Newsletter of the Freshwater Mollusk Conservation Society
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2014 FMCS Workshop

Mussel Studies and Regulatory Processes Associated with Dam Removal Projects

April 24 – 25, 2014 Portland, Maine

Thousands of low head dams no longer serve their intended purpose and there has been increasing interest and success in the removal of dams and other barriers that impede river flows, fish passage, and connectivity within stream reaches. In some cases, even active hydropower dams are being removed because the cost of mitigation, such as effective fish passage, outweigh the economic benefits of power production. Dams are often assumed to negatively affect mussel populations, so the expectation is that dam removal will improve aquatic habitat and freshwater mollusk communities in the affected reaches. In some cases, however, where reservoirs are small or riverine, the removal of dams for stream restoration may adversely

affect existing resident mussel communities. For all of these reasons, the 2014 FMCS Workshop will focus on mussel studies and regulatory processes associated with dam removal projects.

The planning committee is in the final stages of arranging for this workshop to be held on Thursday and Friday, April 24-25 in Portland, Maine. The first day, Thursday, April 24th, will be devoted to invited oral presentations on field studies conducted pre- and post- dam removal concerning projects in various regions of the country. Speakers will share their experiences and lessons learned, in particular where freshwater mussel studies were conducted. These studies are not limited to mussel surveys; they also include other environmental variables that may affect aquatic habitat and thus the restoration capacity for mollusks. Speakers will provide recommendations for others currently dealing with active or potential dam removal or refurbishing projects. A panel discussion will occur at the end of this session. The following talks are tentatively scheduled to be given on Thursday:

- ***Effect of dam removal on the unionid mussel community in the Salmon River, New York*** **John E. Cooper**, Cooper Environmental Research, Constantia, New York
- ***Effects of small dam removal on a freshwater mussel assemblage in the Deep River of North Carolina: findings and lessons learned*** **Ryan J. Heise**, North Carolina Wildlife Resources Commission, North Carolina; **W. Gregory Cope**, Department of Applied Ecology, North Carolina State University, Raleigh, North Carolina; **Thomas J. Kwak**, U.S. Geological Survey, North Carolina Cooperative Fish and Wildlife Research Unit, Department of Applied Ecology, North Carolina State University, Raleigh, North Carolina; and **Chris B. Eads**, College of Veterinary Medicine, North Carolina State University, Raleigh, North Carolina
- ***Not all dams are equal: complex interactions between small dams and mussels in the southeastern USA*** **Michael Gangloff**, Appalachian State University, Boone, North Carolina; **Rachael Hoch**, North Carolina Wildlife Resources Commission, Marion, North Carolina; **Jordan Holcomb**, Florida Fish and Wildlife Commission, Gainesville, Florida; **Megan McCormick**, Appalachian State University, Boone, North Carolina; **Erin Singer-McCombs**, American Rivers, Asheville, North Carolina; **Erin Abernethy**, University of Georgia, Athens, Georgia; and **Robert Nichols**, North Carolina Wildlife Resources Commission, Raleigh, North Carolina
- ***Physical habitat conditions and low-head dams: factors affecting the distribution and abundance of freshwater mussels and their relation to the dam removal process*** **W. Cody Fleece** and **Scott Peyton**, Stantec Consulting Services, Cincinnati, Ohio; David Huntress, Stantec Consulting Services, Topsham, Maine; **Bryon Ringley** and **Travis White**, Stantec Consulting Services, Columbus, Ohio; **Tim Taylor**, Stantec Consulting Services, Charlotte, North Carolina; and **James Kiser**, Stantec Consulting Services, Louisville, Kentucky
- ***Pre-dam removal surveys: Keys to good survey design for successfully quantifying federal and state listed species*** **Daelyn A. Woolnough** and **Shaughn Barnett**, Biology Department and Institute for Great Lakes Research, Central Michigan University, Mount Pleasant, Michigan
- ***Appalachian Elktoe relocation associated with a dam removal project in Western North Carolina*** **John M. Alderman**, Alderman Environmental Services, Inc., Pittsboro, North Carolina; **Joseph D. Alderman**, Alderman Environmental Services, Inc., Hillsborough, North Carolina; **Hugh Barwick**, Duke Energy (retired), Cornelius, North Carolina; **Mark Cantrell**, US Fish and Wildlife Service, Asheville, North Carolina; **Scott Fletcher**, Duke Energy, Environmental Center, Huntersville, North Carolina; and **Gene Vaughan**, Duke Energy (retired), Mooresville, North Carolina

- ***Mussel studies associated with two lower Penobscot River, Maine, mainstem dam removals, Veazie and Great Works hydropower projects*** **Ethan Nedeau**, Biodrawversity, Amherst, Massachusetts

During the evening reception on the 24th, we will hold a poster session relevant to these topics. We are requesting poster abstracts associated with this year's workshop theme and others associated with the following topics: Habitat and Conservation, Range-wide Status and Distribution, Life History and Ecology, Evolution and Phylogenetics, Outreach and Education, Propagation and Reproduction, Recovery, Contaminants and Water Quality, or any other mollusk related work. Abstract submittal requirements are [or soon will be] posted on the event registration page. Please contact Alan Christian (alan.christian@umb.edu) or Mary McCann (mary.mccann@hdrinc.com) for additional information about the poster session.

On Friday morning, April 25th, the workshop focus will shift to state and federal regulatory processes involved in dam removals. Some states have developed regulatory processes specific to dam removals, or have guidelines on both pre- and post- dam removal environmental studies, including mussel studies. This session also will conclude with a panel discussion. The following talks are tentatively scheduled for Friday morning:

- ***Dillsboro dam removal – lessons learned.*** **Ty Ziegler**, P.E., HDR Engineering, Inc., Charlotte, North Carolina
- ***Permitting dam removal in Massachusetts: how mussels fit in to the regulatory framework.*** **Beth Lambert**, Massachusetts Division of Ecological Restoration, Boston, Massachusetts; **Peter Hazelton**, Massachusetts Natural Heritage and Endangered Species Program, **West Boylston**, Massachusetts; and **Misty-Anne Marold**, Massachusetts Natural Heritage and Endangered Species Program, West Boylston, Massachusetts.
- ***Endangered mussels and dams: navigating the complex waters of river restoration and mussel mitigation.*** **Beth Swartz**, Maine Department of Inland Fisheries & Wildlife, Bangor, Maine

Two optional events will be offered on Friday afternoon: a site visit to dam sites on the Penobscot River, and a hands-on mussel identification workshop:

Tour of Dam Removal Sites on the Penobscot River

Two mainstem hydroelectric dams were decommissioned and removed from the lower Penobscot River in the past two years. This site visit consists of a bus trip to the Great Works (2012) and Veazie (2013) dam removals on the Penobscot River near Bangor, Maine. For comparison, the tour also includes a view of a similar existing hydropower project just upstream of the two that have been removed. These were all typical mainstem, low head, run-of-river hydropower dams. These impoundments provide excellent habitat for mussels, including two state-listed mussel species. The widely acclaimed and innovative restoration included an intensive mussel salvage effort by a network of volunteers. Learn more at: Penobscot River Restoration 40 seats are available. The trip will include a box lunch with drink.

Northeastern Mussel Identification Workshop

Dr. Arthur Bogan, Research Curator of Aquatic Invertebrates at the North Carolina State Museum of Natural Sciences will conduct a mussel identification workshop focused on northeastern species. The first portion of the workshop will examine the conservation issues facing freshwater mussels from a worldwide perspective, and will discuss the biology, life history, and distribution of freshwater mussels. The second portion will focus on taxonomic

identification, providing methods as well as some examples of freshwater mussels found throughout the northeastern Atlantic Slope of the United States. A key to the native freshwater mussels of the northern Atlantic Slope mussels will be provided. Participants may bring their own specimens to be examined. A box lunch is included. Space is limited to 25 people.

Venue

The workshop will be held at the Holiday Inn by the Bay in Portland, Maine. A block of rooms has been reserved at a special rate of $112 per night. The Holiday Inn also will honor government rates for this workshop. The hotel provides free parking for guests, free wireless internet, free shuttle service to/from the airport, train, or bus station, and is within walking distance of Portland's downtown Arts District, the Old Port Section, and the working waterfront. As the metropolitan hub of Maine's south coast region, the greater Portland area has a metro population of 230,000; population of the city is 66,363. Portland is an easygoing city with friendly, hardworking people. Portland is a safe, culturally fascinating city, and is highly renowned for its variety and quality of restaurants and micro-breweries.

Registration

Registration for this workshop will include continental breakfast both days, morning and afternoon breaks, lunch on Thursday, and drinks/snacks during the Thursday evening social. More information, including registration rates, poster abstract submission guidelines, and a downloadable PDF of all abstracts, is [or soon will be] available at http://www.molluskconservation.org/Events.html. If you have specific questions about this workshop, please contact Mary McCann (mary.mccann@hdrinc.com).

Society News

2013 Fall FMCS Board Meeting
Friday, November 22, 2013, via Conference Call

Attendees:

Patty Morrison
Teresa Newton
Heidi Dunn
Greg Zimmerman
Caryn Vaughn
Art Bogan
Braven Beaty
Catherine Gatenby
Christopher Owen
Dave Berg
Greg Cope
Dan Hua
John Harris
John Jenkinson
Jeremy Tiemann
Leroy Koch
Mary McCann
Megan Bradley
Nathan Whelan
Nevin Welte
Steve McMurray
Tom Watters

Call to Order and Roll Call

Patty declared that we had a quorum of the Board present. She also noted that every standing committee was represented on the call.

Approval of the July 11, 2013 Board Meeting Minutes (published in September 2013 *Ellipsaria*) Motion to approve the July 11, 2013 minutes, motion carried.

Treasurer Report – Heidi Dunn

As of Oct 31, 2013	Income was:	$100,256.26
2013 Auction		7,160.00
Interest		130.26
Memberships		15,960.00
Sale of misc. items		585.00
2013 Symposium		76,061.00
2012 Workshop		360.00
	Expenses were:	$94,272.50
Mussel app		5,000.00
Regional meetings		200.00
Symposium awards		3,383.89
Credit card/pay pal/bank fees		3,299.75
Bi-annual registration fee		20.00
2013 Symposium expenses		74,904.76
2014 Workshop expenses		2,800.00
Walkerana expenses		2,062.50
Web page expenses		2,601.60

Net income through October 31, 2013	$5,983.76
Balance in accounts October 31, 2013	$114,704.28

Secretary's Report – Greg Zimmerman

The Society continues to grow with 574 active members (see summary below). Of those, 320 have renewals due so numbers may be artificially high if one-time students / symposium registrants do not renew. Heidi suggested that once a year we clean up the records in the web application to remove / archive non-active registrants. Greg agreed and that we will add that in the operations manual as an annual task.

Level	Total	Active	Renewal overdue	Lapsed
Author-Non Member	23	23	-	-
Contributing	7	7	1	-
Lifetime	10	10	-	-
Paper Registr Members	-	-	-	-
Regular	527	413	250	110
Student	153	121	69	28
Total	720	574	320	138

Symposium Committee

FMCS 2014 Workshop: - Mary McCann

This issue of *Ellipsaria* includes a Cover Story about the workshop. Still looking for a few more speakers concerning regulatory issues, but we have a lot of good leads. Optional events for Friday PM – visit to dam removal sites, and session on Atlantic Slope mussel species conducted by Art Bogan. Greg Cope mentioned the Carbonton Dam Removal Project might be a good source for an additional speaker.

The board responded that the workshop plan sounds very good; budget seems in-line w/ past conferences. It was suggested to add in a one-day registration for locals / spouses / visitors, and to add more about the poster session in the *Ellipsaria* article. A board member asked "When registration will be set up on website?" Mary replied that our webmaster was scheduled to add those items sometime soon after Thanksgiving. Greg Z. suggested we add a button for $500 company sponsorship on the website to simplify sponsorship; the description should include text for noting that your company / organization logo will be on the cover of the workshop book. It was noted that the hotel will honor the Government Rates for the workshop.

2015 Symposium, St. Louis (St. Charles), MO. – Heidi Dunn / Steven McMurray

Our 2015 Symposium in St. Louis is now proposed to be hosted in St. Charles (10 miles from airport, 20 miles from St. Louis). After some research, Steve and Heidi have found excellent facilities that are a very good value. We can fit everything in the conference center on one floor, room for plenary sessions, joint sessions, etc. The attached Embassy Suites hotel has smaller rooms for board meetings, etc.. Room rates will Include FULL breakfast, free internet service, AND 2hr happy hour. There may be an airport shuttle service available soon. Casino and Bass Pro shop is nearby, right on the Missouri River and bike trail. There are some cheaper hotels nearby, but, due to the very large size of the rooms, up to 6 persons could stay in one room and make the stay extremely reasonable. While it is not in downtown St. Louis, St. Charles is on a river and a much better value than trying to stay downtown and pay more for less.

The proposed schedule: 2nd or 3rd week in March; schedule is draft at this point. This will be a joint meeting with the Upper Mississippi River Conservation Committee (UMRCC). Saturday – FMCS board meeting, Sunday – Propagation workshop/mixer, Monday – concurrent sessions/poster session, mixer, Tuesday – concurrent sessions, FMCS banquet, Wednesday- joint plenary session, joint concurrent sessions, joint auction/mixer, Thursday- FMCS field trips, UMRCC technical meetings, UMRCC awards banquet, joint mixer. Dual rates; for FMCS a little more since longer duration, for UMRCC a little less since it is shorter.

Many members of the board responded with encouragement for the 2015 Symposium plan and joint meeting, including the dual meeting with UMRCC and the schedule of events which should facilitate lots of interaction between groups.

Symposium at American Fisheries Society (AFS) Little Rock, Sept 2013 – Jeremy Tiemann

The event was well received; approximately100 folks stopped by. Received lots of positive comments on content. Synopsis will be presented in upcoming Fisheries magazine. [Also see report on page 9]

SETAC Meeting Mussel short courses and Special Session, Nashville, TN, Nov. 2013 – Greg Cope

FMCS sponsored two short courses – and set records for attendance! 24 attendees in the AM, and 19 in the PM. Very good feedback and positive reviews. Paul Johnson did a very good presentation on FW gastropods; Chris Barnhart gave, as always, a great talk on mussel biology / ecology. Other FMCS contributors – Patty Morrison via web on the FMCS strategic plan and on mussel die-offs and recovery on the Upper Ohio River. Over 27 abstracts submitted with

only room for 8 platform talks, the rest were posters – and there was standing room only in the platform sessions.

Posting of events to FMCS Website: http://molluskconservation.org/Events.html
Megan Bradley noted that FMCS needs to make sure all key events such as the AFS symposium and SETAC activities need to be posted to the website under "Events". Also, local FMCS-sponsored meetings can be posted under events. Please contact Megan (note new email address: Megan.Bradley@dgif.virginia.gov)when you have events to be posted. The Board agreed the process will be that Megan will be the point contact for the postings, cc the EXCOM for comment with a due date, and then send to the webmaster to post.

Awards – Greg Cope, Emy Monroe
Nothing to report

Nominations – Leroy Koch
Candidates will be needed for the 2014 election year. Please contact Leroy regarding nominations for elected positions or if you are interested in running. Leroy also noted he would eventually like to see someone new in the Nominations Committee position.

Outreach – Megan Bradley
Updating the web page – Megan is the lead contact for website updates. We need to update committee links on the website, and committees need to work on getting content updated.
Mollusks near you page – Need updated links for all the states. Megan will send out a request for updated information to enable more states on this web page to have updated links, and more of them.
Megan is also putting the finishing touches on the revised FMCS brochure.

Gastropod Status and Distribution – Nathan Whelan, Jeremy Tiemann
The AFS Gastropod status article came out [See announcement in September 2013 *Ellipsaria*.]. The article also has been posted on the USGS website http://fl.biology.usgs.gov/pdf/Johnson_et_al._2013_Gastropod_conservation_assesssment.pdf , which is less than ideal. The original goal was to get it up on FMCS website and the database transferred over to the FMCS website. Once that is operational, this might be a good test site for the translocation database that can be updated. Right now the snail database is not searchable and not updated. Greg Cope wondered why the AFS document was hosted by the USGS, but also suggested that we could post a link on our website to the article in the short-term. Outreach will look into these options.

Guidelines and Techniques – Nevin Welte, Mary McCann
Nevin will be working on the National Strategy before the April 2014 Meeting. Mary has been compiling lists of current state mussel protocols to see what states have been developed. Mary was recently added as G&T co-chair – Megan to add Mary as co-chair on website.

Genetics – David Berg
Nothing to report. Please note David Berg's new email address (bergdj@miamioh.edu).

Mussel Status and Distribution –Art Bogan and John Harris
Art and John presented a revised proposal of the committee to fund work on the Mussel Atlas. A board member asked if there were fees to use the database. Art responded that right now there are some fees for consultants, but not for students or university / museum research.

This topic will need to be considered for future use. Questions about compatibility between Google Fusion and ESRI ArcGIS were raised, but the issues did not seem to be problematic. Art noted that Google Fusion supported many more parameters, more easily w/o the licensing issues of ESRI ArcGIS. Greg Z. noted that as long as the Google application could export into xml, xls or some other table format, the data should be able to work in both systems. Questions about how the funds were to be transferred or donated were discussed. Heidi noted that it should not be an issue for the transaction. Art congratulated Nate Whelan for completing his dissertation. There was a motion to approve the transfer of $15,000 to support the Mussel Atlas project. That motion was seconded. All were in favor. The EXCOM noted the great work of the committee on this issue.

Mussel Ap. - Mussel photos are still needed for a number of mussel species. A new announcement regarding this need is on page 10.

Old Business

Reports of the President's Ad Hoc Committees

Committee on Scientific and Common Names Checklist – Jim Williams, Paul Johnson

Action complete for scientific and common names checklist and committee dissolved. EXCOM congratulated committee. The work of keeping the accepted scientific and common names of mollusks current and on the FMCS website will be undertaken by sub-committees of the Mussel Status and Distribution, and Gastropod Status and Distribution committees.

FMCS Procedures Manual update – Steve McMurray and Greg Cope

Steve sent out most recent version of the draft manual last week. Some sections still need to be updated but the manual is close. It is at a point that the EXCOM should strong-arm the completion of the Manual. Committee chairs will be getting the most recent version from Steve for them to edit as necessary for the work of their committee.

Action Items:

- Set a date for the EXCOM to discuss procedures manual items– Steve to set up a Doodle Poll to determine that date, probably early next year.
- Need to set a date for Committees that need to update their parts of the operations manual.
- Set December 31, 2013 as due date for committee / EXCOM descriptions

Revision of National Strategy – Catherine Gatenby

The Committee added some new official members (Bob Anderson, Rita Villella Bumgardner, Bob Butler, Daelyn Woolnough, Kathryn Perez, Teresa Newton, Steven Zigler, Sue Breunderman, and Paul Johnson) to help develop the final wording of the document. The group decided to start developing their own format and then go for the publication later. Sub-groups are working on draft wording for the Introduction and the presentation of one issue (Issue 2) to help determine the tone of the entire document. Catherine is looking into a publication outlet for the strategy. Format: explain up front what is new in the strategy, note international component, etc. Highlight that while the existing strategy has not been cited in many peer reviewed articles, it has been used in many grey literature documents, grad school thesis', focus groups, etc. New strategy goal will strive to be more citable. In response to a question, Catherine said the committee hopes to have the revised strategy published between 6mos and 1 year from now.

There was no **New Business**. Patty said that the call had been efficient and we were able to work through all planned topics in 2 hours and 20 minutes. Motion to adjourn, approved.

FMCS Symposium at 2013 American Fisheries Society Meeting

The Freshwater Mollusk Conservation Society hosted a symposium at the 143rd annual meeting of the American Fisheries Society on 11 September 2013 in Little Rock Arkansas. Steve McMurray, Missouri Department of Conservation, and Jeremy Tiemann, Illinois Natural History Survey, served as the symposium organizers and moderators. Our symposium reinforced the freshwater mollusk – fish connection and presented a better understanding of the relationship between freshwater mollusks and fishes. Our talks advocated the conservation of freshwater mollusk resources, served as a conduit for information about freshwater mollusks, endorsed science-based management of freshwater mollusks, and promoted and facilitated education and awareness about freshwater mollusks and their function in freshwater ecosystems. The title of talks included:

- **Ecosystem Services Provided by Freshwater Mussels** by Dr. Caryn Vaughn, University of Oklahoma, and Past-President of the Freshwater Mollusk Conservation Society
- **Modeling Habitat Suitability for Threatened Mussel Species in East Texas Rivers** by Dr. Lance Williams, University of Texas at Tyler
- **The Texas Instream Flow Program: Developing Instream Flow Recommendations with Consideration for Mussels** by Clinton Robertson, Texas Parks and Wildlife Department
- **How Flood Disturbance Structures The Spatial Pattern Of Mussel Beds and Salmon Spawning Redds In A Large River** by Dr. Christine May, James Madison University
- **Does Scale Matter? A Multi-Scale Investigation of Unionid Species Assemblage and Microhabitat Parameter Relationships Within and Among Great Lakes Tributaries** by Jennifer Bergner, Central Michigan University
- **What is the Role of Habitat, Life History and Host Fish in Determine Distributions of Louisiana Mussels?** by Dr. Kenneth Brown, Louisiana State University
- **Integrative Conservation Biology of European Freshwater Mussels: the Importance of Fish Hosts, Stream Substratum Properties and Population Genetics** by Dr. Juergen Geist, Technische Universität München
- **Freshwater Mussel Conservation and Management in Arkansas: Past, Present, and Future Considerations** by John Harris, Arkansas State University
- **Conservation and Management of Freshwater Mussels (Bivalvia: Unionoidea) in Missouri** by Stephen McMurray, Missouri Department of Conservation
- **Steps Taken During the Reintroduction of Federally-Endangered Mussels** by Jeremy Tiemann, Illinois Natural History Survey

The symposium was well received, with about 100 folks stopping in and hearing at least one talk. Discussions of our work continued well after the symposium and into evening mixers. Several researchers / managers mentioned modeling future projects after those presented at our symposium.

Propagation Workshop at 2015 FMCS Symposium

The propagation and restoration committee is sponsoring a workshop focused on innovations in the propagation and culture of freshwater mollusks to precede the 2015 FMCS Symposium in St. Louis, Missouri. The workshop will focus on techniques for propagation and

culture through invited speakers, digital tours of facilities, and a poster session. More information will be available as the program is finalized.

The Outreach Committee Needs Your Help

If you have information that you'd like to share, you see a problem or typo, or simply have a suggestion for some changes to the FMCS website please let the outreach committee know.

Also, please take a few minutes to visit the 'Mollusks Near You' section on the FMCS website inside the freshwater mussels tab, then click on your state and verify that the page linked is valid and the first choice of your state mussel community. If it is not, please provide a new link or PDF to the outreach committee. megan.bradley@dgif.virginia.gov

More Mussel Pictures Needed

The FMCS mussel identification app needs you! We are looking for mussel photos that would be available for use in the app. We still need high-quality photographs of many species. Can you help? Photographs should be of the exterior of the right valve and interior of the left valve. Ideally the pictures of the valves would be separate files, but at a minimum the valves should be separated and not overlapped. Please include collection location and specimen length, if you have it. Photo credit will be given in the app.

Please send photographs to Susan Oetker at susan_oetker@fws.gov, and cc: Stan Martin at stanmartin@hotmail.com. Alternatively, if the files are very large, please let us know and we can arrange a better way to transfer them.

Ellipsaria Author Index Now Available

John Jenkinson, Ellipsaria Editor

This issue completes the fifteenth volume of our Society newsletter. In addition to serving as a way for members to keep up with what the officers and committees are doing, *Ellipsaria* also always has been a place where anyone interested in freshwater mollusks could "publish" their observations and thoughts about these animals and the habitats in which they occur. Over the last fifteen years a lot of contributions have been published in *Ellipsaria* (472 author-listed articles by my count !), some of which have been cited in the peer reviewed literature. While some of us might be able to remember when a particular article was published in these pages, most would rather use an index to find them. The *Ellipsaria* page on our web site now includes an **Author Index** covering all 15 volumes of this newsletter (including this issue). If all goes according to plan, this author index will be updated each year after the final issue of a volume has been posted.

If you have comments or suggestions about this author index, or when you find the inevitable errors in these listings, please feel invited to send them to me at jjjenkinson@hotmail.com.

Announcements

Two Mussel-related Courses Being Offered at NCTC

Two courses focused on North American freshwater mussels will be taught at the U.S. Fish and Wildlife Service National Conservation Training Center (NCTC) in Shepherdstown, West Virginia, during 2014. These courses are:

Conservation Biology of Freshwater Mussels CSP 1101

Course Length: 4.5 days **Dates:** June 16 – June 20, 2014

This is an introductory course on the biology and ecology of freshwater mussels and the conservation issues facing this highly endangered group of animals. Topics to be covered include anatomy, physiology, life history, health, ecosystem services, mussels as biomonitors, conservation status, population impacts, conservation measures (relocation, propagation, conservation genetics), legal issues (permits and the ESA, Section 7 consultations, critical habitat) and field techniques (survey techniques, sampling techniques, habitat assessment). This course will address key characters for identification of freshwater mussels and will provide opportunities in the laboratory to practice with dichotomous keys, however due to time constraints and the regional nature of mussel assemblages; this is NOT a mussel identification course. **Instructors:** Dr. Chris Barnhart and Heidi Dunn. **College Credit:** 2 semester hours.

Freshwater Mussel Propagation for Restoration CSP 1102

Course Length: 5 days **Dates:** September 8 – September 12, 2014

This is an introductory course designed to explore all culture activities associated with freshwater mussels. Participants will explore the latest culture techniques as they follow freshwater mussels through their entire life cycle in a culture facility, from the collection of gravid females to stocking cultured juvenile freshwater mussels. Following a basic introduction on mussel biology and the goals of mussel propagation, the course will cover the basics of building a culture facility, collecting and maintaining brood stock, collecting host species, infesting host species with larval mussels, collecting and culturing juvenile mussels, and releasing juveniles to the wild. **College Credit:** 2 semester hours.

Tuition:

Tuition for FWS, NPS, and BLM employees is prepaid. Tuition for participants from other agencies and organizations is $1,195.00 for each course.

To Register:

DOI employees: Log In to DOI Learn, enter the course title in the search box, click scheduled classes, and click submit request.

Non-DOI employees: Contact Marilyn Williams for a paper application. Marilyn Williams, 304/876-7940 marilyn_williams@fws.gov

For more information about either course, contact Matthew Patterson, 304/876-7473 matthew_patterson@fws.gov

Recent Publication

The Freshwater Gastropods of Mid-Atlantic States

R. T. Dillon, **M. A. Ashton**, and **T. P. Smith**

We are pleased to announce that a new web-based resource, the *Freshwater Gastropods of Mid-Atlantic States* is now available from the FWGNA website: www.fwgna.org This is the sixth region to be added to the FWGNA site since its debut in 2003, extending our coverage from Georgia to the New York line, raising the total species reviewed from 79 to 87.

The new Mid-Atlantic site covers Delaware, Maryland, New Jersey, eastern Pennsylvania and the West Virginia panhandle. Our database of 2,893 freshwater gastropod records was developed from the collections of the US National Museum, the Academy of Natural Sciences of Philadelphia, the Carnegie Museum of Natural History, and the Delaware Museum of Natural History, the macrobenthic surveys of the Maryland DNR (Annapolis), the Pennsylvania DEP (Harrisburg), and the Delaware DNREC (Dover), as well as our own original fieldwork. The new website features a dichotomous key and a photo gallery for all 41 species recovered from the five-state area, as well as range maps and notes regarding ecology, life history, taxonomy and systematics.

Also new for 2013 is an overall "Synthesis" combining our fresh Mid-Atlantic observations with data previously obtained from Virginia, North Carolina, South Carolina and Georgia to generate a distribution of commonness and rarity over the entire 67-species Atlantic drainage freshwater gastropod fauna. We suggest a new (nonparametric) system of "incidence ranks" as a supplement to, if not necessarily a replacement for, the subjective system of "conservation status ranks" currently in vogue with natural resource agencies.

Regional Meetings

FMCS Regional Mollusk Meeting Assistance Award Program

As described in the December 2012 issue of *Ellipsaria*, the FMCS has established a Regional Mollusk Meeting Assistance Award Program to facilitate regional mollusk meetings that address local and regional concerns with freshwater mollusk conservation and management. Our interest in assisting with these meetings is to 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.

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

Chesapeake Bay Freshwater Mussel Workgroup Meeting January, 2014, Annapolis, Maryland.

We will be holding the fifth meeting of the Chesapeake Bay Freshwater Mussel Workgroup at the U.S. Fish & Wildlife Service, in Annapolis, Maryland. Traditionally, the meeting is held during the latter half of the second full week in January, but is dependent upon the availability of the web conferencing equipment. The need for a second, short day of focused topic discussion will be determined based upon participant interest. The meeting is open to anyone, but primarily attended by resource agency biologists, consultants, and others 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. Light refreshments and pastries are provided in the morning. We particularly encourage any students that might be interested or involved to attend to increase exposure to the issues mussels face in the region. Past presentations and topics of discussion include ecosystem services of mussels, basin-wide inventories, mussel propagation, state updates on the status of listed species, FERC relicensing, plus much more. For more information, contact Julie Devers at julie_devers@fws.gov or Matt Ashton at 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 will also be sent via the Unio list-serve.

Ohio (River) Valley Unified Malacologists 2013 – OVUM 2013

Timothy A. Pearce, G. Thomas Watters, and **Charles F. Sturm**

OVUM 2013 was held on 12 October 2013 at the Museum of Biological Diversity, Ohio State University. The meeting was hosted by G. Thomas Watters. There were 20 participants with 15 presentations. The cost of the meeting was offset by a generous contribution from FMCS.

Front row (left to right): Front row: G.T. Watters, A. Sasson, T. A. Pearce, F. Borrero, Y. Yanes, Dona Blaine. Between rows: R. Esterline. Back row: N. Skomrock, A. Barrett, I. Roznere, J. Halmbacher, J. Tiemann, H. Yarroll, W. Pryor, A. Wright, M. Albin, A. Meyer, B. Kress (photo taken by Matt Blaine)

The presentations are outlined here:

1. **Radioisotopes and nutrition in freshwater mussels**. Amy Barrett, Ohio State University. This study looks at nutritional subsidies available and utilized by river freshwater mussels by using natural abundance isotope tracers. It used the isotopic tracers as quantitative tracers to estimate contributions of bulk resources to mussel diet.

2. **Effects of dreissenid mussels on *Leptodea fragilis* in Lake Erie.** Robert A. (Bob) Krebs, Cleveland State University. Age-size relationships were used to compare growth rates in the presence of dreissenids or not, contrasting different habitats spatially or in time. *L. fragilis* appears to be returning to Lake Erie in the presence of zebra mussels. He compared growth rates, as age versus shell length in fresh dead shells washed on the beach. Growth was slower for animals showing more byssal threads, indicating past attachment by zebra mussels, compared either to individuals with few byssal threads or for animals from populations where dreissenids were not present.

3. **Collecting land snails in Jamaica**. G. Thomas Watters, Ohio State University. A travelogue of a recent trip to collect DNA samples from some Jamaican land snails.

4. **Reintroduction of two federally endangered mussels.** Jeremy Tiemann, Illinois Natural History Survey. This presentation discussed the reintroduction of two federally endangered mussels to Illinois. The former range of these mussels, the Northern Riffleshell and Clubshell, include the former range of eastern Illinois, where they have been extirpated. The host fish is present in Illinois. A planned bridge project in Pennsylvania, that would destroy thousands of these mussels, presents the opportunity to transplant mussels to their former range in Illinois.

5. **Metabolic response to stress in the three ridge mussel *Amblema plicata***. Ieva Roznere, Ohio State University. This presentation described using metabolomics to understand perturbations in biochemical pathways in response to starvation, relocation, and captivity. Monitoring glucose just gives part of (and misleading) stress status. She examined other metabolites from several different metabolic cycles and found that some show great promise as stress indicators.

6. **Survey of freshwater mussels in Sussex County, Delaware**. F. Matthew Blaine, Curatorial Associate, Delaware Museum of Natural History. This presentation presented a progress report of this project to date. Most rivers in Sussex County are brackish, but ponds do contain freshwater mussels. Gaining access because of private property can be a challenge.

7. **Stakeholder Meeting Announcement: Friends of the Lower Muskingum River and Muskingum Watershed Conservancy District**. Rebecca Winterringer, Ecologist, URS Corporation. A stakeholder meeting was held October 24, 2013 at the FLMR Park to discuss funding partnership opportunities and issues associated with a slope stabilization feasibility study near the Luke Chute dam on the Muskingum River in Morgan County, near Stockport, Ohio. This area of the Muskingum River is known to harbor unionids, including state and federally listed species. Interested parties were invited to the meeting or send comments to Rebecca Winterringer or Tom Evans of the URS Cleveland Office.

8. **What to do when everything goes wrong?** Nick Skomrock, Tom Watters, and Meg Daly, Ohio State University. Discussed was the ability to obtain DNA from low quality or museum specimens of gastropods for molecular phylogenetics. They reviewed the ability to obtain specimens, gather usable sequences, and construct phylogenies with missing data in the context of the family Annulariidae.

9. **Upper Maumee Basin Centennial Unionid survey: Preliminary findings 1908-2008.** Warren Pryor, Rosemary Morman, and Joseph Baumgartner. University of Saint Francis. In 2008, we replicated part of Clark & Wilson's 1908 unionid survey by revisiting 11 of their stations on the Maumee River in Allen County, Indiana. Dominance changed from *Actinonaias ligamentina* and *Lasmigona costata* in 1908 to *Truncilla truncata* and *Leptodea fragilis* in 2008. Significant range reductions occurred in 9 species, and significant range increases happened in 2 species. Range changes could be explained by host availability in 2 species, habitat degradation in 5 species, and past harvest in 4 species. <email: Wpryor@sf.edu>

10. **An estimate of energy use by *Lampsilis siliquoidea* at Crooked Lake, Whitley County, Indiana.** Warren Pryor, Rosemary Morman, and Alexandria Wright. University of Saint Francis. We coupled previously determined Q_{10} and whole-animal oxygen consumption values with *in situ* temperature data to estimate energy consumption rates for a "standard" 70 g (live weight) adult *Lampsilis siliquoidea*. Our calculations suggest that more than half of the 27,190 cal estimated annual metabolic activity of a standard mussel occurred during July and August. <email: Wpryor@sf.edu>

11. **Resuming the puzzle: developing a technique to estimate the energy available to *Lampsilis siliquoidea* at Crooked Lake, Whitley County, IN.** Alexandra Meyer, Andrea Geyer, and Warren Pryor. University of Saint Francis. We collected and filtered samples from the water column above the mussel bed to determine the amount of particulate organic material available to *Lampsilis siliquoidea* living in Crooked Lake. The ash-free-dry-weight (AFDW) was determined for particles between 1.6 and 250 µm that had been filtered from water volumes between 4 and 12 L. AFDW values ranged between 0.77 and 1.37 mg/L between 1 July and 17 September 2012. The study is on-going. <email: meyeral@cougars.sf.edu>

12. **Fossil land snails from the Canary Islands as paleoenvironmental archives.** Yurena Yanes, Department of Geology, University of Cincinnati. The Canary Islands exhibit a large Quaternary record of well-preserved land snail shells that offer an excellent opportunity to infer past terrestrial ecosystems. The oxygen isotopic composition of the shell records the environmental conditions (primarily relative humidity and rainfall) when snails grew their shells. Moreover, snail communities may fluctuate in response to paleoenvironmental change at the centennial to millennial scale. Results indicate that land snail richness and diversity from the Canary Islands declined over the last 50,000 years, likely as a response to a decline in relative humidity and a decrease in island area. Combining isotope geochemistry and paleoecological data allow us to reconstruct ancient ecosystems in a more informed and detailed manner.

13. **Are slug shells thinner after egg laying? Preliminary findings.** Timothy A. Pearce and Harriet L. Yarroll, Carnegie Museum of Natural History and Chatham University. Most slugs have internal shells. Are they useless vestiges or could they have a function? If used for calcium storage, they should be thinner, or less x-ray dense, after egg laying. X-raying slugs using dental equipment resolves shells well. Now we are waiting for slugs to lay eggs so we can check for a change in x-ray density of the shells.

14. **The molluscan type digitization project at ANSP.** Francisco J. Borrero, Academy of Natural Sciences, Drexel University. An overview of the project goals, process, and expected and preliminary results is given, as well as challenges and opportunities faced. Techniques used include three imaging systems: camera, microphotography, and SEM.

15. **Darby Creek: Natural History Notes and Conservation Questions.** Mac Albin, Aquatic Ecologist, Metro Parks, Ohio. Discussed original vegetation and geology in Darby Creek watershed.

The next meeting of OVUM will be hosted by Dr. Yurena Yanes in 2014 at the University of Cincinnati, date to be announced.

Ohio River Valley Ecosystem Mollusk Meeting

Thomas More Biology Station, California, KY
November 13-14, 2013

Attendees at ORVE Mollusk Meeting November 13-14, 2013

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Welcoming remarks from Leroy Koch and Chris Lorentz. Emily will offer tours of the facility tomorrow to any who are interested.

Illinois – Kevin Cummings and J**eremy Tiemann**

IL has worked with PA to add 2300 clubshell and riffleshell so far to IL rivers, 1000 new ones added this year. 750 clubshell, 250 nrs. All in the Vermillion River basin, 50 per species per site per new site, total will be 1000 per species per site. Monitoring ongoing, all are PIT tagged. At one site, they found 100/100, another site 99/100. Overall 80% survival over 4 years. All on conservation or state lands. There are some threats in the basin (mining nearby). There is *Q. cylindrica* there also. Recent shells of *V. fabalis* have been seen there, no live ones yet. Would like to use eDNA modeling to do detectability estimates, since there are a known number of new individuals introduced there. Statewide mussel surveys continue. The snail *L. armigera* found very abundant in Mississippi River, near Chain of Rocks, near mouth of the Missouri. Could be moving with rocks for Corps projects?? Pretty disjunct population from the other known ones.

Big floods in the Illinois River this year, barges slammed into a dam, needed to drop the pool to repair dam. IL geared up to do surveys, over 8500 mussels of 25 species, in 6 to 8 miles of exposed habitat. Shoals were littered with shells. A lot of mussels died, very hot air temps at that time. No damage claim pursued by the state yet. It was a dead area in 1966, has re-colonized since then. Interesting finds – *Leptodea leptodon* confirmed genetically.

Kentucky – Monte McGregor

Reviewed KY Center for Mollusk Conservation projects. Illustrated their propagation and culture systems. They control all water conditions, and can grow throughout the winter. Additional hatchery in eastern Kentucky (Minor Clarke) is used for grow out. They like to put stock out in late summer/early fall. Test work with *E. o. o.* this first year, larvae may not have been fully mature, and did not get any transformed juveniles in vitro or on fish (logperch). Found a female *O. retusa* in Green River this year! She was gravid, she is in captivity now. They are watching her larvae develop. Doing some augmentations of endangered mussels in silos in rivers. Re-introduced some nrs and clubshell from PA into Licking River, from the Allegheny River (Hunter Station).

USFWS, Frankfort, KY – Leroy Koch

Doing a lot of biological opinions lately, some producing funding for mussel work in lower TN, Cumberland, Ohio, and Green Rivers. Time to re-initiate consultation with Olmsted Lock and Dam. Lots of new listings have occurred. Ideas welcome from this group. Need a new habitat mapping effort (substrates) and mussel work. New funding has come in after the shutdown. Chad Lewis collecting *P. cooperianus* from lower Ohio River, corral in the lower TN River, Don Hubbs collecting same from the TN River.

Holding 8 female purple cat's paw in cages in Killbuck Creek this year, will hopefully have success with them next spring.

Huntington Corps – Brian Collins

Trying to go to clamshell dredge entirely within the district. Did that this year. New IDIQ contract for 5-years. They will do economic analysis each year. Also borrowed a dump-scow barge from Nashville. Gives them more control over time of year to do the work, and river conditions, and disposal site options. New mussel surveys done at Marietta area and Guyandotte. Mussels were found at all sites, with no options for in-river disposal of dredged material. They are also looking at options for Guyandotte River boat access relocation.

U. Louisville Stream Institute – Art Parola

Restoration of Stream and Wetland System Function. Retentive vs. transport systems, affects the movement of sediment (carbon, etc.). Consequences of shortening and straightening stream segments. Recovery to a new system state will take 100s to 1000s of years. Logging, farming, mill dams, dredging to drain wetlands. Reconnecting to groundwater is important. "Sustainable functions" are what is important. Organic dynamics control eastern streams.

Indiana (TNC) – Cassie Hauswald

Augmentation in Tippecanoe with *L. fasciola*, practice for *E. triquetra*. Doing some cage culture in lakes there, but it may not work in Blue River. Needs someone to raise *L. fasciola* by 2016 (stock juveniles). She will coordinate with KY folks.

WV – Janet Clayton

Fanshells from Licking River in KY in 2010 – stocked 201 at Kanawha Falls, and 203 at Muskingum Island (Ohio River). Good survival to date, detectability varies by year, these are not PIT tagged. Hallprint tags used.

NRS – got 196 in 2012 and placed out in Elk River, 48 eaten by river otters in that area. This year in the area, they found 25 mussels of 38 "pinged" tags. No dead shells found this year. Put rayed beans here in 2010, looked downstream. September 2013, got another 329 nrs and 162 rayed bean. Quarantine for 5 days, lost 2 nrs. 241 PIT tagged, and 15 of the larger rayed bean. All into Queen Shoals. Additional 45 nrs juveniles propagated and raised by WSSNFH were stocked in the Elk River in October.

CRI project – 200 clubshells came to WV: 44 went to Little Kanawha River at Annamoriah, 50 to Greenup Pool, 100 to Muskingum Island. Tissue collected from clubshells from Meathouse Fork of Middle Island Creek, and Hacker's Creek, for genetics work at FWS-Northeast Fishery Center.

WVDOH project on New River, bridge project. Relocation of 3000 muckets to Monongahela (2000) and Ohio River, Blennerhassett Island (1000). Also noted good numbers of *Lithasia verrucosa* at Blennerhassett and Neal islands this year.

Dunkard Creek – restoration started at 5 sites. Inoculate and release fish is primary method, using bluegill and drum. Seven species of mussels added so far. 16 species of adults have been added from excess sites, 1088 individuals.

Janet will be teaching another week long mussel class in May 2014. Also developing a standard form for the mussel survey proposals sent to the WVDNR, and looking for any comments on the 2013 version of the protocol.

U. Cincinnati and ORBCRE – Mike Miller

Do we need to respond to Coast Guard Notice to ship frack waste by barge? Could be devastating to mussels. Should bring it up to FMCS EQA committee. Get the link sent to the group !

ORSANCO – Jeff Thomas

Couldn't do any mussel work this year due to the effects of sequestration on their funding, but they did complete their fish and macro-invertebrate work. 15 random sites in 4 pools planned for fish and macro-invertebrate work in 2014 – in Belleville, McAlpine, Olmsted, and Markland. They will try to target the Olmsted/Open River area & possibly Belleville for mussel surveys, as funding allows.

Ohio River Islands NWR – Patty Morrison

Update on NRDA and CRI projects. For the NRDA this year, cooperators from WSSNFH, WVDNR and TN Tech provided 13,019 tagged juveniles of 9 species, all stocked into the Ohio River at Neal Island. A

record year. For the CRI project, lots of accomplishments from the first year of the grant program, the highlight being the first propagated juveniles of the purple cat's paw by WSS, transformed on mottled sculpin. There are 14 growing out (see picture below). The team also set silos of *E. t. rangiana* juveniles from WSS in the mainstem Ohio River to check for survival, and stocked 194 adult clubshell from PA into 2 sites on the mainstem Ohio River and 1 site on the Little Kanawha. The KY sites could not be worked this year due to persistent high water.

First ever baby purple cat's paw juveniles produced, 14 growing at WSSNFH !

URS – Becca Winterringer

New record of *A. suborbiculata* in Montgomery Pool, upper Ohio River in PA. Common mussels from a loading facility were relocated to Phillis Island. Ohio implemented their mussel survey protocol in 2013; changes are expected for 2014 that includes passing of an identification test. There was a workshop held recently that covered some of the upcoming protocol changes for 2014. Surveys in Greenup Pool this year, 14 species total, 10 live, river mile 316. Presentation on the upcoming FMCS workshop in Maine, April 24 – 25, 2014. Topic is regulatory issues and mussel considerations in dam removals. The Fish Habitat Partnership has some projects on their radar. Three dams on the West Fork River are possibilities; another on the Little Kanawha River near Elizabeth. Corps studying Muskingum River watershed to possibly lower pool levels behind dams, 16 total. Some are "dry" dams. IL working on trying to take out 2 low head dams on the Vermillion, running into opposition from local fishermen.

Mainstream Divers – Craig Fortenbery

Surveys up the TN River mile 60, moderate density, diverse bed. Site for a chlorine plant. Permitting application for outfall, a BA was prepared and BO concurred with conservation measures. The outfall was in the best mussel density area. Recommended doing bore instead of trenching out to middle of the river. Implemented frack-out prevention methods onshore and through procedures near the streambed penetration. No detectible frack out material was found by divers. HDD daylighting. Modified design of diffuser at the outfall, will continue water quality sampling and mussel monitoring. Craig can share with the group. Projects on the Green River, TN, and Ohio Rivers this year. Long-term monitoring for Olmsted Dam project continues, has been ongoing for ~15 years or more.

Huntington Corps – Andy Johnson

FERC is sending EA for RC Byrd hydropower project, this week or next. Contractor is out of Washington State. AMP Ohio is promoter. Corps may be able to hire a contractor to do unbiased review of the modeling interpretation.

Next Year's Meeting

Possibly Illinois Natural History Survey location; New Harmony; or Columbus, OH CZ/OSU, more centrally located. Date considerations?? Avoid Halloween week; possibly as late as early December ? Try a Doodle poll for the best fit of dates, send to all on our aggregate contact list. We can get $100 from FMCS to support the meeting expenses.

Upcoming Meetings

March 29 -- April 2, 2014 -- National Shellfisheries Association Annual Meeting, Hyatt Regency Jacksonville Riverfront Hotel, Jacksonville, Florida, Theme: [yet to be announced] http://www.shellfish.org/annual-meeting .

April 24 – 25, 2014 – FMCS Workshop, Holiday Inn by the Bay, Portland, Maine, USA Theme: *Mussel Studies and Regulatory Process Associated with Dam Removals.* http://www.molluskconservation.org/Events.html

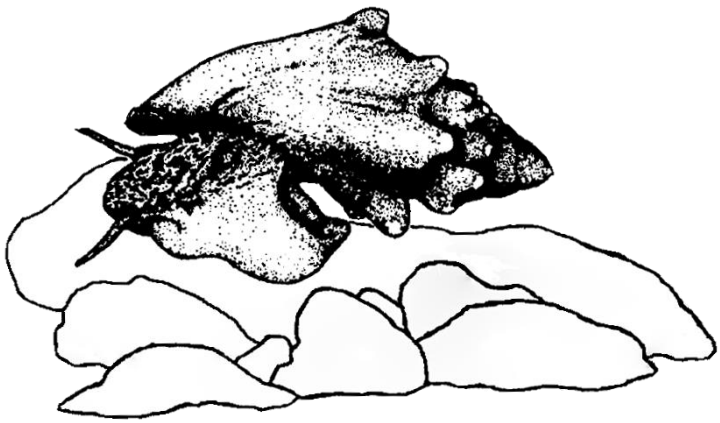
May 18 – 23, 2014 -- The first ever, Joint Aquatic Science Meeting (JASM), Portland, Oregon. This meeting will bring together four societies: Society for Freshwater Science, Association for the Sciences of Limnology and Oceanography, Society of Wetland Scientists, and Phycological Society of America. Theme: *Bridging Genes to Ecosystems: Aquatic Science in a time of Rapid Change.* *http://www.freshwater-science.org/Annual-Meeting/2014-Portland---JASM.aspx*

June 23 – 27, 2014 -- **Mollusca 2014: The Meeting of the Americas** - Joint meeting of the Western Society of Malacologists, the Sociedad Mexicana de Malacología y Conquiliología, the American Malacological Society, and the Asociación Latinoamericana de Malacología. Library Complex Amoxcalli in the Facultad de Ciencias, Universidad Nacional Autónoma de México, Mexico City, Mexico. http://www.malacological.org/meetings.html

July 13 – 17, 2014 – Society for Conservation Biology North American Conference, Missoula, Montana, USA. http://www.conbio.org/conferences/section-meetings

Spring 2015 – FMCS Symposium, St. Louis (area), Missouri. Theme: Big Rivers and Landscape Ecology

March 7 – 10, 2016 – FMCS Genetics Workshop, National Conservation Training Center Shephardstown, West Virginia.



Contributed Articles

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

Observation of Wild Host Use of American Eel by Eastern Elliptio, *Elliptio complanata* Lightfoot (1786), in Two Maryland Streams.

Matt Ashton and **Patrick Graves**, Maryland Department of Natural Resources,
Monitoring and Non-tidal Assessment Division, 580 Taylor Avenue, C-2, Annapolis, MD 21401

Eastern elliptio (*Elliptio complanata)* is a common and abundant freshwater mussel found throughout Atlantic and Great Lakes drainages. Where present, their dominance in the benthic community makes them important components of aquatic ecosystems. Much of their life history information, particularly host studies, was gathered from populations in the Great Lakes (Matteson 1948). This is problematic because host fish use can vary geographically (Rogers et al. 2001). For example, a recent laboratory study found American eel was the most effective host for *E. complanata* collected from tributaries of the Chesapeake Bay (Lellis et al. 2013).

To further expand knowledge on the potential use of American eels as a host for *E. complanata*, we collected eels from two streams (Western Branch and Hall Creek) in the Patuxent River basin, Prince George's and Calvert counties, Maryland. Recent data (J. McCann, MDNR unpublished data, Ashton 2012) indicates that *E. complanata* is the only mussel species found in these streams. On the day of fish collection, water temperature was measured with a Fisher liquid hand thermometer. We also visually inspected mussels for evidence of gravidity before collecting eels using Smith-Root backpack electrofishing units. We electrofished in each stream for at least 800 seconds to collect a minimum of 10 eels. We then anesthetized them in clove oil and fixed tissue in 10% buffered formalin. Eels were rinsed after 48 hours over three successive days in fresh water and transferred to a 70% EtOH solution. We then excised gill arches and examined them for encysted glochidia under 40x magnification. Descriptions from Matteson (1948) were used to verify the identity of glochidia.

On 11 April 2013, water temperature was 18° C in Western Branch and 16° C in Hall Creek. We observed mussels in both streams with marsupial gills in various stages of gravidity. At least one glochidium was observed attached on gills of five and four eels collected from Western Branch and Hall Creek, respectively (Figure 1). Glochidia were present on eels that ranged in size from 230-311 mm TL. We observed no glochidia on gill filaments of eels < 200 mm TL. No glochidia were attached to fin tissue. Although we made no attempt to quantify the level of host infestation, we observed a dozen or more glochidia on the gills of three eels.

Figure 1. *Elliptio complanata* glochidium on American eel gill filament.

Our findings confirm the use of American eel as a host for *E. complanata* in the Chesapeake Bay drainage. We cannot rule out the use of other fish species as hosts because no other species were examined; however, most of the species encountered were found not to be suitable in laboratory infestations (Lellis et al. 2013). Additional work is needed to determine the period of and infestation rates. Based upon our observations and level of correlation between eel abundance and Elliptio

distribution in other data sets (M. Ashton and J. McCann, MDNR, unpublished data, Ashton 2010, Harbold et al. 2013), we concur with Lellis et al. (2013) that American eel is likely the primary host of *E. complanata* in the Mid-Atlantic.

The host-affiliate relationship between *E. complanata* and American eel raises important questions for aquatic conservation, habitat management, and ecosystem restoration that deserve further attention. Chief among them is can patterns in eel distribution explain distributional patterns in an otherwise habitat generalist mussel? Secondly, how do reproductive dynamics of *E. complanata* respond to a host that may occupy habitat for relatively long periods of time and often in high densities?

References:

Ashton, M.J. 2010. Freshwater mussel records collected by the Maryland Department of Natural Resources' Monitoring and Non-Tidal Assessment Division (2005-2009): investigating environmental conditions and host fishes of select species. RAS-MANTA-AIM-10-01. http://www.dnr.md.gov/streams/pdfs/AIM_10_01_mussels.pdf

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Northwest Range Extension of *Quadrula fragosa* in the Minnesota River

Kathryn Murphy[1], **Shelby Marr**[1], **Mark Hove**[1], **Kylene Olson**[2], and **Bernard Sietman**[1]

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The winged mapleleaf, *Quadrula fragosa* is a federally endangered mussel that historically occurred in 34 rivers across 12 states (U.S. Fish and Wildlife Service, 1997). Its range is now reduced to just a few isolated populations in the St. Croix River in Minnesota and Wisconsin, the Bourbeuse River in Missouri, the Little River in Oklahoma, and the Saline and Ouachita rivers in Arkansas (U.S. Fish and Wildlife Service, 2013).

As a part of a statewide mussel survey, we sampled along a 10 km reach of the Minnesota River approximately 20 km southeast of Granite Falls, on the border of Renville and Redwood counties, Minnesota. We canoed the reach on 16 October 2013 when low water exposed several sand and gravel bars containing deposits of relic shells. We surveyed bars with numerous shells, and recovered 27 unionid species (Table 1), including three disarticulated relic *Q. fragosa* valves (Figure 1). Only a few species appeared to have died recently, which is consistent with our previous surveys of the Minnesota River.

Prior to this survey, the most upstream record of *Q. fragosa* from the Minnesota River was in Scott County (Bright *et al.*, 1990). This new record is 135 km upstream and represents a northwest extension of *Q. fragosa*'s historical range.

Table 1. Mussel species found during a survey of exposed bars on the Minnesota River.

Tribe Anodontini	**Tribe Pleurobemini**	**Tribe Lampsilini**
Alasmidonta marginata	*Elliptio dilatata*	*Actinonaias ligamentina*
Arcidens confragosus	*Fusconaia flava*	*Lampsilis cardium*
Lasmigona complanata	*Pleurobema sintoxia*	*Lampsilis siliquoidea*
Lasmigona costata		*Lampsilis teres*
Pyganodon grandis	**Tribe Quadrulini**	*Ligumia recta*
Strophitus undulatus	*Quadrula fragosa*	*Leptodea fragilis*
	Quadrula metanevra	*Obovaria olivaria*
Tribe Amblemini	*Quadrula pustulosa*	*Potamilus alatus*
Amblema plicata	*Quadrula quadrula*	*Potamilus ohiensis*
	Tritogonia verrucosa	*Truncilla donaciformis*
		Truncilla truncata
		Toxolasma parvum

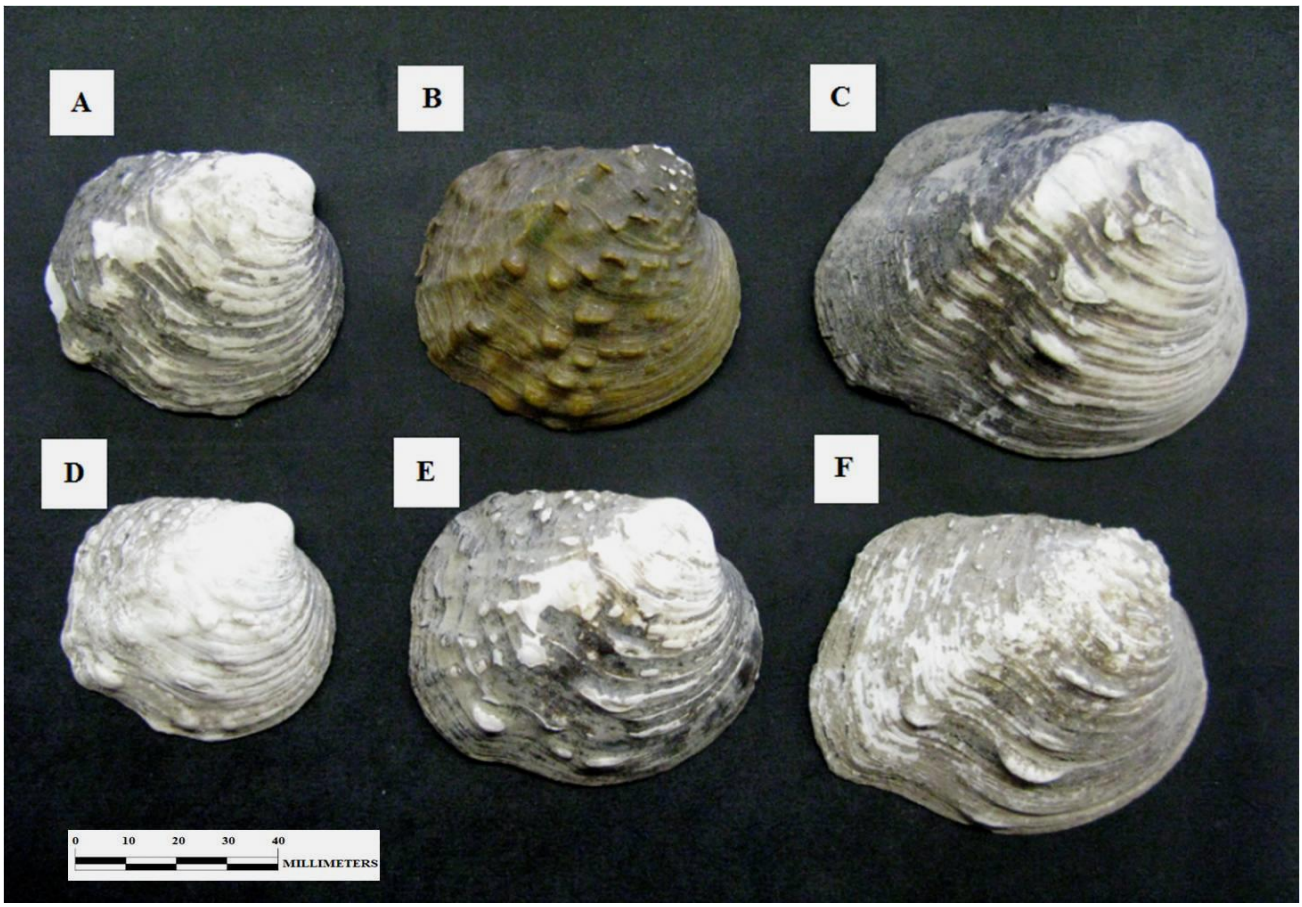

Figure1. *Quadrula fragosa* (A, D, E) and *Quadrula quadrula* (C, F) from the Minnesota River and *Q. fragosa* (B) from the St. Croix River.

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"Winged Mapleleaf (*Quadrula fragosa*)." U.S. Fish and Wildlife Service: Winged mapleleaf mussel fact sheet. N.p., n.d. Web http://www.fws.gov/midwest/Endangered/clams/winge_fc.html . (accessed 14 Nov. 2013).

Confirmation of Hosts and Additional Host Trials for the Cylindrical Papershell, *Anodontoides ferussacianus*.

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Multiple reports have identified potential hosts for the cylindrical papershell, *Anodontoides ferussacianus*, (Fuller 1978, Hove et al.1995, Hove et al. 1997, O'Dee and Watters 2000, Watters 1995). These reports identify several fish species across multiple families as potential hosts. One detriment of these reports is that they do not identify the quality of each host fish or a species suitable for propagation to meet restoration objectives. The present study sought to identify a readily available hatchery reared host fish suitable for captive propagation of cylindrical papershell in the Upper Mississippi River Basin. For the present study, the focus was placed solely on host species available at the Genoa National Fish Hatchery.

In August 2012, six gravid cylindrical papershell were collected from Mineral Creek in Jackson County, Iowa. In January 2013, ten commonly available host species were inoculated with glochidia. All fish were fall fingerlings ranging from 2.0 to 28.1g/fish. Standard production inoculation procedures were followed to attach as many glochidia as safely possible to each potential host to help determine which species, if any, was suitable for restoration efforts. Potential hosts were held by species in an aquarium system at 20°C, tanks were checked daily for live juveniles or sloughed glochidia. Juvenile mussels were recorded from day 8 through 18. Results were reported as total number of juveniles per fish as well at transformation percentage (live juveniles/live juveniles + sloughed glochidia) as another measure of efficiency for each species.

The present study revealed seven species to transform cylindrical papershell glochidia. Green sunfish, black crappie, brook stickleback, fathead minnow, bluegill, largemouth and smallmouth bass all transformed at least one juvenile per fish (Table 1). We recorded a negative result for channel catfish, lake sturgeon and logperch. Looking further at the data, only the green sunfish, black crappie and brook stickleback transformed either enough per fish or a transformation percentage high enough to be considered a marginal host. Results indicate that, of the species tested, the green sunfish is clearly the best option available. The present study did not identify a clearly superior host for captive propagation of the cylindrical papershell. Future host work is recommended to build on the foundation of this work and test species commonly found in the wild such as minnows and suckers.

Table 1. Results of cylindrical papershell host trials conducted at Genoa National Fish Hatchery, January 2013.

Species	Inoculated	Survived	Grams /Fish	Glochidia Attached	Transformed	Number/ Fish	Percent Transformed
Green sunfish	12	10	10.7	2,597	843	84.3	29.4
Black crappie	12	12	7.0	2,393	330	27.5	13.8
Brook stickleback	12	10	2.0	852	125	12.5	14.7
Fathead minnow	12	11	2.6	621	29	2.6	5.0
Bluegill	12	12	9.4	2,625	43	3.6	1.6
Largemouth bass	12	12	19.7	13,143	95	7.9	0.7
Smallmouth bass	12	11	12.9	3,083	17	1.5	0.5
Channel catfish	12	12	28.1	13,753	0	0	0
Lake sturgeon	12	12	7.6	1,272	0	0	0
Logperch	11	11	7.2	2,123	0	0	0

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An Update on a Recently Discovered Population of the Cumberland Moccasinshell, *Medionidus conradicus* (Bivalvia: Unionidae), in Alabama and Georgia

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During 2009-10, personnel of the Geological Survey of Alabama (GSA) conducted routine, project-related sampling for fishes and crayfishes at selected stations in the Tennessee River system of north Alabama, including Lookout Creek just upstream of the Georgia state line. A rather diverse aquatic fauna

was documented for such a relatively small drainage (about 15 square miles in Alabama), including 24 fish species (one otherwise known from Alabama only in high-quality streams in Lauderdale County, which lies on the opposite side of the state), nine crayfish species, four mussel species, and several snail species (McGregor, 2010).

Lookout Creek rises near the community of Valley Head, DeKalb County, Alabama, and is located in the Wills Valley District of the Cumberland Plateau Physiographic Section (Sapp and Emplaincourt 1975). From its source, it flows northeast for about 7.5 miles into Dade County, Georgia, and eventually into the Tennessee River near Chattanooga, Tennessee. The valley averages about 2.0 miles in width in Alabama, and numerous feeder springs are found at the foot of Lookout Mountain (summit elevation 550 feet above mean sea level - msl), which borders the creek to the southeast, and Big Ridge (summit elevation 350 msl), which borders the creek to the northwest. Its two primary headwater tributaries, East Fork Lookout Creek and West Fork Lookout Creek, run parallel to one another and are divided by a long, sharp ridge known as Little Ridge (summit elevation 340 msl). Those forks meet just before the creek enters Georgia. The valley floor in the area is underlain by limestone and dolomite rocks and is relatively level. The creek averages 3.0 m in width, has long, slow pools up to about 1.5 m in depth, interspersed with gentle riffles and runs of stable gravel and sand with depths of about 0.3 m. A pasture with a narrow riparian border lines the creek on the right descending bank of the reach sampled in Alabama. The majority of the left descending bank is bordered by a high bluff covered in hardwood trees with pasture along the lower reach. Cattle have unrestricted access and subsequent bank failure was observed at several places.

Bivalves collected during 2009-10 included Asian Clam, *Corbicula fluminea* (Müller, 1774), Cumberland Moccasinshell, *Medionidus conradicus* (Lea, 1834), Tennessee Pigtoe, *Pleuronaia barnesiana* (Lea, 1838), Rainbow, *Villosa iris* (Lea, 1829), and Mountain Creekshell, *Villosa vanuxemensis* (Lea, 1838). Shells were found primarily among middens dominated by Asian Clams. A few live Mountain Creekshells were subsequently collected in the upper reaches of East and West forks. The record of the Cumberland Moccasinshell is significant because its range in Alabama once included numerous tributaries of the Tennessee River and the main channel Tennessee River at Muscle Shoals, for the past 20 years or so it was only known from the Paint Rock River in Jackson County and Foxtrap Creek in Colbert County, and may be extirpated from the latter (Williams et al., 2008).

A more formal survey to document this population was conducted on September 24, 2013, when 6 person hours were expended snorkeling and 3 person hours wading and visually searching the stream bed from near the state line upstream to the confluence of the East and West forks and a short distance up the West Fork (the East Fork at the confluence was inundated by a beaver dam.) A total of six Cumberland Moccasinshells, 55 Mountain Creekshells, 20 Rainbows, and two Tennessee Pigtoes were found live; along with fresh- and weathered dead shells of each species.

Based on those encouraging results, Georgia Department of Natural Resources (DNR) was contacted and encouraged to sample downstream in Georgia to document the extent of this population. On October 1 and 3, DNR personnel spent about 8.3 person hours sampling with Batiscopes (clear-bottom viewing buckets) at two locations near Sulfur Springs Gap in Lookout Creek, up to a few hundred yards downstream of the state line, and recorded one live Cumberland Moccasinshell, numerous Mountain Creekshells and Rainbows, and a Tennessee Pigtoe.

The Cumberland Mocassinshell's preference for free-flowing streams and its dependence on host fishes also suited to that habitat render it especially susceptible to the deleterious effects of impoundment, the inundation of riffles and runs by sediments, and channel modification. Its precipitous decline in abundance and distribution could likely be traced to the impoundment of larger rivers and the lower ends of tributaries, and to careless land uses in and along tributaries leading to sedimentation or scouring of stream beds and altered flow regimes. The Cumberland Moccasinshell was last collected in Lookout Creek by H.D. Athearn in 1971. Stansbery (1976) considered the Cumberland Moccasinshell endangered. Williams et al. (1993) considered it a species of special concern throughout its range, as did Lydeard et al. (1999) within Alabama. Its vulnerability to extirpation due to limited distribution, rarity, and susceptibility to habitat degradation led to its designation as a species of Highest Conservation Concern in Alabama by Mirarchi et al. (2004).

The presence of the Cumberland Moccasinshell at these locations is likely due to the rural setting of the stream minimizing anthropogenic impacts; the fact that its watershed is largely forested; there are no impoundments that would inundate suitable habitat, alter flows, and fragment populations; and there is an abundance of springs providing a steady supply of water year round. Furthermore, and likely also

due to those same factors, there is a relatively intact fish fauna typical of a healthy headwater system in the Tennessee River valley of north Alabama. In fact, one of the recognized fish hosts for the Cumberland Moccasinshell, the Redline Darter, was the most commonly encountered of the 24 fish species collected during the fish IBI, and represented 24% of the catch. However, habitat quality of Lookout Creek greatly degrades downstream of Rising Fawn, Georgia, and mussels occur sporadically in the creek.

Appreciation is extended to the family of Paul Ray for permitting access to the stream on their property and for assistance with field sampling, and to Tom Shepard, Brett Smith, and Cal Johnson of GSA and Andrew Gascho Landis, Deb Weiler, and Ani Popp of Georgia DNR for field assistance.

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First Record of a Live Sandbank Pocketbook, *Lampsilis satura*, from the Trinity River near Dallas, Texas.

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We have recorded an impressive diversity and abundance of Unionids during recent surveys in the Trinity River near Dallas, Texas (McDermid et al. 2013), including new records for the state-listed (threatened) sandbank pocketbook, *Lampsilis satura.* Until recently, the sandbank pocketbook in the Trinity River was represented from only one record of a single long dead individual that was collected from Lake Lewisville during surveys conducted in 1977 - 1978 (Neck 1990). Neck (1990) proposed that an earlier record of a plain pocketbook (*Lampsilis cardium;* Read 1954) may also represent this species; however Howells et al. (1997; as cited in Randlkev 2011) reported that the sandbank pocketbook only occurred in rivers east of the Trinity basin, and has questioned the identifications made in these earlier records (Howells 2000, 2002).

We collected a single live sandbank pocketbook during SCUBA-based surveys in the Elm Fork of the Trinity River near I-35 in Dallas on 13 August 2013. This individual was collected approximately 22.5 river k downstream of two long dead valves that were collected during surveys in 2012 (Zara Environmental, LLC [Zara] 2012), and approximately 59.5 river k downstream of the Lake Lewisville collection site reported in Neck (1990) (Figure 1).

Figure 1. Sandbank pocketbook (*Lampsilis satura*) collected live from the Trinity (top left) and Sabine Rivers (bottom left). The Trinity specimen was collected from a site in downtown Dallas, Texas near I-35 (right). Previous collections of dead individuals, were made farther north in this system (Neck 1990 and Zara 2012).

The specimen was slightly deformed and so not identical in external morphology to previously described specimens (Howells et al. 1996). We used internal morphological characteristics to make the specific identification, which was confirmed by the second author (Dr. Neil Ford), in consultation with Dr. Charles Randklev. The specimen exhibited the sigmoid shaped hinge margin typical of sandbank pocketbooks, but it was a male and so did not have the diagnostic truncated posterior. This small individual (length 73.4 mm, height 56.3 mm, width 45.8 mm) differed from a specimen of the same length from the Neches River (in the invertebrate collection of The University of Texas at Tyler) by being much thicker shelled and more inflated. This may suggest early maturity or slower growth in the Trinity River for this species. Soft tissues were pale tan. The Trinity River specimen resides in the invertebrate collection at the University of Texas at Tyler (accession number UTT 191).

The live individual was collected from mixed sand and silt substrate during a dive with a maximum depth of two m, and the dead individuals reported in Zara (2012) were collected during dives reaching maximum depths of 4.27 m with gravel and silt substrates. Howells et al. (1996) indicates that this species is found on gravel, gravel-sand, and sandy substrates in rivers with moderate to swift flows, while Isely (1924) collected specimens from Oklahoma in slow moving currents out of the main river channel, in areas with mud and/or sand-gravel bottoms. The characteristics of our collection sites are in loose

concurrence with both of these descriptions, and indicate that sandbank pocketbooks in the Trinity probably occur on substrates that are somewhat intermediate between the two previously described.

These surveys on the Elm Fork and main stem of the Trinity River have taken place as part of the Texas Department of Transportation (TxDOT) work to upgrade several bridges over the Trinity River in and around the Dallas – Ft. Worth metroplex, including California Crossing, IH-30, and IH-35. TxDOT conducts surveys for rare and state-listed freshwater mussels in waterways that could be impacted by infrastructure upgrade projects as a routine part of its environmental stewardship. Until recently these waterways were not considered potential habitat based on a lack of species records in the area, poor water quality, functional impoundment, channelization, high levels of impervious cover, and other anthropogenic changes. This new record demonstrates the continued need to monitor for rare species even after substantial habitat alteration.

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Identification of Freshwater Mussels: the Dangers of Minimalism

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Those of us who have been in the unionid identification business for more than a few years readily recognize how challenging species determination can be (note scientific understatement). Efforts by the founding fathers of the field through more recent work in the 1960s, 70s, and 80s were often plagued by errors resulting from poor appreciation of intraspecific variation, limited numbers of specimens available for examination, imperfect understanding of historic ranges, and lack of biochemical genetic confirmation of identity and relationships. More recently, increased field work, greater specimen availability, comparative morphological studies, and electrophoretic and DNA analyses has helped better define species and their distributions. Nonetheless, unionid identification remains complicated. This is particularly true in regions of the country like Texas where numerous isolated drainage basins with dramatically varied ecological conditions produce a large number of ecophenotypes. Even though historic distributions in Texas waters are relatively well defined, identification difficulties remain.

Taxonomic keys can be useful in areas with limited numbers of mussel species in a single drainage, but in regions with many species, drainages, and environments, classic taxonomic keys become either complex and cumbersome or risk being potentially more harmful and misleading than helpful. Internet availability of instant information in the modern digital-data age further proves to be a double edged sword. On one hand, identification descriptions and images can be quickly accessed, but simultaneously some such information is incomplete, badly flawed, or simply wrong. However, individuals entering the freshwater mussel field often request short taxonomic keys or quick digital identifications over laboring over lengthy books and journals. Sadly, as more information on unionids has become available in recent years, so also has inaccurate identifications and misinformation. Following are cautionary examples of some identification problems that have been noted locally in Texas.

Identification errors can sometimes reflect the geographic work or training areas of biologists themselves. Individuals coming to Texas from states east of the Mississippi River often default to species names with which they were familiar in their home waters. Local *Fusconaia askewi* and *Lampsilis hydiana* from Texas have been inaccurately identified as *F. cerina* and *L. straminea*, respectively, though neither occurs west of the Mississippi. In other cases, biologists from the East Coast may report repeatedly finding *Elliptio* species in Texas, though none are native or established here. Others whose experience has focused on morphologically distinct *Quadrula apiculata* and *Q. houstonensis* in Central Texas have been confused by similarities in *Q. apiculata* and *Q. mortoni* forms in the San Jacinto Basin of southeastern Texas.

Atypical ecophenotypes in Texas are often particularly problematic. *Amblema plicata* is common in much of the U.S. and usually easily recognized by its bold, diagonal ridge sculpturing. However, some juveniles and adults in Texas (and elsewhere) may completely lack any suggestion of external shell sculpturing (Figure 1). Unsculptured specimens from the upper Trinity River drainage have been confused with *Quadrula mortoni* and those from the central Colorado River with *Q. houstonensis.* Although both *A. plicata* and *Q. mortoni* have stable populations in Texas, *Q. houstonensis* is state listed as legally threatened and is being considered for listing by U.S. Fish and Wildlife. Reliance on sources that key only on external ridges or pustules or images that only show these traits without addressing other unsculptured forms could result in inaccurate identifications and legal violations.

A similar case of mistaken identity arose with *Cyrtonaias tampicoensis* when biologists from central and eastern Texas collected this species in southern Texas without recognizing ecophenotypic differences. Populations in the Brazos and Colorado rivers often have moderately heavy shells and boldly colored nacre (most often dark purple) (Figure 2). Short descriptions and keys usually focus on these traits. However, in the Nueces-Frio Drainage of southern Texas, *C. tampicoensis* usually has thinner shells with nacre that is either white or pale pastel. Subsequently, when the visiting biologists collected the local Nueces River form, they suspected it could be *Leptodea fragilis* that also has a thinner shell with white nacre. Here too, ranges of both species are well established in Texas and *L. fragilis* populations are known to be restricted to areas in the Colorado River Drainage and other waters well to the north and east. Knowledge of distribution alone could help contribute to accurate identification, but recognition of different ecophenotypes is paramount.

On several occasions over the years State-threatened *Lampsilis satura* has been reported from areas where confirmed specimens are largely lacking (Figure 3). Demonstration of such populations would be ecologically and legally important. However, subsequent reexamination of some records showed specimens to actually be *Potamilus purpuratus*, a common and widely-distributed mussel in the state. The initial misidentification appears to have focused on their being inflated unionids with dark periostracums, but failed to note significant differences in beak size, beak sculpture, nacre color, hinge tooth morphology, or other traits.

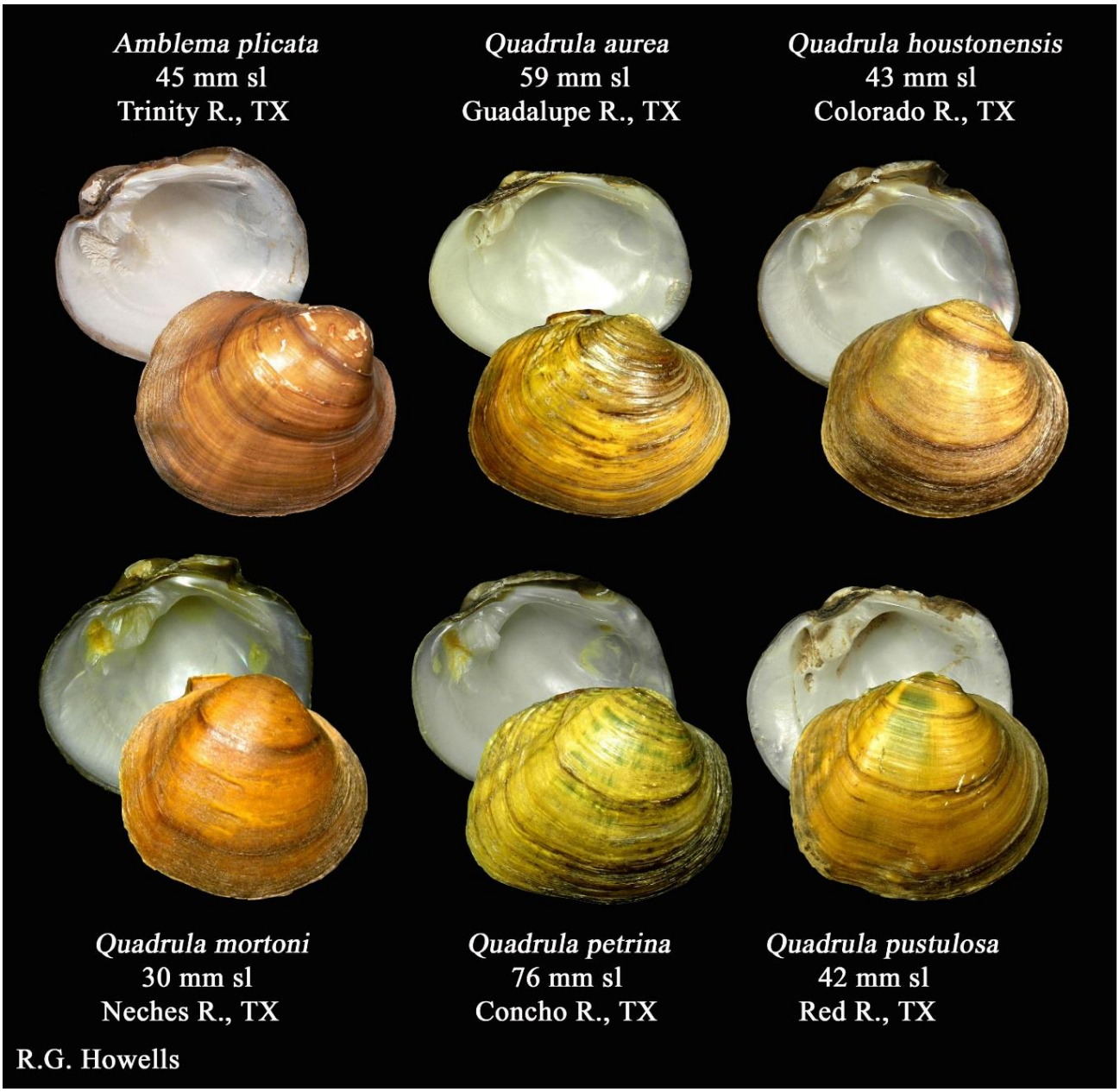

Figure 1. Threeridge (*Amblema plicata*) and Pimpleback species (*Quadrula* spp.) from Texas. Non-sculptured forms of Threeridge can be confused with apustulose Pimpleback taxa when morphological variation in different ecophenotypes is not recognized. Here, the dorsal margin of Threeridge angles upward posterior to the beak and the major axis of the right pseudocardinal tooth angles to the posterio-ventral margin (when the lateral tooth is horizontal). Dorsal margins in Pimpleback species angle downward and the right pseudocardinal tooth angles to the ventral margin anterior of the mid-point (and often directly downward).

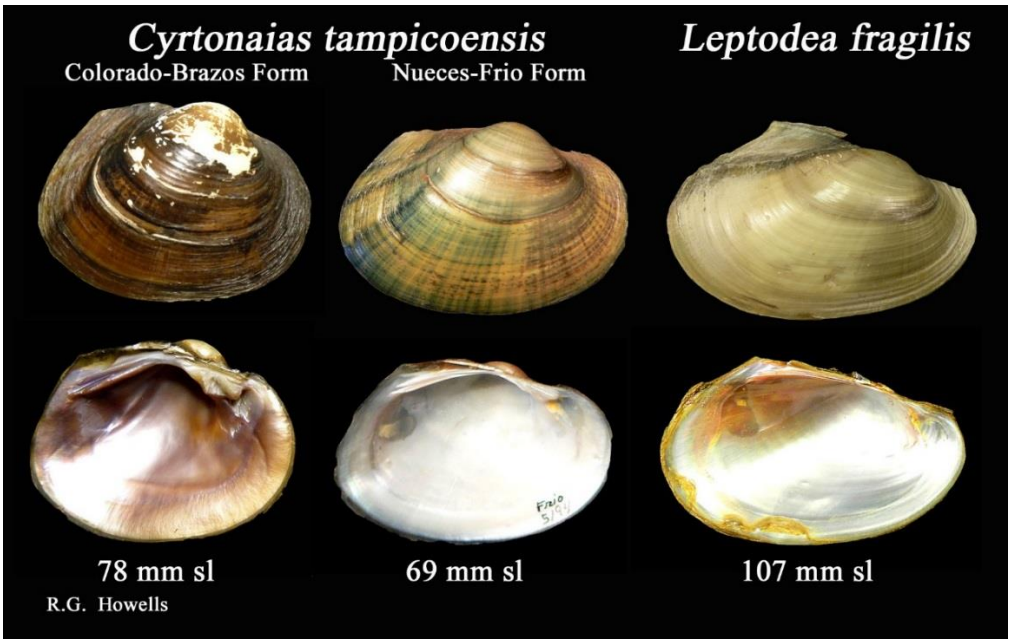

Figure 2. Typical Tampico Pearlymussel (*Cyrtonaias tampicoensis*) shells from Central Texas are often moderately thick with dark purple nacre, but forms from the Nueces-Frio drainage in southern Texas frequently have thinner shells that are more elongate and generally have white or pastel nacre. This South Texas morph has been confused with Fragile Papershell (*Leptodea fragilis*) that occurs only in waters to the north and east.

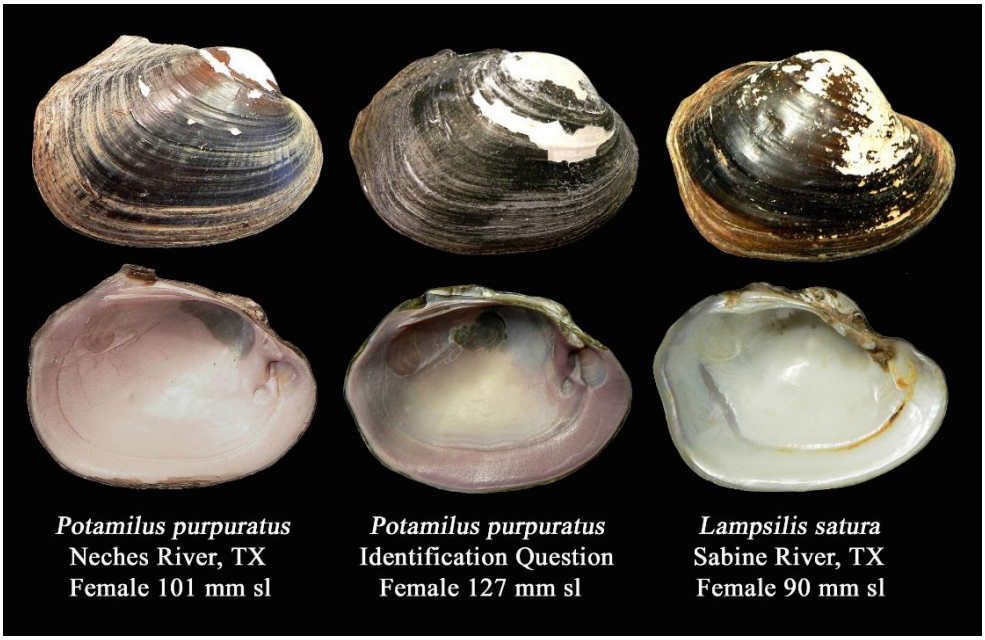

Figure 3. Bleufer (*Potamilus purpuratus*) and Sandbank Pocketbook (*Lampsilis satura*) from eastern Texas waters may both have inflated shells with dark periostracum coloration, but numerous other traits should easily distinguish these two unrelated mussels.

Although requests for short, to-the-point keys and photographic guides continue, accurate mussel identification is likely to remain a complex, multi-dimensional problem…especially in areas like Texas where there are multiple drainages, ecophenotypes, and species. Some recommended points to incorporate into identification efforts include:

1) Examine multiple specimens where possible to develop an appreciation for differences in age, sex, and the full range of morphological variation.
2) Avoid relying only on external shell features alone. Internal shell morphology may be necessary to confirm identification (some species cannot be distinguished based only on external morphology). When living specimens of rare taxa cannot be sacrificed, associated dead-shell material may provide clues to the shell interior.
3) Examine soft tissues for clues to identity. Even in living specimens, tissue color or number of gravid gills can be observed without sacrificing the animal.
4) Accept that in some cases, biochemical genetic analysis may be necessary to confirm identity. Morphological variation within some species may be greater than differences between two similar species. In some cases, conchological features are simply insufficient.
5) Recognize that many museum specimens and those in dated books and reports often include misidentifications. Check collection and publication dates and compare these to current references. Recognize that the Internet is awash with misinformation.
6) Consider distributional information. In an increasing number of states like Texas, historical distributions have become well defined. Many identification errors reflect reports from waters where a given species would not be expected.
7) Be very cautions of information sources that are too simplistic.
8) Be aware that there are no keys in Freshwater Mussels of Texas (Howells et al. 1996) and documents and articles claiming otherwise are false.

Freshwater mussel identification is often complex and frequently relies on employing a suite of traits to determine species. Depending on only a few features or a single trait can produce inaccurate conclusions.

Acknowledgments:
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A First Record of the Common Bladder Snail *Physa fontinalis* from Israel

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The development of the aquatic fauna of Agamon HaHula, a reinstated wetland in the former drained Hula swamps, Upper Galilee, Israel, is being monitored for over 20 years by my colleague Dr. Chanan Dimentman of the Hebrew University of Jerusalem. The fieldwork supporting this project is carried out either by himself or by local collaborators. All the molluscs among the material are submitted for identification to the author and permanently stored in the Mollusc Collection of the National Natural History Collections at the Hebrew University of Jerusalem.

A sample collected by I. Barnea on 29 April 2012 in the Ma'agan of Agamon HaHula contained to my surprise a specimen of the Common bladder snail *Physa fontinalis* (Linnaeus, 1758) (HUJ 53841). This common European species has never been reported before from Israel. It differs from the invasive North-American species *Haitia acuta* (Draparnaud, 1805), an extremely common species in Israel, by its blunt apex and much lower spire.

The nearest locality of *Physa fontinalis* is situated in Turkey, from where it is known to occur among others in the Central Anatolian and Mediterranean regions (Yildirim *et al.* 2006). The preferred biotope of *Physa fontinalis* consists of standing water with a rich submerged vegetation.

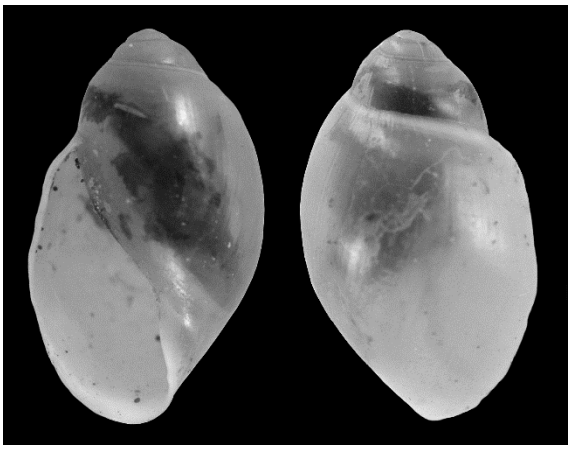
Species belonging to the genus *Physa* have never been collected in a recent or fossil form in Israel (Mienis in Milstein, Mienis & Rittner, 2012). There are at least three possibilities for its sudden appearance in Agamon HaHula:

-it was introduced by means of infected aquatic plants;

-some one emptied the contents of an aquarium in the lake;

-it arrived at the site as a hitchhiker on aquatic birds like ducks or waders.

The last option seems to be the most likely one. Follow up research has to show whether the Common bladder snail will succeed in establishing a permanent foothold in Agamon HaHula.



Physa fontinalis from Agamon HaHula, Israel

Acknowledgements

Thanks are due to my colleague Dr. Chanan Dimentman (Hebrew University of Jerusalem) for regularly forwarding me the material collected in the Agamon HaHula and to my colleague Mr. Oz Rittner (Tel Aviv University) for the photographs.

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Additional Information Concerning the Conquest of Europe by the Invasive Chinese Pond Mussel *Sinanodonta woodiana,* 33. News from Hungary, the Netherlands, Poland, Romania and Spain

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Papers dealing with the presence of the invasive Chinese Pond mussel *Sinanodonta woodiana* (Lea, 1834) in Europe continue to be published. Here is some new information from Hungary, the Netherlands, Poland, Romania and Spain.

Hungary

Arpad & Arpad (2013) addressed the establishment of the Chinese Pond mussel in the Balaton Lake. The first specimens were discovered in 2006; however, according to the size they were 5-6 years old, which means that they had invaded the lake already around 1998-2000. Recently, 50-80% of the biomass encountered in Balaton Lake consisted of this invasive mussel species. In 2012, a population crash took place and 20-30% of the biomass disappeared from the *Sinanodonta* population.

the Netherlands

A previous report on the presence of the Chinese pond mussel in the canalized brook 'de Donge', in Tilburg, North-Brabant, was based on empty valves (van der Leij, 2012). In June 2013, living specimens were noted in the same brook. It constitutes the first record of this invasive mussel under natural conditions in the Netherlands (Stooker, 2013).

During my annual family visit in the Netherlands, I was baffled to see that living specimens of *Sinanodonta woodiana* were still being offered for sale in so-called garden centres.

Poland

Urbańska *et al.* (2013) lectured about symbionts associated with the Chinese Pond mussel in Poland. In 2011, they checked 216 living mussels from 11 localities. Among others they found cercariae of a *Rhipidocotyle* species so far only reported from *Anodonta anatina* in Poland. In addition, they found Hydrachnidia, Chironomidae and the Oligochaete *Chaetogaster limnaei* on or in the mussels.

Romania

David *et al.* (2012) analyzed the presence of trace elements (Cd, Cu, Pb and Zn) in primary producers (algae) and primary (molluscs) and secondary consumers (fish) inhabiting the Lower Prut River. In *Sinanodonta woodiana* low concentrations of copper (Cu) were found.

Spain

Rangers of APAF-Madrid (Asociación Profesional de Agentes Forestales de la Comunidad de Madrid) have discovered the presence of the Chinese Pond mussel in the upper part of the Manzanares River basin which is a tributary of the Tajo River (also called Tagus and Tejo in Portugal) (Anonymous, 2012). So far, this invasive mussel species had only been reported from the Ebro drainage system in North-East Spain. If *Sinanodonta woodiana* manages to get a foothold in the Tajo River, then we may soon expect also a first record of that species from Portugal.

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First Record of Operculated Amphibian Snails "Assimineidae" in Santa Catarina State/ SC, Central Southern Brazil Region

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The family Assimineidae, minute snails with an operculum that live in brackish water, freshwater or on the land, is reported for first time in the Southern Brazil region. This brings to 217 the total number of continental mollusks, terrestrial and freshwater, known to the State of Santa Catarina/ SC, including 187 gastropods (145 terrestrial, 40 freshwater & 2 amphibian) and 30 limnic/ freshwater bivalves (Agudo-Padrón 2008, 2012; Agudo-Padrón *et al.* 2013 a-b), included in 96 genera and 37 families.

They are mostly aquatic gastropod mollusks or micro mollusks. Various species of these snails are distributed worldwide (for the Brazilian territory one species was already previously known: *Assiminea succinea* (Pfeiffer, 1840), for Southeastern Brazil in São Paulo/ SP – http://www.jaxshells.org/4bbj.htm ; http://www.discoverlife.org/mp/20m?kind=Assiminea), occur usually in estuarine habitats, in salt marshes and in freshwater of tropical and temperate regions, at beaches, in water and at land.

Some are terrestrial or "amphibians," the latter being the case of the record made by us in the Santa Catarina's State, occurring both on trunks/ branches of trees and rocks submerged in the bed of streams, such as in riparian vegetation, as well as in terrains with discarded material of ornamental gardens and other urban areas with high moisture content.

Similar at "first sight" with typical aquatic snails Hydrobiidae of the genus *Potamolithus* Pilsbry, 1896, these are very small to medium large snails, between 2 and 13 mm (some adults don't exceed a size of 3 mm). The shape of the thin shells is somewhat ovately conical, more or less egg-cone like shaped. The margin of the aperture is simple. The operculum is in most cases horny.

The eyes are at the end of short, stout stalks. They are characterized by rudimentary cephalic tentacles, a trunk like snout, a foot with a groove (our species jogging by the contraction and elongation of the foot, like a caterpillar) and rudimentary to absent ctenidium (a comb-like respiratory apparatus). They feed on vegetable detritus and small algae. They lay their eggs in the mud and hatch as free-swimming larvae.

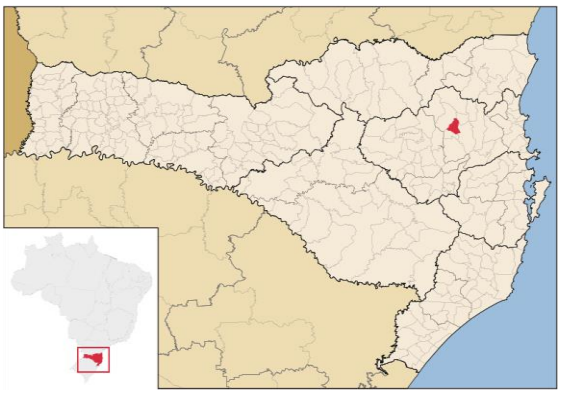
GASTROPODA: CAENOGASTROPODA: RISSOOIDEA
ASSIMINEIDAE H. Adams & A. Adams, 1856
Assiminea Fleming, 1828

Abbreviations:

FURB MO – Malacological Collection of "Regional University Foundation of Blumenau - FURB", Blumenau/ SC.

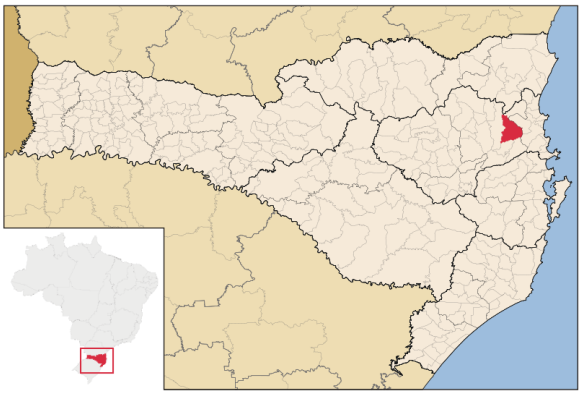
MZSP – Malacological Collection of the "Museum of Zoology, University of São Paulo", São Paulo/ SP.

All four of the following sites are in the Itajai River Basin Valley Region



Rodeio Municipal District:
FURB MO236
"Merdinha" River, 20/07/2013
14 specimens
MZSP 114504
"Merdinha" River, 04/08/2013
33 specimens

Blumenau Municipal District:
FURB MO237
Blumenau City, 23/07/2013
10 specimens



Gaspar Municipal District:
FURB MO234
"Gaspar Alto", 17/07/2013
8 specimens

Indaial Municipal District:
FURB MO190
"Flora Mariva", Indaial City, ??/06/2013
19 specimens
(Figure 1)
FURB MO210
"Flora Mariva", Indaial City, 06/07/2013
13 specimens

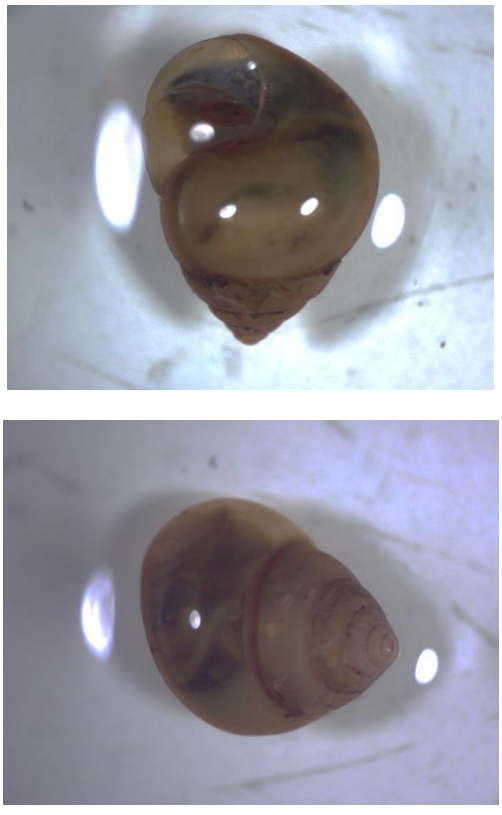


Figure 1.- First specimens of *Assiminea* sp collected in SC State (FURB MO190)
Photos: Ana Elisa Zermiani and Luís Adriano Funez, FURB/ Blumenau, SC

Acknowledgement:

Very special thanks to researcher Luiz Ricardo L. Simone, Ph.D., curator of the malacological collection of the "Museum of Zoology, University of São Paulo", São Paulo/ SP, for his timely previous generic determination of gastropod mollusks covered in this report.

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Two New Geographical Records of Freshwater Mollusks in the Influence Area of the Uruguay River Basin, Midwest Region of Santa Catarina State/ SC, Southern Brazil

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Based on the examination of samples obtained in the course of works done in the field, the present contribution incorporates the geographical records of two more limnic/ freshwater gastropod forms to previous systematic inventories of known continental mollusks of the Santa Catarina's State/ SC, central portion of southern Brazil region (Agudo-Padrón 2008, 2012 a; Agudo-Padrón *et al.* 2013). The taxonomic arrangement persists following basically the original proposal of Agudo-Padrón (2008, 2012 a) and Agudo-Padrón *et al.* (2013), based on the monographic contribution of Simone (2006).

With an area of 981.9 km², temperate humid subtropical climate, and "Araucária" forests, Caçador Municipal District (Figure 1) is located in the Midwest of Santa Catarina State, in the Upper "Rio do Peixe" (Fish River) Valley, tributary of the great Uruguay River system basin in its upper section, located at an average height of 1.000 meters, with culmination of the municipal territory to 1.390 meters elevation.

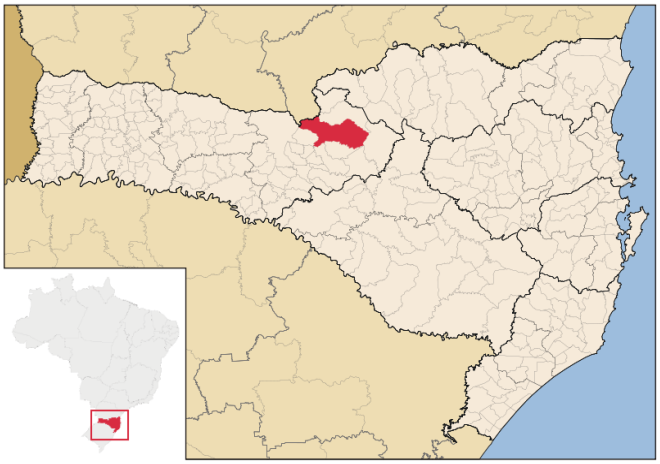

Figure 1.- Caçador Municipal District (red color) in the geographical context of the Santa Catarina's State territory.

The territory of this municipality is rich in hydromineral resources, bathed by several waterways, including the so-called "Rio Castelhano" (Spanish River), source location of the present report (Figure 2).

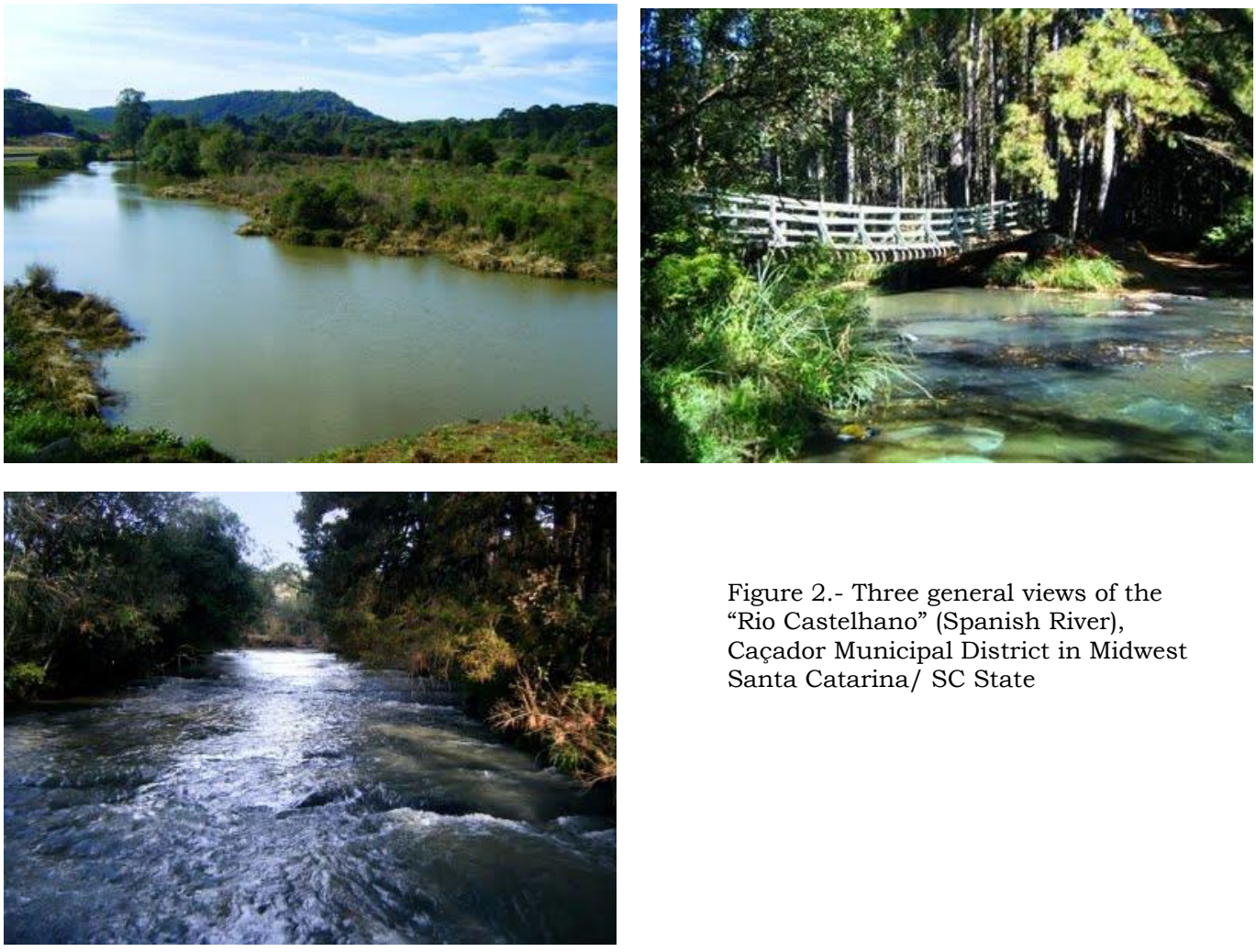

Figure 2.- Three general views of the "Rio Castelhano" (Spanish River), Caçador Municipal District in Midwest Santa Catarina/ SC State

On 10/06/2013, 54 specimens of two native freshwater gastropods (13 limpets and 41 snails) were collected for analysis by the technical Fernando Zanini, originating from the Spanish River in "Caçador" Municipal District (26°48'19"/39"S ; 50°56'08"/33"W), finally examined by us in 02/08/2013, generating the following result for the regional malacological proceedings:

GASTROPODA
CAENOGASTROPODA
Family HYDROBIIDAE

Littoridina charruana d'Orbigny, 1843 (Figure 3)
Species previously cited for the State in Agudo-Padrón (2008:152).

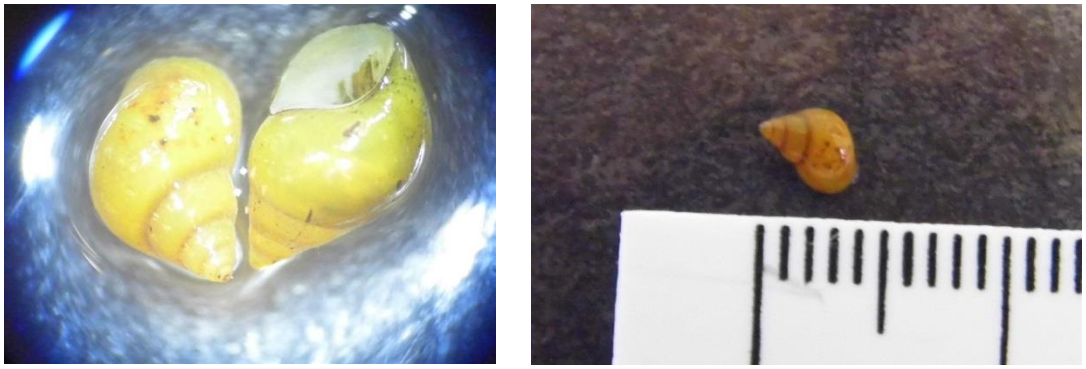

Figure 3.- Freshwater snails *Littoridina charruana* d'Orbigny, 1843 from the "Rio Castelhano" (Spanish River), 26°48'19"S / 50°56'08"W, Caçador Municipal District, SC. Photos: Leonardo Kleba Lisboa

PULMONATA/ BASOMMATOPHORA
Family ANCYLIDAE

Uncancylus concentricus (d'Orbigny, 1835) (Figure 4)
Species previously cited for the State in Agudo-Padrón (2012a:37).

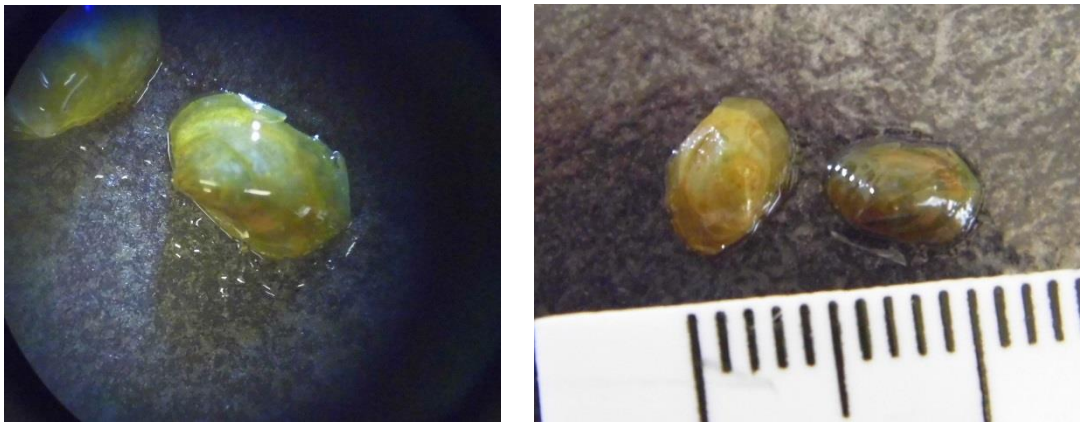

Figure 4.- Freshwater limpets *Uncancylus concentricus* (d'Orbigny, 1835) from the "Rio Castelhano" (Spanish River), 26°48'39"S / 50°56'33"W, Caçador Municipal District, SC. Photos: Leonardo Kleba Lisboa

In addition to the above, we also have the regional registry for the Municipal District of native giant naiads *Anodontites trapesialis* (Lamarck, 1819) in local fish farms (Agudo-Padrón 2012b:38).

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New Occurrences of Native Freshwater Mussels/ Naiads in Fish Farms/ Dams in the Southern Brazil Region

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Giving continuity to the research, and as previously commented (Agudo-Padrón 2012), several waterbodies are the natural habitat of freshwater/ limnic naiad bivalves in southern Brazil, that 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 localities, principally *Anodontites trapesialis* (Lamarck, 1819), the most important and common species involved in this case, one of the largest freshwater bivalves of South America (Agudo-Padrón 2012).

Recently, two new localities in the Southern Brazil territory 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 and 2). The species probably were accidentally introduced by "fingerlings" or reproductive adult fishes infested with the larval parasitic form *lasidium*:

SANTA CATARINA STATE/ SC

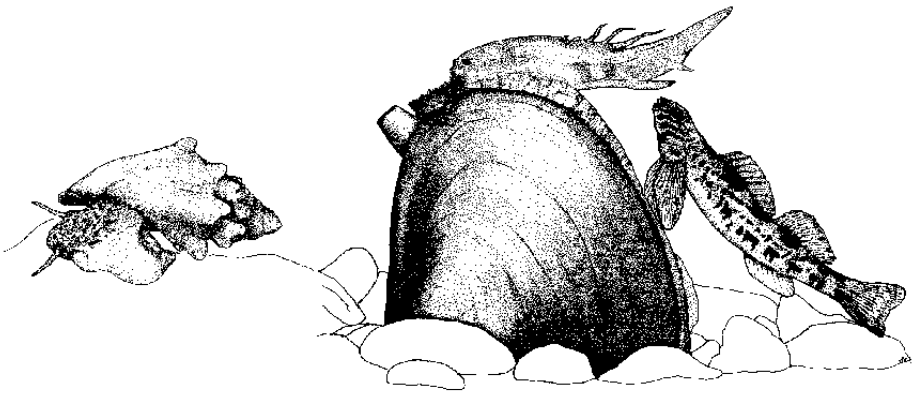
Figure 1.- *Anodontites trapesialis* (Lamarck, 1819) specimens, captured in fish farm/ dam of "Jaraguá do Sul" Municipal District (red color), Santa Catarina State/ SC, Central Southern Brazil region. Photo: Dr. Adriano Marenzi, UNIVALI/ Itajaí, SC (10/07/2013).

RIO GRANDE DO SUL STATE/ RS

Figure 2.- *Anodontites trapesialis* (Lamarck, 1819) specimens detected in particular fish dam of "Passo Fundo" Municipal District (red color), Rio Grande do Sul State/ RS, Southernmost Brazil region. Photos: Dra. Lisete M. Lorini, UPF Passo Fundo, RS (30/04/2013).

Reference:

Agudo-Padrón, A.I. 2012. Conflictive incidence of native freshwater mussels/ naiads in fish farms/ dams of the Santa Catarina's State, Central Southern Brazil. *FMCS Newsletter Ellipsaria*, 14(4):37-41.



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Contributions may be submitted at any time but are due by the 15th of the month before each issue is posted. MSWord is optimal for text documents but the editor may be able to convert other formats. Graphics should to 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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Parting Shot

The threehorn wartyback, *Obliquaria reflexa*, is widespread throughout the large rivers of the Mississippi basin and ranges from Minnesota to Texas. Many populations exhibit substantial variation in periostracum color, including these individuals from the Illinois River. Despite being one of the most common mussel species in North America, much remains unknown about this monotypic genus. Initial host work completed by Watters et al. 1998 indicated that minnows may be a potential host; however, only a small number of juveniles were recovered from three cyprinid species, indicating that the identity of the primary host likely remains unknown. Photo: Andrea Fritts, Illinois Natural History Survey

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