, and Sabine counties in eastern Texas. Recent studies have been conducted on the Sabine River upstream and downstream of Toledo Bend Reservoir, but there are no published studies of the unionid fauna in the Sabine River tributaries within the SNF. This report is a synopsis of the results of a study of freshwater mussels in the SNF that was conducted during exceptional drought conditions in 2011. Objectives of the complete study were to: (1) identify mussel assemblage diversity in the SNF, and (2) determine the relationship between habitat variables and unionids.

This survey was conducted from September to December 2011, when 42 sites on 28 streams were examined. Surveys included visual and tactile collection of mussels during timed searches (3.0 person-hours) along 100-m transects (upstream to downstream and across the entire stream width). Both live mussels and empty shells were collected, identified, and counted. Live mussels were returned to their collection sites. Shells and single valves were not retained unless additional identification efforts were required. Howells et al. (1996) and Howells (2010) were used for identification guides.

Habitat measurements taken at each site included stream dimensions (channel width and depth, bank height, wetted width, sinuosity, width-to-depth ratio), riparian cover (overstory basal area, percent herbaceous cover, understory cover), instream cover (coarse woody debris, leaf litter, logs, pools), and substrate (soil texture; percent coarse fragments, gravel, cobble, bedrock). No water quality data were collected on the 23 of the 28 streams studied that were completely dry during this study.

Substrate samples were taken from each transect and processed in the laboratory to determine soil texture, with percent composition calculated using the Bouyoucos method and substrate texture determined with a soil texture triangle after Brady and Weil (2002).

A total of 144 mussels representing 12 species were collected at 15 of the 42 sites (Table 1). No mussels were found in 19 of the 28 streams sampled. Pond and soft-bottom unionid species were often the most numerous (Table 1). *Villosa lienosa* was the most abundant species; it was found at seven of the 15 sites that contained mussels (Table 1). *Villosa lienosa*, however, is classified as a rare, imperiled species (S1) in the state of Texas; therefore, the SNF apparently contains suitable habitat for the species.

Members of the genus *Unio* that could not be distinguished between *U. declivis* and *U. tetralasmus* were classified as *Unio* spp. *Unio* spp. was the second most abundant taxon, found at nine of the 15 sites that contained mussels. *Quadrula verrucosa* and *Utterbackia imbecillis* were the least abundant species; each found at only one site. Although *Lampsilis teres* represented 14.58% of the collected specimens, it was only present at two of the 15 sites that contained mussels.

Given that only 12 of the 33 species historically known from the Sabine River basin were found during this survey, the species diversity of unionid fauna may be low in the SNF. Additional studies would be required to conduct a more comprehensive assessment, determine the impact of exceptional drought conditions, and design an effective recovery plan for unionid species in the SNF.

Table 1. Freshwater mussels found in Sabine River tributaries within the Sabine National Forest during September-December 2011.

<b>Species</b>	<b>Number Found</b>	<b>Percent of Total</b>	<b>Number of sites/species</b>
<i>Amblema plicata</i>	7	4.86	1
<i>Lampsilis hydiana</i>	18	12.50	4
<i>Lampsilis teres</i>	21	14.58	2
<i>Ligumia subrostrata</i>	6	4.17	4
<i>Potamilus amphichaenus</i>	2	1.39	1
<i>Potamilus purpuratus</i>	2	1.39	1
<i>Pyganodon grandis</i>	24	16.70	5
<i>Quadrula verrucosa</i>	1	0.69	1
<i>Unio merus declivis</i> *	5	3.47	3
<i>Unio merus tetralasmus</i> *	6	4.17	4
<i>Unio merus spp.</i> *	19	13.19	9
<i>Utterbackia imbecillis</i>	1	0.69	1
<i>Villosa lienosa</i>	32	22.20	7
<b>Total</b>	<b>144</b>		

\*Together, *Unio merus* sp. were found at a total of 11 sites

### Acknowledgements

I thank the Sabine River Authority and the U.S. Forest Service for financial support of this research and Stephen F. Austin State University for logistical support. I also thank Mr. Robert Howells of BioStudies for his invaluable assistance with verifying species identification; my graduate advisor Dr. D. Brent Burt for his guidance, and my undergraduate assistants Jane Crysups, Elizabeth Moman, and Kevin Dutcher for their endurance.

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## Tampico Pearlymussel (*Cyrtonaias tampicoensis*) Distribution in Texas

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The native range of Tampico Pearlymussel (*Cyrtonaias tampicoensis*) extends from the Brazos River, Texas, south and west into northeastern Mexico (Howells 2010), at least as far south as the Rio Cotaxla system, Vera Cruz, Mexico (Johnson 1999) (Figure 1). Howells et al. (1996) also included records from the upper Trinity River drainage with the range for this species. Additional studies since then, however, suggest the records from the Dallas-Fort Worth area may have been unsuccessful introductions and not within the natural range of the species.

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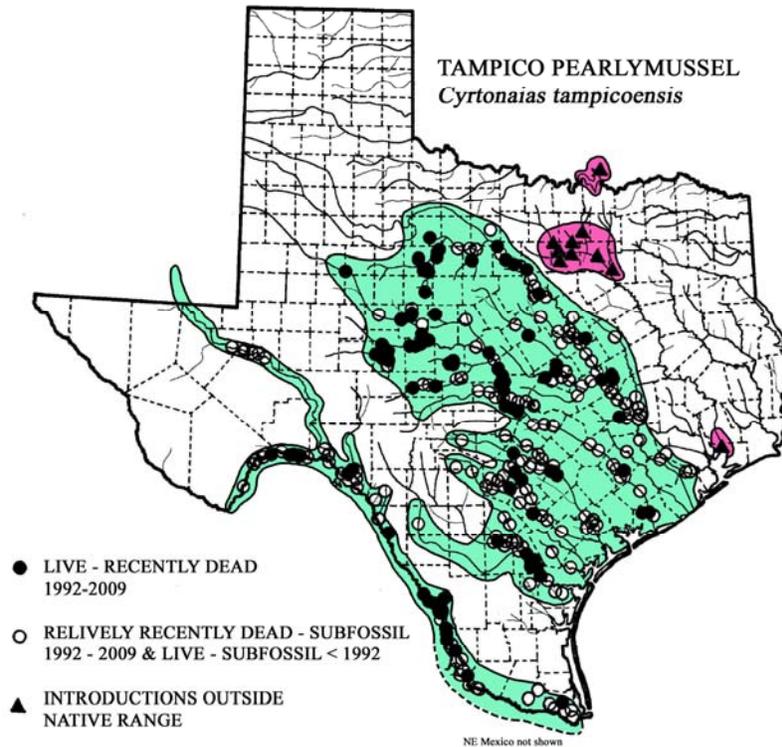


Figure 1. Collection site records for the Tampico Pearlymussel (*Cyrtonaias tampicoensis*) in U.S. waters. The native range (green) extends from the Brazos River south and west into northeastern Mexico; however, other specimens (red) have been taken in Lake Texoma on the Red River (1983) and in the upper (1952-1977) and lower Trinity River drainage (2003). Both northern areas probably represent deliberate relocations of mussels or accidental introductions on bait fishes. The lower Trinity River specimen could have reached the area through natural movement of an infected host fish.

Specimens in collections at the Dallas Museum of Natural History, University of North Texas, and Texas Memorial Museum indicate that for a 25-year period beginning in 1952, Tampico Pearlymussel was taken at several reservoir and river sites in the upper Trinity River drainage in Dallas, Denton, and Tarrant counties, Texas. These include: Lake Lewisville (1952, 1958), Lake Worth (1972), Lake Grapevine (1971, 1975), Lake Benbrook (1977), and the Trinity River (1960s, 1977), with an additional downstream record in Parsons Slough (undated), Kaufman County. However, this species appears absent from area geological and archaeological records prior to 1952 and has not been found in numerous collections in the upper Trinity drainage since. One exception may be an additional record from the upper Trinity River drainage at the University of Michigan Museum of Zoology dated 1934. However, Tampico Pearlymussel has occasionally been confused with Bleufer (*Potamilus purpuratus*) and Round Pearlshell (*Glebula rotundata*); the UMMZ record (not examined by the author) may be a misidentification or a very early introduction. In addition to these records, Tampico Pearlymussel was also found in Lake Texoma, Red River drainage, in 1983 (Mather 1989) and again in the lower Trinity River in 2003 northeast of Houston (Howells and Tirpak 2003).

Introductions on host fishes are possible vectors to transport this species outside of its native range. Tampico Pearlymussel uses gar (*Lepisosteus* spp.), Golden Shiner (*Notemigonus crysoleucas*), Longear Sunfish (*Lepomis megalotis*), and Rio Grande Cichlid (*Cichlasoma cyanoguttatum*) as hosts. Golden Shiner and sunfishes are widely used as live bait in Texas. Although Lake Worth was impounded in 1914 and Lake Texoma was impounded in 1944, many of the upper Trinity River reservoirs were built in the early 1950s, at which time fish stocking and angling increased. Additionally, this mussel is widely recognized and sought in Texas as the source of "Concho River" pearls. Direct, but undocumented, relocation of mussels themselves to sites outside their native waters by pearlery is also possible. The

specimen found in the lower Trinity River, however, may have been a natural relocation. Natural streams and the American Canal (that contains Tampico Pearlymussel) move lower Brazos River water east to the Galveston Bay drainage just south of the Trinity River. Fishes moving through estuarine waters in Galveston Bay or storm-related flooding could allow infected hosts to reach waters of the lower Trinity River.

Although Tampico Pearlymussel forms in Texas have been assigned to several subspecies (*tampicoensis*, *berlandierii*, *heermanii*, and sometimes Mexican *tecomatensis*), electrophoretic analysis of Texas populations failed to find any significant genetic differences, suggesting that the various Texas morphs are only ecophenotypes (Figure 2). Those from the Brazos-Colorado have generally robust shells and nacre colored purple, orange, or pink. The Guadalupe-San Antonio population typically has purple nacre, but less thick shells that are more laterally compressed. Specimens from the Nueces-Frio are also less robust, but usually have white or pastel nacre colors. Rio Grande examples tend to have robust shells, but white or pastel nacre.

Specimens in collections from the upper Trinity River drainage (Figure 3) resemble the Nueces-Frio forms. The individual from the lower Trinity River was characteristic of those from the Brazos River. Regardless of records of Tampico Pearlymussel from the Red or Trinity rivers, this species is not known to be established in either.

Figure 2. Tampico Pearlymussel (*Cyrtornaias tampicoensis*) has several ecophenotypes. Those in the Brazos-Colorado drainages usually have robust shells and boldly colored nacre; specimens from the Guadalupe-San Antonio have dark nacre, but thinner, more-compressed shells; individuals from the Nueces-Frio are also less robust, but typically have white or pastel nacre; and populations in the Rio Grande are robust, but with white or pastel nacre as well.

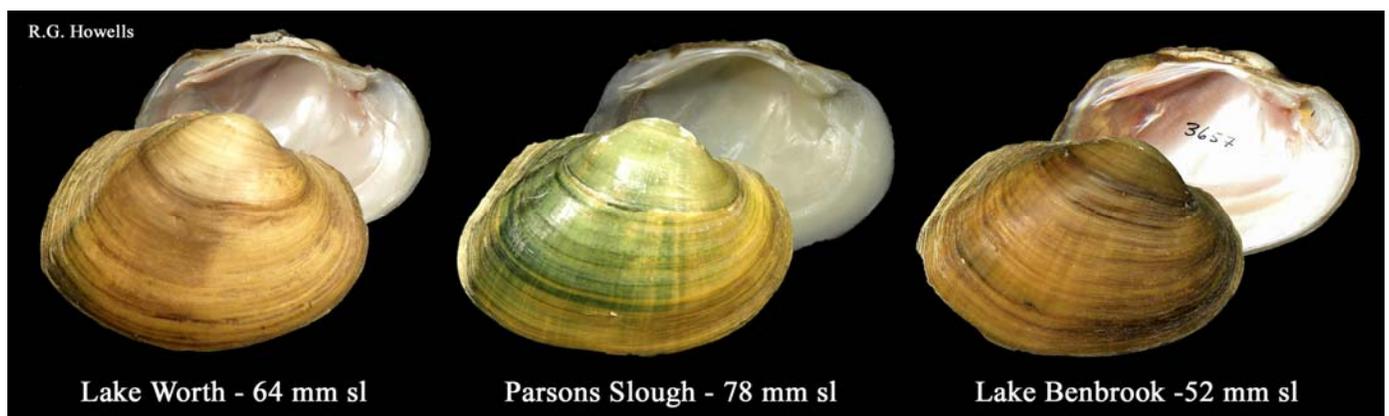


Figure 3. Examples of Tampico Pearlymussel (*Cyrtornaias tampicoensis*) specimens taken in reservoirs in the 1970s and at a riverine site (undated) in the upper Trinity River drainage, Texas. This species appears to have been absent in earlier geological and archaeological records and has not been reported in surveys of this area during the last 30 years.

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**Additional Information Concerning the Conquest of Europe by the Invasive Chinese Pond Mussel *Sinanodonta woodiana*. 29.  
News from Austria, the Netherlands, Poland, and Slovenia**

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Papers dealing with the presence of the invasive Chinese pond mussel *Sinanodonta woodiana* (Lea, 1834) in Europe continue to appear in the malacological literature. Here is a short review of such papers recently published in Austria, the Netherlands, Poland and Slovenia.

**Austria**

In a report concerning the presence of the Quagga mussel *Dreissena bugensis* in Lower-Austria and Wien Reischütz, Reischütz & Fischer (2012) mentioned also the find of empty valves or fragments of the Chinese pond mussel at all the seven studied localities. While referring to the study by Francova et al. (2012), they reached the conclusion that, most probably, this invasive mussel species is using the Black spotted or Round goby *Neogobius melanostomus* in the Donau as hosts for its glochidia.

**The Netherlands**

In a brief note, Nienhuis (2012) has pointed out the importance of tracing the presence of juvenile specimens of the Chinese pond mussel as a proof that we are dealing with a sound reproducing population of this invasive alien mussel. He also pointed out a somewhat neglected character: any large European freshwater mussel with a length over 15 cm and a cracked, dry valve is always a specimen of *Sinanodonta woodiana*! This explains the many illustrations of cracked valves of this mussel on the internet.

**Poland**

Andrzejewski, Pelczyk, Urbańska & Gierszal (2012) presented a lecture during the 27<sup>th</sup> Polish Malacological Seminar on age reconstruction of valves of the Chinese pond mussel collected in the Czesławicki pond. They used shell strips of 4 mm wide cut out of valves from the umbo to the ventral margin. One edge of such a strip was polished with corundum and diamond powder. The internal lines seen on the polished edge corresponded with the external growth lines. In this way, the number of annual and temporary growth interruptions could be established. A follow-up study has to show the exact reasons for the growth interruptions.

Łabęcka & Domagala (2012) lectured at the same meeting about the histology of the gonads and changes in the germinal epithelium of *Sinanodonta woodiana* from the heated waters of the Power Station near Dolna Odra. The results showed that the Chinese pond mussel is producing spermatozoa throughout the year.

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Łakomy, Andrzejewski, Urbańska & Mazurkiewicz (2012) reported at that Congress about a new record of the Chinese pond mussel from a fish farm in Osieczna in Western Poland. According to their estimation, this mussel reached that site by 1992 and, therefore, should be considered the oldest known locality of *Sinanodonta woodiana* in the surface waters of Poland.

Wojton, Kasprzyk, Kościółek & Pilch (2012) studied the joint occurrence of the Swan mussel *Anodonta cygnea*, a protected species in Poland, and the invasive Chinese pond mussel in fish ponds in the Wisłok River Basin. They reached the conclusion that the invasive *Sinanodonta woodiana* might occur also in non-heated waterbodies. In this way, it can turn into a serious competitor of *Anodonta cygnea* of which the range of distribution in Poland is decreasing markedly.

### Slovenia

Klenovšek, Govedič & Vaupotič (2012) reported on the first find of *Sinanodonta woodiana* in Slovenia. Six specimens were found in a drained fishpond of Priložje near Metika. Further information showed that the pond had been stocked with Grass carp (*Ctenopharyngodon idella*) some ten years ago. Since then, the pond had been stocked only with Common carp (*Cyprinus carpio*) and Common bream (*Abramis brama*). Since Grass carps, Silver carps (*Hypophthalmichthys molitrix*) and Bighead carp (*Aristichthys nobilis*), which serve all as primary intermediate hosts for the glochidia of the Chinese pond mussel, are being grown all over Slovenia, *Sinanodonta woodiana* may be expected to occur at many other sites in Slovenia.

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## Europe is Banning the Import of any Apple Snails, but What About Israel?

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Europe has opened the war against Apple snails (*Pomacea*). In a decision taken on 8 November 2012, the European Union has decided to ban the import of any species belonging to the genus *Pomacea* (Anonym, 2012a). This action was taken as a result of the establishment of a viable population of *Pomacea insularum* ((d'Orbigny 1835) in the delta of the river Ebro in Spain.

This decision was not hastily taken but based on an extensive pest risk analysis (Anonym, 2012b) and a subsequent scientific interpretation of it (Anonym, 2012c). Hopefully, all member states will implement the decision as soon as possible. Most species of *Pomacea* are capable to upset the whole ecological equilibrium of an aquatic biotope, especially in the Mediterranean region of Europe.

As a matter of fact, I hope sincerely that Israel will follow the decision taken by the European Union. At the moment at least, four species of *Pomacea*: *bridgesi* (Reeve 1856), *canaliculata* (Lamarck 1819), *insularum* (d'Orbigny 1839) and *paludosa* (Say 1829) and one species of the genus *Marisa*: *cornuarietis* (Linnaeus 1758), are readily available in so-called pet-shops in Israel (Milstein, Mienis & Rittner, 2012). This in spite of the fact that, in Israel, the whole phylum Mollusca is protected by law and the import of living (and dead) molluscs is only allowed after the necessary permits have been acquired.

Most of the species mentioned above have been occasionally found in commercial ponds which were used for the breeding of exotic fish or the cultivation of aquatic plants. No viable populations of any Ampullarid species are known at the moment from the inland waters of Israel. Nevertheless, I hope that the Nature and Parks Authority and the Plant Protection and Inspection Services of the Ministry of Agriculture will take measures to also banish the sale of *Pomacea* and *Marisa* species in Israel.



Figure 1. A huge, aquarium grown specimen of *Pomacea insularum* which the owner intended to set free in the Sea of Galilee, Israel.

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## Conflictive Incidence of Native Freshwater Mussels/ Naiads in Fish Farms/ Dams of the Santa Catarina's State, Central Southern Brazil

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As previously commented (Agudo-Padrón 2011 a: 19), several waterbodies are the natural habitat of freshwater/ limnic mollusks in southern Brazil, bivalve naiads among them. These bivalves have a unique life cycle that begins with a parasitic larval stage in fish that serve as vehicle dispersion (Agudo 2005 a, 2008; Agudo-Padrón 2011 d: 40). However, many of them – a nurtured number of species – can successfully adapt to the artificial conditions imposed by man in this region, including, particularly, the artificial lakes and cultures for fish farming that proliferate in this area (Agudo 2005 a, 2008; Agudo-Padrón 2011 b).

*Anodontites trapesialis* (Lamarck, 1819) (Figures 1 & 2), the most important and common species involved in this case (Agudo 2005 b, 2008; Agudo-Padrón 2011 b), is one of the largest freshwater bivalves of South America, reaching about 13 cm long, 6.5 cm in height and is used as ornaments and decorations and even the manufacture of pearl buttons. It is commonly found in shallow water depths

ranging from 0.1 to 2.0 m and lives buried in clayey soil, silty or sandy-muddy to a depth of approximately 15 to 20 cm. It is not found among the gravel or rocky substrates. The shell is large, trapezoid, periostracum light-colored or yellowish brown, shiny and smooth, and internally pearly. The species is hermaphroditic and requires an intermediate host to complete its reproductive cycle. Its larva, *lasidium*, usually parasite a fish, encysting in the fins or epidermis, which can even cause the death of the host, depending on the degree of parasitism (Felipi & Silva-Souza 2008). Under natural infestations, this mussel does not compromise the fish. Currently, the species is used for biological monitoring of pesticides and heavy metals, and proved to be an excellent monitor due to the characteristics of being an animal strainer, sedentary, occupy the lowest levels the trophic chain, and have high longevity (about 15 years) (MMA 2008: 218-219).

Until now, in the Santa Catarina's State territory, three localities with problems caused by the presence/ occurrence of this native species in "fish farms/ dams" have been mapped, characterized and confirmed by us (Figures 1, 2, & 3). These mussels probalby were accidentally introduced by "fingerlings" or reproductive adult fishes infested with the larvar parasitic form *lasidium*.



Figure 1. *Anodontites trapesialis* (Lamarck, 1819) young specimens, captured in fish farm/ dam of "Pacu", *Piaractus mesopotamicus* Holmberg, 1887 (fingerlings of this fish came from "Foz do Iguaçu", Paraná State/ PR). Caçador Municipal District (red color), Santa Catarina State/ SC, Central Southern Brazil. Photograph and technical information from Alvaro Graeff, Fish Culture Experiment Station, EPAGRI/ Caçador, SC (02/04/2012 and 11/06/2012).



Figure 2. *Anodontites trapesialis* (Lamarck, 1819) adult specimen, captured in particular fish dam. Joinville Municipal District (red color), Santa Catarina State/SC, Central Southern Brazil.



Figure 3.- *Anodontites trapesialis* (Lamarck, 1819) adult specimens, captured in particular fish dam. Guaramirim Municipal District (red color), Santa Catarina State/SC, Central Southern Brazil.

Additionally, the endangered native naiad species *Leila blainvilliana* (Lea, 1834) was probably accidentally introduced in the “Peri Lagoon” of the Santa Catarina’s Island from the neighboring State of Rio Grande do Sul/ RS. This introduction probably occurred on exotic African fishes of freshwater pisciculture *Tilapia rendalli* (Boulenger, 1896), infested with the parasitic *lasidium* produced by the mussel species, (Agudo 2007:11).

Also, on 23/02/2003, the freshwater naiad *Anodontites trapesialis* (Lamarck, 1819) was reported by Prof. Eng. of Fishing César Ademar Hermes, in “Fishery Nursery Dam” located close to the "Reservoir of the Hydroelectric of Itaipu" (aprox. 18 km), District São Clemente, Municipal District of Santa Helena, West of the neighboring State of Paraná/ PR, to North of SC. One specimen was collected and sent to us (Figure 4) for taxonomic determination (Agudo 2005 a: 10).



Figure 4. *Anodontites trapesialis* (Lamarck, 1819) middle size specimen, captured in fishery nursery dam of Santa Helena Municipal District (red color), Paraná State/ PR, Southern Brazil region, by César Ademar Hermes.

Other reports reviewed by us include further occurrences of the same situation in localities in Southeastern Brazil (Agudo 2005b), the Eastern Central region of Rio Grande do Sul State/ RS (Figure 5), and also in the Santa Catarina’s neighboring State of RS, to South, in the influence area of the Upper Mampituba River basin (Agudo 2004a and b).

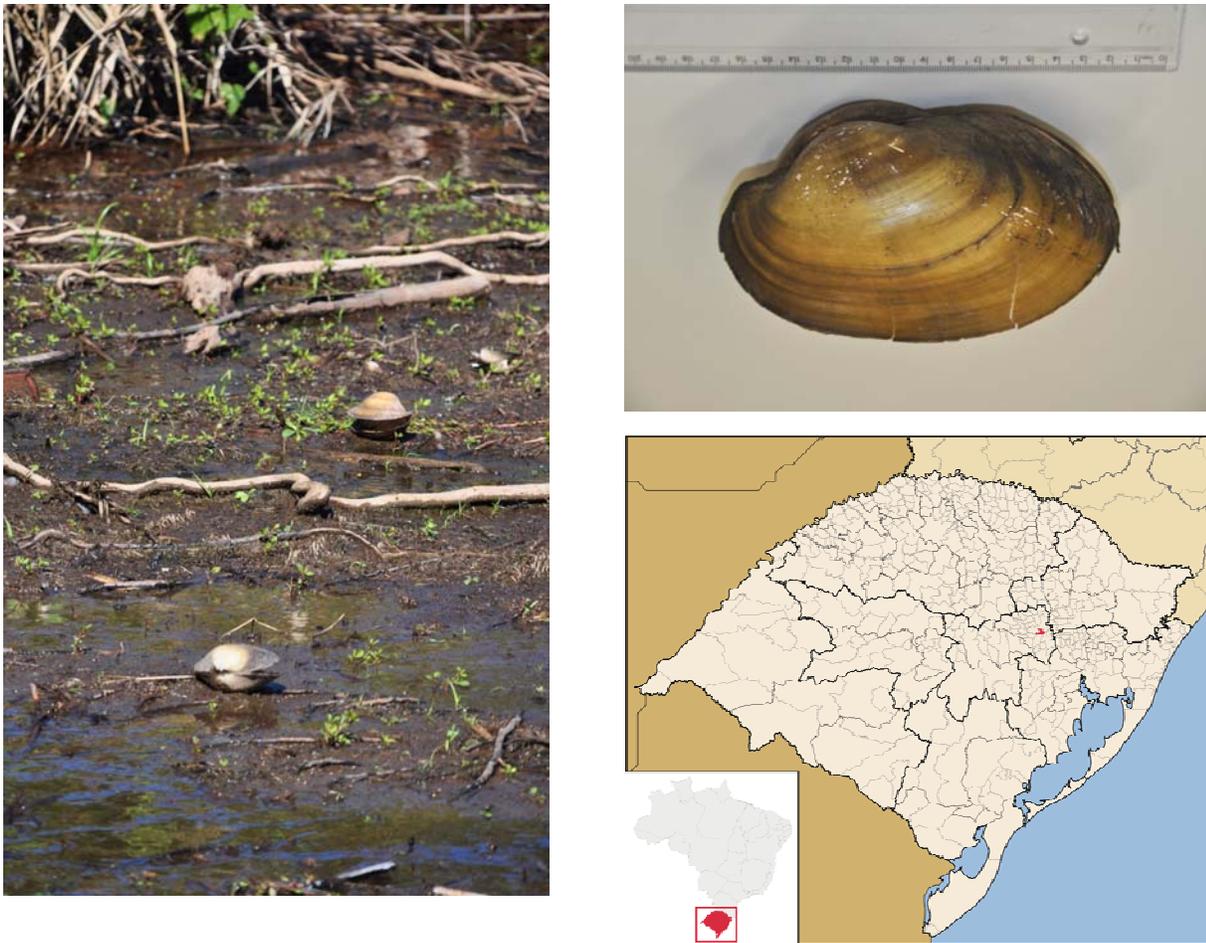


Figure 5. *Anodontites trapesialis* (Lamarck, 1819) specimens in particular fish dam of Colinas Municipal District (small red dot), Rio Grande do Sul/ RS State, Southern Brazil region, “drained for maintenance”. Photographs by Paulo Lenhard, Project AM (02/06/2012).

In general, curious and contradictorily, the International Union for Conservation of the Nature – IUCN, considers this species to be seriously threatened with extinction mainly by human activities and the introduction of exotic species that invade the environment (Agudo-Padrón 2009:7, 2011c:62, 63-Figure 7, 64; MMA 2008:219, 224-225). It can, however, adapt and end up competing with the natives for space and nutrients, taking great advantage.

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### **New Geographical Record of the Little Neotropical Freshwater Clam *Sphaerium cambaraense* Mansur, Meier-Brook & Ituarte, 2008 in Highlands of Southern Brazil**

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For Brazil, and South America in general, a total of 31 species of little freshwater/ limnic clams Sphaeriidae, including five genera and two subfamilies, are related (Agudo-Padrón 2011 a). According to Mansur *et al* (2008: 228, 233-234), *Sphaerium cambaraense* is the fifth *Sphaerium* Scopoli, 1777 species described from South America and the first species of the genus described from Southern Brazil. It was described from the highlands near the Atlantic Ocean, a location geographically very distant from the Andes and Amazon River. The type locality is “Lajeado da Margarida” ( Flagstone Daisy ) (50°15.75’W, 29°0.87’S; 870–880 m altitude) on “Camisa River, Antas River Basin”, considered to be the headwaters of “Taquari River”, the main tributary of Jacuí River, South Atlantic Brazilian Basin in “Cambará do Sul” Municipal District, this last situated in the Northeastern territory of Rio Grande do Sul State/ RS, in the highest part named “Planalto Riograndense” (Figure 1). The species was collected in small ponds along the river course, where currents were lower, allowing the accumulation of decayed leaves and very soft, dark, and fine sand deposits, not deeper than 1 m.

Physiographically, this region is characterized by a basaltic shield covered by low grass steppes and “Araucaria Forest” mixed with the Southeastern limits of the Atlantic Forest. The altitude varies from 850 to 1,050 m and, in the winter, temperatures fall below freezing and there is occasional snow. The rivers that cross the region, flanked by a low gallery forest, have hard bottoms formed by flattened basaltic stones, and currents are strong (Mansur *et al* 2008: 233-234).



Figure 1. Cambará do Sul Municipal District (left - red color), “Lajeado da Margarida” (right & below left) and other regional hydrography (below right) in RS State, Southernmost Brazil

Recently, reviewing material deposited in the scientific malacological collection of the Museum of Natural Sciences - MCNU from Brazilian Lutheran University - ULBRA/ Canoas (Agudo-Padrón 2011 b), we found two singular very little specimens of limnic clams preserved in liquid, originally collected by A. Zimmer on May 25 2003 from the locality “Vale das Trutas” ( Trouts Valley ), “São José dos Ausentes” Municipal District, RS State (MCNU-U 028), geographical neighbor of the previous Municipality and physiographic region commented (Figure 2).

The taxonomic determination of these specimens was based on the fundamental contributions of Simone (2006), Mansur *et al* (2008) and Pereira *et al* (2012), coming to the conclusion that they belong to the species *Sphaerium cambaraense* Mansur, Meier-Brook & Ituarte, 2008, and form the second known report of this species in highlands of the Southern Brazil region.



Figure 2. São José dos Ausentes Municipal District (upper left - red color) and “Vale das Trutas” region (upper right & below) in the RS State, Southernmost Brazil, new record of occurrence for the species.

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## Proposed Strategies for Conservation of Neotropical Endangered Limnic Mussels/ Naiads (Unionoida, Mycetopodidae) in Southernmost Brazil

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The South American continental bivalve naiads of the order Unionoida (families Hyriidae and Mycetopodidae), including the endemic limnic species *Leila blainvilliana* (Lea, 1834), the great and representative freshwater naiad *Anodontites trapesialis* (Lamarck, 1819), and others, currently represent the group of animals in freshwater at increased risk of extinction (IBGE 2009; MMA 2004, 2006). They are sensitive to trampling, organic and chemical pollution, eutrophication, habitat fragmentation, and fouling of the environment (Agudo-Padrón 2011a). These animals have relatively slow growth and generally do not return to occupy previously disturbed environments. There are endemic species for each river basin and many of these occur in very limited areas (for example *Leila blainvilliana* - Figure 1), and are terribly threatened by the many recent environmental changes caused by human occupation (Lima 2010; Nascimento & Campos 2011).



Figure 1. Endangered endemic South American mussel/ naiad *Leila blainvilliana* (Lea, 1834) (left) and its geographic distribution known in the Rio Grande do Sul State/ RS territory (right), Southernmost Brazil region. Photograph - Rio Grande do Sul Zoobotanical Foundation – FZB/RS, Porto Alegre, RS; Map – Figure 16 in Mansur *et al* 2003:65.

Despite the great biological and ecological role that mollusks play in limnic ecosystems, few studies of this group have been held in Brazil. Simone (2006), for example, records for Brazil 373 native species of freshwater mollusks, of these 117 are bivalves and 256 are gastropods. The opinion of many researchers, however, is that these numbers can be controversial due to the large number of synonyms and aggregation studies in certain localities (Mansur & Pereira 2006; Pereira *et al* 2012).

The Southern region of Brazil contributes significantly to the knowledge of Brazilian limnic malacofauna (Pereira *et al* 2012), covering a large percentage of existing studies, and among the southern States, the Rio Grande do Sul/ RS is the most outstanding. It is noteworthy that according to the Brazilian Red Books (Mansur *et al* 2003, Amaral *et al* 2008), there are many species in the State that are in a vulnerable or endangered level, such as the fair *Leila blainvilliana* (Lea, 1834). Another major problem that faces the regional malacological fauna is the introduction of invasive species, such as: the bivalves *Corbicula fluminea* Müller, 1774, and *Limnoperna fortunei* (Dunker, 1857), and the

gastropod *Melanoides tuberculatus* (Müller, 1774). Among the few studies on this group, they are concentrated more in rivers of large orders, putting in the background, research streams (Figure 1). The approaches given to studies of large rivers are about orders: the distribution and occurrence of mollusks, environmental preferences linked to environmental factors associated with macrophytes, the occurrence of species of medical importance, and assessments of the impact on the introduction of exotic species.

Overall, all the species object of attention in this opportunity are in “**danger of extinction**”, including in regional, national and South Cone endangered species lists (Mansur *et al* 2003; Scarabino 2004, Amaral *et al* 2008; Clavijo 2010; Clavijo *et al* 2010). Thus, viewing and managing properly the knowledge concerning the negative factors that compromise is the existence of *Leila blainvilliana* (Lea, 1834) and other native naiads in the environment, we can formulate strategies applicable to the scope of its effective conservation.

This brief report aims to fill the information gap that now prevails against this serious environmental problem at the regional level, despite the efforts and specific allowances previously made (Mansur *et al* 2003), even if it is spreading so scary the territory of Brazil and other countries located in the Atlantic Slope of the Southern Cone of South America (Scarabino 2006; Clavijo 2010; Clavijo *et al* 2010):

### **I. Problematic factors faced by the species:**

- a) Action of invasive alien species (its main threat is the golden mussel, *Limnoperna fortunei* (Dunker, 1857), laying on the surface of the shell, killing all specimens by suffocation);
- b) Fragmentation/ alteration of habitat (deforestation of riparian vegetation and riparian areas, construction of hydroelectric dams, dredging for navigation and sand mining for construction, sewage pollution of waters, trampling by swimmers);
- c) Breach of reproductive dispersion factor (interruption of the path of "piracemas" - massive migration of fish - by hydroelectric dams, which affect the dispersion of ecto-parasitic lasidium larvae of the species);
- d) Lack/ absence of general populational studies.

### **II. Viable proposed strategies for their effective conservation:**

- a) Relocation (transport of live specimens from one place to another: specimens are collected in areas affected and changed/ transferred to another non-impacted area, ecologically similar). Strategy recently put into practice in the neighboring country of Uruguay (Clavijo *et al* 2012);
- b) Artificial cultivation (in vitro) of larvae (viable technique to obtain, under laboratory conditions, of young seeking their spread in the environment). Activity developed experimentally at the University of Sao Paulo - USP, Ribeirão Preto Campus (Lima 2010);
- c) Controlled exploration (deliberate cultivation of the species in ponds/ tanks/ reservoirs for human and animal consumption). Activity called "*Naiadicultura*" in Brazil (cultivation of naiads or freshwater bivalves), using fish grown in ponds to provide the necessary intermediate vector for the “larval cycle” of bivalves (Agudo 2006);
- d) Reintroduction (translocation and release of specimens in a region within its original area of occurrence, from animals reproduced deliberate and/ or spontaneously in ponds/ tanks/ dams). Our proposal in this case is the use of individuals who develop “freely and naturally” in fish ponds located in the facilities of the “Rice Experiment Station - EEA, Irrigated Rice Institute - IRGA”, headquartered in Cachoeirinha Municipal District, Rio Grande do Sul State/ RS (Agudo-Padrón *et al* 2010; Agudo-Padrón & Lenhard 2011: 168; Agudo-Padrón 2011 b, 2012: 19) (Figure 2), with abundant testimony material deposited by us in diverse scientific malacological collections of regional museums (MCNU, MCP, MCN-CMOB).\*

In effect, this local ponds/ dams housing at least four species of regional great native freshwater bivalves/ naiads (Agudo-Padrón *et al* 2010:10; Agudo-Padrón 2011b:21-Figure 3) admittedly have some degree of threat (Agudo-Padrón 2011a:63-64): *Anodontites patagonicus* (Lamarck, 1819), *Anodontites trapesialis* (Lamarck, 1819), *Leila blainvilliana* (Lea, 1835) and *Mycetopoda legumen* (Martens, 1888).

\* Dra. Silvia Drugg Hahn, Natural Sciences Museum Curator, Zoobotanical Foundation – FZB/RS,

Southernmost Brazil, 10/09/2012, Pers. com.) timely notifies that, after review/taxonomic determination, it was found that the particular Unionoida/Mycetopodidae specimens (singular shells) deposited in the scientific malacological collection of MCN, getting the no. MCN-CMOB 39.455 – *Leila blainwilliana*, really belong to species *Anodontites trapesialis* (Lamarck, 1819).



Figure 2. Artificial fish ponds of the "Experimental Irrigated Rice Station IRGA", Cachoeirinha Municipal District, RS State, spontaneous habitat of great endangered native freshwater mussel/ naiads in the Southernmost Brazil region. Photos: A.I. Agudo-Padrón & Paulo Lenhard, Project "Avulsos Malacológicos – AM"

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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 freshwater mollusks. Contributions may be submitted at any time but are due by the 15<sup>th</sup> 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](mailto:jjjenkinson@hotmail.com).

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 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 any questions about possible submissions or transmission concerns.

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## Obituary -- Ronald D. Oesch (1930 – 2012)



It is with great sadness that we note the passing of Ron Oesch (1930-2012). Ron was well known to many of us through his field guides to freshwater mollusks and for the help he gave many of us learning the molluscan faunas of Missouri. Ron grew up near Olds, Iowa, and later near East Lynn, in Cass County, Missouri. He graduated from Harrisonville High School in 1948, and, initially, worked with his family's business terracing fields for erosion control. After military service in Korea and 10 years at General Motors in St. Louis, Ron enrolled at University of Central Missouri (CMSU) in Warrensburg to earn Bachelor's and Master's degrees in Biology.

While at CMSU, Ron was strongly influenced by Professor Oz Hawksley and developed lifelong interests in conservation, natural history, biodiversity, caves, and prairie restoration. For his Master's thesis in vertebrate paleontology, Ron excavated the Pleistocene vertebrate fauna from a cave in western St. Louis County, Missouri. The work was coauthored with zooarchaeologist and malacologist Dr. Paul Parmalee and was a landmark study of the Pleistocene fauna of the Ozarks. After completing his graduate studies, Ron taught Biology at Ritenour High in St. Louis and, later, was an administrator in charge of audiovisual educational resources for the Cooperative School Districts of Greater St. Louis, retiring in 1992. But long before he retired from vocational pursuits, Ron avocations were in full-flower.

A major focus of Ron's work was the systematic documentation of diversity and distribution of the invertebrate faunas of Missouri. He spent over forty years studying the Mollusca of Missouri, resulting in three books: *Missouri Naiades* (1984, 1995), *Missouri Aquatic Snails* (1997, with Wu and Gordon), and *Land Snails of Missouri* (with Watrous and Barnhart, forthcoming). These projects all involved thousands of miles of self-funded travel for the survey work and visits to museum collections for taxonomic identification and comparative material. Ron's coauthors and collaborators will always remember the cheerful, self-effacing, yet relentless determination with which he engaged each of these projects over decades.

Ron credited Paul Parmalee with interesting him in freshwater mussels, and he was also influenced by his friends Frieda Schilling and Hessie Kemper, who were avid amateur malacologists and members of the St. Louis Shell Club, and by Alan Buchanan, malacologist with the Missouri Department of Conservation.

Ron's first book, *Missouri Naiades* (1984), couldn't have been more timely. The science of freshwater mussels was beginning an exponential growth driven by a conservation crisis, and by the increasing need for monitoring and protection of endangered species. Ron's book was, and still is, an

indispensible guide through the maze of mussel lifecycles, geographic ranges, redundant taxonomic names, and the difficult task of identification.

In the 1980's Ron began surveying Missouri crayfishes and, between 1981 and 1989, amassed 950 crayfish species-locality records. When he learned that Bill Pflieger of the Missouri Department of Conservation (MDC) was also planning a guide to Missouri crayfishes, Ron generously donated his records to MDC, comprising a large part of the data on which *The Crayfishes of Missouri* (Pflieger 1996) is based.

In the 1990s, Ron surveyed freshwater snails and published *Missouri Aquatic Snails*, with Wu and Gordon, in 1997. His final book, *The Land Snails of Missouri*, will be published soon by MDC. This work will certainly equal *Missouri Naiades* as the door to a diverse, fascinating, and unexpected fauna.

In addition to his publications, the collections that Ron made during his faunal surveys and paleontological studies were donated during his lifetime to enrich the collections of several universities and museums, including the Field Museum of Natural History, the University of Colorado at Boulder, Ohio State University, and Missouri State University.

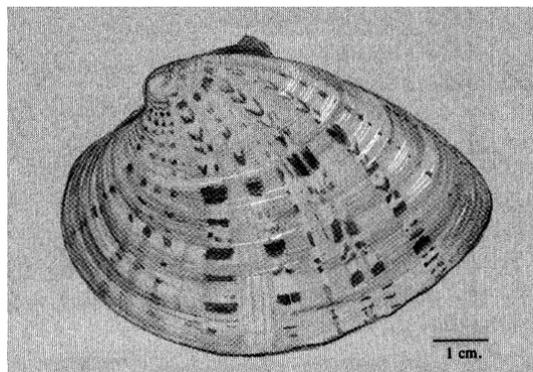
Among Ron's other contributions to conservation, prairie and glade restoration was a particular passion. Ron worked for many years with Tom and Cathy Aley on a major glade/prairie restoration project on the watershed of Tumbling Creek Cave in Taney County, Missouri. The cave is the home of the Ozarks Underground Laboratory and of the federally endangered Tumbling Creek snail, *Antrobia culveri*.

In his later years, despite failing health, Ron participated enthusiastically in volunteer-based and professional biodiversity surveys. He identified specimens of prairie mollusks and other invertebrates for Missouri Prairie Foundation and the Nature Conservancy. He taught a continuing education course at St. Louis Community College, Meramec Campus: "The Identification and Appreciation of Missouri's Terrestrial Snails". Ron was also a long-time volunteer at the Nature Conservancy Field Office in St. Louis and, for many years, donated his time for activities ranging from field work and preserve stewardship to lichen spore identification and running the office recycling program.

Ron was the first president of the Missouri Chapter of the Sierra Club. For many years, he was an active member of the Webster Groves Nature Society, the Missouri Prairie Foundation, and the Middle Mississippi Grotto of the National Speleological Society. He received awards and recognitions, including the Citizen's Award of the Missouri Chapter of the American Fisheries Society, twice named Volunteer of the Year by The Nature Conservancy and, in 2012, was commended by the Conservation Federation of Missouri for lifelong contributions to wildlife conservation.

Reflecting on Ron's life reminds us of the big messages in little things, and of how much can be accomplished by curiosity, persistence, careful scholarship, and generosity. He leaves us better able to appreciate the wonders of nature.

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from *Missouri Naiades: A Guide to the Mussels of Missouri*. Copyright 1995  
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## Parting Shot



This series of pictures may be the first in-the-wild documentation that females of the oyster mussel, *Epioblasma capsaeformis*, actually do capture darters between their shells. Nick King, at Virginia Polytechnic Institute and State University, took these photographs of an undisturbed mussel and darter in the Clinch River during May 2007. He used a Nikon Coolpix 7900 camera in an Ikelite underwater housing. The mussel held the darter for about four minutes, then released it. When inspected later, the darter did have glochidia attached.

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](mailto:jjjenkinson@hotmail.com).

