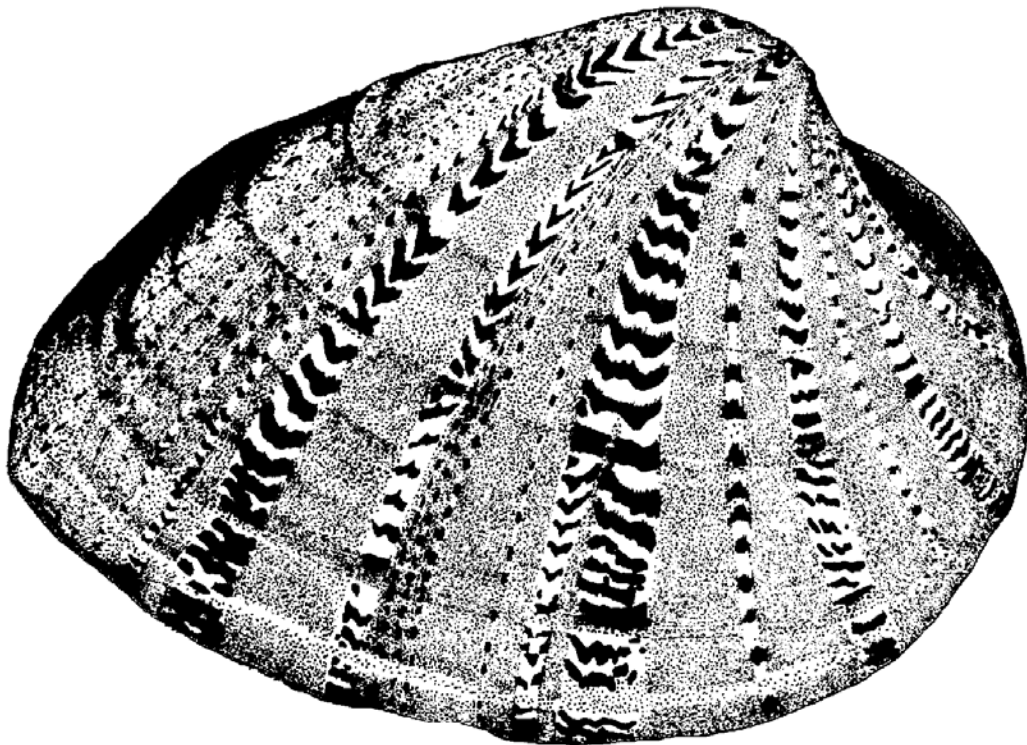


Ellipsaria

The Newsletter of the Freshwater Mollusk Conservation Society

Volume 3 - Number 3

December 2001



In this issue:

2002 Workshop Information and Registration Form

November 2001 Board Report

2002 Membership Renewal Form

***Ellipsaria* – Volume 3, Number 3 – December 2001**

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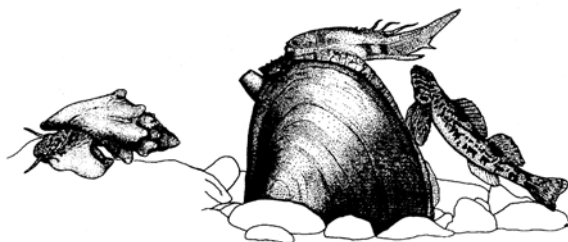
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Freshwater Mollusk Conservation Society



<http://ellipse.inhs.uiuc.edu/FMCS/>

FMCS Reports

FMCS Propagation and Restoration of Freshwater Mussels Workshop March 14-15, 2002

The FMCS Propagation and Restoration Workshop will be held March 14-15, 2002 at the National Conservation Training Center (NCTC) in Shepherdstown, West Virginia. This 2-day workshop will provide a forum and an educational opportunity for conservation professionals and others who are interested in the propagation and restoration of native mussels. Topics that will be addressed include culture methods, habitat requirements, conservation genetics, and regulatory issues. Native mussels are symbiotic with fish, and the participation of hatchery and fisheries management professionals is strongly encouraged.

Program

Thursday, March 14, 2002

- 1) Introduction and overview.
- 2) Mussel reproductive biology.
- 3) Care of adult mussels.
- 4) Handling and transforming glochidia.
- 5) Transformation *in vitro* versus use of host fish.
- 6) Culturing juveniles in recirculating systems.
- 7) Culturing juveniles in raceways.
- 8) Nutrition.
- 9) Diseases and predators.
- 10) Habitat.
- 11) Genetics issues.
- 12) Genetics methods and resources.

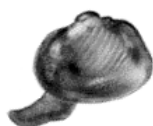
Friday, March 15, 2002

- 1) Regulatory issues.
- 2) Fish and Wildlife Service policies.
- 3) Nature Conservancy initiatives.
- 4) Reports of ongoing projects, including those at Genoa National Hatchery, Mammoth Springs National Hatchery, Warm Springs National Hatchery, White Sulphur Springs National Hatchery, and others.
- 5) Technique demonstrations.
- 6) Panel discussion.

Registration

A registration form has been included with this newsletter. Early registration is due by February 1, 2002.

For program details and additional information, visit the workshop website at <http://unionid.smsu.edu> or contact Chris Barnhart at chrisbarnhart@smsu.edu



FMCS 2002 Officer Nominations

The FMCS is seeking nominees for the position of president-elect and treasurer. The new president-elect will take office in April 2002, become president in April 2003, then serve as past-president in 2004 for a total of 3 years of service to the board. The treasurer serves for 2 years beginning in April 2002. The deadline for nominations is January 15th, 2002. Position statements will be mailed out with the ballots after nominations close. Please forward all nominations to:

Leroy Koch
U.S. Fish and Wildlife Service
3761 Georgetown Road
Frankfort, KY 40601
502.695.0468
leroy_koch@fws.gov

FMCS Membership Renewal

Please take the time to renew your annual membership. A renewal form has been included with this issue of the newsletter. Note that our treasurer has a new address:

Heidi Dunn
FMCS Treasurer
1417 Hoff Industrial Park
O'Fallon, MO 63366

636-281-1982
Hdunn@ecologicalspecialists.com

FMCS Board Meeting Minutes November 7-8, 2001 Crittenden, Kentucky

Mussel Valuation/Replacement Costs

Rob Southwick gave an overview of the valuation of freshwater mollusks proposal. The values will be used for small kills for which there currently is no restitution and will not apply to those large mussel kill events or events involving federally listed species. Rob will work with a mollusk advisory committee. AFS Special Publication No. 24 on investigation and valuation of fish kills is being updated and we would like to see the mollusk valuation as part of this document. The proposal will be submitted to the Fish and Wildlife Foundation Freshwater Mussel Conservation Fund.

Treasurers Report

\$7,045 was collected in membership dues, \$665 more than in 2000. Other income was from the Pittsburgh symposium,

generating over \$11,000 in profits. The general fund has \$10,335.16 and the earmarked fund for the 2003 symposium is \$25,524.00, which includes \$3,372 from the auction. There is \$10,859.16 in the checking account, \$25,000 in savings. Expenses were approximately \$1000 with \$889.75 in operating expenses. The board recommended increasing the symposium account to at least \$40,000 to help cover any unforeseen events. The first 2 symposiums have run between \$42,000 to \$45,000. The membership form will be revised and the society address will change to Heidi's new office address.

Committee Reports

Gastropod Status & Distribution Committee

Rob Dillon maintains a website on committee activities (<http://www.cofc.edu/~dillonr/fwgnahome.htm>). There will be a strategy session at the AMS meeting in Charleston to discuss the proposal on gastropod conservation that was submitted to NSF and a special session on freshwater gastropods. A freshwater gastropod workshop proposal was submitted to FWS for funding. If funding is received the workshop would be held in conjunction with AMS meeting in July 2002.

Guidelines & Techniques Committee

Mussel replacement cost effort is proceeding (see above) and Dave Strayer has a draft mussel sampling methods document titled "An Introduction to Mussel Sampling." FMCS may play a role in publishing the document.

Information Exchange Committee

The FMCS webpage (<http://ellipse.inhs.uiuc.edu/fmcs/>) is up and each committee chair is to submit a paragraph on the mission of their committee. Results of the symposium questionnaire on support of a society journal: 54 voted yes and 1 voted no (see complete results later in this issue). Approximately half would support a new journal and half would like to take over an existing journal. All those responding were willing to pay an additional \$20 to \$30 in membership dues. Biology and conservation biology were the main topics of interest. The majority voted for quarterly publication but this isn't possible, at least in the near future. The society has the funds to publish the first issue in 2002; but timing with *Walkerana* may push the date to 2003. Our objective is to issue 2 numbers each year.

Mussel Status & Distribution Committee

Primary activity is developing a mussel atlas for North America. Received \$30,000 from U.S. Forest Service to produce accounts for 16 taxa in the Shawnee National Forest in Illinois. Guidelines for species accounts will be posted on the webpage.

Outreach Committee

Main focus is on developing an aquatic biodiversity teaching guide. The packet will be made available to anyone interested in this guide. Finalizing the society poster was discussed at

the last meeting. The committee sees their mission as being a conduit for information exchange.

Propagation and Restoration Committee

Website is up for pre-registration for the March 14-15, 2002 workshop at NCTC. Sixty people have pre-registered as planning to attend and it is anticipated that more than 100 will attend. The committee is still pursuing sponsors.

Symposium Committee

2001 Symposium

Only 44 people returned the symposium survey from the Pittsburgh meeting. The auction and social ranked high and most were satisfied with the contributed sessions. The papers and interacting with colleagues ranked highest.

2003 Symposium

The symposium will be in Raleigh, NC at the Sheraton Imperial March 16-19, 2003. Rooms are \$90 for both single and double rooms. Shuttles are provided to and from the airport. The theme for the symposium is centered on habitat and John Alderman is soliciting ideas for a catchy title.

Water Quality, Habitat, & Zebra Mussel Committee

Greg Cope is working on the zebra mussel protocol for the FWS. The document will be a review of existing documents. Schedule is for a December draft to be sent to those in the committee that volunteered to review and comment. The deadline is September 2002.

Nominations Committee

Leroy Koch has been handling nominations and will select another member to serve with him on the committee. Nominees are needed for president elect and treasurer. All nominations are to be sent to Leroy. There will be a separate ballot mailing.

Award Committee

FMCS currently has two awards, the Lifetime Achievement award and the Clench award. Greg Cope is heading up the effort to develop a student travel award that will be paid out of the auction fund. The board decided to have 2 student travel award recipients at each symposium. This committee will deal with all travel grant issues. FMCS has previously covered travel costs for invited speakers out of the symposium budget. To cover foreign travel costs the recipient would be required to present a paper and costs will be covered from the symposium account.

Memberships

If a member pays before November 1, he/she will be a member for the current calendar year and will receive back issues of *Ellipsaria* for that year. If a member pays after November 1, membership will be for the following year.

Long-term Financial Plan

The board will consider placing a percentage of the profits each year into a conservative fund; there are several

environmental friendly funds that often outperform the S&P 500. Paul Johnson will evaluate different financial plans and report to the board in March.

Other Business

Spending by the President

The board decided to have a line item in the FMCS budget for discretionary spending by the society president with an initial limit of \$1,000.

Logo

The board has received several emails from members on the complexity of the design and that it is not ecologically correct. The board is soliciting ideas from the members for a new logo.

FMCS Liaison with AMS and NSA

A freshwater mussel special session at the upcoming NSA meeting in Mystic, Connecticut is being organized. FMCS, AMS and NSA all have a common interest in mollusks that warrants better interaction and support for the efforts of each group, especially in outreach and advocacy issues. Catherine Gatenby has been serving as the FMCS liaison with NSA and Rob Dillon is our liaison with AMS. Dick Neves will contact NABS to see if they are interested in a similar relationship.

Liability Insurance

The bylaws state that officers are insulated from liability, however, the society assets are not covered. As FMCS becomes more involved in advocacy this may become an issue. Some hotels often want to see liability insurance prior to allowing an organization to book meetings. AIBS recommended an insurance company that is based in Washington, DC and Paul Johnson is in the process of getting a premium quote to decide whether the society will purchase coverage.

New Business

There are currently 18 student members in FMCS. Dick Neves will contact faculty members to have them encourage their students to join the society.

Fish/Mollusk Coordinator Position

The Fish and Wildlife Service Region 4 currently has not determined whether this position will be maintained. Paul Johnson has drafted a letter from the society stating the continuing need for the position and that it remain in a field office for better coordination of conservation and research activities. The letter will also emphasize how this position has been successful in facilitating fish and mollusk recovery efforts and similar positions are needed at the ecosystem level in other regions. Paul will finalize the draft that board members will review prior to submitting to the regional director.

Black Carp

The FWS was petitioned to list the black carp as an injurious species. The FWS has a recommendation on the listing but is

waiting until the new director is briefed before releasing their response.

The next FMCS board meeting will be in March 2002 in conjunction with the Propagation and Restoration Workshop at the National Conservation Training Center (NCTC) in Shepherdstown, West Virginia.

Submitted by Rita Villella, Secretary

FMCS Logo Pogo

It has been expressed to the board that the "logo" of the FMCS is not biologically correct and there has been some interest in changing it. The current logo is an outstanding drawing but it isn't really a logo per se. So we are soliciting ideas for a new logo. It doesn't have to be a finished product but rather a blueprint. It is likely that we will job out the final product to make it look professional. We start the wheels grinding and see what you can come up with. The logo should try and incorporate the major groups of freshwater mollusks (fingernail calms, snails, mussels). Send all new logo idea submissions to Kevin Cummings, INHS, 607 E. Peabody Dr., Champaign, IL 61820 or ksc@inhs.uiuc.edu

Results of the FMCS Journal Questionnaire

55 people returned the questionnaire at the Pittsburgh symposium:

1. Should the FMCS adopt a journal?
Yes – 54 No – 1
2. Should we found a new journal or consider taking over/merging with an existing journal?
New – 22 Existing – 23 No Opinion – 7
3. How often should the journal be published, at least initially?
Annually – 13 Biannually – 14
Quarterly – 24 Bimonthly – 0
4. What level of increased dues would you be willing to pay to cover a subscription for 2 or 3 issues?
\$20 – 22 \$30 – 24 \$40 – 8
5. Should authors pay for page charges?
Yes – 16 No – 12 Case by case basis – 25
6. Would be willing to pay more than \$30 in subscription dues to offset page charges?
Yes – 26 No – 26
7. Would you be willing to submit your own manuscripts to an FMCS journal?
Yes – 46 No – 2

8. What topics would you most like covered in an FMCS journal?
- | | |
|------------------|----------------------------|
| Biology – 34 | Systematics – 17 |
| Surveys – 14 | Methods – 12 |
| Physiology – 6 | Conservation – 24 |
| Ecology – 27 | Historical – 4 |
| Bibliography – 2 | Environmental Impacts – 15 |
| Habitat – 23 | Restoration – 11 |
| Species Keys – 9 | Toxicology – 3 |
9. Should the journal focus solely on North American fauna?
Yes – 18 No – 31
10. Should the journal also accept manuscripts about terrestrial mollusks?
Yes – 29 No – 22
11. Should the journal include studies on the affects of introduced species on native mollusks?
Yes – 50 No – 3

Other Miscellaneous Comments:

- Publishing a society journal is an important part of moving this field of study and the FMCS forward.
- A new journal is definitely needed. The price should be low to begin. Page charges should be subsidized for foreign biologists.
- I think there is a definite niche for a rigorous mollusk journal. Most mollusk journals have had limited credibility in the scientific community. We need a journal on par with JNABS or Conservation Biology.
- An FMCS journal would provide an excellent alternative to the AMS bulletin which comes out irregularly at best.
- Page charges force authors to be succinct or poor.
- Page charges should cover the costs of the journal.
- I hope there would be a reduced subscription price for students.
- More on outreach programs (teacher workshops etc.).
- More on education with zoo and aquarium participation.
- Dr. Burch has made the society a generous offer. As a new society, lets go for Walkerana.
- Include a statistical editor on the editorial board. I'd be happy to volunteer – Jay Levine.
- Journal title: Rocks With Guts

FMCS Committee Reports

Most of the committees gave reports at the November board meeting. Please see the minutes for their reports.

Guidelines & Techniques Committee Report Commercial

Robb Southwick from Southwick and Associates will give a presentation to the FMCS board during our November

meeting on how to evaluate the cost of mussels in the event of a mussel kill. This will give board members a chance to provide comments or insights into this process. Southwick and Associates have done fish values for the American Fisheries Society and are currently in the process of re-doing fish values for AFS. The AFS would like this to be all in one document (both fish and mussels) and have waived their fee. We are in need of funding for this project (\$43,500) in order to accomplish this and Beth Whetsell (Illinois Department of Natural Resources) may have \$20,000, settlement from a pollution incident, to apply to this. The Mussel Mitigation Trust Fund (Wayne Davis) is willing to help pay for this and FMCS will also contribute. We need approximately \$8,000 to establish mussel values.
Submitted by Steve Ahlstedt

Outreach Committee Report

The main focus of Outreach for the past few months has been the development of an aquatic biodiversity teaching guide. Committee members produced a bound "teachers guide" to be used as a reference by educators for teaching aquatic biodiversity. The product includes brief sections on river ecosystems, mussels, non-game fishes, crayfish, snails, endangered species and reference resources.

It was the intention of Outreach to distribute this to workshop participants at the NAAEE (North American Association of Environmental Educators) conference this October in Little Rock, AR as a supplement to a day afield experiencing aquatic diversity first hand. Unfortunately, low workshop registration canceled FMCS involvement. *However, the package is an excellent tool and can be made available to anyone who wants or needs a resource for introducing the lay public to the breadth of diversity found in the waters of a typical healthy stream.* The Outreach Committee has yet to "polish" the final edition but all sections are completed and can be a one-stop-shopping source of information for anyone interested. For more information contact Janet Butler (janet_butler@fws.gov) or Kurt Welke (welkek@dnr.state.wi.us - see back inside cover for complete address).

Other Outreach items identified at the Pittsburgh meeting include:

1. Finalizing the Society's' poster for use at professional meetings such as AFS, NALMS, etc.
2. Developing an issues brief for use by the sportsmen's caucus of the House and Senate to elevate mussel issues.

Outreach also sees itself as a conduit for information exchange and may collate information that society members identify as necessary. An example may be a directory of mussel related databases for distribution in the near future.

Our charge is to serve!

Submitted by Kurt Welke & Janet Butler, Co-chairs

Water Quality, Habitat, and Zebra Mussel Committee Report

Greg Cope, the WQ/H/ZM committee co-chair, has been actively working on a protocol/procedure for assuring that unionids do not become vectors for zebra mussels during relocation efforts to other habitats or into hatcheries. This protocol was requested by, and is being funded by, the U.S. the Fish and Wildlife Service. A number of agencies and organizations have previously developed similar protocols. Greg is reviewing existing documents on the topic as well as contacting people to request similar information. A single document that reflects the current understanding of zebra mussel and unionid biology will be drafted. The schedule is to have a draft by December 2001, which will be sent out for review to the WQ/H/ZM committee members who previously volunteered to assist. A final draft will be available for the membership and board to comment on at the March 2002 symposium. Publication and distribution should be finished by September 30, 2002 to correspond with the end of the federal fiscal year.

If anyone has information that will be useful for this protocol please contact Greg Cope or myself:

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

W. Gregory Cope, Ph.D.
Aquatic Toxicologist and Leader
Department Extension Department of Environmental and
Molecular Toxicology
North Carolina State University
Box 7633
Raleigh, NC 27695-7633
greg_cope@ncsu.edu

Submitted by Robert Anderson & Greg Cope, Co-chairs

Announcements

The American Malacological Society 68th Annual Meeting Charleston, South Carolina August 3 – 7, 2002

The 2002 American Malacological Society meeting will be held at the College of Charleston's Lightsey Conference Center in historic Charleston, SC. The city is America's most beautifully preserved architectural treasure, featuring historic homes, restaurants, shops, museums, and tours. The Lightsey

Center is a modern facility with a complete range of conference services.

Symposium: The Biology and Conservation of Freshwater Gastropods. The North American fauna includes about 500 nominal species of freshwater gastropods. The taxonomy of many groups predates the modern synthesis, and great confusion exists regarding the specific identity of even the most common populations. As a consequence, large regions of the continent have never been adequately surveyed, and fundamental aspects of the ecology of many freshwater gastropod groups remain obscure. In the absence of a recommitment to basic research on the biology of freshwater gastropods, a critical element of our biota is in danger of slipping away. Organizer: Rob Dillon.



Special sessions include "Mollusk Phylogeny: Reconciling different data sources" and several in the planning stages. In addition, there will be general sessions for contributed papers on a wide variety of topics, in both oral and poster format. Several awards for student presentations will be given.

Housing will be available at modest cost in dormitory facilities at the College of Charleston. Lodging is also available at the Westin Francis Marion Hotel (adjacent to the Lightsey Center).

A variety of special activities is planned, including evening programs, an expanded endowment auction, and a dinner cruise on Charleston Harbor. Field trips will be available for every taste, featuring historic tours, a fossil trip, and a boat trip to pristine Bull Island.

For further information contact:
Robert T. Dillon, Jr., AMS President
Department of Biology
College of Charleston
Charleston, SC 29424
DillonR@cofc.edu
<http://www.cofc.edu/~dillonr/AMS2002.htm>

National Shellfisheries Association Annual Meeting
Mystic, Connecticut, USA
April 14 – 18, 2002
Call for Papers

A special session on the Biology and Conservation of Freshwater Mussels will be held at the annual meeting of the National Shellfisheries Association (NSA) in Mystic, Connecticut, USA, April 14-18, 2002. This special freshwater session will cover applied and basic research on the biology of freshwater mussels. In addition, talks on state and federal management programs which are directed at the conservation and preservation of dwindling mussel populations also will be presented. All freshwater mussel biologists and conservation managers are encouraged to attend and present their research and management programs.

Not since 1997 at Fort Walton Beach, Florida have freshwater mussel biologists met with marine shellfish biologists and conservation managers. The goal once again of this session is to bring biologists from freshwater and marine disciplines together in order to better understand suspension-feeding bivalves, and develop better aquatic resource management programs. This session presents a unique opportunity for those interested in the biology, culture and propagation, and ecological function of freshwater mussels to meet and exchange ideas with leaders in bivalve physiology, aquaculture, and aquatic resource management. Several sessions on the biology and culture of other bivalves, as well as bivalve habitat suitability and the role of bivalves in the ecosystem are planned which should be highly informative to freshwater mussel biologists. Please visit the NSA web-site (www.shellfish.org) for information on other sessions occurring at this meeting.

Program Chair Dr. Carolyn Friedman has announced the **CALL FOR PAPERS** for the Mystic meeting (<http://www.shellfish.org/call2002.htm>). **Invited speakers should send their abstracts and abstract fees (\$25 US) BY DECEMBER 8th to Dr. Catherine Gatenby**, Patrick Center for Environmental Research, Academy of Natural Sciences, 1900 Ben Franklin Parkway, Philadelphia, PA 19103 by December 4, 2002. Electronic submission of invited papers is acceptable.

For those interested in contributing a paper to this special session, please send in an abstract and abstract fee (\$25 US) by **December 17, 2001** to:

Dr. Carolyn Friedman
School of Aquatic and Fishery Sciences
University of Washington
PO Box 355020
Seattle, WA 98195 USA

Please note that students are extremely welcome and encouraged to attend this meeting. A number of scholarships

are available to defray travel costs and registration costs. For more information on the meeting, other sessions, student endowment funds, and instructions for submitting abstracts please visit the following web-site: www.shellfish.org. For local arrangements, contact Evan Ward at 860-405-9073 (jeward@uconnvm.uconn.edu). Other questions regarding the freshwater mussel session please contact Catherine Gatenby (gatenby@acnatsci.org).

Submitted by Catherine Gatenby

***Ellipsaria* Submissions**

Submissions for the March issue of *Ellipsaria* can be sent in at any time. The tentative due date for the Spring issue is March 8, 2002. FMCS board and committee reports are due immediately following the Propagation and Restoration Workshop.

Anyone may submit an article but you must be a member of the FMCS to receive *Ellipsaria*. Categories for contributions include society reports, news, announcements (publications, meetings, job postings), contributed articles (including abstracts, ongoing work), etc. Electronic submissions are preferred; please send submissions to Chris Mayer at cmayer@inhs.uiuc.edu (see inside front cover for 'snail mail' address).

Jobs

Iowa State University Graduate Research Assistantship: Landscape Ecology of Mississippi River Mussels

Overview:

The Department of Animal Ecology at Iowa State University has an opening for a Ph.D. student in a project examining the relationship between freshwater mussel populations and the Mississippi River landscape. The project is co-sponsored by Iowa State University and the USGS Upper Midwest Environmental Sciences Center. The position could begin as early as January 2002.

Research Project:

This study will use a landscape-level approach to assess whether the spatial distribution of mussels is related to the spatial distribution of their obligate fish hosts and hydraulic forces that influence the location of mussel beds.

Our goal is to examine the relationships between selected hydraulic and biological features and the distribution of unionid mussels at several spatial scales in the Upper Mississippi River basin (UMR). Our specific objectives are to:

- I. Determine the degree of spatial overlap between the distribution of unionids and their host fishes.
- II. Determine the degree of spatial overlap between the distribution of unionids and hydraulic features.
- III. Compare the degrees of overlap between unionid distributions and the two predictor variables (host fishes and hydraulics) at several spatial scales to evaluate how the scale of analysis influences our ability to predict the spatial distribution of mussels.

Advisors:

The project will be co-supervised by:
 John A. Downing, Department of Animal Ecology, Iowa State University, Ames, IA, and
 Teresa (Naimo) Newton, U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI

Desired Qualifications:

- Strong training in ecology, biology, limnology, landscape analysis or related field;
- Demonstrated ability in quantitative methods such as GIS, mathematics, or statistics;
- Knowledge of or desire to learn about freshwater mussels;
- Academic standing concomitant with a demanding graduate career.

Application Information:

Send letter of interest, resume, GRE scores, and contact information for three references to:

John A. Downing,
 Department of Animal Ecology
 Iowa State University
 124 Science II
 Ames, IA 50011-3221

Or send as e-mail attachments to: downing@iastate.edu
 Information on applying to Iowa State University can be found at <http://www.grad-college.iastate.edu/>
Submitted by John Downing

Publications

New Publications

Chen, L. Y., A. G. Heath, and R. J. Neves. 2001. Comparison of oxygen consumption in freshwater mussels (Unionidae) from different habitats during declining dissolved oxygen concentration. *Hydrobiologia* 450: 209-214.

Henley, W. F., and R. J. Neves. 2001. Behavioral responses of glochidia of freshwater mussels (Bivalvia: Unionidae) to chemical cues of fish. *American Malacological Bulletin* 16(1/2):131-135.

Jones, J. W., R. J. Neves, M. A. Patterson, C. R. Good, and A. DiVittorio. 2001. A status survey of freshwater mussel populations in the upper Clinch River, Tazewell County, Virginia. *Banisteria* 17: 20-30.

Li-Yen Chen, A. G. Heath, and R. J. Neves. 2001. An evaluation of air and water transport of freshwater mussels (Bivalvia: Unionidae). *American Malacological Bulletin* 16(1/2): 147-154.
Submitted by Dick Neves

Roe, K. J., P. D. Hartfield, and C. Lydeard. 2001. Phylogeographic analysis of the threatened and endangered superconglutinate-producing mussels of the genus *Lampsilis* (Bivalvia: Unionidae). *Molecular Ecology* 10: 2225-2234.
Submitted by Kevin J. Roe

Contributed Articles

Duck River Mussel Survey

Steve Ahlstedt
 U. S. Geological Survey, Knoxville, TN 37921
ahlstedt@usgs.gov

A three-year study of the mollusks of the Duck River was started this summer by the USGS and Southeast Aquatic Research Institute (Paul Johnson) under contract to The Nature Conservancy and Tennessee Wildlife Resources Agency. The study is centered between Normandy Dam and old Columbia Dam (120 miles) including tributary streams. Forty-one mussel species and at least 15 species of snails have been documented. Mussel reproduction/recruitment is tremendous with many small individuals found including three federally listed species (*E. capsaeformis*, *L. rimosus*, and *Q. intermedia*). Minimum flows and oxygen re-aeration over the last 10 years from TVA's Normandy Dam have had a major positive impact on mollusk populations in the river.

Green River Mussel Blitz

Bob Butler
 U.S. Fish & Wildlife Service
 160 Zillicoa Street, Asheville NC 28801
bob_butler@fws.gov

During the week of August 27-31, 2001, biologists from several Federal and State agencies and academia converged upon the Green River, in west-central Kentucky, to participate in a "mussel blitz." A blitz is a concerted effort by numerous biologists to intensively sample a few select under-sampled sites in a stream particularly for rare mussels. The U.S. Fish

and Wildlife Service's (Service) Asheville Field Office secured regional funding to cover travel for blitz participants.

Fourteen representatives from the Service, U.S. Geological Survey, U.S. Environmental Protection Agency, Kentucky State Nature Preserves Commission, Tennessee Wildlife Resources Agency, Alabama Division of Wildlife and Freshwater Fisheries, and Western Kentucky University participated in the blitz. Unusually heavy rains made river conditions marginal for sampling and had by midweek deteriorated to zero visibility. Nonetheless, results were promising. Sampling at 6 main stem Green sites and 4 sites in its largest tributary, the Barren River, a total of 41 species were sampled, 35 as live or fresh dead. Overall, 71 species are known from the Green River system. Encouragingly, we found evidence of recent recruitment for 22 species, or nearly two-thirds of the extant fauna.

Three federally endangered species (rough pigtoe, *Pleurobema plenum*; fanshell, *Cyprogenia stegaria*; and pink mucket, *Lampsilis abrupta*) were found live, while relics of two endangered species (clubshell, *Pleurobema clava*; and ringpink, *Obovaria retusa*), were sampled. The Green represents the last known ringpink population, possibly the best remaining rough pigtoe and fanshell populations, and the only verified population of clubshell remaining south of the Ohio.



Winged mapleleaf once enjoyed a greater range in the St. Croix River

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At one time the federally endangered winged mapleleaf inhabited at least 34 river systems in 12 states (USFWS 1997). *Quadrula fragosa* (Conrad 1835) is now thought to occur in select reaches of St. Croix River, Wisconsin, Kiamachi River, Oklahoma, and Bourbeuse River, Missouri. One of the last known reproducing populations occurs in the St. Croix River where the river forms the border between Minnesota and Wisconsin. Until very recently winged mapleleaf were thought to occur only downstream of the St. Croix Falls dam. Doolittle (1988) and others conducted a mussel survey of the St. Croix and Namekagon rivers and found that *Q. fragosa* occupies a relatively small reach of the lower river. Recent evidence suggests the range of winged mapleleaf may extend upstream of the dam (Hove *et al.* 1999).

This summer we surveyed select sites to better describe the historic and current range of winged mapleleaf in the St. Croix River. A total of 85 sites were surveyed above and below the St. Croix Falls dam. We collected empty winged mapleleaf valves at eleven locations spread throughout the surveyed reach and one live winged mapleleaf 9.6 km downstream of the previously thought downstream edge of its range. Live winged mapleleaf appear to be very rare in the lower half of its range in the St. Croix River. As mentioned in Hove *et al.* (2001) we found two winged mapleleaf valves upstream of the dam at St. Croix Falls which is a barrier to fish migration. Next summer additional survey work will be conducted in a central reach of the St. Croix River to determine if this species used to or still occurs this far upstream.

We thank Jill Medland, Bob Whaley, and Randy Ferrin and the National Park Service who provided administrative, logistic, and financial support for this project.

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- Hove, M. C., D. C. Allen, R. S. Derhak, K. M. Swenson, J. E. Thomas, and D. J. Hornbach. 2001. Second collection of winged mapleleaf valves from the upper St. Croix River. *Ellipsaria* 3(2): 11-12.
- U.S. Fish and Wildlife Service. 1997. Winged mapleleaf mussel (*Quadrula fragosa*) recovery plan. Fort Snelling, Minnesota. 69 pp.

Summary of Ongoing Research: Assessment of Effects of Road Crossings and Road Runoff on Freshwater Mussels in North Carolina Streams

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Funded by the North Carolina Department of Transportation and North Carolina State University's Center for Transportation and the Environment, NCSU is conducting a study to assess the impacts of road crossings and road runoff on freshwater mussels. The first component of the project focuses on attributes of road crossing structures, adjacent land uses and their potential effects on mussel distribution, abundance and diversity. We surveyed mussel populations at 44 sites in the upper Neuse River basin encompassing the 300-meter reaches upstream and downstream of road crossings. Mussel data collected included, species, length, sex, gravidity, and distance from bridge (25-m increments). We are also using GIS, macroinvertebrate samples, and water chemistry data to aid analysis.

The second component focuses on identifying contaminants in road runoff and assessing their effects on freshwater mussels at 20 sites of the original 44 sites. Semipermeable Membrane Devices were deployed and sediment samples were collected at each site to be analyzed for a suite of PCBs, pesticides, petroleum products and heavy metals. In addition to conducting surveys, we collected 15 *Elliptio complanata* from both upstream and downstream of the road crossing and collected mussel tissues for a variety of analyses. Hemolymph was drawn to be used as a measure of organ function and individual health. Foot tissue was collected for stable isotope analysis to provide an indication of runoff source and petroleum exposure. Finally, we sacrificed 8 of the 15 mussels for organ histology evaluation and contaminant analysis. This research will provide natural resource managers and transportation officials with information needed to better manage and conserve remaining freshwater mussel fauna.

Are Basommatophoran Snails of American Origin Replacing Local Species in Israel and Palestine?

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The freshwater, basommatophoran mollusc fauna of Israel and Palestine is under constant threat not only from urban, agricultural and industrial pollution, but also from an increasing shortage of perennial streams and temporary waters. This has led to the extinction the snails *Acroloxus lacustris* (Linnaeus, 1758) and *Biomphalaria alexandrina* (Ehrenberg, 1831) during the second part of the 20th century. Several other species such as *Radix auricularia auricularia* (Linnaeus, 1758), *Radix peregra tenera* (Mousson, 1861) and *Stagnicola palustris* (Müller, 1774) are threatened with extinction.

Further, the international trade in aquarium and pond plants has led to the introduction of the exotic snails *Physella acuta* (Draparnaud, 1805), *Physella ancillaria* (Say, 1825), *Physella heterostropha* (Say, 1817), *Planorbella duryi* (Wetherby, 1879) and *Pseudosuccinea columella* (Say, 1817) from North America and *Radix rubiginosa* (Michelin, 1831) and *Radix viridis* (Quoy & Gaimard, 1832) from S.E.-Asia. Some of these are rapidly becoming the dominant species in the few remaining water bodies still suitable for molluscan life. The following case histories suggest the magnitude of these biological invasions.

Physella acuta is now the most common species in slow flowing streams, lakes, swamps, and even temporary rainpools throughout Israel and Palestine. It can withstand considerable pollution and is one of the few species inhabiting extremely polluted rivers like the Yarqon, Alexander, Hadera, and Qishon. In the Qishon river it occurs with *Physa heterostropha*, a relatively recent arrival in Israel.

Pseudosuccinea columella has become the dominant species in the "clean" upper part of the Yarqon River and in the Hula Agmon (a swampy area recently created in the drained Hula swamps). *Pseudosuccinea* reached both areas by means of the transplant of infected Yellow pond lilies *Nuphar lutea* from the Botanical Gardens of the Tel Aviv University.

Planorbella duryi is becoming more abundant not only in perennial pools (e.g. the Solomon Pools west of Artas and Nizzanim), ponds of public gardens (e.g. Rishon le Ziyon and Tel Aviv), and many agricultural settlements, but also in springs (e.g. 'Ein Duyuk near Jericho) and even in the Sea of Galilee.

These North American species have adapted quickly to the degraded ecological conditions in Israel and Palestine and outnumber the local species wherever they occur. In addition, it is common for local aquaria to dump surplus snails in the few remaining aquatic biotopes that are suitable for animal life. Those waters still support fair numbers of aquatic snails, but in our opinion local species seem to show a slow-but-steady drop in numbers of individuals. These observations suggest that, if this situation continues, the basommatophoran mollusc fauna of Israel and Palestine will eventually be dominated by American species.

Ferrissia in Europe: One or More Species?

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In the second half of the 20th Century freshwater limpets belonging to the genus *Ferrissia* Walker, 1903 turned up all over Europe. Various names were used to indicate those limpets until Mirolli described it in 1960 as a new species: *Ferrissia wautieri*. Instantly all previous identifications were altered into *wautieri*, until it was recognized that *Ferrissia clessiniana* (Jickeli, 1882), originally described from the Nile in Egypt, was an older name for the same taxon. The latter name is now accepted in the CLECOM-list (Falkner, Bank & von Proschwitz, 2001).

Although the genus *Ferrissia* was present in the Pleistocene in Europe, the recent species is obviously a recent introduction. It behaves like an invasive species: it rapidly builds up enormous populations, then often disappears the following year.

Its rapid expansion throughout Europe is probably enhanced by the ability to disperse itself through the air (i.e. like other limpets it is known to hitchhike from one place to another on the elytra of water beetles). However, in my opinion we can not rule out the possibility that man plays an important role in its rapid expansion. *Ferrissia* is often found adhered to the underside of the leaves of water lilies (*Nymphaea* and *Nuphar*). Because of their beautiful flowers, lilies are often planted in ponds, pools, lakes, ditches, and canals. Most of these waterlilies are bought in so-called garden centres and are often imported from other continents. I have encountered *Ferrissia* on *Nymphaea* several times in garden centres in the Netherlands and I am convinced that more than one species is currently hiding under the name *Ferrissia clessiniana* (= *wautieri*) in Europe. This may also explain the large variability in shell morphology in European specimens. An interesting subject for a student of freshwater snails in Europe.

Cited literature

Falkner, G., Bank, R.A., and Proschwitz, T. von, 2001. Checklist of the non-marine molluscan species-group taxa of the

States of Northern, Atlantic and Central Europe (CLECOM I). *Heldia*, 4 (1-2): 1-76.

2000 and 2001 St. Croix River Research Rendezvous Abstracts

The following abstracts were selected from presentations made at the 12th and 13th annual meetings of the St. Croix River Research Rendezvous. The meetings were held on October 17, 2000 and October 16, 2001 respectively at Marine on the St. Croix, Minnesota and sponsored by the Saint Croix Watershed Research Station. The next Rendezvous meeting will take place on October 15, 2002 at the same location. In time all abstracts presented at the meeting will be available on the Saint Croix Watershed Research Station's web site (<http://www.smm.org/SCWRS/Rendezvous.html>).

Submitted by Mark Hove, Macalester College,
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2000 Abstracts

ONGOING AND PLANNED TRACE ELEMENT STUDIES IN THE ST. CROIX RIVER BASIN, 2000-2003

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Diffuse and point sources of trace element contaminants may be adversely affecting the aquatic ecosystems of the St. Croix River Basin. Other studies have found that in mussels from the St. Croix River Basin mussel growth rates were inversely correlated with mussel-shell concentrations of several trace elements; the highest trace-element levels were typically in the downstream reaches of the St. Croix River, where human disturbance is the greatest¹. There are also fish-consumption advisories in the basin due to high mercury concentrations in game fish. We seek to better define the occurrence, variability, and natural and human factors that govern trace element concentrations in the Basin.

During the summer of 2000, we collected stream-bottom sediments from 30 tributary and mainstem sites in the St. Croix River Basin. Sites were selected upstream of and downstream of the larger cities in the basin, so that the effect of urban runoff on trace element levels could be studied. Analysis of these sediments will commence during the fall of 2000 for a suite of 40 elements by inductively coupled plasma spectroscopy; arsenic, mercury, and selenium by atomic absorption spectroscopy; and carbon (total and carbonate).

Included in the analyses are elements that may be governed entirely by composition of geologic source material (such as aluminum and titanium), and elements for which atmospheric deposition from diffuse sources may be the dominant source (such as lead and mercury).

Also in the summer of 2000, we sampled selected sites to investigate total mercury and methylmercury concentrations and loads and their potential relation to land use/land cover, and other basin attributes. We sampled 10 small streams (indicator sites; drainage areas ranged from 264-448 km²), which span a large range in land use/land cover (percentage of basin area noted in parentheses): wetlands (0-26%); forest (4.6-78%); agriculture (1.8-92%). Two more rounds of sampling are planned at these sites, during the summer of 2001.

¹Troelstrup, N.H., Jr., and Foley, J.L., 1993, Examination of mussel growth and shell chemistry as indicators of water quality within the Lower St. Croix National Scenic Riverway: Minnesota-Wisconsin Boundary Area Commission B.5.

EFFECTS OF SEDIMENTARY AMMONIA ON JUVENILE UNIONID MUSSELS IN THE ST. CROIX NATIONAL SCENIC RIVERWAY

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The St. Croix River basin is experiencing rapid land-use changes, from forest and agriculture to suburbanization, as the metropolitan area of Minneapolis-St. Paul expands. One result of urbanization may be an elevation of ammonia in sediment porewater. The St. Croix contains an extremely rich fauna of unionid mussels--animals sensitive to changes in habitat quality--and increased sedimentary ammonia poses a significant threat to this fauna. We have initiated a combination of laboratory and field studies to examine the effects of sedimentary ammonia on juvenile unionids. Through field studies, our objective is to characterize the existing concentrations of sedimentary ammonia to determine what effects, if any, these concentrations are having on survival or growth of juveniles. Through laboratory studies, we will determine the lowest concentrations of sedimentary ammonia that adversely affect the survival and growth of juveniles. The difference between the existing and lowest effects concentrations can be used by the National Park Service and other resource agencies to help guide future monitoring of ammonia in the Basin. We conducted a 10-day *in situ* toxicity test with *Lampsilis cardium* at 12 sites in the St. Croix River, including 2 tributaries (Sunrise and Snake rivers). The sites were chosen based on sedimentary ammonia concentrations at 28 sites during sampling in August 1999. At

each site, we placed 5 chambers, each containing 15 juveniles; 2 chambers were placed in the water column and 3 were buried in the sediment. We recovered all 60 chambers, however, survival was highly variable and ranged from 0% to 73% in the sediment chambers and 33% to 87% in the water column chambers. We hypothesize that the low survival in the sediment chambers was a result of anoxic conditions in the sediments. Furthermore, the placement of the chambers in the sediment may have prevented the juvenile mussels from burrowing to areas with sufficient dissolved oxygen. In the laboratory, we conducted a 96-hour toxicity test with *L. cardium* exposed to sedimentary ammonia concentrations ranging from 0 to 1000 ug NH₃/L. Survival averaged 78% in the controls and the nominal 96-hr LC₅₀ was 233 ug NH₃/L. Future laboratory tests will include tests of longer duration and lower ammonia concentrations to better bracket existing concentrations in the River. Both studies will continue through September 2001 with additional species and a variety of test durations.

Suggested Reading:

Frazier, B.E., T.J. Naimo, and M.B. Sandheinrich. 1996. Temporal and vertical distribution of total ammonia nitrogen and un-ionized ammonia nitrogen in sediment pore water from the upper Mississippi River. *Environmental Toxicology and Chemistry* 15:92-99.

Warren, L.W., S.J. Klaine, and M.T. Finley. 1995. Development of a field bioassay with juvenile mussels. *Journal of the North American Benthological Society* 14:341-346.

LONG-TERM DYNAMICS OF MUSSEL POPULATIONS IN THE ST. CROIX RIVER

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In the summer of 2000 we quantitatively assessed 4 mussel communities in the St. Croix River downstream of St. Croix Falls. We had sampled these populations at least once before: 1992 at Bayport, 1993 at Osceola, 1995 at Lakeland and 1992, 1995 and 1998 at Interstate Park. Population density was greatest at Interstate Park (average 29-39 mussels/m²), followed by Lakeland (14-18 mussels/m²), Bayport (5-10 mussels/m²) and Osceola (7-9 mussels/m²). Twenty-eight species of mussels were found at Interstate Park, with 25, 24 and 16 species at Lakeland, Osceola and Bayport, respectively. The endangered *Lampsilis higginsii* was found at all locations except Bayport and the endangered *Quadrula fragosa* was found at Interstate Park. The Lakeland location had the highest species diversity (H'=2.0) followed by Osceola (H'=1.88), Interstate Park (H'= 1.87) and Bayport

($H'=1.44$). Lakeland had 5 dominant species while Bayport and Osceola had 2 dominant species and Interstate Park only had 1 dominant species. Zebra mussels were found at Lakeland in 2000.

At all 4 locations mussel density was lower in 2000 compared to earlier periods. The most dramatic decline, 51% was at Bayport; other populations had declines of 22-26%. None of the changes were statistically significant. However, juvenile mussel density (mussels < 30mm), at all locations except Osceola showed a significant decline over the period. Two possible reasons for the decline in juvenile density could be high juvenile mortality, or lack of recruitment. Shell-length frequency diagrams for dominant species show a general lack of recruitment during this time period. Since mussels require approximately 6 years to mature, long periods of low recruitment may be possible.

An increase in fine sediments was noted at all locations. Previous studies found neither increased sedimentation nor lack or recruitment above the dam at St. Croix Falls. This suggests that increased sedimentation below the dam may be influencing mussel recruitment or juvenile mussel survival.

NATIVE FRESHWATER MUSSELS OF THE UPPER MISSISSIPPI RIVER SYSTEM: HOW DOES THE ST. CROIX RIVER FIT IN THE PICTURE?

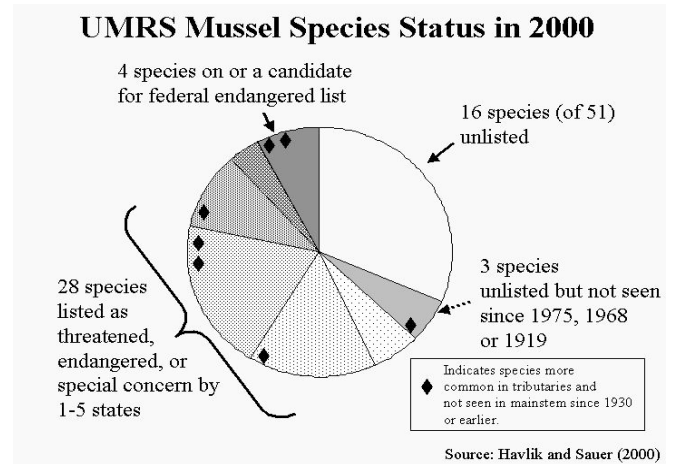
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Historically, 51 of the 304 native freshwater mussel species (Order Unionoida) in the United States have been documented in the Upper Mississippi River System (UMRS = Upper Mississippi and Illinois Rivers). Three of these species are federally endangered, and one species is under federal review. Although 28 species have some type of special status designation in the five states that border the UMRS, only 44 species have been documented in surveys conducted in the UMRS within the past 35 years. This loss of UMRS species richness may be linked to habitat changes after the locks and dams were built. Nearly all of the seven species not found recently were considered infrequent inhabitants of the UMRS mainstem by late 19th and early 20th century biologists, but they were more commonly found in UMRS tributaries where they all still survive. Havlik and Sauer (2000) give the status of all 51 species historically found in the UMRS. The conservation status varies from state to state, because each state describes the status of a species population within that particular state, not the UMRS as a whole. Some species, such as the scaleshell and slippershell, have usually been found in UMRS tributaries, but very rarely in the UMRS. Some species reported in the early literature were apparently

misidentified, or else vouchers do not seem to exist. Some rare species may easily go unrecognized, indicating the importance of having unusual specimens deposited in a museum, and the identification verified by an experienced malacologist.



SUGGESTED READING:

Witter, F. M. 1883. The mollusca of Muscatine County and vicinity. The Muscatine Conchological Club, Muscatine, Iowa. S.E. Cassino and Company. Boston. 24 pages.

Havlik, M.E. and J.S. Sauer. 2000. Native freshwater mussels of the Upper Mississippi River System. PSR 2000-004. USGS, UMESC, 2630 Fanta Reed Road, La Crosse, WI
Download at:
http://www.umesc.usgs.gov/reports_publications/psrs/umes_c_psr.html

DEVELOPING A SAMPLING STRATEGY TO EXAMINE POPULATION TRENDS FOR THE ENDANGERED WINGED MAPLELEAF MUSSEL, *Quadrula fragosa*

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Sampling for endangered species is an extremely difficult task, especially in riverine systems where sampling involves SCUBA in areas of high current and low visibility. There are also statistical issues surrounding sampling rare species. Managers must decide the level of population change and the degree of statistical confidence that should be used to trigger management actions. If population density is low it takes a large sampling effort to detect small changes with great confidence.

In 7 years of quantitative sampling at Interstate Park and Franconia, MN where *Q. fragosa* is found, Hornbach collected 4594 mussels from 30 species (mean density=22 mussels/m²).

Only 5 *Q. fragosa* were found. Given the rarity of *Q. fragosa*, it would require over 15,000 0.25 m² quadrat samples to detect a significant change in the population density of *Q. fragosa* with any degree of certainty. This is an unacceptably high level of sampling activity.

On May 16, 2000 a team of managers and researchers met to discuss a sampling protocol for sampling *Q. fragosa*. Given the difficulties of sampling this rare species quantitatively a two-step approach was suggested: 1. Sample the entire mussel community, quantitatively, to examine whether there are major shifts in mussel density; 2. Qualitatively sample the Interstate Park area to determine whether the proportion of the community that *Q. fragosa* constitutes changes over time. To focus the sampling effort we will limit sampling to mussels that contain pustules. Of these species, *Q. fragosa* constitutes 3.7% (95% confidence range=2.5-5.0%).

We developed a resampling model that allowed us to examine the statistical power obtained with a range of sample sizes. Based on this model if *Q. fragosa* constitutes as little as 2.5% of the mussels with pustules, we could detect a 20% decline in the proportion of the population constituted by *Q. fragosa* with 88% confidence with a sample size of 2500. This represents a compromise between sampling effort and statistical power and confidence.

CONSTRUCTION OF A TAXONOMIC KEY TO THE MUSSELS OF THE ST. CROIX RIVER USING RESTRICTION FRAGMENT LENGTH POLYMORPHISMS

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During the life cycle of native freshwater mussels, they undergo a larval or glochidial period of parasitic encystment on fish or amphibian hosts. These relationships play a vital role in the maintenance of mussel populations and in order to preserve the notable diversity and abundance of North America's freshwater ecosystems, species-specific mussel-host relationships need to be more clearly defined. One of the major difficulties in clarifying these relationships in nature involves identification of the microscopic juvenile forms, both as encysted glochidia and as successfully transformed juveniles. In this study, molecular techniques are used in determining species-specific genetic markers. An intron in the genes encoding ribosomal RNA within the mussel genome, the ITS-1 region, was chosen that was suspected to display interspecies polymorphism. This region is amplified using the Polymerase Chain Reaction (PCR). The amplified DNA is fragmented with selected restriction endonucleases (REs), which cut the DNA at sequence specific sites. The amplified and cut DNA is analyzed by agarose gel electrophoresis. If sequence polymorphism sensitive to the chosen REs appears within this region (Restriction Fragment Length

Polymorphism, RFLP), unique DNA fragmentation patterns are generated.

The goal of this RFLP analysis is the construction of a taxonomic key for the St. Croix River mussel populations that would allow species level identification of glochidia or transformed juveniles. To date, RFLP patterns have been obtained for a total of 24 species. Distinguishing patterns for a number of species, including members of the genus *Quadrula*, are reported.

2001 Abstracts

THE GREAT FLOOD OF AUGHT-ONE: WHAT CAN WE LEARN FROM IT?

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In April 2001, a combination of snowmelt and rainfall events created the highest recorded flow on the St. Croix River at the US Geological Survey's gage at St. Croix Falls, Wisconsin. The flow exceeded the predicted hundred-year flood at that site and the river's floodplain was inundated for weeks after the peak. The most visible aftereffect was the tremendous deposition of sand, but other effects included bank erosion, undercut banks, and toppled trees. A follow-up survey at long-term erosion study sites on the islands of the lower river found further loss of soil materials at unstable sites and deposition at stable sites. Impacts to floodplain plants and animals are largely unknown but due to the length of inundation and/or the extensive deposition of silt and sand could be severe. Likewise, impacts to benthic organisms, turtles, fish and other river-dependent organisms could be significant. This presentation reviews the flood and its potential impacts, poses some research questions, and serves as a reminder for future research that a major flood occurred in 2001.

Suggested Reading:

Galat, D.L. and A.G. Frazier, editors. 1996. Overview of river-floodplain ecology in the upper Mississippi River Basin, volume 3 of Kelmelis, J.A. editor. Science for floodplain management into the twenty-first century. Washington, D.C. Government Printing Office.

UNDERWATER MACRO PHOTOGRAPHY OF AQUATIC INSECTS OF THE ST. CROIX WATERSHED

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Wetbugs Press, Stillwater, MN

Photographing aquatic insects and other small invertebrates can be approached in several ways. The Nikonos camera

system is designed to be submerged, and macro lenses allow fairly close-up shots underwater. Two housings allow the more popular, "terrestrial" 35 mm single lens reflex camera, or SLR, to be used underwater: a flexible vinyl bag housing made by Ewa (about \$180), and a rigid acrylic housing made by Ikelite (about \$600). Each has its pros and cons, and for all but the most shallow water shots, the photographer must also be submerged.

For about \$60, a very simple plastic box can be made to house an SLR and, importantly, two flash units. The camera and flash bracket are mounted on a focusing rail, which is securely mounted to one side of the box. One handle on each end of the box, plus a flexible cable shutter release, enable the photographer to hold and submerge the bottom of the box and snap a photo of an underwater scene. The box is completely open on the top, and only the lower few centimeters of the box is submerged. For photographing many aquatic invertebrates, this is all that is needed.

By changing lenses and extension rings, one may take photographs of fish, etc. on a stream or lakebed perhaps 60 cm away. The most successful use of the box, however, has been in taking photographs of aquatic insect communities in streams in water from just a few to about 20 cm. deep. Using an 80 mm or 50 mm macro lens and short extension tubes, communities of Baetis mayflies, Simuliidae, and Trichoptera larvae are easily photographed. A 38 mm macro lens with various extension rings allows photographing an area less than 2 cm. across, and individual mayfly nymphs, caddisfly larvae, or small numbers of black fly larvae may be photographed in their natural setting. Two flashes allow the use of slow, fine-grained film emulsions (ISO 100).

For closer shots, rocks or woody debris with insect larvae attached may be placed in a streamside aquarium and photographed through the aquarium glass with the camera/flashes combination mounted firmly on a tripod.

SAMPLING FOR PESTICIDE PRESENCE IN MUSSEL HABITATS

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We began a project in 2001 to sample selected mussel habitats for the presence of pesticides. The goal of the project is to determine if potentially harmful pesticides are present in Wisconsin mussel waters and to attempt to work towards a resolution of such problems.

We collected sample sets consisting of column water, pore water, and sediment at 7 sites including 3 sets on the Mississippi, 1 on the Wisconsin, 1 on the Chippewa, and 2 on the St. Croix. The samples were processed and analyzed by

DATCP's lab with broad screens for organophosphates, organonitrogens, organochlorines, and some metabolites.

I will share our results for 2001 as well as discuss our plan for 2002 and 2003 in the hope of receiving additional advice and help.

LETHAL AND SUBLETHAL EFFECTS OF UN-IONIZED AMMONIA TO JUVENILE UNIONIDS IN SEDIMENT TOXICITY TESTS

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The National Park Service has identified ammonia as one of the primary threats to biota in the St. Croix National Scenic Riverway (SACN). Ammonia is a relatively toxic compound generated in natural waters and sediments by heterotrophic bacteria as a by-product of organic matter decomposition. Ammonia and other contaminants often preferentially accumulate in sediments and porewater. As such, sediments and associated porewater may be an important route of exposure to contaminants for benthic filter-feeding organisms such as unionid mussels. Unionids have been found to be extremely sensitive to un-ionized ammonia (NH₃), relative to other groups of organisms. The SACN has an abundant and diverse community of unionids, and may contain the last reproducing population of the federally endangered *Quadrula fragosa*. We conducted a series of 96-hour and 10-day sediment toxicity tests by modifying a flow-through system and spiking sediments with ammonia to maintain concentrations of NH₃ over these test durations. Twenty juvenile *Lampsilis cardium* were placed into cages in each of 36 experimental units (6 replicates/concentration). The cages were constructed of polycarbonate tubing with mesh-covered holes on the sides and bottom. The cages were buried ~2.5 cm into the sediments such that juveniles were exposed to NH₃ via sediment porewater. Survival, growth (height and surface area), the stressed:alive ratio (stressed individuals defined as no evidence of foot movement but ciliary activity present), and NH₃ concentrations in porewater were measured at the end of each test. In all tests, survival exceeded 77% in the controls. In short-term tests, the LC₅₀ ranged from 150-175 ug NH₃/L with effects on the sublethal indicators occurring at about 40-100 ug NH₃/L. In longer-term tests, we did not always observe 50% mortality in the highest test concentrations, but effects on growth occurred around 30 ug NH₃/L. A companion study measured concentrations of NH₃ in porewater over a 150 km reach of the SACN and found concentrations to be highly variable, ranging from 0.1-181 ug NH₃/L. These data suggest that in some locations and under certain conditions (especially low flow and high temperatures), sedimentary ammonia concentrations in the

SACN approach, and sometimes exceed, concentrations shown to cause lethal and sublethal effects in laboratory tests.

EFFECTS OF SEDIMENTARY AMMONIA ON SURVIVAL AND GROWTH OF JUVENILE MUSSELS IN THE ST. CROIX NATIONAL SCENIC RIVERWAY

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The St. Croix River basin contains an extremely rich fauna of unionid mussels, including two federally endangered species. This faunal group, which is highly sensitive to environmental perturbations, is one of the Riverway's most significant natural resources. As the metropolitan area of Minneapolis-St. Paul expands into the river basin, there is a greater threat of deteriorating water and sediment quality. The increase in point and non-point source pollution associated with urbanization often results in enrichment of ammonia in riverine sediments and associated porewater. We measured concentrations of un-ionized ammonia (NH₃) in sediment porewater over a 150 km reach of the Riverway to determine if existing concentrations of NH₃ were affecting survival and growth of juvenile mussels. In 2001, we conducted 4, 10, and 28 day *in situ* toxicity tests with juvenile *Lampsilis cardium* at 8 sites in the Riverway, including one tributary (Sunrise River). At each site, we deployed 6 chambers in surficial sediment, each containing 20 juveniles, and randomly removed 2 chambers at each of the three exposure durations. Sedimentary ammonia was characterized at each site using a coring device and an *in situ* pump. Ammonia concentrations ranged from 0.1 to 122 ug NH₃/L in the cores and from 0.9 to 46 ug NH₃/L in the pump samples. We also measured NH₃ concentrations in the chambers directly by pumping out a small volume of porewater; concentrations of ammonia in these samples ranged from 0.8 to 181 ug NH₃/L. Across this sedimentary ammonia gradient, mean survival of juveniles was 45% at 4 days, 28% at 10 days, and 41% at 28 days. Regardless of the method used to estimate sedimentary ammonia, we observed a decreasing trend of survival with increasing sedimentary ammonia concentrations. However, our ability to predict survival based on ammonia was generally poor. The growth rate of juveniles was highly variable and ranged from 0 to 45 um/day. Unlike survival, the growth rate of juveniles was positively correlated with sedimentary ammonia. Although these results are highly variable, the methods we developed indicate that it is possible to conduct *in situ* exposures with juvenile mussels. We were able to culture, deploy, retrieve, and measure the survival and growth of juveniles in the 300-1,000 um size range. However, correlating survival or growth to sedimentary ammonia concentrations was problematic. Ammonia concentrations are spatially variable and it was difficult to predict biological

responses across this chemical gradient. Refinement of these *in situ* techniques is needed before juvenile mussels are used as biological monitors.

DISTRIBUTION AND STATUS OF SELECT MUSSELS IN THE ST. CROIX RIVER

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The St. Croix River is a nationally important ecological resource with a diverse mussel community that serves as a refuge for upper Mississippi River fauna. During the summer of 2001 we quantitatively assessed 4 mussel communities and searched for federally endangered winged mapleleaf in the St. Croix River. Standard methods were employed to quantitatively describe the mussel communities at: Riverside, WI; Wild River State Park, MN; Franconia, MN; and Prescott, WI. We had sampled these populations at least once before: at Riverside in 1992, at Wild River in 1993, 1996, and 1999, at Franconia in 1991, 1995, and 1999, and at Prescott in 1994 and 1999. We observed 17 species at Wild River and Franconia, 14 species at Prescott, and 9 at Riverside. Average mussel density was highest at Wild River (14.5 mussels/m²), followed by Prescott (5.3 mussels/m²), Franconia (4.4 mussels/m²), and Riverside (3.1 mussels/m²). The federally endangered Higgins eye was collected at Prescott as were zebra mussels. Over the last 10 years two species numerically dominate the mussel communities at Riverside, Wild River, and Franconia, and three species at Prescott. Over time mussel density has dropped 50-60% at Riverside, Wild River, and Franconia, and 32% at Franconia but due to the variability in mussel density none of these changes are statistically significant. Shell-length frequency diagrams suggest there has been recent recruitment among some dominant species at select sites.

Results from the summers' winged mapleleaf survey reveal these animals once enjoyed a much broader distribution in the St. Croix River. We used SCUBA equipment to survey 21 locations for 15-90 min between Nevers Dam and Stillwater, MN. More time was spent at select sites. All live and dead mussels were recorded. Some empty valves were deposited as voucher specimens at the Bell Museum. Diverse, dense mussel beds were uncommon and were generally where we found winged mapleleaf valves. Although no live winged mapleleaf were observed, empty valves were collected as far upstream as Wild River State Park and downstream as far as Arcola, MN. These results show the species once occupied at least an additional 42 km of river beyond its present 8 km range. Additional work is needed to describe the range of this species in the St. Croix River and determine if it is extant upstream of the dam.

Administrative and financial support provided by the St. Croix National Scenic Riverway and the NRPP-Threatened and Endangered Species Fund.

Suggested Reading:

Hornbach, D. 2000. Macrohabitat factors influencing the distribution of naiads in the St. Croix River, Minnesota and Wisconsin, USA. Pages 213-230 in Ecology and evolution of the freshwater Unionoida. Bauer, G, and K. Wachtler (Eds.). Springer-Verlag, Berlin, Germany. 394 pp.

ZEBRA MUSSEL CONTROL EFFORTS ON ZEBRA MUSSEL CONTROL EFFORTS ON THE ST. CROIX NATIONAL SCENIC RIVERWAY MINNESOTA AND WISCONSIN

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In 1992, zebra mussels were discovered in the Mississippi River as it flows through Minneapolis. Downstream lies the St. Croix National Scenic Riverway, a unit of the National Park System. Renown for its recreational and biological resources, the St. Croix River is nationally significant for its richness and abundance of freshwater mussels (~40 species). With the greatest diversity of unionids in the Upper Mississippi watershed, the Riverway will be severely impacted by a zebra mussel infestation.

Since that discovery of zebra mussels on the Mississippi River, the National Park Service has led an interagency task force (U.S. Fish and Wildlife Service, Minnesota/Wisconsin Departments of Natural Resources, MN/WI Boundary Area Commission, Minnesota Sea Grant, Great Lakes Indian Fish and Wildlife Commission, St. Croix Marina Association, and others) designed to halt or slow the spread of zebra mussels (*Dreissena polymorpha*) into the St. Croix Riverway. The prevention efforts include education and information, access

management, monitoring, planning for remediation and research. A new element for the task force last year was the formation of an agency-staffed SCUBA dive team to monitor the river from under the surface. With the creation of a dive team staffed with members of the National Park Service and the U.S. Fish and Wildlife Service, the river began to be surveyed by trained biologists and experts, all of whom sit on the task force. Thus, monitoring conclusions and recommendations were developed with a unique degree of first-hand information.

The creation of a St. Croix dive team could not have come at a more critical time in the history of the zebra mussels on the Riverway. Zebra mussels were found attached to a small number of boats in the St. Croix since 1995 and individual mussels have been discovered scattered in small numbers on substrate along the lower 25 miles of river. While these animals have had an individual presence on the river for a number of years, a reproducing population has never been discovered in the St. Croix River. Unfortunately, that changed during the summer of 2000. For the first time, zebra mussel reproduction was documented within the lower 16 miles (or so) of the river. The source of reproduction has yet to be pinpointed, but the resulting settlement of juvenile mussels is very disturbing, if not unexpected. In 2001, it has been documented that zebra mussel populations in the St. Croix River have significantly diminished.

Armed with the unfortunate knowledge that the mussels have arrived, the task force is beginning the painful chore of creating recommendations for policymakers and agency managers. The river may indeed be at a juncture in its ecological history. What actions are taken may be critical to the plants and animals that call the river home and a recreating public that enjoys the many wonderful aspects of this nationally protected waterway. The management issues surrounding zebra mussels are complex and may be controversial. This presentation will focus on the multi-agency actions designed for 2001 and beyond.

Tennessee Commercial Mussel Shell Harvest

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The commercial shell market in Tennessee continues its rebound from the recent historic low harvest of 601 tons in 1998.

Tennessee commercial mussel shell industry volume and wholesale value, 1994-00.

Year	1994	1995	1996	1997	1998	1999	2000
Harvesters	1,133	1,397	1,188	641	351	260	410
Dealers	34	32	23	25	19	15	24
Tons	2,707	3,881	2,362	1,061	601	1,335	1,717
million's \$	\$8.5	\$14.7	\$6.8	\$3.0	\$0.7	\$2.8	\$2.4
Shell Fee	\$68,285	\$98,713	\$65,731	\$33,140	\$15,185	\$38,187	\$50,946
Average Wholesale price/lb.	\$1.57	\$1.95	\$1.44	\$1.42	\$0.59	\$1.05	\$0.70

Mussel harvester license sales have remained below 500 per year since 1998, while harvest volume has increased nearly three fold. Wholesale lake mix (*Amblema plicata*, *Quadrula quadrula*, *Fusconaia flava*) and washboards (*Megaloniais nervosa*) shell prices remain depressed, with lake grade washboards averaging less than \$1.50/lb in 2000 and bringing less than \$1.00/lb in 2001. Price on lake mix shells averaged \$0.58/lb for 2 5/8" and \$1.44/lb for 2 3/4". Ebony shells (*F. ebena*) continue to dominate the harvest, due largely to their abundance and demand for small to medium sized bead producing shells. Prices averaged \$0.28/lb. for small (2 3/8") \$0.53/lb medium (2 _ to 2 5/8") to \$0.84/lb. for large (2 3/4") during 2000 and are up slightly in 2001. The average wholesale price is weighted by the percent weight of the various shell types in the harvest. In years where cheaper categories of shell (ebonys) dominate the harvest, the value declines dramatically.

If current market trends continue, 2001 will be the fifth year in a row that Tennessee's shell harvest fails to break the 2,000 ton mark. Moderate harvest pressure is paying off for the mussel populations of Kentucky Reservoir, which produces more than 90% of the annual harvest. Our survey data has documented increases in the percentage of legal sized mussels, which now range from 15% (lake mix and washboards) to 40% (ebonys). In the past (1992-96), the percentage of legal sized mussels ranged from 2% for washboards to 15% for ebonys.

Survival Rates of Unionid Species Following a Low Oxygen Event in Big Darby Creek, Ohio

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In July of 2000 a spill from an agribusiness resulted in at least 20,000 gallons of runoff mixed with fermented grain, molasses, and other organic substances finding its way into the upper reaches of Big Darby Creek, a state and national Scenic River in central Ohio. The spill resulted in what was primarily a low dissolved oxygen (DO) event extending several miles downstream, the worst of which lasted for roughly a week. At the peak of the event readings approaching zero DO were recorded, especially at night. Thousands of fish and mussels died.

The Ohio Department of Natural Resources permitted staff from the Ohio State Museum of Biological Diversity to salvage dead mussel shells from the spill zone. Over the course of several visits--both during and after the period of low DO--surviving mussels were noted and rough estimates were made of the percentage of the fauna surviving the event (Table 1).

Though most individual mussels showed some reaction to the event (i.e. most either partially or completely emerged from the substrate), differences in survival rates among species were remarkable. For instance, almost all *Lampsilis fasciola* and *Ptychobranchus fasciolaris* succumbed very quickly, while virtually every *Fusconaia flava* and *Amblema plicata* suffered no

apparent lasting effect. Another discrepancy was noted between the survival rate for individuals of a species living in riffles vs. individuals of the same species living in pools, with the latter having greater success. Perhaps pool individuals were better adapted to lower DO levels. However, age may have been a factor as well. Pool individuals were generally older than riffle individuals and juveniles appeared to fare poorly.

Species-selective kills may help explain why this section of Big Darby, while supporting large populations of mussels, no longer harbors some of the rarer, presumably more sensitive unionids living elsewhere in the watershed such as *Epioblasma rangiana*, *E. triquetra*, *Pleurobema clava*, and *Quadrula cylindrica*. Perhaps unobserved pollution events have quietly eliminated these species over the years.

Despite the tragedy of the Darby spill, some good may come of it. By recording species-specific responses to documented spills we add knowledge that may some day prove useful in identifying the nature and origins of other more mysterious mussel kills.

Table 1. Estimated survival rates for various unionid species following a low oxygen event in Big Darby Creek, Union County, Ohio, 2000.

Common Name	Scientific Name	Abundance at spill site	Estimated survival after 3 weeks
paper pondshell	<i>Utterbackia imbecillis</i>	uncommon	15 percent
giant floater	<i>Pyganodon grandis</i>	fairly common	70-80 percent
cylindrical papershell	<i>Anodontoides ferussacianus</i>	rare*	50 percent
squawfoot	<i>Strophitus undulatus</i>	common	50 percent
slippershell	<i>Alasmidonta viridis</i>	rare*	none observed
elktoe	<i>Alasmidonta marginata</i>	rare*	50 percent
fluted shell	<i>Lasmigona costata</i>	common	90 percent
creek heelsplitter	<i>Lasmigona compressa</i>	uncommon	80 percent
threeridge	<i>Amblema plicata</i>	very common	near 100 percent
Wabash pigtoe	<i>Fusconaia flava</i>	fairly common	100 percent
spike	<i>Elliptio dilatata</i>	abundant	50 percent
kidneyshell	<i>Ptychobranhus fasciolaris</i>	abundant	less than 5 percent
fragile papershell	<i>Leptodea fragilis</i>	rare*	12.5 percent
rainbow	<i>Villosa iris</i>	common	50 percent
fat mucket	<i>Lampsilis radiata luteola</i>	abundant	33 percent
plain pocketbook	<i>Lampsilis ventricosa</i>	common	30 percent
wavy-rayed lampmussel	<i>Lampsilis fasciola</i>	very common	5 percent

*sample size fewer than 10 individuals

Helpful Hints from Hoppy:



Sampling tip: "You have to dig to find shell"

Submitted by Steve Ahlstedt

Don't Forget

to send Leroy your nominations for treasurer and president-elect
and
to renew your FMCS membership.

Freshwater Mollusk Conservation Society

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If you are interested in assisting or learning more about any of the FMCS Standing Committees, please contact the appropriate chair at the address listed below.

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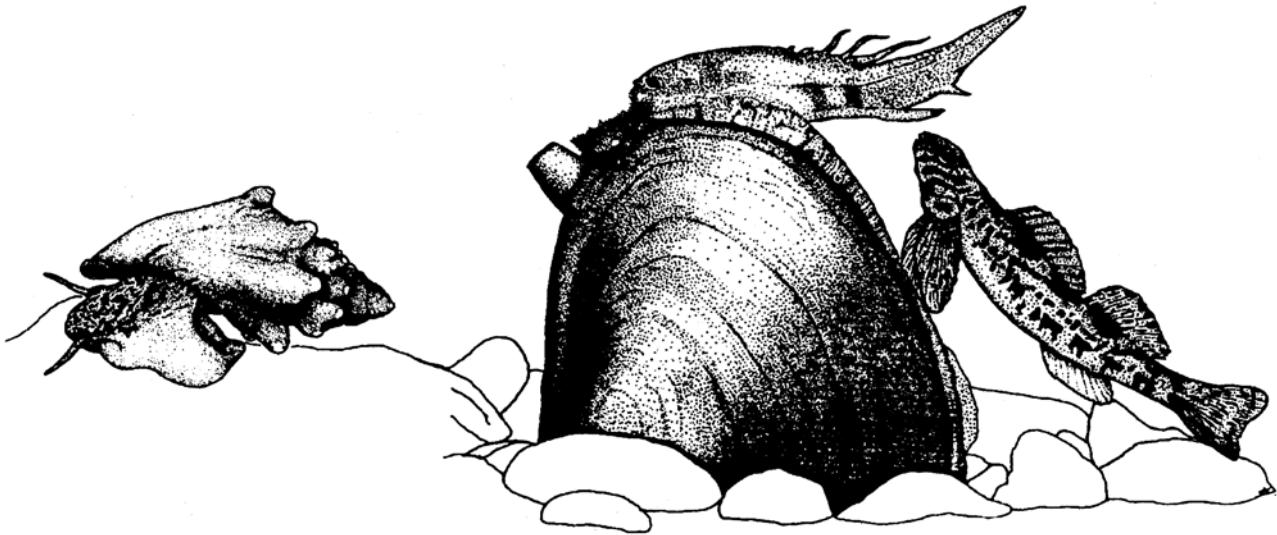
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Freshwater Mollusk Conservation Society



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