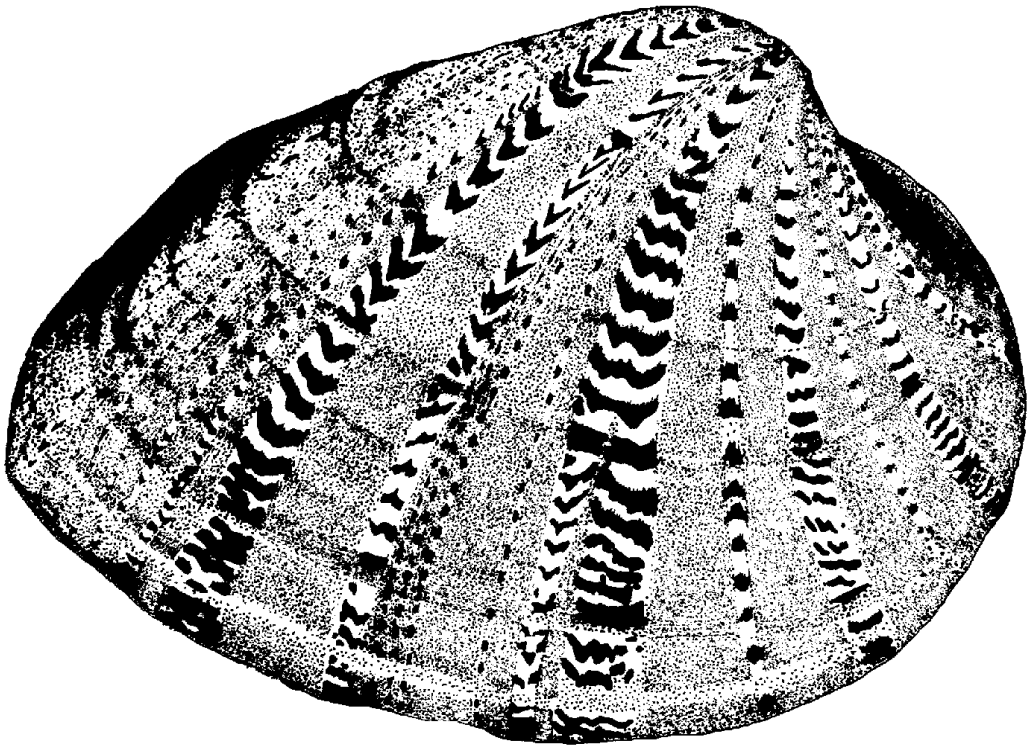
Ellipsaria

The Newsletter of the Freshwater Mollusk Conservation Society

Volume 9 – Number 1 **April 2007**



In this issue:

2007 Symposium & Workshop Wrap-up

Freshwater Mollusk Conservation Society Officers

President
Steve A. Ahlstedt
USGS
1820 Midpark Drive
Knoxville, TN 37828
865-545-4140 x 17; Fax: 4496
ahlstedt@usgs.gov

President Elect
W. Gregory Cope
North Carolina State University
Dept. of Environ. & Molecular Tox.
Box 7633
Raleigh, NC 27695-7633
919-515-5296; Fax 7169
greg_cope@ncsu.edu

Secretary
Greg Zimmerman
EnviroScience, Inc.
6751 A-1 Taylor Road
Blacklick, OH 43004
614-866-8540
gzimmerman@enviroscienceinc.com

Treasurer
Heidi L. Dunn
Ecological Specialists Inc.
1417 Hoff Industrial Park
O'Fallon, MO 63366
636-281-1982; Fax: 0973
Hdunn@ecologicalspecialists.com

Past President
Robert M. Anderson
U.S. Fish and Wildlife Service
312 South Allen Street, Suite 322
State College, PA 16801
814-234-4090
Robert_M_Anderson@fws.gov

Ellipsaria Editor

Christine Mayer
Illinois Natural History Survey
1816 S Oak Street, Champaign, IL 61820
camayer@inhs.uiuc.edu

Submissions for the August 2007 issue of Ellipsaria may be sent to the editor at any time but are due by **July 18, 2007**. Anyone may submit an article but you must be a member of FMCS to receive Ellipsaria. Please limit submissions to about one page. Categories for contributions include news, new publications, meeting announcements, current issues affecting mollusks, job postings, contributed articles (including ongoing research projects), abstracts, and society committee reports. Electronic submissions are preferred; contact the editor with any questions. Note that submissions are not peer reviewed, but are checked for content and general editing.

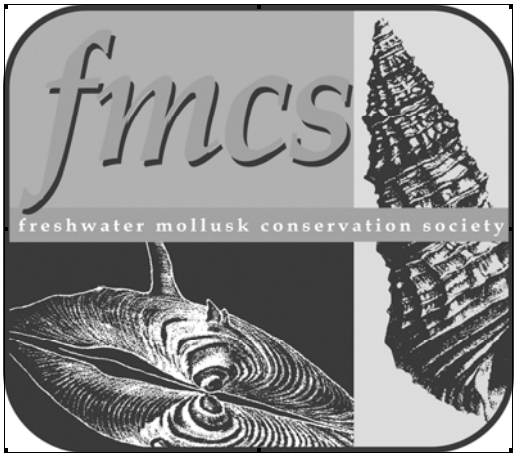
Thanks to Jeremy Tiemann for help assembling and mailing this newsletter.

Please send change of address information to the Secretary.

Ellipsaria

NEWSLETTER OF THE FRESHWATER MOLLUSK CONSERVATION SOCIETY

Volume 9, No. 1 http://ellipse.inhs.uiuc.edu/FMCS/ April 2007



President's Message

I first want to thank Bob Anderson our former president of the FMCS for a job well done in keeping our society moving forward. I also want to recognize President-elect Greg Cope and thank all former board members and new board members. We have a new genetics committee chaired by Dave Berg and co-chair Jess Jones. I am very delighted that Alan Buchanan is back with us. Alan brings tremendous energy and thoughtful insight into our society and was a major advocate for forming FMCS. Further, congratulations to Richard Neves for receiving the Lifetime Achievement Award and John Harris for the William Clench Award. Both individuals have done so much for protecting our mussel resources and are most deserving. I realize that most individuals have numerous responsibilities that are part of their current employment but it is refreshing to see individuals taking on additional responsibilities related to FMCS that take a lot of extra time. The state of our society is strong and we currently have approximately 300 active members. Financially we are in great shape and I want to give thanks to all for our careful management of society funds. I would encourage each and every one of you to continue to pursue new membership,s especially resource managers responsible for protecting our resources.

The acquisition of *Walkerana* as our society journal will become a reality, thanks to the generous offerings of Jack Burch. We just have a minor legal issue to resolve in order to get it transferred to our society. So, get your manuscripts ready because we will go full steam when this is completed. Thanks Jack, Bob, Tom, Kevin. I think this may be an appropriate place to thank Christine Mayer for all the work she does as editor of *Ellipsaria*. Where would we be without Chris keeping track of all this news and sending it out to all our members?

The FMCS symposium in Little Rock was a tremendous success and sets a standard of excellence for future symposiums. Alan Christian and John Harris, along with a host of razorbacks, did an exceptional job, and the workshop provided timely topics for society members (thanks Heidi Dunn). I was pleased to see that 54 of the presentations were given by students and I thank their college professor's for encouraging them to participate in presenting their research.

The National Strategy for the Conservation of Freshwater Mollusks will be updated. Rachel Muir is heading this up and we are looking forward to have this completed. Hopefully, this can be presented at the Society for Conservation Biology (SCB) meeting July 13-18, 2008 in Chattanooga. The SCB has 10,000 members and we are welcome to have a workshop before and a topical session during their symposium. It definitely would give us a chance to highlight the problems facing our mussel and snail fauna. We have yet to find a local sponsor, but Ryan Evans is working hard on this along with others. Will keep you posted!

The 2009 symposium will be held in Baltimore, Maryland and hosted by Catherine Gatenby. It will have an international, tribal and Margaritiferid focus and should provide many of us a chance to mingle and exchange ideas concerning problems they are having with their mussel resources. I want to reiterate what I said at the banquet…we should all seek sponsorship monies from our respective state and federal agencies, NGO, and private entities. The costs associated with hosting a symposium keep accelerating and we need to offset those costs with sponsorship monies. The symposium is two years away – this gives everyone time to put it

in their budgets for sponsorship. The money generated by sponsorship helps to defray hotel costs, registration fees, and coffee breaks, which are very expensive. The money generated by Kurt Welke's magnificent auction, this year bringing in over $5700, goes for student awards – 18 students attending this meeting each received $220 from past auctions. Thanks Kurt, you do an exceptional job.

Steve Ahlstedt, FMCS President

Members Recognized with Awards at the Biennial Symposium

Both new students and longstanding professional FMCS members were recognized with awards at the 5th Biennial Symposium held recently in Little Rock, Arkansas.

Student Travel Awards. The Student Travel Award program expanded its number from 14 awards in 2005 to 18 travel awards in 2007. This program assists students in participating in the Symposium by providing monetary awards to help defray the cost of travel, registration, and lodging. In 2007, the Society provided a cash award of $220 to each of the 18 students submitting qualified applications. Although not a condition of receiving a travel award, almost all of these students volunteered to work on various activities while at the Symposium such as the registration table, lights and audio-visual, and the raffle/auction. The students receiving travel awards in 2007 were as follows: Chad Boeckman, Andrea Crownhart, Todd Fobian, Amanda Hemmingsen, Jennifer Kurth, Todd Levine, Mark Lyons, Jason Meador, Emy Monroe, Shad Mosher, Tamara Pandolfo, Cianna Pender, Sharon Prochazka, Eric Rahm, William Sheftall, Geoff Smith, Lori Tolley-Jordan, and David Zanatta.

Best Student Platform Award: Daelyn A. Woolnough; Honorable Mention: Kody F. Kuehnl

Best Student Presentation Awards. The Best Student Platform Presentation was awarded to Daelyn A. Woolnough of Trent University. Daelyn's presentation was titled "Functional connectivity of host fish among freshwater mussel communities." Honorable mention was awarded to Kody F. Kuehnl of Ohio State University for his presentation titled "What's in a name? A preliminary phylogenetic analysis of the genus *Villosa* using mitochondrial and nuclear DNA."

The Best Student Poster Presentation was awarded to Daniel C. Allen of the University of Oklahoma for his poster titled "Daily burrowing behavior of four freshwater mussel species." Honorable mention was awarded to Zachary S. Beussink of Missouri State University for his poster titled "Effects of host exposure to suspended clay on attachment and transformation success of mussel glochidia."

Best Student Poster Award: Daniel C. Allen; Honorable Mention: Zachary S. Beussink

Winners of the best student platform and poster presentations were awarded a plaque and a $500 cash award for which they are encouraged to use to fund travel to another scientific meeting to present their award winning presentations.

Professional Member Awards. The Society recognizes the accomplishments and contributions of professional members through three main awards; the Lifetime Achievement, William J. Clench Memorial and Meritorious Service Awards. In 2007, two professional level awards were presented. The Lifetime Achievement Award was presented to Dr. Richard J. Neves of Virginia Tech University in recognition of more than 30 years of dedicated service to conservation of freshwater mollusks and as one of the founding members of FMCS. The William J. Clench Memorial Award was presented to Dr. John L. Harris of the Arkansas Department of Transportation in recognition of his long-term contributions that have advanced the natural history and understanding of freshwater mollusks.

Lifetime Achievement Award: Dick Neves

Past President and Secretary Service. The 5th Biennial Symposium represented the 10th anniversary of FMCS and as a fitting time of reflection and appreciation, all of the individuals who have served the Society as President and Secretary since inception were honored with plaques of appreciation on behalf of the membership. This special recognition was given to Al Buchanan, Paul Johnson, Kevin Cummings, Dick Neves, Tom Watters, Bob Anderson, Rita Villella, and Patty Morrison.

William J. Clench Memorial Award: John Harris

Business Meeting Minutes

FMCS Business Meeting
March 14, 2007
Peabody Hotel, Little Rock, AR

Treasurers Report. $57,574.08 in the bank.

President's Report. The state of the Society is strong. Approximately 300 active members this past year.

2008 Workshop Plans. One choice is a joint meeting with Society for Conservation Biology July 13 – 18, 2008. They have 10,000 members. We are welcome to have a workshop before and topical session during. We need a local sponsor and volunteer to help organize the session, although SCB would do most of the logistical work. Other choice is AMU meeting in Carbondale, IL, in the spring.

Symposium 2009, Baltimore, MD. International, tribal and Margaritiferid focus. Catherine Gatenby gave a presentation plugging Baltimore; probably Convention Center area.. Theme would be "Healthy Mussels = Healthy Rivers = Healthy People." Attendees can visit DC and museums easily, via Metro. Reasonable flights from international venues, free airport shuttle. Possibly a trip behind the scenes at Smithsonian Museum.

Proposed Amendments to the Society By-Laws. First proposed amendment: to make Past President a voting member of the Board of Directors – motion carries. Second proposed amendment: to form a new committee on Genetics. Jess Jones spoke on the importance of focusing on this topic. Genetics is clearly a big part of our understanding of the fauna, and reflects the changing direction of the work we do; it also provides a forum for students to get involved. The larger PRI committee would be too large to handle this large topic integrated into one. Dave Berg would be the first chair of this new Committee – motion carries.

Introduction of new committee chairs:
- Awards – Greg Cope, Teresa Newton
- Environmental Quality and Affairs – Ryan Evans, Al Buchanan
- Gastropod Status and Distribution – Paul Johnson
- Guidelines and Techniques – Chuck Howard, Janet Clayton
- Information Exchange – Al Buchanan, Tom Watters
- Mussel Status and Distribution – Art Bogan, Jim Williams
- Outreach – Matt Patterson, Tom Jones
- Propagation, Restoration, Introduction – Tony Brady
- Genetics – Dave Berg
- Symposium 2009 – Catherine Gatenby

The President had earlier established 2 ad hoc committees: (1) National Strategy revision; (2) forming local chapters. Both of these remain active and will continue under the new administration. Society journal news: Dr. Burch has agreed to turn over publication of Walkerana to us.

Stuart McGregor asked to be recognized. Colleague Malcolm Pierson passed away last week. Contributions would be welcome to Cahaba River Society or Alabama Rivers. Motion and second to contribute $500 in memory of Malcolm Pearson. All in favor.

New Officers
- Treasurer – Heidi Dunn
- Secretary – Greg Zimmerman
- President-elect – Greg Cope

Awards Presentation by Awards Committee. We will have 133 presentations at this symposium, 54 of them are by students (41%). We funded 18 students to help attend this meeting, each receiving $220.

Best Student Presentation Award Platform: Daelyn Woolnough – "Functional Connectivity of Host Fish

Among Freshwater Mussel Communities"; Honorable Mention Kody Kuehnl – "What's in a Name? A Preliminary Phylogenetic Analysis of the Genus *Villosa* Using Mitochondrial and Nuclear DNA ".

Best Student Poster: Daniel Allen – "Daily Burrowing Behavior of Four Freshwater Mussel Species"; Honorable Mention Zac Beussink – Effects of Host Exposure to Suspended Clay on Attachment and Transformation Success of Mussel Glochidia."

Professional Awards:

Lifetime Achievement Award: Dr. Richard Neves.

William Clench Memorial Award: John L. Harris.

This symposium and workshop has gone wonderfully, smoothly, days have been full and rewarding. Kudos to Alan and John and their team for this great symposium. Plaques were presented by the President to both Alan and John.

This is the 10th anniversary of FMCS. All past Presidents and Secretaries were asked to come forward and were presented with a plaque. Time to pass the horned hat to the new President Steve Ahlstedt. His first order of business is to present a plaque to Bob Anderson as Past President.

New President's message. We should all seek sponsorship money from our agencies and organizations for the upcoming 2009 Baltimore symposium. We all need to participate and help with the National Strategy. Protection of biodiversity hot spots is the key. We need a host for our next workshop in 2008. It all takes volunteerism. His door is open.

Having no further business to conduct, the meeting was adjourned.

Submitted by Patricia Morrison, FMCS Secretary

Board Meeting Minutes

FMCS Board Meeting
March 12, 2007
Peabody Hotel, Little Rock, AR

Welcome & Introductions

Quorum was present for the meeting.

Secretary's Report – Patty Morrison. Review of November Board meeting minutes as published in the December 2006 *Ellipsaria*. For 2006, the Society had 291 paid members; for 2007 so far, 135 (not including symposium registrations).

Treasurer Report – Heidi Dunn. 2006 income $18,424; expenses $3917. Some sponsors of the 2006 workshop did not pony up. Expenses run about $3200 annually for the newsletter. Balance sheet at the end of 2006 was $66,480.44 in the bank. This year so far income $4270, paid workshop expenses, now -$8900 on the year, but $57,574 net balance. Need to ask the membership to help seek sponsorship of future workshops and symposia.

Committee Reports and Issues

Symposium 2007, *Al Christian*

Pre-registrants: 127 for the workshop, 245 symposium.

Thanks to his hard working committee team, the symposium is going great. Raised $18,000 from sponsors. Catering $49,000, will go up with walk-ins. $84,000 total income, $61,000 expenses, now in black $23,000. Still some outstanding expenses, but should finish ~$10,000 net. We are covering Plenary presenters and keynote speaker costs. Over $5000 in-kind contributions from agencies; AR DOT printed the program for us. Ways to thank the donators – Al will send letters to them.

Awards, *Greg Cope and Catherine Gatenby*

All set for professional awards Wednesday. As to student participation, there will be 133 presentations overall; 54 are students. Helped fund 18 students' travel; $220 per student. Will offer best presentation award at dinner. Members willing to judge (23 people willing); committee is very appreciative of this volunteer effort. Best student recipients will receive $500 and plaque. Proceeds from raffle and auction usually dedicated to student awards. Might need more funds in the future if more students apply for financial assistance. We want to insure long-term sustainability. Usually raise $3000 to $6000 each symposium auction. The amount is equivalent to student registration. Need Society historian to keep track of where we've been. Can keep some of it on the web page, and this may be a good role for the Past President.

Information Exchange, *Kevin Cummings*

Dr. Burch gave a history of the journal. Need editorial committee to meet and agree on terms regarding format, finances, advice for the future, possibly putting it on the web. Journal is actually owned by a non-profit Michigan organization. Copyright is held by another entity. Need to work towards a smooth transition. Bob, Steve, Tom, and Kevin will meet with Dr. Burch tomorrow and try to finalize the plans.

Propagation, Restoration and Introductions, *Jess Jones*

Symposium being held this Sept. 5 – 7, 2007 on coal mining and the environment. Does FMCS want to sponsor? Asking $500 to $1000. He will present to the membership a proposed amendment to the by-laws that establishes a new full Genetics Committee. Motion by Heidi, second by Steve to contribute $750 to the symposium. Catherine will send the FMCS display and Matt to the symposium. Use it as an outreach opportunity. All in favor.

Environmental Quality and Affairs, *Ryan Evans*

Letter from NABS about how the proposed EPA water quality standards for ammonia and other compounds are not protective of mussels. AFS has done it as well. The Committee will draft a letter for the Society.

Mussel Distribution and Status, *Art Bogan & Jim Williams*

Proposal for dividing the work on the mussel atlas into regional areas with regional coordinators, seeking multiple small pots of money. Mapping function unified and handled

by NatureServe. States would get the database and maps for a contribution of $6000 to $8000 for 2 years. State Wildlife Grants would be a good mechanism.

Gastropod Distribution and Status, *Paul Johnson & Ellen Strong*
First checklist of North American snails and their status – Paul has a first draft. AFS wants to revisit mussels, fish and crayfish too. Motion by Paul, second by Art to have the President ask Rob Dillon to take the FMCS logo off his website. All in favor. The use of the logo incorrectly suggests the Society's unanimously support for information presented at the website, which has neither been reviewed by the Gastropod Committee nor has it been approved by the Committee or the Board.

Outreach, *Matthew Patterson*
Will have elections for co-chairs at their meeting. CD/DVD project was not funded. Seeking possible funding for speakers going to the Midwest Fish and Wildlife Conference in WI for no more then 8 people. Attendance is usually 1000 to 1200 people. Proponents for support of travel award were asked to prepare a proposal for Board consideration. Offer by Marshall University to have volunteer students do IT projects, maybe can update or augment the website.

Guidelines and Techniques, *John Van Hassel*
Nothing to report.

Standing Business

Election Results, *Leroy Koch*
Results will be announced at the business meeting

Revision of the National Strategy, *Rachel Muir*
Review and input received, needs feedback from Society and Board. Rachel will present to the membership this week.

Workshop 2008 – *Rachel Muir*
Still have 2 possibilities, with AMS or Society for Conservation Biology. SCB would like to have us; date is July 13-18, 2008, Chattanooga, TN. Rachel will be meeting with them in April. We can choose topic. Also need to work with local watershed groups. Ask the membership Weds. night Business meeting for their interest.

Symposium, 2009 – *Catherine Gatenby*
Just held first interest meeting – theme is international. Location is Baltimore. There is a real need to transfer and share knowledge. Need to bring in tribes, people working on coasts. Also need to shine the spotlight on Margaritiferids; expand interest beyond Unionidae. Suggest healthy mussels = healthy rivers = healthy people. Possible Sunday night event at the Aquarium to kick it off. Many foreign travelers may bring their families. Easy to get around, great seafood, Little Italy, Orioles ballpark. Haven't settled on a hotel yet. Probably near the Convention Center. Significant support expected from FWS Regional Office, plus VA Tech, AZA, Virginia Fish and Game. Use the media, have an event and invite the public. Go global with advertisement and marketing.

Committees will meet this week and elect chairs. Chairs should please update their committee lists and get them to the Secretary.

There being no further business to conduct, the meeting was adjourned.
Submitted by Patricia Morrison, FMCS Secretary

Outreach Committee Meeting

Little Rock, Arkansas
March 2007
Chair: Matthew Patterson

I would like to thank everyone who was able to attend the outreach committee meeting and share your ideas on this very important issue. Attendance was great as were the discussions.

FMCS Outreach List-serve
The Committee decided to form our own list-serve to discuss outreach issues affecting FMCS and freshwater mollusks in general. Anyone that was unable to attend the symposium or the committee meeting can join the list-serve by sending an e-mail to Jay_Levine@ncsu.edu.

Co-Chair Election
The first order of business was to hold Co-Chair elections. Two excellent candidates, Marsha May from the Texas Parks and Wildlife and Tom Jones from Marshall University, expressed interest in the position and gave short speeches regarding their interest in outreach. Tom Jones won a very close race and was announced as the new Co-Chair at the business meeting.

Mollusk DVD-ROM
The committee has been working on a proposal to create an outreach DVD-ROM/interactive web site on the biology, life-history, and ecology of freshwater mollusks. A grant proposal submitted to the Wildlife Conservation Society earlier this year was not funded but we continue to look for funding sources. There also was discussion at the meeting about creating an eye-catching movie clip to include on the DVD with different endings designed to target different audiences (i.e. school kids, the general public, policy makers, etc…).

Call for new "Tools for Outreach"
The committee would like to put out a call for new Outreach items that can be added to the Tools for Outreach. Please send a description of the item and a photo to matthew_patterson@fws.gov.

Comments on the Outreach Section of the National Strategy
The committee is planning to assist in revisions of the outreach section of the National Strategy. A pdf copy of the National Strategy can be downloaded from the FMCS website:

http://ellipse.inhs.uiuc.edu/FMCS/Meetings/NatStrategyConsev.pdf
If you have thoughts or comments, please send them to matthew_patterson@fws.gov.

FMCS Website Updates
The committee is planning to begin an update of the FMCS website using undergraduate students in the Department of Integrated Science and Technology at Marshall University. Look for a call for website items in the near future.

FMCS Outreach Subcommittees
Because of the complexity and importance of outreach, the committee discussed the development of subcommittees based on different target audiences. We are in the process of developing subcommittees for 1) Children K-12, 2) General public, 3) Policy Makers, 4) Science Professionals, and 5) Partnerships. Anyone interested in joining one of these subcommittees please contact matthew_patterson@fws.gov.

~ Don't forget to renew your membership! ~

Announcements

Coal Mining & Aquatic Environment Symposium, September 2007

The Nature Conservancy, U.S. Fish and Wildlife Service and their partners are convening a symposium to engage stakeholders in discussions of coal mining and aquatic conservation. This is a unique opportunity to have positive collaboration with industry leaders, regulatory agencies, natural resource agencies, academia and other public stakeholders on the many important issues related to coal mining and aquatic resources. The symposium features field trips on September 5 to learn hands-on about the coal mining process and the fish and mussels of the Clinch River. The symposium will be held at the Southwest Virginia Higher Education Center in Abingdon, Virginia, September 5-7, 2007. To learn more or register, please visit the website at www.cpe.vt.edu/cmrs/
Submitted by Jess Jones

Publications

Liberty, A. J., B. J. Ostby, and R. J. Neves. 2007. Determining a suitable substrate size and sampling frequency for rearing juveniles rainbow mussels *Villosa iris*. North American Journal of Aquaculture 69:44-52.

Valenti, T. W., D. S. Cherry, R. J. Neves, B. A. Locke, and J. J. Schmerfeld. 2007. Case study: Sensitivity of mussel glochidia and regulatory test organisms to mercury and a reference toxicant. Chapter 14 (pp.351-367) in Freshwater Bivalve Ecotoxicology, J. L. Farris and J. H. Van Hassel (eds.). CRC Press, Boca Raton, FL.

Zanatta, D.T. and Murphy, R.W. 2006. Development and characterization of microsatellite markers for the endangered northern riffleshell mussel *Epioblasma torulosa rangiana* (Bivalvia: Unionidae). Molecular Ecology Notes, 6(3): 850-852.

Zanatta, D.T. and Murphy, R.W. 2006. The evolution of active host-attraction strategies in the freshwater mussel tribe Lampsilini (Bivalvia: Unionidae). Molecular Phylogenetics and Evolution, 41: 195-208.

Zanatta, D.T. and Murphy, R.W. in press. Range-wide population genetic analysis of the endangered northern riffleshell mussel, *Epioblasma torulosa rangiana* (Bivalvia: Unionoida). Conservation Genetics, advanced online access. (doi: 10.1007/s10592-007-9290-6)

New Series: Sporadic Papers on Mollusks
(ISSN 1934-9734)

A new serial devoted to the study of mollusks, with an emphasis on historical topics. For more information, contact Richard Johnson, 124 Chestnut Hill Rd., Chestnut Hill, MA 02467-1310.

No. 1, December 2006 ($6) – Table of Contents:

Johnson, R.I. Conchology at the Lyceum of Natural History of New York: 1817-1876.

Johnson, R.I. John du Pont and Other Natural History Museum Related Murders. [Kevin Cummings favorite]

Johnson, R.I. Dates of the Plates Describing the Mollusks Collected on the *Voyage au Pole sud et dans l'Océanie sur les corvettes l'Astrolabe et l'Zélée exécuté par Ordre de Roi pendant les années 1837-1838-1839-1840 sous le Commandement de M. Dumont d'Urville* … by Hombron and Jacquinot.

Johnson, R.I. Joseph Pitty Couthouy (1808-1864) and the United States Exploring Expedition: A Second Look.

Johnson, R.I. *Fusconaia (Lexingtonia) collina* (Conrad, 1836), No Longer an Endemic, But a Probable Example of Stream Capture.

No. 2, December 2006 ($5) – Table of Contents:

Johnson, R.I. Joseph Charles Bequaert (1886-1982): His Malacological Contributions.

No. 3, December 2006 ($6) – Table of Contents:

Johnson, R.I. William J. Clench and Ruth D. Turner, with a Personal Perspective on the Department of Mollusks, Museum of Comparative Zoology.

Johnson, R.I. David Humphreys Storer (1804-1891): The Conchological Phase.

Contributed Articles

The following articles were contributed by FMCS members and others in the malacological community. The contributions are incorporated into the newsletter with minimal editing and the opinions expressed therein are those of the authors.

Volunteer Field Programs: Consideration of Value

Robert G. Howells
BioStudies, 160 Bearskin Trail, Kerrville, Texas 78028
Robert.Howells@hotmail.com

A number of volunteer programs that use members of the public to gather data on freshwater mussels have become topics of discussion in recent issues of *Ellipsaria* and at the Little Rock FMCS Symposium. Certainly access to free man-power and additional field data is appealing. So also are its general public relations benefits. However, it may be wise to critically consider and review such programs to evaluate cost-effectiveness, quality of data generated, and recognize any potentially negative aspects and limitations.

The Texas Mussel Watch (TMW) program was created by Texas Parks and Wildlife Department (TPWD) staff in 1998 to train volunteers to survey unionid populations around the state. Trainees have ranged from grade-school students to adults. Instruction typically involved an hour lecture and 2-3 hours of field experience. The Texas Master Naturalist (TMN) program is a broader endeavor from the Texas A&M Cooperative Extension Service and TPWD. TMN is designed to create a local corps of volunteers that can provide education, outreach, and service directed to the beneficial management of natural resources in their local communities. The TMN program involves some 40 hours of training, covering lectures and field trips related to naturalist history, ecological concepts, eco-regions, ecosystems, geology and soil, weather and climate, taxonomy, plants, birds, insects, fishes, herpetology, mammals, archeology, system ecology (forest, wetland, rangeland, aquatic, urban), and volunteers as teachers. Many sections are covered in 30-60 minutes. Participants are typically adults, often educated, and are expected to perform 40 hours of service annually. The TMN program did not initially include specific curriculum covering unionids (or other mollusks, crustaceans, or most other invertebrates). TMW has been included in some local TMN programs.

Some of the following questions should be considered in evaluating volunteer programs:

Does preparation time and expense justify the return from volunteers?
Preparation of programs, reference collections, and handout literature; travel to training sites; and subsequent data management can be substantial.

What proportion of volunteers actually provide subsequent useful data following training?
Do the vast majority of individual fail to obtain and submit information following training, do so only once, or provide only very superficial information?

Is the type and focus of volunteer data provided actually useful?
Do volunteers focus efforts largely on farm ponds, drainage ditches, and other sites that are unlikely to produce useful data? Do they visit these same sites repeatedly?

Is species identification sufficiently accurate?
Given the large number of taxa and ecophenotypes, can volunteers with such limited training accurately identify mussel species? Are there potential consequences if particularly rare species are misidentified? Is any post-training testing conducted to confirm volunteer identifications?

Do volunteers complete specimen labels and data sheets properly and is designated terminology used?
Are all specimens properly labeled? Are data sheets fully and accurately completed? Do volunteers use designated terms or do they create their own?

Do volunteers obtain as much data as possible from specimens they document?
Particularly when rare species are discovered, will volunteers recognize what information needs to be obtained beyond simple identification and count (e.g., spawning condition, glochidial descriptions, tissue for genetic studies)?

Do volunteers recognize legal issues associated with mussel collection and understand potential risks associated with inappropriate release of information?
Do volunteers follow legal aspects associated with mussel survey work? Are there unauthorized or ill-advised releases of location information that may be used by collectors to find rare species or to direct shell or pearl harvesters to significant populations?

Is a volunteer mussel program equivalent to other "Watch" programs?
Programs involving watching birds or horned lizards, for example, only require these species be observed (or photographed in some cases), but mussel work usually involves actually handling specimens and often sending them to experts for examination. Is this difference important? Should volunteers be expected (or allowed) to handle unionids, particularly regarding rare species?

Is sampling efficiency and success comparable to that of professional biologists? Can a volunteer field program replace a formal, professional unionid program?
Can the very existence of a volunteer program be used as reason to preclude support for staff malacologists and professional programs?

Does volunteer data address management information needs? Is volunteer data utilized in professional resource management programs?
Is the volunteer information providing insights into species status and distribution, assemblage diversity and abundance, etc.? Is volunteer data actually used in resource management?

Are there physical and legal risk factors associated with fielding volunteer workers?
Mussel field work can be dangerous and deaths have occurred. Is it reasonable to preclude use of some volunteers under certain conditions? For example, should early grade school students be permitted to conduct field activities? What about disabled or elderly volunteers? Are there legal considerations if injuries or deaths occur?

SUMMARY:
More boots in the water are certain to generate additional information on our declining unionid fauna and increase chances of discovering rare species. Enhanced public awareness is also nearly always positive. However, volunteer programs may not always be the panacea they may seem to be. Return on invested time and expense is often rather meager. Records based on specimens misidentified by volunteers with limited training can create the illusion that particularly rare species are more abundant and more widely distributed than they actually are. Some trainees may falsely assume that they know far more than they actually do and have license to do more than they actually should. Observing birds or lizards is quite different from directly handling freshwater mussels and programs directed at doing so need to be carefully considered relative to their costs and benefits. Good data can be critically important, but flawed data can be worse than no data at all. Even some good data may not be worth the expense of obtaining it.

Some Literature Dealing with Predation on Bivalves by the Muskrat *Ondatra zibethicus* in North America and Europe

Henk K. Mienis
Mollusc Collection. National Collections of Natural History
Department of Zoology, Tel Aviv University,
IL-69978 Tel Aviv, Israel
mienis@netzer.org.il

In February 2007 the UNIO-Listserver carried numerous items dealing with the predation on freshwater mussels by the Muskrat *Ondatra zibethicus.* I got the impression from the various reactions that a large number among the correspondents do not know the basic literature concerning this subject.

Although the Muskrat is in principal an herbivore, during winter, when aquatic vegetation is less available, they turn to animal food and consume large numbers of aquatic mollusks, among which mussels play an important role.

Several studies have shown that this mammal species is an expert in locating even the rarest mussel species. A study of the unpalatable remains in or near Muskrat dens is therefore of utmost importance for better knowing the mussel-diversity of an aquatic biotope.

Quite some time ago I collected a fair amount of the basic literature dealing with Muskrat predation on freshwater mussels. Since most of these works were published in general journals, they remained hardly known among malacologists. Therefore I have listed here these works. For references which I could check personally, I have added between brackets the predated species. The nomenclature is the one used in the original reports.

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The Quagga Mussel Has Arrived Already in the Netherlands

Henk K. Mienis
Mollusc Collection, National Collections of Natural History, Dept. Zoology, Tel Aviv Univ., IL-69978 Tel Aviv, Israel
and
National Mollusc Collection, Dept. Evolution, Systematics & Ecology, Hebrew University of Jerusalem, IL-91904 Jerusalem, Israel
mienis@netzer.org.il

In the wake of the recent discovery of the Quagga mussel *Dreissena bugensis* (Andrusov, 1897) in two widely separated stretches of the Romanian part of the Danube (Popa & Popa, 2006), I have published in three different places either a short note in English: "How long will it take the Quagga mussel *Dreissena bugensis* to reach Western Europe?" (Mienis, 2006a), or a variant of it in Dutch: "When can we expect *Dreissena bugensis* in the Rhine" (Mienis, 2006b-c).

I did not expect an immediate response; however, to my surprise a short report was recently published by Bij de Vaate (2006) on the first find of the Quagga mussel in the Dutch part of the river Rhine. During fieldwork in the delta of the Rhine, he encountered it in the Hollands Diep off Willemstad on 19 April 2006 – in the same month I posted two of my questions! He found typical specimens of the Quagga mussel at a rate of 1% among thousands of Zebra mussels *Dreissena polymorpha* (Pallas, 1771). The identification was not only made on shell characters but also with the help of DNA-analysis (Molloy et al., in print).

He followed Therriault et al. 2004 in the nomenclature of the Quagga mussel and mentioned it as *Dreissena rostriformis bugensis* (Andrusov, 1897). Since it is still questionable whether the recent mussels identified as *Dreissena rostriformis* from the Caspian Sea are conspecific with the type-material of *Dreissena rostriformis* (Deshayes, 1838), a Middle-Pliocene species originally described from the Crimean Peninsula, I follow Banicki (2003), Hubenov (2005) and Zhulidov et al. (2005; 2006) and stick for the meantime to the name *Dreissena bugensis.*

I doubt whether there is any connection between the presence of *Dreissena bugensis* in the Romanian stretch of the Danube and the find of this invasive mussel in the delta of the Rhine, although it may not ruled out altogether. So called Rhine barges are known to travel from the delta of the Rhine by means of the Rhine-Main-Danube Canal to the delta of the Danube and vice versa. Yet at the same time we may not rule out the trans-Atlantic transport of this species in ballast water from North-American harbors to Western Europe. In the past this has happened with the Dark falsemussel *Mytilopsis leucophaeata* (Conrad, 1831), which was first discovered in Europe in the harbor of Antwerp, Belgium, already in 1835 (Nyst, 1835 as *Mytilus cochleatus* Kickx n.sp.), and most recently, in 2005, with the Atlantic rangia *Rangia cuneata* (Sowerby, 1831) remarkably also in the harbor of Antwerp (Verween et al., 2006).

Whatever the way of introduction may have been with the Quagga mussel present at both ends of the trans-European shipping route Danube – Danube-Main-Rhine Canal – Rhine we may expect *Dreissena bugensis* at many additional localities along this immense stretch of freshwater.

Noteworthy is still the unconfirmed rumor that specimens differing in shell morphology from typical *Dreissena polymorpha* have been collected in the IJssel, another branch of the Rhine Delta in the Netherlands.

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Some Observations About Continental Mollusks (Gastropoda & Bivalvia) in Two Ecological Parks of Paraná State, Southern Brazil

A. Ignacio Agudo
Projeto Naiade (Naiade Project)
Avulsos Malacológicos – AM
Caixa Postal (P. O. Box) 010, 88010-970 Centro,
Florianópolis, Santa Catarina – SC, Brasil
iagudo@lycos.com – http://www.malacologia.com.br

During a malacological inventory of the Santa Catarina (SC) and Paraná (PR) States continental territories, some regional ecological parks are being included in our independent research. In the State of Paraná, two of its more protected local notables were visited in 2005 and 2006(Agudo 2005; Agudo 2006 a, b, c), with the purpose of knowing its composition and its environmental structure, as well as the natural occurrence of terrestrial and freshwater mollusks.

First Exploratory Results:

I. STATE PARK OF "VILA VELHA"

Located in the Municipal district of "Ponta Grossa" in the Second Plateau (Agudo 2005: 9), with caverns (deep circular craters permanently full of water), the "Lagoa Dourada (Golden Lagoon)"* and arenitos, grand natural sculptures in stone - 23 curious rock formations, formed by the action of wind and rain battering the rocks for millions of years**. Very poor territory as to representatives of mollusks fauna.

Unknown freshwater mussels/naiads were observed in the bed of the "Lagoa Dourada" (50° 03'W, 25° 14'S) by employees of the park. We suspect, for zoogeographical reasons, *Diplodon expansus* (Küster, 1856). Morretes (1949:19) cited this species under the synonymy *Diplodon*

(*D.*) *semigranosus* Simpson, 1914 for the "Ponta Grossa" region.

*Geomorphologic description: Moro & Bicudo (1998:48).
**Complete geographical description: Lima et al (1975:14-28), Ganho & Marinoni (2003 728), Marinoni & Ganho (2003:738).

Systematic Species List:
Class BIVALVIA
Order UNIONOIDA
Family HYRIIDAE
Class GASTROPODA
Subclass Pulmonata
Family AGRIOLIMACIDAE
-*Deroceras laeve* (Müller, 1774)

II. IGUAÇÚ NATIONAL PARK
Located in the westernmost extreme of Paraná, in the Iguaçú river basin of the binacional Brazil/Argentina region, the largest complex of waterfalls on the planet, with 275 falls, and 7,000 meters of footbridges & exuberant forest trails.

The available literature (Rumi et al 2005) informs of high values of diversity of mollusks for the Argentinean section of the Park and the waterfalls.

Systematic Species List:
Class BIVALVIA
Order UNIONOIDA
Family MYCETOPODIDAE
-*Haasica balzani* (von Ihering, 1893)*
Class GASTROPODA
Subclass Prosobranchia
Family AMPULLARIIDAE
-*Pomacea canaliculata* (Lamarck, 1819)
Family HYDROBIIDAE
-*Littoridina* (= *Heleobia*) sp.**
Subclass Pulmonata
Family LYMNAEIDAE (1)
-*Pseudosuccicnea* (=*Lymnaea*) *columella* Say, 1817**
Family CHILINIDAE
-*Chilina fluminea* (d'Orbigny, 1835)***
-*Chilina megastoma* H. Scott, 1958****
Family PLANORBIDAE
-*Acrorbis petricola* Odhner, 1937**
-*Biomphalaria intermedia* (Paraense & Deslandes, 1962)*
- Drepanotrema sp.**
Family BULIMULIDAE
-*Leiostracus perlucidus* (Spix, 1827)*****
-*Mesembrinus interpunctus* (Martens, 1887) *****
Family VERONICELLIDAE
-*Belocaulus angustipes* (Heynemann, 1885)

*Original report contained in Agudo (2006:9). Many other uncertain shells of mussels observed in the bed of the close river to the waterfalls.
**Mentioned from the Argentinean territory of the Iguaçú Waterfall National Park by Rumi et al (2005).
***"Spring" of the ecological forest trail, "Iguaçú Waterfall National Park", Brazilian territory (Agudo 2006:9).
****Argentinean territory of the Iguaçú Waterfall National Park by Rumi et al (2005). Species not specifically referred in the wide work of revision of Simone (2006).
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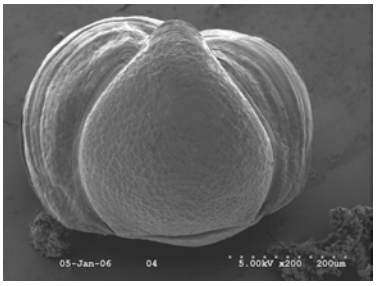
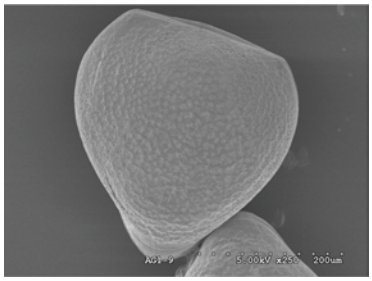


Unknown juvenile mussel collected from a white sucker

Identification of Juvenile Mussels Collected from a Naturally Infested White Sucker Using Scanning Electron Microscopy



White heelsplitter, *Lasmigona complanata,* glochidium

Luke I. Kusilek[1], Mark C. Hove[1, 2], Bernard E. Sietman[3], Dan J. Hornbach[2], Dan C. Allen[3], J. Mike Davis[3], Andrea K. Crownhart[3] and Anne R. Kapuscinski[1]

[1]University of Minnesota (UMN), 1980 Folwell Ave., St. Paul, MN 55108

[2] Macalester College, 1600 Grand Ave., St. Paul, MN 55105

[3] Minnesota Dept. of Natural Resources (MN DNR), 500 Lafayette Rd., St. Paul, MN 55155

Corresponding authors: kusil002@umn.edu or Mark_Hove@umn.edu

The diversity of our native aquatic fauna is declining at an alarming rate. Since 1900, 123 freshwater animal species have become extinct, with 48.5% of North American freshwater mussels listed as imperiled (Ricciardi and Rasmussen 1999). These dramatic declines in native bivalve populations have been attributed to habitat degradation and reduced water quality. Many Unionid larvae (glochidia) only metamorphose on select fish species, making knowledge of host fishes critical for effective conservation and management. Ideally, glochidia hosts are determined through identification of juvenile mussels recovered from naturally infested fishes. However, identifying juveniles is problematic due to their small size (<1mm). Identification of juveniles using molecular techniques has proven inconsistent to date; in contrast scanning electron microscopy shows promise (Kennedy and Haag 2005).

The objective of this study was to identify juvenile mussels collected from a naturally infested white sucker (*Catostomus commersonii*) captured from Deer Creek, a tributary of the Root River in southeastern Minnesota, known to contain state-listed mussel species. To date, there have been few observations of white suckers serving as hosts for Anodontine species. Scanning electron microscopy was used to compare standard glochidia valve dimensions (valve length, valve height, hinge length; see Hoggarth 1999) of unknown juvenile mussels with glochidia of seven Anodontine species known to occur in the Root River basin (Sietman 2003). We used JMP V. 3.2.2 (SAS Institute, Cary NC) to conduct discriminant function analysis (DFA) of valve dimensions of 269 known glochidia and 9 unknown juveniles.

Although glochidia valve dimensions overlapped for several species, DFA was useful in distinguishing Anodontine glochidia (Table 1). Consistent with previous studies (Kennedy and Haag 2005), DFA yielded an overall misclassification percentage of 22.7% (Table 2). We determined that juvenile mussels recovered from the white sucker were most likely white heelsplitter, elktoe, or both (Figure 1). Howard and Anson (1922) also report elktoe glochidia naturally infesting white suckers.

Following this analysis we exposed two groups of white suckers to elktoe and white heelsplitter glochidia. We collected four juvenile elktoes from five suckers, and 636 juvenile white heelsplitters from four suckers. These trials provide evidence that the naturally infested juvenile mussels could be white heelsplitter or elktoe.

We thank the UMN Undergraduate Research Opportunity Program for funding this project, and Matt Berg, and Marian Havlik and her field crew for assisting with collecting glochidia used in host suitability trials.

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Figure 1. Discriminant analysis showing 95% confidence circles for Root River Anodontines and unknown juvenile mussels.

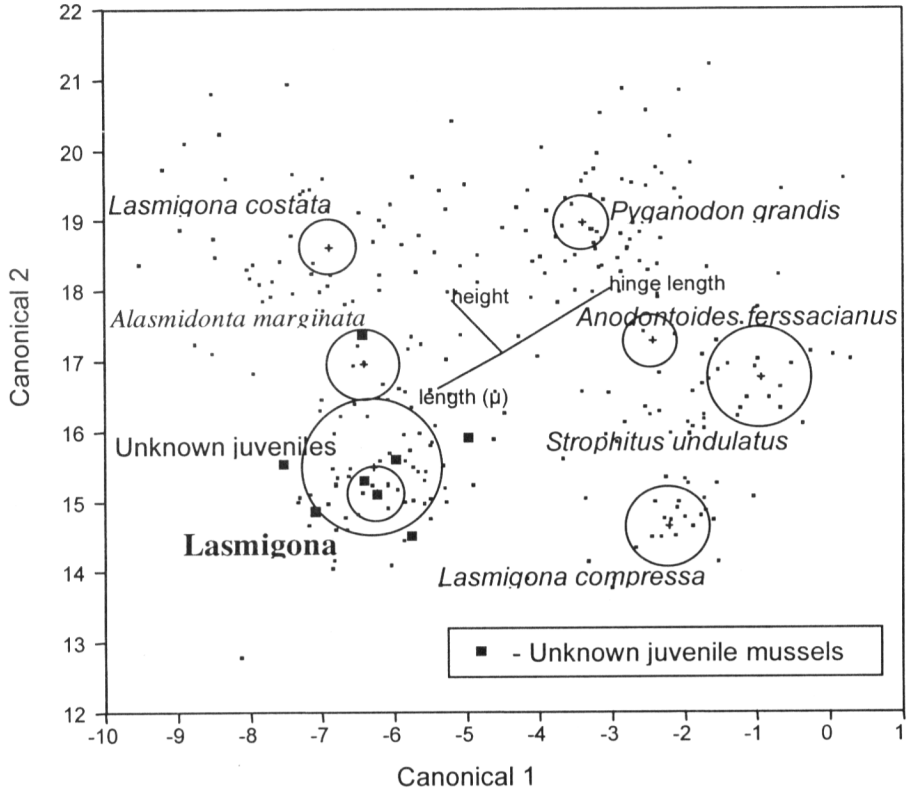

Table 1. Glochidia valve dimensions (in microns) including mean, standard deviation and range of Root River Anodontines and unknown juvenile mussels.

Common Name	Species	Valve height (µ)		Valve Length (µ)		Hinge Length (µ)	
		Mean	Range	Mean	Range	Mean	Range
creek heelsplitter	*Lasmigona compressa*	277.5 ± 7.1	261.9-292.1	325.7 ± 13.3	298.4-347.6	233.8 ± 12.5	207.9-250.8
cylindrical papershell	*Anodontoides ferussacianus*	329.6 ± 27.3	339.7-390.9	330.2 ± 23.4	328.8-388.4	253.9 ± 22.2	209.1-304.5
elktoe	*Alasmidonta marginata*	367.3 ± 32.2	316.2-434.4	331.0 ± 23.9	287.9-372.6	225.9 ± 15.1	197.8-263.0
flutedshell	*Lasmigona costata*	402.8 ± 23.8	362.4-457.0	374.1 ± 18.6	334.1-411.3	254.4 ± 14.1	216.5-287.6
giant floater	*Pyganodon grandis*	369.7 ± 15.8	339.5-415.1	366.0 ± 15.8	332.4-403.1	276.0 ± 14.1	246.2-306.3
strange floater	*Strophitus undulatus*	303.2 ± 9.0	292.5-326.4	373.3 ± 15.0	341.5-400.0	282.2 ± 11.6	254.7-298.8
white heelsplitter	*Lasmigona complanata*	332.4 ± 11.4	300.0-361.9	321.6 ± 16.5	288.5-352.9	211.0 ± 10.8	186.5-232.9
Unknown juveniles		340.1 ± 17.3	315.9-374.4	314.9 ± 10.5	300.0-330.2	209.7 ± 11.1	193.0-227.9

Table 2. Discriminant function analysis representative assignments and misclassification percentages for unknown juveniles and seven species of Root River Anodontines.

Species (Species Code)	AMI	AFC	LCL	LCR	LCT	PGD	SUL	UJN
A. marginata (AMI)	10	1	2	0	9	0	0	8
A. ferussacianus (AFC)	2	39	1	1	0	10	0	1
L. complanata (LCL)	3	0	31	0	0	0	0	14
L. compressa (LCR)	0	0	0	23	0	0	0	0
L. costata (LCT)	5	0	0	0	42	1	0	0
P. grandis (PGD)	2	4	0	0	1	45	0	0
S. undulatus (SUL)	0	0	0	0	0	0	14	0
Unknown juveniles (UJN)	1	0	2	2	0	0	0	5
Misclassification	56.5%	11.4%	13.9%	11.5%	19.2%	23.9%	0.0%	50.0%

A Survey of the Freshwater Snails of the Major Ecoregions of South Dakota

Bruce J. Stephen and Valerie B. Winkler
Southeast Community College, Lincoln, NE

The second phase of a study of the aquatic snails of South Dakota was conducted in 2006. This study concentrated on getting at least ten survey sites from each of the three major level III ecoregions (the Environmental Protection Agency of South Dakota (EPA, 2005)) found within the state. South Dakota is made up of eight level III ecoregions; however, the majority of the area in the state encompasses only the three regions targeted in this phase of the survey: the Northwestern Great Plains, the Northwestern Glaciated Plains, and the Northern Glaciated Plains.

The initial phase of this survey of the aquatic snails of South Dakota was conducted in the Prairie Coteau region of northeastern South Dakota in 2005. The aim of this study is to ultimately provide a comprehensive survey of the freshwater gastropods of the state. While several checklist of South Dakota mollusks have been compiled (Over, 1915; Henderson, 1927; Over 1928) little recent data exists and no comprehensive study has ever been completed.

Snails were collected from shallow water areas in 10 aquatic habitats in each of the three regions for a total of 30 sample sites. Sampling was done by hand and dip net. Live specimens and shells were collected. Shells were housed in jars while live specimens were preserved in 95% ethanol before storage. Several physical and chemical analyses were performed for each water body sampled, these included Calcium, pH, water body size and shallow water vegetation.

Calcium (as $CaCO_3$) ranged from 60>500 mg/L. The range of pH values was 7.1-10.0. Common shallow water vegetation was cattails and grasses. Water bodies ranges in size from small roadside ditches less than 0.01 ha to large lakes.

Two prosobranch and eight pulmonate snail species were discovered and collected for a total of 91 records. Live snails were found at 77 of the 91 sites, with shells or subfossils providing evidence of snail habitation in the remaining sites. These species are combined in Table 1 with the species collected in 2005. All together 13 species of snail have now been collected in South Dakota during this project.

Table 1. A list of thirteen species of snail found throughout South Dakota in 2005 and 2006.

Species	Year found	Number of Sites in 2005/2006
Pulmonates		
Lymnaea stagnalis	2005	5 / 0
Lymnaea (Stagnicola) elodes	2005/2006	26 / 17
Lymnaea (Stagnicola) caperata	2005/2006	5 / 4
Lymnaea (Fossaria) obrussa	2005	3 / 0
Aplexa elongata	2005	9 / 2
Physa gyrina	2005/2006	25 / 23
Physa acuta	2005	3 / 0
Helisoma trivolvis	2005/2006	16 / 11
Helisoma anceps	2006	0 / 4
Gyraulus deflectus	2005/2006	10 / 17
Promenetus exacuous	2005/2006	8 / 3
Prosobranchs		
Valvata tricarinata	2006	0 / 9
Amnicola limosa	2006	0 / 1

Several water bodies in extreme Northwest South Dakota (for example Lake Gardner in Harding County) had no visible snail fauna. Calcium levels at this lake were >500 ppm, above the range of the test kit used, while pH was >11.

Although the ecoregions with the greatest area in the state have now been sampled, several smaller ecoregions remain. Some, for example the Sandhills and the Blackhills, should provide vastly different aquatic habitats and may therefore have different snail species then have already been found.

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Acknowledgements:
This study was funded by a grant from the South Dakota Department of Game, Fish and Parks Wildlife Diversity Small Grants Program.

Commercial Mussel Harvest Update 2002 to 2006

Don Hubbs, Mussel Program Coordinator
Tennessee Wildlife Resources Agency, PO Box 70 Camden, TN 38320
731-584-9032, tnmussels@aol.com

Commercial Mussel Harvest Update 2002 to 2006:
Tennessee's freshwater mussel shell market increased moderately during 2002 to 2006. Total harvest wholesale value improved due to increased landings resulting from more consistent buying activity and higher prices. Higher prices were noted for all shell categories except for washboards (*Megalonaias nervosa*), which remained one dollar per pound. Monthly price data obtained from wholesale mussel dealers and TWRA wholesale mussel dealer sales receipts were tabulated to compute average price paid for the major categories of shell. Shell values were only reported for green (live mussels), because the wholesale market for open (dead) mussel shell was very limited.

Wholesale mussel dealer reports, in addition to the wholesale price survey, were used to compute the volume and value of the commercial mussel harvest. Tennessee wholesale mussel dealers reported purchasing 12,748,302 pounds of mussels from Tennessee waters during the last five years. The wholesale harvest value for this period was estimated at $8,160,781. Increased prices attracted additional harvesters; the number of licensed harvesters increased from 144 in 2002 to 264 in 2005.

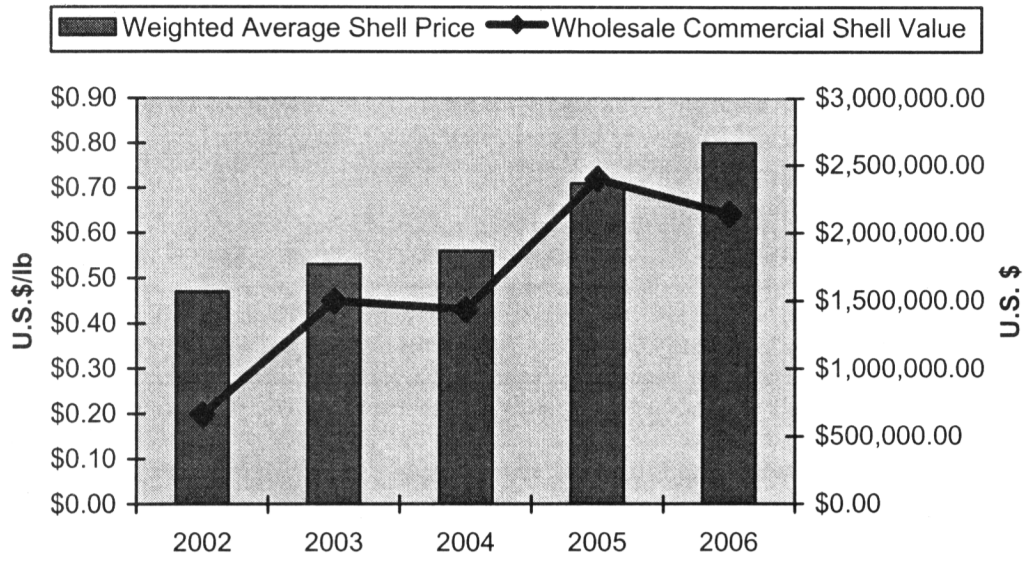
Commercial Mussel Statistics	2002	2003	2004	2005	2006*	TOTAL	Average
Harvester Licenses	144	215	247	264	250	**1120**	**224**
Shell Dealers Licenses	11	13	14	15	15	**68**	**14**
Pounds Harvested	1,429,293	2,878,808	2,533,947	3,386,254	2,520,000	**12,748,302**	**2,549,660**
Wholesale Harvest Value	$665,326	$1,531,327	$1,417,753	$2,404,375	$2,142,000	**$8,160,781**	**$1,632,156**

*estimated based on shell fee received

Mussels are harvested according to minimum legal diameter measured in inches. During 2005, the average price of 2 3/8" ebony shells *(Fusconaia ebena)* increased $0.20 to $0.57/lb. The 2 ¾" lake mix (threeridge (*Amblema plicata),* southern mapleleaf *(Q. apiculata),* mapleleaf (*Q. quadrula),* and lake pigtoe *(Fusconaia flava)*) price also increased $0.20 from $0.67 to $0.87/lb, while 2 5/8" lake mix shells increased $0.11 to $0.75/lb. Minimum sized 4.0"lake washboard *(Megalonaias nervosa)* prices remained at $1/lb. The lower priced 2 3/8" and 2 ½ (ebony and monkey-face *Q. metanevra*) categories combined comprised 42% of the harvest weight and 35% of the total value. Ebony shell in the 2 5/8" to 2 ¾" size comprised 21% by weight and 21% by value of the harvest. The combined ebony shell harvest produced 64% by weight and 56% by value of the 2005 harvest. Lake mix categories (2 5/8" and 2 ¾") made up 29% of the shell harvest by weight and 34% by value. For the second consecutive year, the volume of 2 ¾" lake mix shells exceeded that of the 2 5/8", and the 2 ¾" shells comprised 19% of the harvest value compared to 14% for the 2 5/8" group. Lake grade washboards 4.0" and larger continued to decline in harvest significance; they made up only 2.95% by weight and 4% by value compared to 3% of the total weight and 7% of the total harvest value in 2004. River grade washboard production increased suspiciously, especially since 109,010 pounds were reported from Kentucky Reservoir and not from the Cumberland River, which has historically produced the majority of river grade washboards in Tennessee. River grade washboards increased from 0.65% by weight and 1.2% by value in 2004, to 3.28% by weight and 4.63% by value in 2005. The market for colored shells (pinks, principally *Potamilus alatus*) produced 0.62% by weight and 1.31% by value down from 1.33% by weight and 3.77% by value harvested in 2004. These shifts in species and sizes of commercial shell landings were attributed to a general increase in market demand. Weighted average wholesale price paid to harvesters ($0.71/ lb in 2005) has maintained a steady increase during the last five years.

According to wholesale dealer receipts, 98.1% of the 2005 Tennessee mussel harvest came from Kentucky Reservoir. An analysis of Kentucky Reservoir's harvest data and size distribution by species group showed 66% by weight of the ebony shells were between 2 3/8" and 2 ½", compared to 34% at 2 5/8" and larger. The lake mix group continued to benefit from reduced harvest pressure, with the weight of 2 ¾" shells (55%) exceeding the 2 5/8" (45%) by 10%. Lake grade washboards were entirely made up of 4.0" grade

shells with none reported as => 5.0". Kentucky Reservoir's river grade washboards were reported as 75.3% 4.5" size class and 24.7% as 4". Mussel shells imported from other states equaled 72,476 pounds, and comprised 2.1% of the total Tennessee market during 2005.



Freshwater drum confirmed as suitable host for butterfly (*Ellipsaria lineolata*) glochidia: high host specificity evident

Nissa Rudh[1], Mark Hove[1, 3], Andrea Crownhart[2], Bernard Sietman[2], Paula Frank[2], Mike Davis[2], Dan Hornbach[3], and Anne Kapuscinski[1]

[1]University of Minnesota, 1980 Folwell Avenue, St. Paul, MN 55108

[2]Minnesota Department of Natural Resources (MN DNR), 500 Lafayette Road, St. Paul, MN 55155

[3]Macalester College, 1600 Grand Avenue, St. Paul, MN 55105

The butterfly (*Ellipsaria lineolata*) is a threatened species in Minnesota, occurring sporadically in the Mississippi River south of the Twin Cities and in the lower St. Croix River. It is suspected that the host fish for the butterfly is the freshwater drum and possibly the green sunfish and sauger (Surber 1913, Howard 1914, Coker *et al.*, 1921).

Host suitability trials were conducted using standard procedures. Brooding *E. lineolata* were collected from the St. Croix River and fishes were collected from various rivers and streams located in central and southern Minnesota, including one large *Aplodinotus grunniens* (freshwater drum). Fishes were held in the laboratory at 22±2 °C for at least two weeks prior to glochidia exposure. Glochidia attachment was confirmed for at least one individual of each species tested. Tank bottoms were siphoned and water was sieved through a 45µ mesh sieve. Siphonate was examined for juveniles with a Nikon SMZ-2B dissecting microscope.

We conducted *E. lineolata* glochidia host suitability trials on 43 fish species (Table 1). Forty-four juvenile *E. lineolata* were recovered from one large (approximately 0.4m) freshwater drum, confirming host suitability studies by Howard (1914) and Coker *et al.*, (1921). Juveniles were shed roughly 25 days after infestation until the subject died on day 32. No other species facilitated butterfly glochidia metamorphosis.

Gravid female *E. lineolata* were observed to have a peculiar, palpitating mantle display that consisted of a cycle of several rapid jerking motions inward followed by a resting period. We will focus our 2007 study efforts on describing butterfly brooding behavior and attempting to recover juvenile butterfly from naturally infested freshwater drum.

We thank the University of Minnesota Undergraduate Research Opportunities Program, and the MN DNR Ecological Services Stream Habitat Project for funding, and the Wisconsin DNR, Bureau of Endangered Resources for loaning us the dissecting microscope used in this study.

Table 1. Fishes exposed to *Ellipsaria lineolata* glochidia.

longnose gar*	weed shiner	northern pike*	smallmouth bass
shortnose gar*	topeka shiner	rainbow trout	largemouth bass*
central stoneroller	mimic shiner	banded killifish	black crappie*
common carp	northern redbelly dace	brook stickleback	rainbow darter
spotfin shiner	white sucker	slimy sculpin	johnny darter
brassy minnow	northern hogsucker	rock bass*	yellow perch*
common shiner	shorthead redhorse	green sunfish*	logperch
horneyhead chub	black bullhead*	pumpkinseed	blackside darter
golden shiner	yellow bullhead*	orangespotted sunfish	sauger*
emerald shiner	channel catfish*	bluegill*	walleye*
bigmouth shiner	flathead catfish*		freshwater drum*

* Species tested twice

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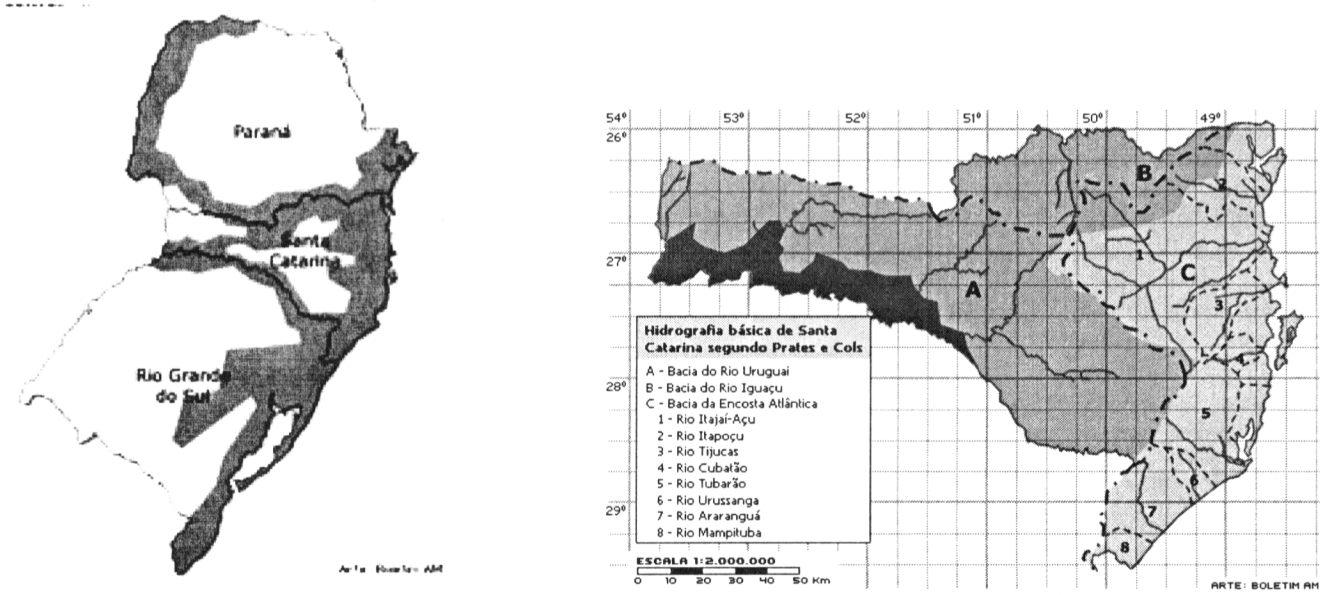
Invader progress of the asiatic golden mussel, *Limnoperna fortunei* (Dunker, 1857), in Southern Brazil. II: vulnerable geographical points to its entrance in the Santa Catarina State territory

A. Ignacio Agudo

Projeto Naiade (Naiade Project), Avulsos Malacológicos – AM , Caixa Postal (P. O. Box) 010, 88010-970 Centro, Florianópolis, Santa Catarina – SC, Brasil; iagudo@intergate.com.br - http://www.malacologia.com.br

In the recent literature (Agudo 2006, Darrigran & Damborenea 2006, Silva 2006), the asiatic golden mussel, *Limnoperna fortunei* (Dunker, 1857), arrived at Argentina in the water of ballast of ships about 1991. It reached Uruguay and Brazil, advancing 400 kilometers a year in the rivers of the area. The progress of this exotic limnic invader bivalve in the direction of the Southwestern Brazilian territory, specifically the Western hidrographical region of Santa Catarina's State, was characterized previously (Agudo 2006). Based on the wide documented knowledge generated by the specialists in biological invaders in Brazil and the South Cone, Santa Catarina's territory presents three "hot points" or "regional hotspots" immediately vulnerable to the entrance of the species (Agudo 2004) (see maps).



Brazil's southernmost region and Santa Catarina State river basin systems.

Regional Hotspot 1 - THE UPPER URUGUAY RIVER BASIN, to the South:

The first reports of local composition of the fauna of bivalve mollusks didn't register occurrence in the area, just two exotic species of asiatic freshwater clams, *Corbicula fluminea* (Müller, 1774) and *Corbicula largillierti* (Phillippi, 1844 (Agudo 2005, Castillo et al 2005, Agudo & Bleicker 2006). The specialized literature (Mansur et al 2004: 37; Darrigran & Damborenea 2006: 108) doesn't show asiatic golden mussel in Brazil through the Uruguay River, in spite of its entrance being imminent through this sets fluvial. Even so, in January 2006 journalistic matter denies this position when indicating the presence of the species in the area of "Barra of Quaraí or Cuareim River" (Lisboa 2006), information only just confirmed in field (city of "Barra do Quaraí", RS - Brasil), in January/February 2007, by the Brazilian Institute for Environment and Renewable Resources – IBAMA.

Starting in November 2006, the medium Uruguay River basin was inspected under the coordination of IBAMA, jointly with other environmental groups, promoting in parallel form the organization of regional "barriers" with help of the population to try to contain the invasion above the city of "Uruguaiana" (RS), in direction to the Upper session, among Rio Grande do Sul and Santa Catarina States, thirst of six hydroelectric reservoir complexes (hydro power stations), built in 3 local river basin on the way to the nascent of the Uruguay: "Foz de Chapecó" (in construction) and "Quebra Queixo" in the Chapecó River; "Itá, Machadinho and Barra Grande" in the Pelotas River; "Campos Novos" in the Caveiras River. To have an idea of the gravity of the situation, for example, the great Hydroelectric of Itaipu, in the State of Paraná - PR (the largest of the world), stops once to every week to clean equipment of the Asian Mussel.

Regional Hotspot 2- THE IGUAÇU RIVER BASIN, to the North:

The presence of *Limnoperna fortunei* (Dunker, 1857) in small reservoirs of the city of Curitiba, Paraná State, geographically close with Santa Catarina, was recorded for the first time in Iguaçu Rver (Mansur 2003: 19, Takeda et al 2003, 2006). Occurrence of larval forms of the species is still denounced in the recent literature (Silva 2006) (Obs.: Darrigran & Damborenea (2006: 93) and Santos et al (2005)). This result alerts for the risk of invasion of this important stream of the Paraná and, secondarily, Santa Catarina States.

Regional Hotspot 3- THE ITAJAÍ PORT, to the Atlantic River Basin System:

The largest and most important commercial port of Santa Catarina, established in the mouth and estuary of the river Itajaí-Açu (the largest hidrographical basin of the State that discharges into the Atlantic Ocean), whose waters irrigate and provide drinkable water to the Itajaí Valley region. For this geographical area, the reports of exotic mollusks corresponds to the asiatic freshwater clam species *Corbicula largillierti* (Phillippi, 1844) (Agudo & Bleicker 2006). Other tentative ports of invader entrance are in the "São Francisco do Sul Island", in the North of the State, with previous registrations of the exotic freshwater clam *Corbicula fluminea* (Müller, 1774) (Agudo & Bleicker 2006), and "Imbituba", in the Southern area. It seems that the occurrence of exotic freshwater clams *Corbicula* spp. precedes the entrance of the Asian Golden Mussel in the ecosystems invaded (coincidence?). In agreement with specialists (Darrigran & Damborenea 2006: 108), the roads of invasion followed for *Corbicula* spp. indicate a similar though faster migration through the fluvial basins for *Limnoperna fortunei*, considering the great dispersion speed and larger proliferation of Golden Mussel.

Currently in Brazil, nearly all of the attention on exotic mollusks is focused on 2 species, ignoring other potential agricultural and vectorial plagues of diseases (Agudo & Bleicker 2006): in terrestrial ecosystems the african gastropod, *Achatina fulica* (Bowdich, 1822) and in aquatic ecosystems the asiatic bivalve, *Limnoperna fortunei* (Dunker, 1857).

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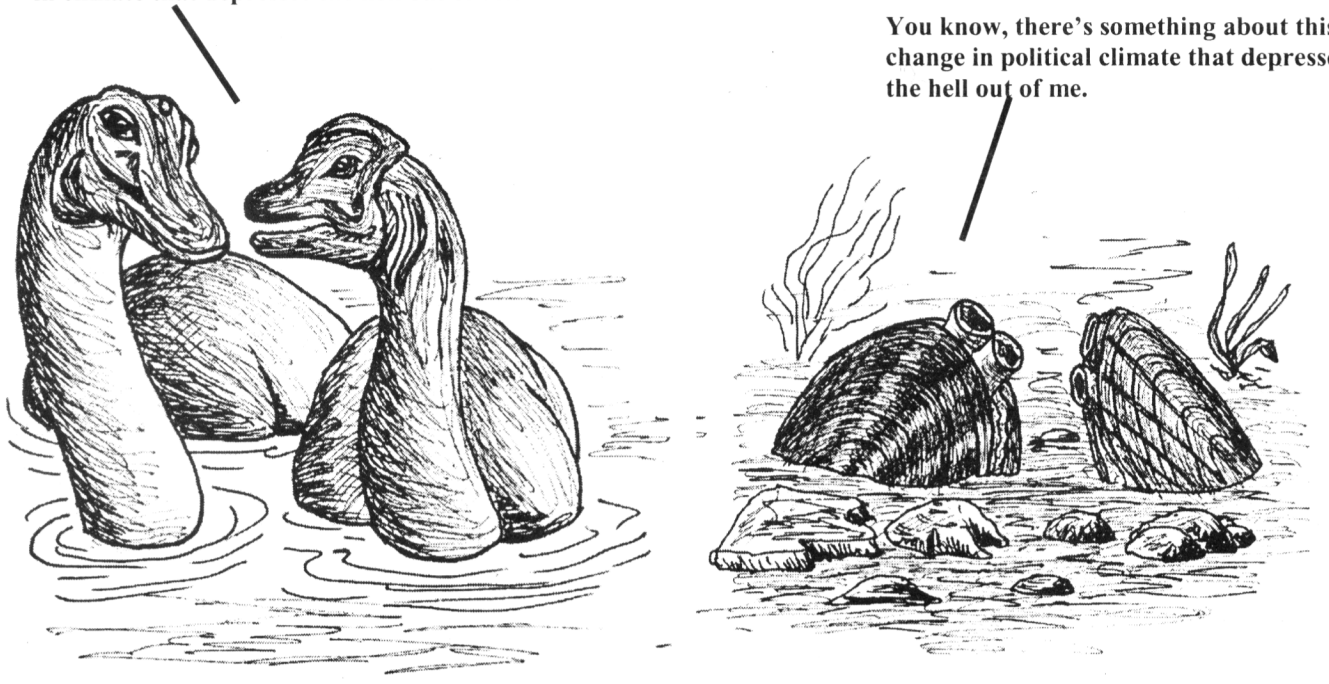
Ryan Evans
Kentucky State Nature Preserves Commission
801 Schenkel Lane
Frankfort, KY 40601
502-573-2886 x102; fax: 2355
Ryan.Evans@ky.gov

Robert G. Howells
BioStudies
160 Bearskin Trail
Kerrville, Texas 78028
830-367-5940
Robert.Howells@hotmail.com

Jennifer Kurth
Iowa Dept. of Natural Resources
Watershed Improvement Section
502 E 9th St
Des Moines, IA 50319
Jennifer.Kurth@dnr.state.ia.us

Kelly McNichols
University of Guelph
Dept. of Integrative Biology
Guelph, ON N1G 2W1
Canada
kmcnicho@uoguelph.ca



This was originally drawn some years ago for the Info-Mussel Newsletter (motivated by an even earlier cartoon) during a time of attacks on the Endangered Species Act and several ecological losses. However, the Powers-That-Be at that time found it to be too controversial and it was ultimately dropped. A report in a recent issue of River Crossings [1(16):10] that addressed administrative review of information releases at USGS reminded me of this earlier expression of frustration. Perhaps history does repeat itself.

Robert G. Howells – 3 April 2007

Helpful Hints from Hoppy:

Hoppy Says —If you enjoy the FMCS...get involved!

Submitted by Steve Ahlstedt

Freshwater Mollusk Conservation Society
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If you are interested in joining a committee, please contact one of the appropriate chairs.

Awards
W. Gregory Cope – North Carolina State, Dept. Environ. & Molecular Toxicology, Box 7633, Raleigh, NC 27695-7633
919-515-5296; greg_cope@ncsu.edu

Teresa Newton – Upper Midwest Environ. Sci. Center, 2630 Fanta Reed Rd., LaCrosse, WI 54603
608-781-6217; tnewton@usgs.gov

Environmental Quality and Affairs
Ryan Evans – Kentucky State Nature Preserves Commission, 801 Schenkel Lane, Frankfort, KY 40601
502-573-2886 x102; fax: 2355; Ryan.Evans@ky.gov

Al Buchanan – 1001 S. Johnmeyer Lane, Columbia, MO 65203
573 -445-1521; gandalfpoint@yahoo.com

Gastropod Status and Distribution
Paul D. Johnson – Alabama Aquatic Biodiversity Center, Route 3, Box 86, Marion, AL 36756
334-683-5000; paul.johnson@dcnr.alabama.gov

Genetics
David J. Berg – Miami University, 546 Mosler, Oxford, OH 45069
513-785-3246; bergdj@MUOhio.edu

Guidelines and Techniques
Chuck Howard – Ecological Specialists, Inc., 470 A Schrock Road, Columbus, OH 43229
614-430-3780; choward@ecologicalspecialists.com

Janet Clayton – West Virginia Division of Natural Resources, PO Box 67, Ward Road, Elkins, WV 26241
304-637-0245; janetclayton@wvdnr.gov

Information Exchange
Al Buchanan – 1001 S. Johnmeyer Lane, Columbia, MO 65203
573-445-1521; gandalfpoint@yahoo.com

G. Thomas Watters – Museum of Biological Diversity, The Ohio State University, 1315 Kinnear Road, Columbus, OH 43212
614-292-6170; Watters.1@osu.edu

Mussel Status and Distribution
Arthur E. Bogan – North Carolina State Museum of Natural Sciences, 4301 Reedy Creek Road, Raleigh, NC 27607
919-733-7450 ext 753; arthur.bogan@ncmail.net

James D. Williams – U.S. Geological Survey, 7920 NW 71st Street, Gainesville, FL 32653
352-264-3475; JDWilliams@usgs.gov

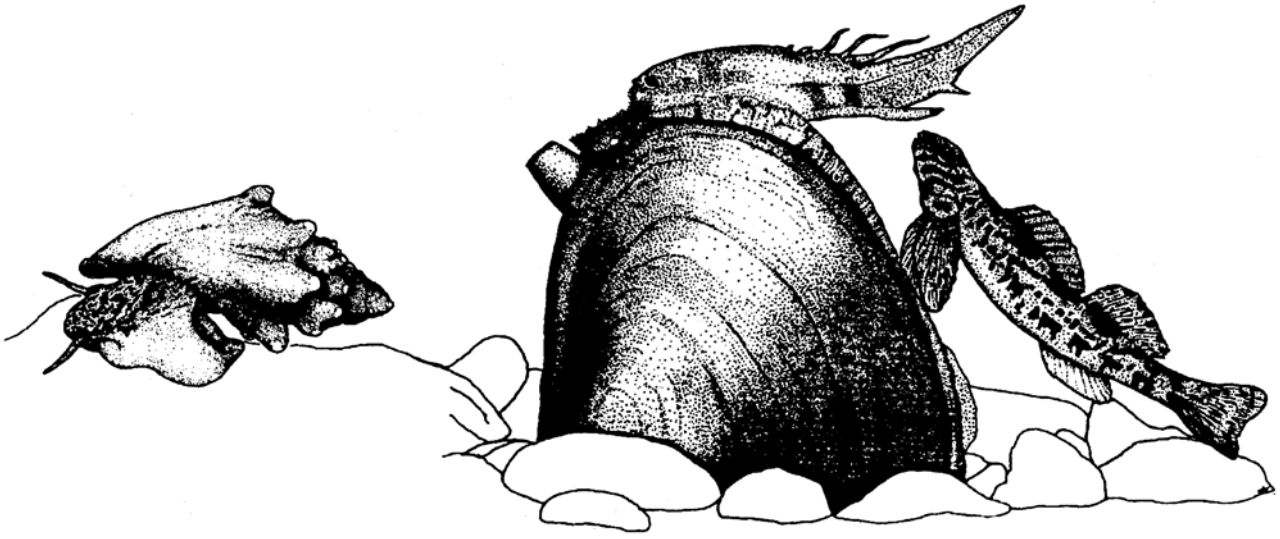
Outreach
Matthew Patterson – USFWS White Sulphur Springs Nat. Fish Hatchery, 400 E Main St., White Sulphur Springs, WV 24986
304-536-1361; matthew_patterson@fws.gov

Tom Jones – Marshall University, 110 Heather Court, Scott Depot, WV 25560
304-389-5832; jonest@marshall.edu

Propagation, Restoration, and Introduction
Tony Brady – Genoa Fish Hatchery, S 5689 State Road 35, Genoa, WI 54632
608-689-2605; tony_brady@fws.gov

Symposium Committee –2009
Catherine Gatenby – White Sulphur Springs National Fish Hatchery, 400 E Main S., White Sulphur Springs, WV 24986
303-536-1361; Catherine_Gatenby@fws.gov

Freshwater Mollusk Conservation Society



…dedicated to the advocacy and conservation science of freshwater molluscan resources