TRIANNUAL UNIONID REPORT

Report No. 15

July 1998

A forum for the informal exchange of information on the status of North American unionid research, management, and conservation

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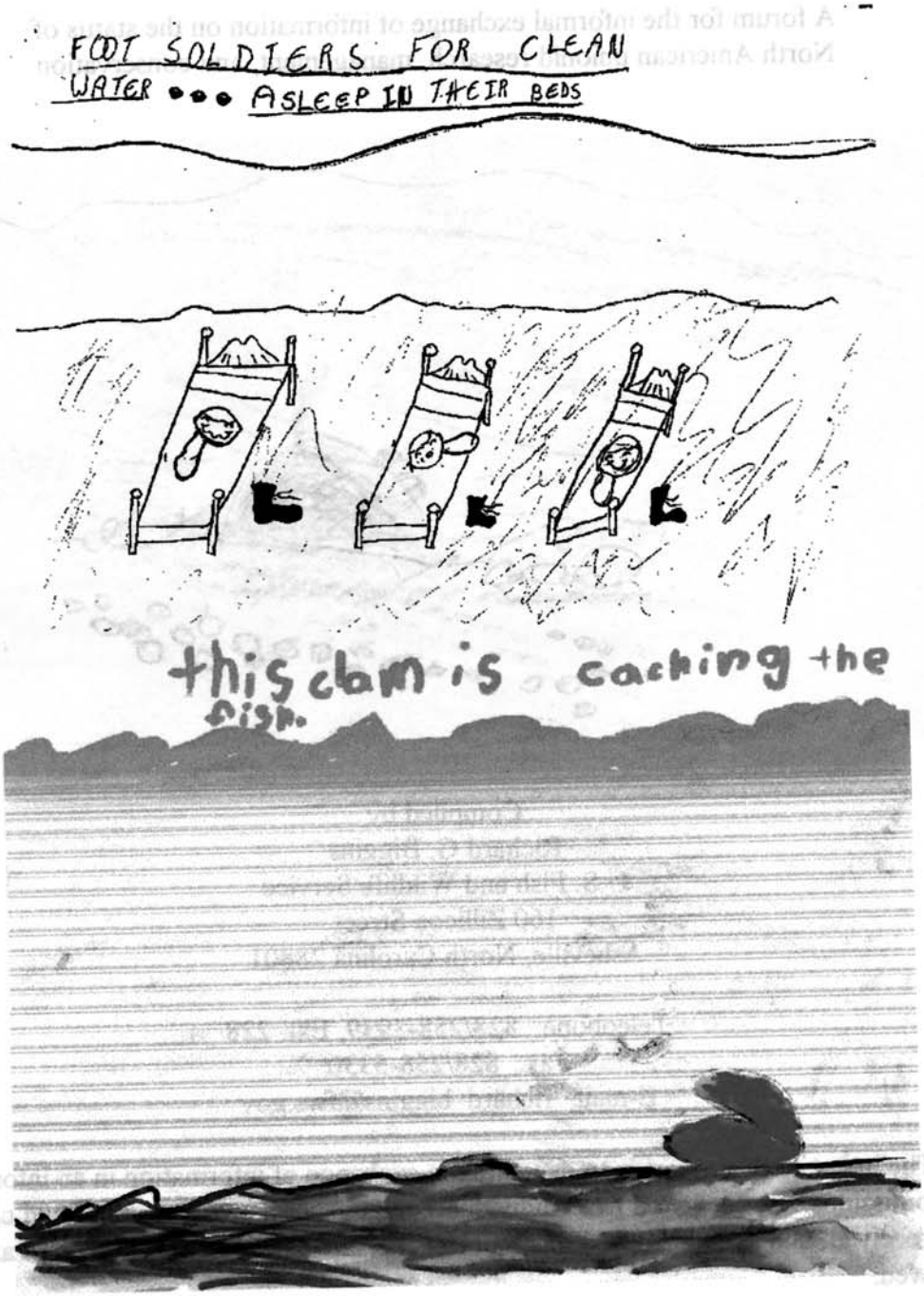
NOTE: The intent of this report is to expedite the exchange of information in an informal format. Report submissions were solicited from individuals and agencies involved in unionid conservation, copied as received, and assembled into this report. The submissions were **not** edited and were **not** peer reviewed.

FRONT COVER MUSSEL ART: THANKS TO LARA CANTRELL, ASHEVILLE, NORTH CAROLINA.

INSIDE COVER MUSSEL ART: THANKS TO ELIZABETH ANNE ALDERMAN, PITTSBORO, NORTH CAROLINA AND EMILY LYDEARD, TUSCALOOSA, ALABAMA.



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JULY 1998

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The following are selected abstracts of papers and posters given at the Mississippi River Research Consortium, Inc. 30th Annual Meeting, April 23-24, 1998, La Crosse, Wisconsin.

MISSOURI DEPARTMENT OF CONSERVATION

MEMORANDUM

Date: March 30, 1998

FROM: Al Buchanan

TO: National Native Mussel Conservation Committee

SUBJECT: March 5, 1998 Meetings

On March 5, 1998, the National Native Mussel Conservation Committee (NNMCC) met at the Ohio State University Museum in Columbus. Attached are the minutes of the NNMCC Excom Meeting and the general meeting of NNMCC. Rita Villella, the Secretary of NNMCC, compiled the minutes. Following are some highlights of the meetings.

Probably the most significant thing we decided at the NNMCC meeting was to form a society. Since our first meeting in February, 1997, we have discussed the advantages and disadvantages of both staying as a subcommittee of MICRA and becoming a free-standing society. While MICRA gives us a good base of state support from the 28 member states and is an accepted recognized entity, those states not normally included within MICRA have not all been comfortable with the NNMCC being part of MICRA. A number of participants feel that they will receive more support from their organization to travel to and attend a meeting of the mussel committee if it is a national committee rather than part of a regional organization. Therefore we are now the Freshwater Mollusk Conservation Society (FMCS). With the decision to form the FMCS comes a lot of work to create bylaws, agree to an official mission, and all the other stuff that comes with creating a society. Eleven of us have agreed to work on a subcommittee to create bylaws with the goal to agree upon the bylaws at the Executive Meeting in October. One of our challenges in creating a society is to keep the focus management-oriented and continue to use the National Strategy as the guide for how we focus our energies.

One of the exciting things about the recent meetings is the amount of progress the subcommittees have made on various projects within their areas of interest. The National Strategy will be published in the Journal of Shellfish Research in September/October; the proceedings of the Water Quality and Freshwater Mollusks Workshop will be published in the Journal of the North American Benthological Society later this year; plans for the 1999 Mussel Symposium in Chattanooga, TN are moving along nicely; we are working on a symposium for AFS 2000; progress is continuing on creation of a Mussel Atlas; Outreach is nearing selection of a logo, is working on the concept of a "Speakers Bureau for the National Strategy," and on a Memorandum of Understanding to implement the National Strategy; and Guidelines/Techniques is working on assembling protocols for various mussel management-related activities. And these are just some of the many projects the NNMCC/FMCS is involved in. You are all doing a great job.

The Columbus Symposium on *Conservation, Captive Care and Propagation* of freshwater mussels was an excellent example of how a group of motivated, dedicated folks can focus attention on and facilitate information exchange on a specific area of need. My compliments to Richard Tankersley, Doug Warmolts, Brian Armitage, and the other people involved in organizing an excellent symposium.

Below is a list of subcommittees, their chairs and their phone numbers and addresses if you would like to become involved on any of the subcommittees. As we evolve from a committee to a society, there will be lots of challenges and opportunities to participate.

SUBCOMMITTEES AND CHAIRS

Symposium	Steve Ahlstedt (423/545-4140); ahlstedt@usgs.gov John Jenkinson (615/751-6903; jjjenkinson@tva.gov
Status/Distribution	Kevin Cummings (217/333-1623); kscummin@uiuc.edu
Outreach	Linda Drees (913/539-3474); linda-drees@fws.gov Mike Davis (612/345-3331); mike.davis@dnr.state.mn.us
Information Exchange	Madeleine Lyttle (802/951-6315); madeleine-lyttle@fws.gov
Water Quality/Habitat Alteration/Zebra Mussels	Tom Muir (703/648-5114); tmuir@usgs.gov
Propagation/Restoration/ Introduction	Dick Biggins (704/258-3939; richard-biggins@fws.gov Richard Tankersley (410/455-3381); tankersl@umbc.edu
Guidelines/Techniques	Heidi Dunn (314/447-5355); ecologists@aol.com
Commercial	Cheryl Ballenger (319/264-2033); cherylb@muscanet.com Nelson Cohen (812/232-5081); enelsonc@aol.com

aa

Attachment

bc via email: Norm Stucky, Gary Novinger, Steve Weithman, Travis Moore

Executive Committee Minutes
March 5, 1998
Al Buchanan, chair

Commercial Subcommittee Report: Cheryl Ballenger and Nelson Cohen are chairs of this subcommittee. Decision to close the upper MS may have caused the national committee to lose its connection with the industry. The co-chairs have not had time to work on the commercial subcommittee so we may need to ask for volunteers to serve as the new chairs. Steve Ahlstedt, with no vested interest but with good contacts, may be a good liaison. Commercial interests feel they have been used because they have funded some work and now the commercial shelling season has been closed. May need a cooling off period. Originally offered to co-sponsor the symposium next year but have now backed out. Need some way to maintain the lines of communication and Steve has offered to do that. Subcommittee was to pull together the commercial harvest data but this has not moved along well. Subcommittee needs to be recharged.

Steve Ahlstedt will be the liaison between industry and the subcommittee and give updates.

National Strategy: The national strategy was presented by Susi von Oettingen at The National Shellfisheries Association (NSA) meeting last April. The strategy was sent out for review, with the overall comments being quite complementary. Some minor revisions were suggested and the strategy will be published in *The Journal of Shellfish Research* in June 1998. Ed Pendleton has been talking with the editor about printing reprints. Susi had cut some of the introduction and expanded the executive summary. The National Mussel Conservation Committee will be the listed authors so it does not come across as a FWS document. Cost of the journal will be paid by BRD and/or NSA. This committee needs to decide how many reprints are needed and what should the distribution be. The editor has informed us they can do 2,000 reprints for $2,000, including putting on a cover. The strategy should be going to state agencies, possibly governors and it should be sent by the National Committee. A transmittal letter should come from the committee and accompany the reprints. It was decided that one letter will be sent with signatures from both MICRA and the National Committee.

We had originally thought of having the states sign off on the strategy first but this would delay the document coming out. Instead, we will get the document out and have the states sign off later. MICRA has about $2,000 set aside, some being used for this meeting. FWS fisheries section is also working to get the strategy out. Susan Mangin needs to get together with Ed Pendleton to coordinate their efforts. Should have printed at least 2,000 copies. Madeleine Lyttle has a mailing list and has volunteered to coordinate her list with other mailing lists to come up with a complete list for mailing the strategy reprints. Need recommendations on who in the legislature should these be sent. The EXCOM will be Madeleine's connection on how many copies are needed and who these should be mailed to. A minimum of 100 copies is needed for state governors and heads of state agencies. The document should also go to AFS and other societies and conservation groups. Between now and July Madeleine will get in touch with people concerning their mailing lists. Ed Pendleton will get the final costs for the reprints and Al Buchanan will coordinate with Leetown on getting these printed. Susan

Mangin is working on the art work for the cover. Al will also draft the transmittal letter but needs help to review the letter - will be emailed to the EXCOM for review. Al will update the national committee on the strategy this afternoon.

EXCOM Structure

Chair - Al Buchanan
Treasurer - Heidi Dunn
Secretary - Rita Villella
Subgroup chairs - volunteers
Symposium - Steve Ahlstedt, John Jenkinson
Status/Distribution - Kevin Cummings
Outreach - Linda Drees
InfoExchange - Madeleine Lyttle
Water Quality/Habitat/Zebra mussel - Tom Muir
Restoration - Dick Biggins, Rick Tankersley
Guidelines - Heidi Dunn
Commercial - Cheryl Ballenger, Nelson Cohen

MICRA or Society:

There was considerable discussion on structure of this group. The main question is should the structure remain as is. Al sent out the EXCOM minutes and gave all Subcommittee Chair emails and phone numbers telling people to contact the chairpersons if interested in working on a particular subcommittee. The organization hinges on whether the national committee comes under MICRA or becomes a society. The mussel subcommittee is different than other subcommittees under MICRA. The EXCOM generally steers activities, sets the goals and directions, holds meetings, and makes the day to day decisions and presents these to the overall national committee.

Heidi Dunn gave a report on what it would take to initiate becoming a society: To be nonprofit the purpose must be for scientific and education purposes. If lobbying there are tax implications. This society would be more of an advocacy group. We would need to set up as a not-for-profit corporation, decide which state in which to incorporate, hire a lawyer to prepare and file the paper work ($300-400) which will likely take 4-5 months, then file for tax exempt status, and establish bylaws. Paperwork is filed annually to confirm tax exempt status. Bylaws should be on file and/or in the minutes. As a society we will have to do our own mailing, hold elections for officers, and collect dues. But it does coalesce the group, giving it more clout as a society and not just a committee. Need to weigh advantages and disadvantages. The advantage of being under MICRA is it already has structure, has the buy in of 28 states, and it is a recognized organization. MICRA takes 10% off the top and puts these funds into a pool for special projects which helps with operating expenses, but this money would not be taken from any sales. We need something more concrete around this group to set the bounds and focus the organization. It was pointed out that MICRA is considered too restrictive to Northeastern states, western states, Canada, etc. making them less apt to participate. One option is to stay under MICRA till we get more structured and get our feet on the ground, realizing we are moving toward becoming a society, the question is how soon. We may want

to have the next EXCOM meeting in association with MICRA. In their eyes we are huge and there are concerns within MICRA, so we need to decide within the next year what we are going to do. It was decided to take a straw poll at the general meeting to determine whether we need to become a society. Since this group moving in this direction anyway, we should do it to get those outside MICRA to feel part of a group. There are advantages to being tied politically to a larger group for support. There was discussion as to whether we should be aligned with a larger group (MICRA or AFS or AMU) or take on our own identity. It was recognized that becoming a society will take a lot of energy and a lot of support. The options will be presented to the national committee this afternoon. Afraid we may lose momentum if we don't decide on a more firm structure such as a society.
What will the society offer to its members - symposiums, meetings journals?
The outreach group is in the process of developing a logo, hats, teeshirts, but it is anonymous. If we decide to become a society we need to get this information to the outreach group. The momentum is there, people don't want to wait 3 years for a meeting, so we need to capture that momentum and move forward.

Advantages of a Society:
Perceived as more conservation oriented
Gives structure and focus to the group
Elections/Bylaws
States outside MICRA more likely to participate
More recognition/awareness
Doesn't limit association with multiple groups

Disadvantages of Society:
Takes a lot of energy and support
Will take 1-3 years to establish

Advantages of MICRA:
Administrative support provided
MICRA is a recognized organization of 28 states
Paperwork taken care of
MICRA provides a source of funds
Has support of State directors

Disadvantages of MICRA:
Perceived as a regulatory agency
Outgrowing MICRA

This should be put before the whole committee and get a vote on the options.

Options -

1. Stay as we are and operate as a subgroup under MICRA
2. Become a separate society (within a year)
3. Set up bylaws, mission statement while under MICRA as make transition toward a

separate society. Time limit - 3 years. If we stay under MICRA under these conditions we need to give MICRA more credit since they don't see us as part of MICRA.

EXCOM will reconvene after the national committee meeting to discuss results of straw poll.

Symposium: Paul Johnson gave an update on the progress to date on organizing the symposium next spring in Chattanooga. Dec. 15 is the deadline for getting abstracts in for the meeting, and he will need help deciding on which will be presentations and which will be posters.

Next EXCOM meeting: Tentatively set for October, 1998.

Minutes of the Second Meeting of the National Mussel Conservation Committee
March 5, 1998

Background/Progress - Al Buchanan

Started with the Symposium in 1992 with Dick Neves giving the keynote address. In 1995 freshwater mussel needs were put down on paper by a group meeting in Roanoke, VA that spring. This document was presented as a draft strategy at the 1995 symposium in St. Louis. In spring 1996 MICRA contacted Al and Kevin Cummings to set up a mussel subcommittee under MICRA. Agreed to include all states in the mussel subcommittee. A letter sent to the states to nominate a representative to the national committee and to review the strategy. Response was received from 30-35 people to help prioritize the needs listed in the strategy. In Feb. 1997 the first meeting of the mussel subcommittee was held. The group set priorities based on comments received. The role of the native mussel committee was established. At this meeting the name was changed to the National Native Mussel Conservation Committee. The main role of this committee is to be an advocate for the fauna and serve as a link between mussel groups that have formed around the country to facilitate information exchange. Established 8 subcommittees. Where do we go from here and what should we be from here on out.

Subcommittee Reports

1999 Symposium Subcommittee
John Jenkinson and Steve Ahlstedt are co-chairs. Paul Johnson presented information on progress so far. The symposium will be held in 1999 in Chattanooga, TN. A letter will be coming out shortly to give people an opportunity to help with this meeting and he is interested in receiving everyone's input. The meeting will be March 1999 at the Clarion Hotel near the aquarium. Theme of the meeting - "Musseling In On Biodiversity". The World Wildlife Fund may participate in the meeting. It was felt a theme focusing on biodiversity will target some of these organizations to get them to participate in this symposium. Still working on a logo for the meeting. The date is March 17-19. A tentative schedule was presented. The first session will be a plenary session with some invited papers on mussel contributions to biodiversity. The symposium will have a keynote speaker, a banquet speaker, and a speaker for the closing session. Two basic workshops will be offered - mussel and snail identification and one by Heidi Dunn for guidelines/protocols. Would like a special session on status and conservation of gastropods. Though it is preferred not to have concurrent sessions, there will be concurrent sessions if there is a large response for papers. If so it will be on the morning of the second day. Poster session will be held the second morning and posters will remain up all day. A field trip is scheduled for Saturday. Comments/suggestions on the meeting organization are welcome.

Symposium planning: A flyer has been placed in this meeting's packet. Announcement will be posted in the summer issue of the NABS bulletin and will put one in fisheries. Draft copies of the symposium announcement were presented and will come out around labor day. Please comment on the format. Deadline for contributed papers will be Dec. 15, 1998.

Registration: Cost of about $125 and $75 for students. Price will include drink tickets, breakfast, and banquet cost for all participants, and includes proceedings. Institute is setting up a web site to register online. Confirmation notices will be sent out for conference and hotel reservations for those that register early. Emphasize register early to help plan the symposium. Hope to attract between 225 and 300 participants.

Hotel room rates are $62 per night, $72 for double. Add 12.25% for final cost, and prices are good up

to 3 weeks prior to the meeting. Hotel rooms are limited so register early. Meeting rooms are free. The poster session may be problematic but believe space will be sufficient. Topics covered in the symposium will be broad. Symposium is being sponsored by various agencies, all contributing a minimum of $1000 each. Will welcome sponsorship by any state and the logo will be placed on the proceedings.

AFS 2000:
Al has contacted AFS and they have us scheduled as 1 of 2 special symposiums. Will be held at Adams Mark Hotel in St. Louis, MO. Conference theme is "Reflections (Looking backward and forward)". Registration fee is around $100-$150. May need additional fee if we have costs. Expected attendance 1500-2000. Contacts are Roger Rulifson and Julie Clawson. We will also plan on having a poster session. Will recruit people to help organize this symposium. The mussel symposium will likely be one day and our theme should fit in with their theme. This theme fits well with mussels. Good chance to put our foot forward in the fisheries arena. Meeting will need careful planning. Suggested that the committee work on how to best represent mussels at the AFS. Volunteers for the symposium committee:
Leroy Koch
Teresa Naimo
Tom Watters
Mike Davis

Status/Distribution Subcommittee
Kevin Cummings, Chair. The subcommittee is in the process of preparing a Mussel Atlas showing the distribution of all freshwater mussels in North America similar to the one for fish of N. America. There is a working group getting this started. It is a huge task that as of yet does not have funding. There's plenty of work for everyone to do. A meeting was held in October 1997 in Arlington to go over how to proceed. An outline for the atlas format was prepared and the group proposed a completion date of the year 2000 for publication, however this may be ambitious. NSF is seen as a potential funding source for submitting the proposal since they favor projects with multiple partnering. A poster was on the agenda and one has been prepared for the Columbus, OH symposium. Encourage everyone to get involved. Another charge of this committee was to compile a list of biologically significant streams, but they have not had the time. Would like volunteer or volunteers to head up this effort, what criteria to use, time frame, etc. Bob Butler volunteered. The Ohio River Ecosystem subgroup has already started this effort with focus areas in the watershed.

Outreach Subcommittee
Kurt Welke: Drafted an MOU to implement the National Strategy. Have been told we need buy-in from the States on the National Strategy. May also want to target NGOs. The subcommittee is trying to establish a logo and help create ways to establish visibility for the group and for mussels. There were a number of submissions for a logo which were pared down to a handful, and the subcommittee would like to have everyone at this symposium vote on choices for both a logo and a slogan. Looking for volunteers to help create some marketing materials. Speakers Bureau for the National Strategy - looking for volunteers to speak about freshwater mussels to various groups such as conservation groups, state and federal agencies, and schools. We welcome anyone to contribute ideas and assist in outreach. Texas Parks and Wildlife is putting up a display on freshwater mussels, and the Houston Museum has a display for the public. These can be a guide on what works, what people like or don't like. Need to coordinate to develop a repository for slides, and other outreach material. Leroy Koch and Mark Hove volunteered to help the outreach subcommittee. Freshwater mussel exhibit has opened in Marietta Ohio at the Ohio River Museum.

Information Exchange Subcommittee

Madeleine Lyttle, chair. Making progress on publishing the National Strategy; development of a web site listserver needs to be discussed by the committee; the triannual report has been put on the Natural History Survey web site, and a searchable bibliography on freshwater mussels is being worked on by Kevin Cummings, Art Bogan and Dick Biggins. There are over 9000 citations. Art has a technician working on the bibliography and verifying the citations, especially the gray literature. They are discussing the best way to present or publish the bibliography. One option is a searchable cdrom, or the second option is a searchable site license on internet with a subscription. A hard copy is too cumbersome. Need to discuss finances and arrangement for handling collection of fees. Up-front costs for developing the bibliography are estimated at $40,000 (travel money, cd costs, laptops, etc.). If a grant request is developed, Dick Biggins would be willing to try to help fund this, and possibly USGS/BRD. Members of the committee (Kevin, Dick, Art and Kurt) will get together to pull together a grant proposal to present to various agencies. Mussel Mitigation Trust may also be interested.

Another item taken on by the subcommittee was to make a list of adverse projects that currently is or may be detrimental to a mussel population. An outline was developed. Jerry Rasmussen is also willing to publish these white pages on adverse projects in River Crossings. If this moves ahead they should be sent to Madeleine Lyttle to begin the review process, therefore, Madeline would need volunteers from different areas of the country to review the submittals. A disclaimer would be needed on a home page if one is developed. Another option is if there is an adverse project that should be brought to everyone's attention it can be posted to the Unio listserver. It would be helpful if a format for submitting or posting projects was developed and posted on the unio listserver. Dick Neves mentioned that AFS has an endangered mollusk subcommittee of the endangered species subcommittee. Another option is if a project will affect a listed species or rare species, AFS can then comment on the project. AMU also has a conservation committee that can comment in writing providing strong letters of support. A letter can be sent from the national native mussel committee. This was agreed on by the committee. Madeleine volunteered to centralize or coordinate the projects that are received and would draft a letter, send it to Al and it would be emailed to the EXCOM for comment and review. Volunteers to assist Madeleine are Kurt Welke, Deb Mignogno, and Mike Davis. The current mailing list for the national strategy is about 500 names. Send mailing lists to Madeleine.

Funding Workgroup

Kurt Welke. Need funds for bibliography, atlas, and other projects. Kurt is willing to serve as a source of information to provide people with potential sources of funding and sources for cost-sharing. The committee needs some working capital to grow. Subcommittee is made up of only a couple people so far (Kurt, Rita Villella). Diane Waller volunteered to help. We need to collate all sources of money resources. If anyone has information on funding, send to Kurt and any projects you need help for funding also send to Kurt.

Draft National Strategy

Al Buchanan. Al and Dick Biggins are working with Susan Mangin. Susan Mangin and Susi von Oettingen presented it at the National Shellfisheries Association meeting last spring. It will be published in the June issue of the *Journal of Shellfish Research*. Number of copies (1-2000) is being looked into. Al will work with Rita on getting copies, determining costs of reprints. Al and Jerry Rasmussen would sign a letter accompanying the strategy. Susan Mangin is working on artwork for the cover. Susan will coordinate with Ed Pendleton on the reprints. Dual publication will be addressed with the editor of *J. Shellfish Research*. Tom Muir will also approach Paul Brouha about publishing a summary of the strategy in Fisheries.

Water Quality/Habitat Alterations/Zebra Mussels Subcommittee

Tom Muir, Chair. Jim Williams and Tom held a workshop last spring and enlisted people to write a series of papers on various aspects of water quality and habitat changes which impact mussels. The papers were presented at NABS. Dave Strayer is coordinating the reviews for these papers and will have comments back to the authors May 1. They will be published in NABS as an introduction on water quality and freshwater mollusks. It should come out sometime this year. Tom will approach NABS to see if extra copies can be run and made available. A series of slide presentations were made. Tom is asking for the slides to put together a couple of slide presentations, one for the general audience. Tom will involve the help of BRD outreach personnel. These would be available for anyone to use for outreach. A slide showing the logo and the committee name should be part of the slide shows. Tom is working with NAWQA to put together a compendium of methods, based on a study by Leetown, to use in sampling that covers various levels of intensity that will be available to NAWQA biologists (Tom suggested this be done under the auspices of the guidelines/techniques subcommittee). Tom asked for input on future direction for the subcommittee.

Propagation/Restoration/Introduction Subcommittee

Dick Biggins, Chair. Rick Tankersley will be co-chair of this subcommittee. A list of tasks was submitted by the subcommittee and these tasks were ranked. Now need guidance from the overall national committee on where to go with these tasks. Bob Butler is developing guidelines on relocation, reintroduction, and augmentation including genetic guidelines. This will be basic guidelines on do's and don'ts before animals are put back in the wild. A handout was passed out on the Draft Guidelines for Maintaining Genetic Integrity in Population Augmentation and Reintroduction Efforts for Aquatic Mollusks in the Eastern United States. Please review the draft and send comments to Bob Butler. These guidelines point out a series of needs that should be considered. A white paper is being developed on introductions and augmentations of freshwater mussels in North Carolina (John Alderman).

Guidelines/Techniques Subcommittee

Heidi Dunn, chair. The goal of this subcommittee is to compile and disseminate guidelines and techniques that are available and not to come up with new techniques. A product that has been discussed is a series of papers that will be a summary of techniques, annotated bibliography, and contacts for further information. There are 15 members but welcome any and all help. The subcommittee will meet this Friday evening in the Sienna room. Guidelines/techniques from the national strategy and ORVE document were compiled and put on the Unio listserv and 20 responses were received. The priority need from this response was for standardized survey techniques. Suggestions were received on how to possibly group the laundry list of needs. The subcommittee can serve as reviewers for papers on techniques developed by others. The subcommittee document will be in a form that can be updated. A format for writing guidelines will be developed by the subcommittee and made available in the minutes. Anyone that has documents or papers on techniques, send to Heidi.

Commercial Subcommittee

Cheryl Ballenger/Nelson Cohen, Chairs. There hasn't been much progress in this subcommittee. Since shelling has been closed in some states, there has not been much cooperation or communication with shellers. Steve Ahlstedt has agreed to be the go between the national committee and commercial shellers to help improve communications.

Organizational Review:
National Native Mussel Conservation Committee -

Chair - Al Buchanan
Treasurer - Heidi Dunn
Secretary - Rita Villella
Subcommittee Chairs

Symposium
Steve Ahlstedt, John Jenkinson
Status/Distribution
Kevin Cummings
Outreach
Linda Drees, Mike Davis
Information Exchange
Madeline Lyttle
Water Quality/Habitat/Zebra Mussels
Tom Muir
Restoration/Propagation
Dick Biggins, Rick Tankersly
Guidelines/Techniques
Heidi Dunn
Commercial
Cheryl Ballenger

Advantages and disadvantages of staying under MICRA or forming a society were reviewed. Three options were presented: 1) Stay as we are under MICRA; 2) form a society (within a year); and 3) stay with MICRA but begin forming bylaws with the intent of becoming a society in 3 years.

The group suggested that the national committee should focus on freshwater mollusks as a whole. If we go to a society we should involve states outside MICRA, including western states. This would likely be accomplished if change focus to mollusks. In 1994 a letter was sent to NABS formalizing a request to form a mollusk subgroup or section under the umbrella of the parent society. In 1995 NABS rejected our request to form a mollusk subgroup. AMU is seen as too expensive, so students would basically be left out, and they are also seen as primarily focused on marine fauna and taxonomy. MICRA is uncomfortable with the mussel national committee because of its size and it is not traditional fish management. Forming a society would not necessarily alienate us from MICRA; we would still maintain ties with various groups. It currently is difficult to explain just who this group is. It is difficult for states outside MICRA to justify sending biologists to committee meetings because it is seen as a MICRA national mussel committee.

AFS has always been in the forefront on aquatic issues and has been supportive of freshwater mussel issues. A suggestion was to hold an independent meeting every other year on our own and a meeting associated with other organizations (AFS, AMU, etc.) other years. Should an independent society be formed, we need to assure it is not a society that exists in isolation. We need to evaluate the advantages of being under an umbrella of AFS or becoming a society but still maintain association by having a meeting associated with them some years.

Not hitching our wagon with any specific organization allows us the flexibility needed for a diverse group as this. If the group becomes an independent society we would have the flexibility to have a

Memorandum of Understanding with any group we would like to work with. If we becom part of AFS, many people will have difficulty getting to attend meetings. Can either attach to a large, powerful group or form a society and be perceived as a small group, but a group that may grow in the future. Whether we form a society depends on our goals and objectives. The advantage of AFS is it has a large constituency, it is geographically widespread and well established; however, their bread and butter resource is commercial and sport fisheries.

If a society is formed, what would be its goals and objectives:

Conservation of native freshwater mussels
Goals as listed in the strategy

A preliminary poll was taken on the three options: Stay with MICRA, Stay with MICRA but form a society, or form a subcommittee under another society, i.e., be one society. There was overwhelming support for NNMCC to become its own society. Several preferred to become part of another society.

A suggestion was made to change the focus from mussels to mollusks with a current focus on freshwater mussels for now. It was suggested that Al Buchanan begin to explore getting the appropriate documents needed to form a non-profit society, get the necessary background information, put it on the web for comment, and present the package next year at the meeting in Chattanooga. Whatever we do we need to do it soon because the logo will be produced soon.

Proposed name:
North American Freshwater Mollusk Society.
The American Freshwater Mollusk Society
Freshwater Mollusk Conservation Society - the winner

The overall committee decided to adopt forming a society and adopting the name **Freshwater Mollusk Conservation Society**. The motion was made and accepted that the paperwork, charter and bylaws be prepared and be completed by the Chattanooga meeting. During the year of transition, for the strategy include in a letter that The Freshwater Mollusk Conservation Society was formerly a subcommittee under MICRA, the National Native Mussel Conservation Committee. The motion was made to prepare the package for tax exempt status and begin preparing the charter and bylaws. As of today we are the Freshwater Mollusk Conservation Society and this will be the name used for the Chattanooga meeting.

Committee to set up the bylaws and charter:

Al Buchanan
Patty Morrison
Theresa Naimo
Susi von Oettingen
Dick Biggins
John Alderman
Heidi Dunn
Tom Muir
Diane Waller
Deb Mignogno
Dick Neves

Brown bullhead suitable host for *Tritogonia verrucosa*; *Cumberlandia monodonta* host(s) remain elusive

Mark C. Hove, Jennifer E. Kurth, and Anne R. Kapuscinski
University of Minnesota, Department of Fisheries & Wildlife, 1980 Folwell Avenue,
St. Paul, MN 55108 (612) 624-3019,
Mark.Hove@fw.umn.edu, kurt0007@tc.umn.edu, ark@fw.umn.edu

Tritogonia verrucosa and *Cumberlandia monodonta* are threatened in Minnesota. We conducted a series of host suitability tests to better understand their life history requirements.

We followed standard protocol for conducting host suitability tests (Neves *et al.* 1985). Gravid mussels were collected from and later returned to the St. Croix River, Minnesota. A mussel was considered a juvenile when foot movement was observed.

Metamorphosis of glochidia into juveniles was observed for *T. verrucosa* but not for *C. monodonta* (Tables 1 and 2). Six *Tritogonia verrucosa* juveniles were collected from seven brown bullheads 26-36 days post-infestation. No juvenile mussels were collected from eighteen species exposed to *T. verrucosa* glochidia or seven species exposed to *C. monodonta* glochidia (Table 1).

Table 1. Trials where glochidial metamorphosis was not observed.

Species	Number tested	Glochidia attachment period (days)	Species	Number tested	Glochidia attachment period (days)
T. verrucosa					
northern pike	10	7-10	brook stickleback	14	4-11
central mudminnow	15	5-8	banded killifish	14	2-5
black bullhead	42	10-37	mottled sculpin	3	8-13
brown bullhead	5	16-19	blackside darter	6	4-7
yellow bullhead	4	16-20	fantail darter	9	4-7
channel catfish	9	1-8	Iowa darter	11	4-24
tadpole madtom	8	8-21	Johnny darter	13	1-4
eelpout	3	4-8	logperch	7	4-7
trout-perch	2	1-4	walleye	7	8-12
C. monodonta					
black bullhead	15	1-9	mottled sculpin	6	6-8
yellow bullhead	6	1-6	eelpout	6	3-6
stonecat	1	1-4	freshwater drum	3	1-6
tadpole madtom	6	1-4			

Host suitability trial results to date suggest most Ictalurids tested are only marginal hosts for the pistolgrip. Only six juveniles were collected from brown bullheads in this study. Past studies have shown yellow bullheads will serve as hosts (Pepi and Hove 1997) but very few juveniles were collected and yellow bullheads did not facilitate metamorphosis this year. However, flathead catfish facilitated metamorphosis of 'many' juveniles in a study by Howells (1997). Additional studies should be conducted to determine if other species serve as hosts for *T. verrucosa* and *C. monodonta* glochidia.

Partial funding for this study was provided by the Minnesota's Natural Heritage & Nongame Research Program and Bell Museum of Natural History. The Minnesota Environmental and Natural Resources Trust Fund provided additional funds. We gratefully thank Dave Heath, Ron Benjamen, and Mark Endris of the Wisconsin Dept. of Natural Resources for collecting gravid mussels.

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At extinction's edge: *Margaritifera auricularia* (Bivalvia: Unionoida)

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One of the most endangered naiads (unionoid bivalves) in the world is *Margaritifera (Pseudunio) auricularia* (Spengler, 1793), originally distributed in large rivers of Western Europe and the Maghrib. Once considered extinct, a living population was rediscovered in 1985 in the lower reaches and adjoining channels of the river Ebro in Spain.

An intensive sampling along 47 Km, triggered by public works aimed at recovering riverine navigation, has allowed an evaluation of the status of this population. Individuals between less than 2 and more than 14 cm long have been located, the latter having an age (assessed by examination of thin sections of empty shells) close to 100 years. Their total number was initially estimated at 27,000 ± 4,000, although a statistical recalculation showed that it is probably 8,400 ± 3,100. The spatial distribution is very irregular, with over 80% of them confined to less than 2% of the river bottom, and half of the study area unoccupied due to pollution and impoundment.

It is possible to save this last, fragmented population of *M. auricularia* with an effective protection embracing the river itself. Water authorities have responded to the pledge, and popular activities have resulted in a growing awareness among the area's residents. Without this species, the riverine ecosystem would lack an emblematic species, and would remain impoverished in terms of biodiversity, structural complexity, and interaction richness.

This research program started in February 1996, and has been the subject of previous contributions to the Triannual Unionid Report. In this context, the claim made by Araujo, Jimenez and Ramos in this newsletter (T.U.R. 14: 15) that nobody had seen the species alive since 1917 seems most strange. Indeed, last February they attended an official meeting on the current status of the species, hosted by the Ebro Delta Natural Park, where our research was fully exposed. I believe it is most unfortunate that their desire of notoriety conflicts with conservation action for this species. At any rate, we continue to work, and a large ecological project, funded by the Spanish Ministry of the Environment, is due to start next January.

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A preliminary report of an investigation of whether brooding pistolgrip and purple wartyback release chemical attractants

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It is widely believed that certain unionids use visual cues to attract fish to their glochidia. For example, many lampsilines wave portions of their mantles that resemble food items (small fish or aquatic insects) to fish. Also, conglutinates produced by mussels appear to resemble food items of fish, sometimes with startling detail (*e.g.* larval fish-like conglutinates of *Ptychobranchus occidentalis*). The precise nature of the sensory cues used by mussels to attract their hosts has yet to by fully elucidated, however.

For the past year we have been investigating the possibility that naiades may have evolved to produce chemical attractants to supplement visual cues. This is a preliminary report of this work that is still in its infancy.

We believe that naiades may have evolved to produce chemical attractants simply because chemical cues are generally the primary means by which fish find food items in turbid freshwaters from a distance. Further, chemicals are readily distributed in the water and are detected with great sensitivity and specificity by fishes. The unusual mantle displays of pistolgrip (*Tritogonia verrucosa*) and purple wartyback (*Cyclonaias tuberculata*) mussels lead us to investigate the possibility that these species may use chemical cues to attract their catfish hosts. To determine if catfish are attracted to these mussel odor we observed catfish under the following conditions: (1) in the presence of brooding pistolgrip, (2) in the presence of a purple wartyback conglutinate, and (3) while exposed to the water from a container holding brooding purple wartyback or pistolgrip. Here we report our initial findings.

In the first experiment, year-old channel catfish were placed in a 10-gallon aquarium that contained both brooding and non-brooding pistolgrip. After being permitted to acclimate for 15 min., the fishes' behavior was observed. On two occasions a fish was seen to brush against the mantle of a displaying pistolgrip but this did not elicit feeding behavior (vigorous snapping and nosing against object). Although the fish did not appear attracted to the inflated pistolgrip mantle, one fish did nose and nudge the excurrent siphon of a gravid, non-displaying pistolgrip. Although inconclusive, these results are suggestive of a role of chemical cues, leading us to the second experiment.

The second experiment using a purple wartyback conglutinate also produced suggestive but as yet inconclusive results. Feeding behavior was not observed during two trials where young, hatchery-reared channel catfish were placed in a 10-gallon aquarium with a petri dish holding the conglutinate. During a third trial however, a conglutinate was placed in a 40-gallon aquarium with three 3-5 year old, wild-caught channel catfish. One of the fish briefly inhaled and expelled the conglutinate.

Tests are currently underway to address our initial suggestive findings that mussel odor might be important to host attraction. Six trials with different channel catfish and one yellow bullhead have been conducted in a 75-gallon flow-through tank with painted floor lines to form five quadrants. After a 24 hour acclimation period 200 ml of water from an aquarium holding brooding purple wartyback or pistolgrip was introduced to one end of the tank through a plastic tube. The number of times a fish crossed a quadrant line and its orientation to the added water was recorded. During the first four trials fish moved very little. However, in the last two trials, we reduced test chamber light level and a yellow bullhead began exhibiting searching behavior approximately five minutes after water was added to the tank. The fish repeatedly approached the water inlet tube, rubbed against it, and bit it. After 1-3 minutes, it returned to searching behavior, eventually investigating the tube again. These behaviors lasted 5-10 minutes, after which time the bullhead resumed resting.

We plan to continue testing mussel odor to see if we can repeat the last finding. In addition, we hope to expand this study to observe the reaction of different Ictalurids to gravid purple wartyback and pistolgrip, and compare the behavior of wild-caught and hatchery-reared fishes. We welcome suggestions.

Funding for this study was provided by Minnesota's Natural Heritage & Nongame Research Program, Minnesota Environmental & Natural Resources Trust Fund, University of Minnesota, CBS Summer Undergraduate Research Program, and Minnesota Agriculture Experiment Station.

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Report: Abstract of a dissertation, University of Tennessee, Department of Ecology and Evolutionary Biology: Multi-scale analysis of unionid freshwater mussel community structure in the upper Tennessee River Basin

Populations of freshwater mussels of the family Unionidae are experiencing a decline in the upper Tennessee River basin. An understanding of the processes by which the structure of mussel communities is created and sustained may aid conservation efforts. Here, modeling is used to explore the patterns that are generated in local, mesoscale, and regional communities when particular biotic or abiotic processes are specified, and to generate predictions to which actual mussel data are compared.

Locally competing mussel species can coexist under equilibrium conditions only when each is sufficiently more successful on a different resource in terms of either resource use, life history characteristics, or a combination of the two. Temporal variability in fecundity promotes coexistence of a poorer competitor, particularly when variability is high and uncorrelated between species. Neither resource partitioning nor the influence of temporal variability explained coexistence of two similar freshwater mussel species.

At the mesoscale, competition can reduce species number and lead to spatially nested composition, whereas long-distance dispersal consistent with metapopulation dynamics has the opposite effect. Patterns in three mussel communities in the upper Tennessee River were most consistent with structuring by competition, however, at the low species number exhibited in real communities, competitive interactions were relatively weak in generating patterns.

Regional species richness in model communities increased with decreasing critical fitness values for colonization and extinction. High richness reduced average individual species' fitness, which inhibited colonization and further promoted richness through speciation. High-richness communities exhibited low variability among replicate scenarios and high resource specialization among species, consistent with structuring by biotic processes. Data from the upper Tennessee River basin appeared to be structured by biotic processes.

Different processes appear to structure freshwater mussel communities at different spatial scales: communities appear increasingly structured by biotic processes with increasing spatial scale. In general, biotic processes generate simple rules that guide a system's development, while abiotic processes control expression of pattern. The results of this study can be used to develop predictive models, and to interpret observed patterns of decline.

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This office has partnered with a number of individuals on projects related to **water quality and the conservation of freshwater mussels**. Specific projects are outlined here; more detail is available upon request:

I. The University of Georgia has been funded to conduct acute and sub-chronic toxicity tests on early lifestages of three non-endangered mussels that will serve as surrogates for three of North Carolina's five endangered mussels: the Carolina heelsplitter (*Lasmigona decorata*), dwarf wedgemussel (*Alasmidonta heterodon*), and Tar spinymussel (*Elliptio steinstansana*). Proposed surrogates are the green floater (*Lasmigona subviridis*), the Atlantic pigtoe (*Fusconaia masoni*), and a species to be selected from the FWS / NBS Surrogate Species for Freshwater Mussels list.

ii. We entered into an agreement with the U.S. Environmental Protection Agency's Science and Ecosystem Support Division in Athens, Georgia, to conduct fluoride toxicity testing on the endangered Appalachian elktoe (*Alasmidonta raveneliana*) and a surrogate species. Fluoride is a known contaminant in habitat for the Appalachian elktoe, but there are currently no pertinent data to evaluate the significance of this pollutant on freshwater mussel survival or reproduction. Acute and sub-chronic toxicity tests on glochidia and juvenile stages will provide data to help evaluate existing fluoride exposure and provide a foundation for reviewing proposed additional loadings.

iii. The North Carolina State University College of Veterinary Medicine received a grant to conduct an assessment of the health of the Carolina heelsplitter (*Lasmigona decorata*). We funded their proposal with the expectation of realizing a first ever report of observed prevalences of diseases detected in a surrogate species for Carolina heelsplitter. Because of the small size of these organisms and the number of tests to be performed, a significant ancillary benefit

will be the development of health assessment protocols suitable for other listed fish and molluscs. Parameters to be assessed include overall condition, histology of major organ systems, and the prevalence of specific bacterial, viral, fungal, protozoan, and metazoan disease agents.

Distribution and habitat of freshwater mussels in Colorado

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North America has the greatest diversity of freshwater mussels in the world, yet members of the superfamily Unionacea are the most highly threatened group of organisms in the United States. Colorado represents the westernmost range of some plains species. With the exception of the generalist *Anodonta grandis grandis*, freshwater mussel populations are in decline in Colorado, both at the species level and at the population level. Eight former Colorado species have been reduced to only three, one of which is represented by only one dead shell. Of 26 documented localities from museum and published records, only eight remain. This study adds another five. Only one of the ten previously documented lotic habitats still contains mussels. Surviving populations are largely confined to human-created reservoirs of recent origin.

The cylindrical papershell, *Anodontoides ferussacianus* (Lea), was once the most common species in the state (15 localities). It is currently found only in a slow-moving foothills stream with sand/cobble substrate and a small foothills lake with high turnover and mud/cobble substrate. Neither habitat is subject to large-scale annual changes in flow or water level. *A. ferussacianus* has never been documented to occur in the Republican or Arkansas River drainages and this study confirms its absence there. A single dead shell of *Uniomerus tetralasmus* (Say), the pondhorn, found in Queen's Reservoir is the only recent evidence of the pondhorn in Colorado. This specimen was found in a southeastern plains lake with a thick mud/clay bottom subject to periodic dessication. *Anodonta grandis grandis* Say, the giant floater, has maintained steady populations in Colorado, but no longer occurs in streams. It occurs on mud substrates in recent, human-created, plains reservoirs with hard, alkaline water, and calcium contents greater than 46 mg/l. The spread of the species into reservoirs along the Arkansas River drainage testifies to its adaptability.

Management of these species in Colorado requires knowledge of the location of population sources, the status of those populations, and the habitat conditions under which the populations exist provided in this study as well as a reintroduction program to prevent further decline. The success of the introduced Pueblo Reservoir population lends testimony to the fact that reintroduction can be successful, at least for *Anodonta grandis grandis*. Potentially stable population sources for reintroduction along the South Platte River drainage include Boulder Reservoir and Cherry Creek Reservoir for *Anodonta grandis grandis* and Valmont Reservoir for *Anodontoides ferussacianus*. Stable population sources along the Republican River drainage no longer exist. The Flagler Reservoir population is in rapid decline and can no longer be considered stable. Stable population sources along the Arkansas River drainage include Pueblo Reservoir and CF&I Reservoir Nos. 1-3. It is likely already too late for *Uniomerus tetralasmus* as all former populations seem to have disappeared.

Cleveland Island Mussel Survey, 1997

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Introduction

In December 1997 Don Gowan, The Nature Conservancy, and Leroy Koch, U.S. Fish and Wildlife Service, visited the Cleveland Island mussel site at Clinch River Mile 271. This site is a series of three forested islands located 0.6 miles below the Virginia Route 82 bridge at Cleveland, Virginia. These islands split the river into four distinct channels which form a large area of good mussel habitat. Church (1992) reported 21 species of mussels, including five federally endangered species, at the site.

The purpose of the survey was to assess the status of the unionid fauna following installation of an ultraviolet light disinfection system at the town of Cleveland's wastewater treatment plant, which discharges to the Clinch River 0.1 miles above Cleveland Island. This plant was upgraded from a chlorination/dechlorination disinfection system to an ultraviolet light disinfection system in 1994 to protect the mussels at Cleveland Island from an accidental release of chlorine, or failure of the dechlorination system at the plant. Laboratory bioassays have demonstrated the sensitivity of unionids to chlorine and other halogen based compounds (Goudreau, *et al.*, 1993).

Results of Survey

Sampling consisted of the collection of fresh dead mussel shells from muskrat middens at the site and limited instream sampling with view scopes. A total of nine species and 43 fresh dead individuals were collected in the middens (Table 1). The most abundant species collected was *Actinonaias pectorosa* (pheasantshell), with 18 fresh dead individuals, followed by *Elliptio dilatata* (spike), with nine fresh dead individuals. One individual of the federally endangered species *Fusconaia cor* (shiny pigtoe) was collected. Four specimens collected were less than four years old.

Recommendations

The mussel population at Cleveland Island appears to be reproducing as evidenced by the presence of specimens less than four years old. However, it is recommended that additional survey work be conducted to fully establish the health and reproductive status of the mussel population at the site.

References

Church, C.W. 1992. An assessment of the mussel fauna at Cleveland Islands, Russell County, Virginia. Report to The Nature Conservancy, Abingdon, Virginia.

Goudreau, S.E., R.J. Neves, & R.J. Sheehan. 1993. Effects of wastewater treatment plant effluents on freshwater mollusks in the upper Clinch River, Virginia. USA. Hydrobiologia 252: 211-230.

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I wish to thank Dick Biggins (USFWS, Reg. 4), Roberta Hylton (USFWS Reg. 5), Wayne Poppe (TVA), Leslie Colley (TN Nature Conservacy), Don Hubbs (TWRA), Don Gowan (VA Nature Conservancy), Steve Roble (VDCR), and Monty McGregor (VCGIF), for funding the poster "Mussels - Upper Clinch River Tennessee and Virginia." Posters can be obtained from Don Gowan (540) 676-2209 or USFWS, Region 5, Abington Field Office (540) 623-1233.

Common pleurocerid snails (4 species) collected from the Nolichucky River the past two years and reintroduced into the Pigeon River are surviving. Mark Fagg (Tennessee Wildlife Resources Agency) and I moved another 5,000 snails this spring into the Pigeon. This project will continue at two sites until reproducing populations are established.

Spiny riversnails will be monitored in the Holston and French Broad rivers late July or early August. Those populations will be further augmented in cooperation with the TWRA until reproduction is found. Spiny riversnails will also be reintroduced into the Little River at a site where they occurred historically. If anyone would like to help with this please contact me.

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Tennessee's commercial mussel industry is again experiencing low demand for shell. As of the first week of July, TWRA has sold approximately 300 musseling licenses compared to ~ 650 for all of 1997, and 1,200 in 1996. This lull in harvest has allowed the mussel resource of Kentucky Lake to begin recovering from almost a decade of increasing harvest pressure. Samples taken thus far indicate that in some areas, as much as 50% or more of the resource is at or above legal size. This compares favorably to estimates of 5 to 10% legal size from previous years. Tennessee mussel shell prices are : ebony - 2 3/8" $0.35/lbs (if buyers are puchasing), threeridge/mapleleaf -2 5/8" $0.50/lbs, 2 3/4" $1.80/lbs, washboards 3 3/4" (have not been buying since April), washboards 5" or at least shell 5/8" thick - $5.50/lbs (all prices are for "live" meat in shell).

TWRA mussel program personnel have been busy assessing mussel population status and harvester activity during this time of decreased harvest pressure. We have yet to see evidence of the exotic zebra mussel increasing on the lower TN River, although we did collect a couple of blue crabs from TVA's New Johnsonville steam plant. We have also continued attemps to culture common mussel species and are working on an improved collection method for juvenile (1+ year class mussels). This new method employs a 4" suction dredge capable of moving up to 4 cu. Yards of material per hour. We hope to use this new method to collect sufficient numbers of juvenile mussels from high density areas for restocking in preselected habitats.

Tennessee and Alabama have received funding for a joint project to collect endargered mussel brood stock from the Tenn. River in TN and AL later this summer/fall. We will also be locating habitat to release cultured juvenile mussels for future monitoring.

COPPER RESIDUALS IN FISH HATCHERY POND SEDIMENTS: POSSIBLE ASSOCIATIONS TO FRESHWATER MUSSELS

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Freshwater mussels (Family Unionidae) are among the fastest declining faunal groups in North America (Neves 1993; Williams et al. 1993) with impacts from environmental modification and pollution, introduced exotic species like zebra mussels, over harvest, and a host of other threats. Subsequently, scientific attention to this group has increased dramatically over the past 10 years. One area of study has included establishing captive populations, often at fish hatcheries, as a source of specimens for future reintroduction and to protect from invading zebra mussels (Dunn and Layzer 1997; and others).

Shortly after Texas Parks and Wildlife Department initiated work with unionids at Heart of the Hills Research Station (HOH) in 1992, over 100 specimens of each of four species and additional specimens of other taxa were stocked into holding cages in research station ponds in 1992-93 and again in 1993-94. An apparently introduced disease caused losses during the first effort, but otherwise, mussels generally survived well. Dissections confirmed feeding in all species and reproduction in several. However, virtually no growth was documented. In an effort to examine possible explanations for this apparent lack of growth, chemical composition of pond sediments was considered. HOH was constructed in the mid-1920s as a fish hatchery. It continued to function as a hatchery until 1969 when it became a fisheries research station. Throughout its use, ponds at HOH were treated frequently with copper in the form of copper sulphate or copper acetate to control parasites on fishes and algal growths in the ponds. Further, copper readily perciptiates out of solution in hard-water alkaline environments typical of HOH ponds. Copper is also particularly toxic to invertebrates.

Samples of sediments were obtained from the spring which feeds water to HOH and from two HOH ponds. These were sent to Angelo State University where they were subjected to energy dispersive x-ray fluorescence to examine levels of copper present. Techniques followed Webb and Dawkins (1998) where labware was washed with nitric acid and distilled water and oven dried. Triplicate subsamples were ground and placed on Formvar film slides then irradiated for 1,000 live seconds with 35 kV primary x-rays generated by a Rh target with a target current of 30 mA. Calculations to determine copper concentration (Webb and Dawkins 1998) found levels at the spring of 15.1 ± 2.0 ppm, but found levels in the two research station ponds of 48.4 ± 7.1 and 36.8 ± 6.0 ppm.

Whether the copper concentrations found relate to the lack of observed growth in unionids living in these sediments is unclear. However, amounts copper in research station (i.e., hatchery) ponds which had been treated with copper for many decades were clearly higher than local background levels. This suggests the possible presence and potential impacts of copper and other substances in hatchery ponds should be considered when unionids are relocated to these facilities.

References:

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Williams, J.D., M.L. Warren, Jr., K.S. Cummings, J.L. Harris, and R.J. Neves. 1993. Conservation status of freshwater mussels of the United States and Canada. Fisheries (Bethesda) 18(9):6-22.

Meramec River Freshwater Mussel
Identification Workshop

"...every scrap of biodiversity is priceless, to be learned and cherished, and never to be surrendered without a struggle."

Edward O. Wilson

Dear unionid novices and enthusiasts,

The Meramec River is one of Missouri's most treasured streams. Among other taxonomic groups associated with stream habitats, the Meramec supports over 100 species of fish and over 40 species of freshwater mussels. Many who have witnessed the awesome scenery and rich biodiversity of this river call it "Missouri's Gem". Over the last several decades, conservation agencies, environmental groups, stream teams, land owners, and local people have worked hard to preserve this river in its natural state.

To celebrate the diversity of life in the Meramec River, the U.S. Fish and Wildlife Service will be sponsoring a freshwater mussel identification workshop on September 9th and 10th. This workshop is a good opportunity to become acquainted with these unique mollusks and gain hands-on experience with identification. The first day will be held indoors at the Meramec State Park visitor center in Sullivan, Missouri. Invited Malacologists will give several slide presentations and lead group laboratory exercises in identification. We will spend the second day in the Meramec River collecting and identifying shells and live mussels. Many species we will be working with are common throughout the Midwest, so this will be beneficial to those outside Missouri as well.

If you are interested in attending, please provide the information requested below and return by COB Friday, July 17. Unfortunately, there are a limited number of slots available (the first 40 responses will be accepted). Those attending will receive more detailed information and others will be notified accordingly. Feel free to forward this message to others you feel would be interested. If you have any questions please don't hesitate to contact me. Thank you.

Sincerely,

Andy Roberts

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Meramec River Freshwater Mussel Identification Workshop

Place: Meramec State Park Visitor Center in Sullivan, Missouri (approximately 1 hour west of St. Louis)
Dates: September 9 (lab exercises) and 10 (field trip) (there will be an optional field survey on the 11th)
Time: 8:00 a.m. to 5:00 p.m.

Lodging: There are several options. Motel rooms are available in the park that can accommodate up to three persons (1-2 people--$55, 3 people--$60). A variety of hotels are also available in Sullivan, approximately three miles from the park. U.S. government perdiem for Sullivan, Missouri is $50 for lodging and $30 for food. The room rates in Sullivan are as follows:

		Regular Rates		Government Rates	
		1 Person	2 People	1 Person	2 People
Best Western	(573) 468-3136	44.99	53.99	39.99	48.99
Family Motor Inn	(573) 468-3891	39.95	47.95	35.95	43.95
Ramada Inn	(573) 468-4172	55.00	50.00	32.00	32.00
Sullivan Super 8	(573) 468-8076	41.88	49.88	37.70	44.90

Please respond by e-mail or phone and provide the following information. If responding by e-mail, copy and paste the following text to a reply letter and fill out the information requested.

_____

_____

I would like to attend the mussel workshop.

Name:
Job Title:
Business Mailing Address:
Business Phone:
Emergency Contact (name and phone):

____Please reserve a private room for me in Meramec State Park

____To cut down on expenses, I would be willing to share a room with another participant at Meramec State Park. I will be sharing a room with (name):

____I will be lodging in Sullivan and will call to reserve a room for myself

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Our new book "The pearly mussels of New York state" has just been published as Memoir26 of the New York State Museum. This hardcover book (113 pages plus 27 plates) summarizes the distribution of unionoid mussels in New York and discusses the zoogeographic and ecological reasons behind those distributions. The book contains spot maps, descriptions, differential remarks, and illustrations (most in color) for each of the 53 species known or thought to occur in New York. The book also includes keys to the identification of the species, general reviews of mussel biology and zoogeography in New York, notes on collection and identification of mussels, a discussion of 10 species erroneously reported from New York, a brief synonymy, and an extensive list of references. The color illustrations are numerous and of remarkably high quality. Twenty-five plates contain 165 life-size paintings originally prepared in 1906-1925 by Helen Winchester, Wilfred Davison, and George Barkentin for Henry Pilsbry's unpublished monograph on New York's nonmarine mollusks. These illustrations, used by the kind permission of the Academy of Natural Sciences of Philadelphia, are of extraordinary fidelity and beauty. They are supplemented by 15 color photographs and many black-and-white drawings.

This book should be useful to anyone interested in the ecology or distribution of unionoid mussels in northeastern North America. It is available for $50 (plus $4 for shipping) from Publication Sales, New York State Museum, Albany, NY 12230 (518-449-1404).

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Report: Statewide Survey of Listed and Candidate Freshwater Mussels in Missouri

Between July and November, 1997, we surveyed unionid mussels in the Meramec River Basin to complete the first of a three-year statewide survey to assess Missouri's mussel fauna. Of 79 localities sampled in the Meramec River Basin, fifty-eight (58) were sampled previously by Buchanan (1979). Twenty-one (21) additional localities had never been sampled before, to our knowledge. In total, we examined 11,067 living specimens in 338 person-hours of search time in the basin. Overall catch per unit effort (CPUE) was 32.7 mussels/person-hour. We documented the presence of forty-three (43) extant unionid species in the Meramec River Basin during this study; we collected live specimens of forty-one (41) and freshly dead valves of two (2) additional species. The five most abundant unionid species in the basin were the mucket, *Actinonais ligamentina* (29.2% total catch), spectaclecase, *Cumberlandia monodonta* (20.9%), threeridge, *Amblema plicata* (11%), round pigtoe, *Pleurobema coccineum* (4.8%)

and pimpleback, *Quadrula pustulosa* (4.5%). We collected live specimens of one federally endangered (pink mucket, *Lampsilis abrupta*) and eight unionid species either officially listed or of special concern in Missouri: elktoe (*Alasmidonta marginata*), rock pocketbook (*Arcidens confragosus*), spectaclecase (*Cumberlandia monodonta*), snuffbox (*Epioblasma triquetra*), ebonyshell (*Fusconaia ebena*), scaleshell (*Leptodea leptodon*), sheepnose (*Plethobasus cyphyus*) and salamander mussel (*Simpsonaias ambigua*). Comparison of catch-per-unit-effort (CPUE) at localities sampled in Buchanan's (1979) and again in our survey revealed that numbers of unionids declined by 45%, from 39.7 to 21.8 unionids/person hour. Similarly, mean species richness (total number of species) of live unionids at 28 sites in the Meramec, and 17 sites in the Bourbeuse rivers, declined from 13.6 to 8.1, and 18.8 to 6.9 per site, respectively. As judged by the presence of young mussels less than 6 years of age (=recent recruitment) at sampling localities, we documented that reproduction is still occurring at one or more sites of occurrence for 77% (23 of 30) of the species in the Bourbeuse, 30% (6 of 21) of the species in the Big, and 89% (33 of 37) of the species in the Meramec River.

Richard I. Johnson

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New publication

Johnson, R. I. 1998. A new mussel, Potamilis metnecktayi (Bivalvia: Unionidae) from the Rio Grande System, Mexico and Texas with notes on Mexican Disconaias. Occasional Papers on Mollusks 5 (76) 427-455, pls. 22-27 (January)

ABSTRACT: *Potamilis metnecktayi*, a new species of Unionidae from the Rio Grande system of Mexico and Texas, is described. It has been mistaken for *Lampsilis (Proptera) salinasensis* Simpson, 1908, which is a synonym of both *Lampsilis fimbriata* Frierson, 1907 and *Disconaias disca* (Lea, 1838) from the Rio Panuco System. Also discussed are *Potamilis purpurata* (Lamarck, 1819), *Cyrtonaias tampicoensis* (Lea, 1838), *Disconaias walkeri* (Baker, 1922), and *Lampsilis explicata* (Morelet, 1849).

In Press

Johnson , R. I. Unionidae of the Rio Grande (Rio Bravo del Norte) System of Texas and Mexico.

ABSTRACT. Rio Grande Subprovince is redefined as being limited to only the Rio Grande System of Texas and Mexico. Fifteen species of Unionidae occur in the basin. The recent description *Disconaias conchos* Taylor and *Potamilis metnecktayi* Johnson brings the total number of endemic Unionidae to four. Only one of the eleven species which occur north of the Rio Grande also occur in Mexico.

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TWO YEARS OF FOLLOW-UP AFTER A 1996 UNIONID TRANSLOCATION FROM AN AREA WITH HEAVY *Dreissena polymorpha* (Pallas 1771) INFESTATION, MISSISSIPPI RIVER MILE 695.7, HWY 14-61 BRIDGE, LA CROSSE, WI.

This translocation was probably the first to be conducted in an area heavily impacted by *D. polymorpha* 6-44 mm long. In July/August 1996, prior to riprap placement around bridge piers, 12698 unionids (27 species) including five endangered *Lampsilis higginsi* and 575 special status unionids, such as 39 *Ellipsaria lineolata*, 29 *Arcidens confragosus*, and 234 *Pleurobema sintoxia*, were translocated. Mean densities were: Pier 6, 2.8/m2 (22 sp.); Pier 7, 0.07/m2 (12 sp.); Pier 8, 10.65/m2 (27 sp.); depths were 4-9 m. *Amblema plicata* was 39.75% of the fauna. At Piers 6 and 7 there were a small number of *D. polymorpha* on most unionids, but at Pier 8, downstream of a grain dock, the substrata was covered with *Dreissena* 25 to 75 mm deep. Up to 120 or more were on 80% of the unionids which greatly slowed unionid recovery. Many unionids were nearly covered with *D. polymorpha*, but few were fresh-dead. A saving factor be the strong current at Pier 8, on the outside of a large river bend. Some unionids were devoid of *D. polymorpha* but had byssal threads. Processing time was doubled by hand stripping *D. polymorpha* before each shell was marked on both lower anterior valves; debris was bagged and buried in a landfill. Site I, 0.4 mi downstream of the bridge, was used for translocation of most of the common species. Site II, 4 miles upstream, was used for special status unionids. Recent Mississippi River records included three *Alasmidonta marginata*, and four *Lasmigona costata*, found at 6-9 m deep, probably depth records for these small stream species.

Special status unionids were doing well 6 October 1996; 50 small *D. polymorpha* were on one dead *Ligumia recta*. On 6-19 September 1997 follow-up was done at both Translocation Sites. Up to 60 small (5 mm) *D. polymorpha* were removed from most marked shells. Site I marked shell density = 8.1/m2 (93.7% survival); resident density = 14.5/m2. Site II marked shell density = 6.2/m2 (93.6% survival); resident density = 11.6/m2. At Site II 337 (58.8%) of the numbered mussels were found (96.8% survival) including one *L. higginsi*. Two year follow-up at Site II, 25 June 1998, on 332 special status unionids (57.2%) = 98.5% survival which indicates a 1-2%/year natural mortality. 40% of *L. higginsi* were recovered in 1998. Two species seem most affected by hand-translocation. In 1997 five (of 51) numbered *L. recta* found were dead (90.2% survival), plus the one found dead October 1996. At a similar nearby project two of four *L. recta* were dead after one year. Others have reported *L. recta* laying on the substrata, therefore, *L. recta* should be allowed to dig in on its own rather than being hand "planted". Three of 21 *A. confragosus* were dead (85.7% survival); only two of 50 *M. nervosa* were dead (96% survival) after one year, and in 1998 all 56 *M. nervosa* recovered were alive.

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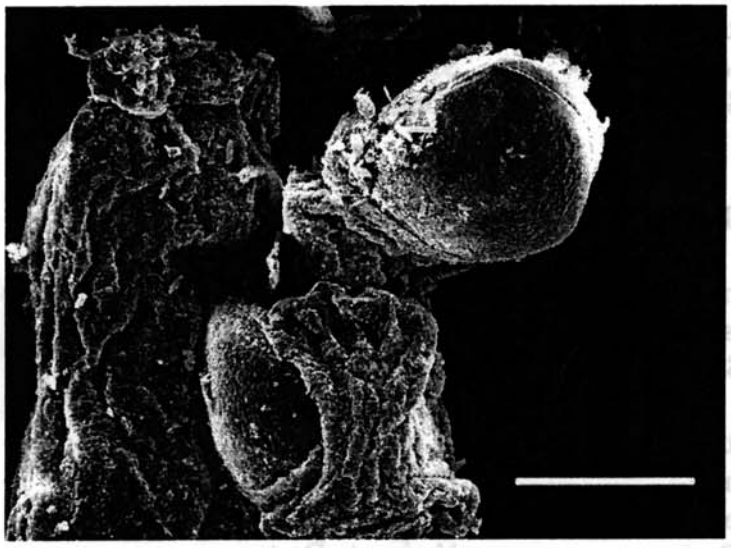
A 'Kinetic' Conglutinate in *Strophitus undulatus* (Say, 1817)

The conglutinate of the Squawfoot has been known for many years, and illustrated as far back as 1858. The infective conglutinate is a short, white cord bearing glochidia attached to it on the outside surface by a glochidial thread. However, we have found that when within the marsupium, the glochidia are on the inside of the conglutinate. After the conglutinates are released by the female, the glochidia are pushed through pores in the sides of the conglutinate, and within 1-2 minutes (sometimes within seconds), they emerge to the outside and open, ready to infect. The mechanism for this movement is believed to be osmotic.Conglutinates may be bathed in a hypotonic solution in the marsupium, and when expelled to the outside water, the conglutinate material swells, pushing the glochidia out through the pores. We believe this is the first report of such a 'kinetic' conglutinate - a conglutinate that has innate movement. This phenomenon probably facilitates release of the conglutinates by the female, which may be difficult if the glochidia are already on the outer surface and open.



Left: SEM photo of a 'kinetic' conglutinate. The lower glochidium is just emerging; the upper one is nearly free, but has not opened. Bar indicates 200 μ.

New Potential Hosts

1. Squawfoot, *Strophitus undulatus* (Say, 1817) - Ohio River drainage

Laboratory transformations occurred on the following species:
Bluntnose Minnow

The following fishes did not act as hosts:

Lavender Gourami	Goldfish	Central Stoneroller
Longear Sunfish	Banded Darter	

2. Squawfoot, *Strophitus undulatus* (Say, 1817) - Susquehanna River drainage

Laboratory transformations occurred on the following species:

Longnose Dace	Sand Shiner	White Crappie
Banded Darter	Fantail Darter	

The following fishes did not act as hosts:

Siamese Fighting Fish	Spotfin Shiner	Rosyface Shiner
Central Stoneroller	Bluntnose Minnow	Silverjaw Minnow
Fallfish	Largemouth Bass	Shield Darter

3. Triangle Floater, *Alasmidonta undulata* (Say, 1817) - Susquehanna River drainage

Laboratory transformations occurred on the following species:

Slimy Sculpin	Common Shiner	Central Stoneroller
Rosyface Shiner	Northern Hogsucker	Pumpkinseed
Largemouth Bass	Fantail Darter	

The following fishes did not act as hosts:

Siamese Fighting Fish	Bluntnose Minnow	Silverjaw Minnow
Swallow Shiner	Spotfin Shiner	Longnose Dace
Banded Darter		

4. Mucket, *Actinonaias ligamentina* (Barnes, 1823) - Ohio River drainage

Laboratory transformations occurred on the following species:

Largemouth Bass	Rock Bass	Tippecanoe Darter
Silverjaw Minnow	Central Stoneroller	

The following fishes did not act as hosts:

Bluntnose Minnow	Creek Chub	Rosyface Shiner
Central Stoneroller	Sand Shiner	Spotfin Shiner
Striped Shiner	Banded Darter	Variegate Darter
Slenderhead Darter	Greenside Darter	Logperch
Yellow Perch	Bluegill	Longear Sunfish
Mottled Sculpin	Grass Pike	

5. Fluted-shell, *Lasmigona costata* (Rafinesque, 1820) - Ohio River drainage

Laboratory transformations occurred on the following species:

Northern Hogsucker	Longnose Dace	Banded Darter

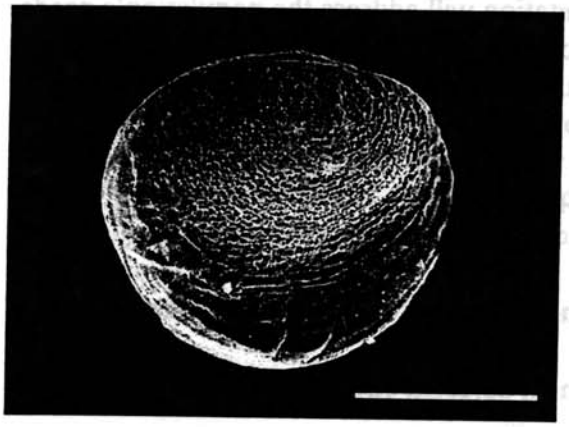
The following fishes did not act as hosts (* - extralimital):

Longnose Gar	White Sucker	Rosyface Shiner
Spotfin Shiner	Swallowtail Shiner*	Central Stoneroller

Longear Sunfish	Largemouth Bass	Pumpkinseed
Yellow Perch	Greenside Darter	Slimy Sculpin*

Infective and non-infective glochidia in *Lasmigona costata*?

While conducting host identification studies on *Lasmigona costata*, we encountered two types of glochidia within the marsupia. The first is a triangular, strongly hooked infective glochidium. The second (see figure) is a round, weakly-hooked or unhooked glochidium. Individuals of this second type had obviously grown shell material while in the marsupium. We suspect that this species, like its congener *Lasmigona subviridis*, may be able to forego the parasitic stage (see elsewhere in this report). But unlike that species, *L. costata* may be a facultative parasite. It is possible that the two types of glochidia are formed at different times of the year.



Scale bar = 200µm

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I am soliciting comments on the following draft guidelines on mollusk translocation projects (many of you have seen earlier drafts of these guidelines). Of particular interest are the genetic implications of mixing populations from different drainages (e.g., augmentation projects), and what researchers should do to prevent the swamping of resident populations. Please address your comments directly to me at the above address.

DRAFT GUIDELINES FOR MAINTAINING GENETIC INTEGRITY IN TRANSLOCATION EFFORTS FOR AQUATIC MOLLUSKS

Recent advances in propagation techniques are enabling researchers to potentially produce large numbers of juvenile mollusks in the lab. Concomitantly, water and habitat quality has improved at many riverine sites throughout the eastern United States. The coupling of propagation research advances and improvement in habitat conditions has enabled population augmentation and reintroduction efforts to become a reality.

Genetics research involving certain faunal groups (e.g., fishes) is continuing to indicate that many forms, particularly in the Southeast, that were formerly thought to be fairly wide-ranging species are actually complexes of species that have discreet distributions in specific stream/tributary systems and/or physiographic provinces. As many researchers know, there are numerous questions that must be answered regarding the taxonomic identity of aquatic molluscan forms as

well (e.g., southern Atlantic Slope *Elliptio*, *Pleurobema oviforme* and *Villosa iris* complexes, certain pleurocerids). What follows are a set of preliminary guidelines to reduce the possibility of unnecessary and potentially deleterious mixing of genetic stocks in the wild when conducting population augmentation and reintroduction activities for aquatic mollusks.

I. Population Augmentation--adding individuals to an existing population

A. Potential recipient sites for population augmentation efforts should be adequately surveyed to determine the presence of the target taxon.

1. Make an attempt to assess the recipient population size and natural population fluctuations in order to determine if the population is unnaturally low.

a. If the population is unnaturally low, determine the factors limiting population growth as a measure of whether augmentation will address the population's needs.

B. When a "seed source" is available, juvenile specimens should be propagated using brood stock from the recipient stream metapopulation.

1. Endeavor to reduce homozygosity in the donating population by increasing brood stock numbers as much as possible without totally swamping the recipient population.

C. When a recipient population is too small to adequately supply adults for artificial propagation, the juveniles should come from another metapopulation using the following criteria (in order of decreasing importance):

1. Brood stock from another metapopulation in the same stream/tributary system in the same physiographic province.
2. Brood stock from another metapopulation in an adjacent stream/tributary system in the same physiographic province.
3. Brood stock from another metapopulation in an adjacent stream/tributary system in an adjacent physiographic province.
4. Brood stock from the only metapopulation with sufficient adults to provide progeny.

II. Reintroduction--returning individuals to historical habitat

A. Potential recipient sites for reintroduction efforts should be determined to no longer harbor the target taxon.

B. See Items I.B and I.C above.

General Considerations:

- Priority should be given to critically imperilled endemic taxa versus wide-ranging taxa where feasible when considering a propagation program. Drastically declining taxa or unique gene pools may also warrant high prioritization.
- Donor populations should not be chosen strictly on the basis of the ease in obtaining culture or reintroduction brood stock.
- Increasing genetic heterozygosity of propagated individuals to the fullest extent possible should be a significant consideration when conducting propagation studies.
- Reintroduction efforts should focus on streams near the center of a species historical range where possible.
- Non-imperilled organisms representing species complexes should be lower priority for propagation efforts unless they are used for developing techniques. If such taxa are propagated, resulting juveniles should be returned to the stream reach from which the brood stock was collected to reduce the potential for genetic swamping.
- When augmenting populations with genetic stock from elsewhere, researchers should recognize the possibility that the donor gene pool they introduce may have traits that reduces the overall fitness of the recipient population. Augmentation efforts may therefore actually do more harm than good in some situations. This may pose a potential problem particularly for low mobility, locally adapted, narrowly endemic species characteristic of mollusks in southeastern river systems.

- In certain situations involving population augmentation, it may be more genetically sound to sacrifice large numbers of artificially propagated siblings than to put them back into the wild, where there may be the possibility of swamping the natural population.
- There may be the possibility of introducing disease to a recipient population.
- If certain already imperilled species are species complexes, conservation efforts may need to be redirected to address the needs of the critically imperiled taxa comprising the complex.

Needs:

Establish or adopt an existing committee to more formally develop the following criteria:

- Create a priority list of taxa targeted for propagation, augmentation, and/or reintroduction efforts based primarily on imperilment. The highest ranked priorities will be those taxa guidelines.
- Develop a set of criteria to use as guidelines in propagation programs, including a reintroduction and augmentation strategy
- Develop and prioritize a database of stream reaches suitable for: 1) brood stock acquisition; 2) historical habitat reintroduction; 3) population augmentation; 4) protection and/or restoration efforts; and 5) use as refugia.
- Establish a network to share data among propagation/reintroduction researchers.
- Develop a comprehensive database of propagation, augmentation, and reintroduction projects, including the following information: 1) research objectives; 2) species selected; 3) size and number of specimens involved; 4) identifying river reaches suitable for donor and/or recipient populations; 5) dates of field activities; 6) contacts; and 7) current status of the project.
- Develop a prioritized list of mussels in need of fish host identification research.
- Develop a prioritized list of taxa in need of taxonomic identity research.
- Strongly encourage funding for taxonomic identity research. This research should be primarily for molecular genetics, but also soft anatomy studies, and ecological research deemed critical in making taxonomic distinctions.
- Encourage funding for disease research on freshwater mollusks. Many marine bivalves have been eliminated by diseases carried by introduced individuals.

The following table was compiled by Cindy Schulz and Kim Marbain, Virginia Field Office, U.S. Fish and Wildlife Service, P.O. Box 99, Gloucester, VA 23061. If you have comments, additions, or deletions, please provide them to Cindy Schulz at (804) 693-6694 x127. Fax (804) 693-9032. E-mail cindy_schulz@fws.gov.

HOST SPECIES FOR RARE FRESHWATER MUSSELS IN VIRGINIA
PREPARED BY U.S. FISH AND WILDLIFE SERVICE, VIRGINIA FIELD OFFICE
Last Revised: 1/5/98

Freshwater Mussel	Host Fishes	References
Dwarf wedge mussel (*Alasmidonta heterodon*)	[1]johnny darter (*Etheostoma nigrum*) [1]mottled sculpin (*Cottus bairdi*) [2]slimy sculpin (*Cottus cognatus*) [1]tessellated darter (*Etheostoma olmstedi*)	[1]Michaelson, D.L. and R.J. Neves. 1995. Life history and habitat of the endangered dwarf wedgemussel *Alasmidonta heterodon* (Bivalvia: Unionidae). J. N. Am. Benthol. Soc. 14(2):324-340. [2]Dr. Barry Wicklow, St. Anselm College, NH
Elktoe (*Alasmidonta marginata*)	[1,2]northern hogsucker (*Hypentelium nigricans*) [1,2]shorthead redhorse (*Moxostoma macrolepidotum*) [1,2]rock bass (*Ambloplites rupestris*) [1,2]warmouth (*Lepomis gulosus*) [1,2]white sucker (*Catostomus commersoni*)	[1]Fuller, S.L.H. 1974. Clams and mussels (Mollusca:Bivalvia). In: C.W. Hart, Jr. and S.L.H. Fuller (eds.): Pollution Ecology of Freshwater Invertebrates. New York: Academic Press, pp. 215-273. [2]Howard A.D. and B.J. Anson 1922. Phases in the parasitism of the Unionidae. J. Parasitology 9:68-82.
Brook floater (*Alasmidonta varicosa*)	[1]blacknose dace (*Rhinichthys atratulus*) [1]golden shiner (*Notemigonus crysoleucas*) [1]longnose dace (*Rhinichthys cataractae*) [1]margined madtom (*Noturus insignis*) [1]pumpkinseed (*Lepomis gibbosus*) [1]slimy sculpin (*Cottus cognatus*) [1]yellow perch (*Perca flavescens*)	[1]Dr. Barry Wicklow, St. Anselm College, NH.
Birdwing pearlymussel (*Conradilla caelata*)	[1,2]banded darter (*Etheostoma zonale*) [3]snubnose darter (*Etheostoma simoterum*) **Possible hosts:** [1]greenside darter (*Etheostoma blennioides*) [2]mirror shiner (*Notropis spectrunculus*) [2]spotfin shiner (*Cyprinella spilopterus*) [2]whitetail shiner (*Cyprinella galactura*)	[1]Hill, D.M. 1986. Cumberlandian Mollusk Conservation Program Activity 3: Identification of fish hosts. Tennessee Valley Authority Office of Natural Resources and Economic Development. [2]U.S. Fish and Wildlife Service. 1983. Birdwing pearly mussel recovery plan. Atlanta, GA. [3]Based on Brian Watson's M.S. Thesis (in preparation), VA Tech (R.J. Neves, VA Coop. Fish and Wildl. Res. Unit, pers. comm. 11/97).

Freshwater Mussel	Host Fishes	References
Spectaclecase (*Cumberlandia monodonta*)	unknown	
Fanshell (*Cyprogenia stegaria*)	[1]sculpin (*Cottus carolinae*) [1]greenside darter (*Etheostoma blennioides*)	[1]Based on Brian Watson's M.S. Thesis (in preparation), VA Tech (R.J. Neves, VA Coop. Fish and Wildl. Res. Unit, pers. comm. 12/5/97).
Dromedary pearlymussel (*Dromus dromas*)	[2]fantail darter (*Etheostoma flabellare*) **Possible hosts:** [2]tangerine darter (*Percina aurantiaca*) [2]logperch (*Percina caprodes*) [1,2]gilt darter (*Percina evides*) [2]banded darter (*Etheostoma zonale*)	[1]Neves, R.J. 1991. Dromedary pearlymussel. Pages 292-294 in K. Terwilliger, ed. Virginia's Endangered Species, Proceedings of a Symposium. McDonald and Woodward Publishing Co., Blacksburg, VA. [2]Watson, B.T. and R.J. Neves. 1998. Fish host identification for two federally endangered Unionids in the Upper Tennessee River drainage. Triannual Unionid Report No. 14.
Yellow lance (*Elliptio lanceolata*)	unknown	
Cumberlandian combshell (*Epioblasma brevidens*)	[1,2]banded sculpin (*Cottus carolinae*) [1,2]greenside darter (*Etheostoma blennioides*) [1,2]logperch (*Percina caprodes*) [1,2]redline darter (*Etheostoma rufilineatum*) [1]spotted darter (*Etheostoma maculatum*) [1,2]Tennessee snubnose darter (*Etheostoma simoterum*) [1,2]wounded darter (*Etheostoma vulneratum*)	[1]Yeager, B.L. 1987. Fish hosts for glochidia of *Epioblasma brevidens, E. capsaeformis*, and *E. triquetra* (Pelecypoda: Unionidae) from the upper Tennessee River drainage. Unpublished report on file with Office of Natural Resources and Economic Development, Tennessee Valley Authority, Norris, TN. [2]Yeager B.L. and C.F. Saylor. 1995. Fish Hosts for Four Species of Freshwater Mussels (Pelecypoda:Unionidae) in the Upper Tennessee River Drainage. Amer. Midland Naturalist 133(1):1-6.
Oyster mussel (*Epioblasma capsaeformis*)	[1,2,3]banded sculpin (*Cottus carolinae*) [1,2,3]dusky darter (*Percina sciera*) [1,2,3]redline darter (*Etheostoma rufilineatum*) [1,3]spotted darter (*Etheostoma maculatum*) [2]wounded darter (*Etheostoma vulneratum*)	[1]Yeager, B.L. 1987. Fish hosts for glochidia of *Epioblasma brevidens, E. capsaeformis*, and *E. triquetra* (Pelecypoda: Unionidae) from the upper Tennessee River drainage. Unpublished report on file with Office of Natural Resources and Economic Development, Tennessee Valley Authority, Norris, TN. [2]Yeager, B.L. and C.F. Saylor. 1995. Fish Hosts for Four Species of Freshwater Mussels (Pelecypoda:Unionidae) in the Upper Tennessee River Drainage. Amer. Midland Naturalist 133(1):1-6. [3]Hill, D.M. 1986. Cumberlandian Mollusk Conservation Program Activity 3: Identification of fish hosts. Tennessee Valley Authority Office of Natural Resources and Economic Development.

Freshwater Mussel	Host Fishes	References
Green-blossom pearlymussel (*Epioblasma torulosa gubernaculum*)	unknown	
Snuffbox mussel (*Epioblasma triquetra*)	[1,2,3]banded sculpin (*Cottus carolinae*) [1,2,3]logperch (*Percina caprodes*) [4]blackside darter (*Percina maculata*)	[1]Yeager, B.L. 1987. Fish hosts for glochidia of *Epioblasma brevidens, E. capsaeformis*, and *E. triquetra* (Pelecypoda: Unionidae) from the upper Tennessee River drainage. Unpublished report on file with Office of Natural Resources and Economic Development, Tennessee Valley Authority, Norris, TN. [2]Yeager, B.L. and C.F. Saylor. 1995. Fish hosts for four species of freshwater mussels (Pelecypoda:Unionidae) in the Upper Tennessee River Drainage. Amer. Midland Naturalist 133(1):1-6. [3]Hill, D.M. 1986. Cumberlandian Mollusk Conservation Program Activity 3: Identification of fish hosts. Tennessee Valley Authority Office of Natural Resources and Economic Development. [4]Hillegass, K.R. and M.C. Hove. 1997. Suitable fish hosts for glochidia of three freshwater mussels: strange floater, ellipse, and snuffbox. Triannual Unionid Report No. 13.
Tan riffleshell (*Epioblasma walkeri*)	[1]banded sculpin (*Cottus carolinae*) and/or mottled sculpin (*Cottus bairdi*) [1]fantail darter (*Etheostoma flabellare*) [1]greenside darter (*Etheostoma blennioides*) [1]redline darter (*Etheostoma rufilineatum*) [1]Tennessee snubnose darter (*Etheostoma simoterum*)	[1]Based on work conducted by Brian Watson, graduate student at VA Tech (R.J. Neves, VA Coop. Fish and Wildl. Res. Unit, pers. comm. 7/23/96).
Shiny pigtoe (*Fusconaia cor*)	[1,2]whitetail shiner (*Cyprinella galactura*) **Possible hosts**: [2]common shiner (*Luxilus cornutus*) [2]telescope shiner (*Notropis telescopus*) [2]warpaint shiner (*Luxilus coccogenis*)	[1]Neves. R.J., F.X. O'Beirn, G.S. Schurig, and G.S. Libey. 1996. Fish host and propagation studies of freshwater mussels in the upper Tennessee River Drainage, Virginia and Tennessee. [2]Neves, R.J. 1991. Shiny pigtoe. Pages 272-274 in K. Terwilliger, ed. Virginia's Endangered Species, Proceedings of a Symposium. McDonald and Woodward Publishing Co., Blacksburg, VA.

Freshwater Mussel	Host Fishes	References
Fine-rayed pigtoe (*Fusconaia cuneolus*)	[1]central stoneroller (*Campostoma anomalum*) [1]fathead minnow (*Pimephales promelas*) [1]mottled sculpin (*Cottus bairdi*) [1]river chub (*Nocomis micropogon*) [1]telescope shiner (*Notropis telescopus*) [1]Tennessee shiner (*Notropis leuciodus*) [1]white shiner (*Luxilus albeolus*) [1]whitetail shiner (*Cyprinella galactura*)	[1]Bruenderman, S.A. 1989. Life history of the fine-rayed pigtoe pearly mussel, *Fusconaia cuneolus* (Lea 1840), in the upper Clinch River, Virginia. M.S. Thesis, Virginia Polytechnic Institute and State University, Blacksburg, VA.
Atlantic pigtoe (*Fusconaia masoni*)	**Possible hosts:** [1]bluegill (*Lepomis macrochirus*) [1]shield darter (*Percina peltata*)	[1]Watters, G.T. and S.H. O'Dee. 1997. Identification of potential hosts. Triannual Unionid Report No. 13.
Cracking pearlymussel (*Hemistena lata*)	unknown	
Pink mucket pearlymussel (*Lampsilis abrupta*)	[1]freshwater drum (*Aplodinotus grunniens*) [1]sauger (*Stizostedion canadense*) [2]largemouth bass (*Micropterus salmoides*) [2]smallmouth bass (*Micropterus dolomieu*) [2]spotted bass (*Micropterus punctulatus*) [2]walleye (*Stizostedion vitreum*)	[1]Virginia Department of Game and Inland Fisheries. 4/3/96. Fish and Wildlife Information System. Richmond, VA. [2]Barnhart, M.C., F.A. Riusech, and A.D. Roberts. 1997. Fish hosts of the federally endangered pink mucket, *Lampsilis abrupta*. Triannual Unionid Report No. 13.
Yellow lampmussel (*Lampsilis cariosa*)		
Tennessee heelsplitter (*Lasmigona holstonia*)	[1]banded sculpin (*Cottus carolinae*) [1]rockbass (*Ambloplites rupestris*) **Possible hosts:** [1]central stoneroller (*Campostoma anomalum*) [1]striped shiner (*Luxilus chrysocephalus*) [1]warpaint shiner (*Luxilus coccogenis*)	[1]Steg, M.B. and R.J. Neves. 1997. Fish host identification for Virginia listed Unionids in the Upper Tennessee River Drainage. Triannual Unionid Report No. 13.
Green floater (*Lasmigona subviridis*)	unknown	

Freshwater Mussel	Host Fishes	References
Slabside pearlymussel (*Lexingtonia dolabelloides*)	[2]smallmouth bass (*Micropterus dolomieu*) **Possible hosts:** [1]popeye shiner (*Notropis ariommus*) [1]rosyface shiner (*Notropis rubellus*) [1]saffron shiner (*Notropis rubricroceus*) [1]silver shiner (*Notropis photogenis*) [1]telescope shiner (*Notropis telescopus*) [1]Tennessee shiner (*Notropis leuciodus*)	[1]Kitchel, H.E. 1985. Life history of the endangered shiny pigtoe pearly mussel, *Fusconaia edgariana*, in the North Fork Holston River. M.S. Thesis, Virginia Polytechnic Institute and State University, Blacksburg, VA. [2]Neves, R.J., F.X. O'Beirn, G.S. Schurig, and G.S. Libey. 1996. Fish host and propagation studies of freshwater mussels in the Upper Tennessee River Drainage, Virginia and Tennessee.
Virginia pigtoe (*Lexingtonia subplana*)	unknown	
Black sandshell (*Ligumia recta*)	[1]largemouth bass (*Micropterus salmoides*) [1]green sunfish (*Lepomis cyanellus*) [1]redbreast sunfish (*Lepomis auritus*) [1]rockbass (*Ambloplites rupestris*) [1]white perch (*Morone americana*) [1]yellow perch (*Perca flavescens*) [1]platy (*Xiphophorus maculatus*) [1]convict cichlid (*Chichlasoma nigrofasciatum*)	[1]Steg, M.B. and R.J. Neves. 1997. Fish host identification for Virginia listed Unionids in the Upper Tennessee River Drainage. Triannual Unionid Report No. 13.
Little-wing pearlymussel (*Pegias fabula*)	**Possible hosts:** [1]banded sculpin (*Cottus carolinae*) [1]redline darter (*Etheostoma ruflineatum*)	[1]Ahlstedt, S.A. 1986. A status survey of the little-wing pearly mussel *Pegias fabula* (Lea, 1838). Unpublished report on file with Endangered Species Field Office, United States Fish and Wildlife Service, Asheville, NC.
James River spiny mussel (*Pleurobema collina*)	[1]blacknose dace (*Rhinichthys atratulus*) [1]bluehead chub (*Nocomis leptocephalus*) [1]central stoneroller (*Campostoma anomalum*) [1]rosefin shiner (*Lythrurus ardens*) [1]rosyside dace (*Clinostomus funduloides*) [1]satinfin shiner (*Cyprinella analostana*) [1]swallowtail shiner (*Notropis procne*) [1]mountain redbelly dace (*Phoxinus oreas*)	[1]Hove, M.C. and R.J. Neves. 1994. Life history of the endangered James spingymussel *Pleurobema collina* (Conrad, 1837)(Mollusca: Unionidae). Amer. Malacological Bulletin 11(1):29-40.

Freshwater Mussel	Host Fishes	References
Tennessee clubshell (*Pleurobema oviforme*)	[1]central stoneroller (*Campostoma anomalum*) [1]common shiner (*Luxilus cornutus*) [1]fantail darter (*Etheostoma flabellare*) [1]river chub (*Nocomis micropogon*) [1]telescope shiner (*Notropis telescopus*) [1]Tennessee shiner (*Notropis leuciodus*) [1]whitetail shiner (*Cyprinella galactura*)	[1]Weaver, L.R., G.B. Pardue, and R.J. Neves. 1991. Reproductive biology and fish hosts of the Tennessee Clubshell *Pleurobema oviforme* (Mollusca: Unionidae) in Virginia. Amer. Midland Naturalist. 126:82-89.
Rough pigtoe (*Pleurobema plenum*)	**Possible hosts:** [1]bluegill (*Lepomis macrochirus*) [1]rosefin shiner (*Lythrurus ardens*)	[1]Neves, R.J. 1991. Rough pigtoe. Pages 284-285 in K. Terwilliger, ed. Virginia's Endangered Species, Proceedings of a Symposium. McDonald and Woodward Publishing Co., Blacksburg, VA.
Pink pigtoe (*Pleurobema pyramidatum*) = Pyramid pigtoe (*Pleurobema rubrum*)	**Possible hosts:** [1]bluegill (*Lepomis macrochirus*) [1]rosefin shiner (*Lythrurus ardens*)	[1]Neves, R.J. 1991. Pink pigtoe. Pages 285-286 in K. Terwilliger, ed. Virginia's Endangered Species, Proceedings of a Symposium. McDonald and Woodward Publishing Co., Blacksburg, VA.
Rough rabbitsfoot (*Quadrula cylindrica strigillata*)	[1]bigeye chub (*Hybopsis amblops*) [1]spotfin shiner (*Cyprinella spiloptera*) [1]whitetail shiner (*Cyprinella galactura*)	[1]Yeager, B.L. and R.J. Neves. 1986. Reproductive cycle and fish hosts of the Rabbit's foot mussel, *Quadrula cylindrica strigillata* (Mollusca: Unionidae) in the Upper Tennessee River Drainage. Amer. Midland Naturalist. 116(2):329-340.
Cumberland monkeyface pearlymussel (*Quadrula intermedia*)	[1,2]blotched chub (*Erimystax insignis*) [1,2]streamline chub (*Erimystax dissimilis*)	[1]Hill, D.M. 1986. Cumberlandian Mollusk Conservation Program Activity 3: Identification of fish hosts. Tennessee Valley Authority Office of Natural Resources and Economic Development. [2]Yeager, B.L. and C.F. Saylor. 1995. Fish hosts for Four Species of Freshwater Mussels (Pelecypoda: Unionidae) in the Upper Tennessee River Drainage. Amer. Midland Naturalist. 133(1):1-6.
Appalachian monkeyface mussel (*Quadrula sparsa*)	unknown	
Purple lilliput (*Toxolasma lividus*)	[1,2]green sunfish (*Lepomis cyanellus*) [1,2]longear sunfish (*Lepomis megalotis*)	[1]U.S. Fish and Wildlife Service. 1984. Pale lilliput pearly mussel recovery plan. Atlanta, GA. [2]Hill, D.M. 1986. Cumberlandian Mollusk Conservation Program Activity 3: Identification of fish hosts. Tennessee Valley Authority Office of Natural Resources and Economic Development.
Rayed bean (*Villosa fabalis*)		

Freshwater Mussel	Host Fishes	References
Purple bean (*Villosa perpurpurea*)	[1]banded sculpin (*Cottus carolinae*) and/or mottled sculpin (*Cottus baird i*) [1]fantail darter (*Etheostoma flabellare*) [1]greenside darter (*Etheostoma blennioides*)	[1]Based on work conducted by Brian Watson, graduate student at VA Tech (R.J. Neves, VA Coop. Fish and Wildl. Res. Unit, pers. comm. 7/23/96).
Cumberland bean (*Villosa trabalis*)	**Possible hosts:** [1]fantail darter (*Etheostoma flabellare*) [1]striped darter (*Etheostoma virgatum*) [1]barcheek darter (*Etheostoma obeyense*) [1]stripetail darter (*Etheostoma kennicotti*)	[1]Based on work conducted by Jim Layzer at TN Tech (Leigh Ann McDougal, USFS, pers. comm. 11/6/97).

PROCEEDINGS OF THE MISSISSIPPI RIVER RESEARCH CONSORTIUM

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PLATFORM PRESENTATION ABSTRACTS ALPHABETICAL LISTING

DENSITY, SIZE AND AGE OF THE COMMERCIAL UNIONID *MEGALONAIAS NERVOSA* (RAFINESQUE 1820), IN 277 MILES OF THE MISSISSIPPI RIVER, REACHES 9-19, LANSING - FORT MADISON, IA, JULY - SEPTEMBER 1997

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In 1997 the Shell Exporters of America Inc. (SEA) sponsored the most extensive commercial unionid survey ever done. From 1 July -14 September we sampled the Mississippi River Mile 663.0-386.0, Reaches 9-12, 14-16, and 19, with emphasis on *M. nervosa*. Sites were identified by divers, malacologist, clammers, buyers, and a Resource Inventory. I designed a modified 0.25 m2 Surber sampler with an attached mesh bag, a 15 m rope, and an inflatable buoy (11 made by Tennessee Shell, Camden, TN). One or 2 major, plus several minor sites, were sampled in most Reaches. Sylvan Slough Sanctuary, Moline, IL, was sampled in Reaches 15/16. 252 random timed dives were done starting near shorelines to determine a CPUE. If this was productive, we did quadrats (N = 692) in transects across the width of the unionid bed. Over 20,400 live and dead unionids were processed from 944 dive sites. Mean density of *M. nervosa* / reach ranged from 2.7-7.6/m2. Over 4800 living *M. nervosa* were measured and aged after being scrubbed with steel bristled brushes to remove *Dreissena polymorpha* debris. Few *M. nervosa* were fresh-dead from *D. polymorpha*. The weak age classes of young *M. nervosa* reported in 1986, were not real as evidenced by large numbers of 10-13 year old age classes. These strong age classes may also represent a response to the 1982-1986 Mississippi River die-off. In some areas 5-7 year age classes were also well represented. Nearly all age classes were quite well represented from ages 5-early 20's. Age does not equal size. Growth varies from reach to reach. Growth rates generally increase further south, but Reach 9 (WI) also had good growth. The youngest commercial *M. nervosa* was 9 yrs, the oldest 38 yrs. In most reaches 2.4-10.8% (mean 7.8%) of a bed is of commercial height (101.6 mm). The highest percentage of legal unionids were in Sylvan Slough (18.5%) indicating little illegal harvest; sanctuary status is working. 2200 dead M. nervosa were measured for height. The smallest and largest *Amblema p. plicata* (Say 1817) from each sample were also measured and aged. Few have ever had the opportunity to observe unionid age and growth in such a long reach of a large river.

REACH	LOCATION	# QUADS	#M.n.	#/m2	TOT.LEGAL	TOT.Mn
9	Lynxville, WI	101	192	7.6	2.08%	1394
10	Prairie du Chien	69	65	3.77	10.77	526
11	Platte River, WI	130	88	2.71	10.23	823
12	Dubuque, IA	-	-	-	-	62
14	Princeton, IA	147	109	2.97	12.84	330
15	Moline, IL	-	-	-	-	245
	Sylvan Slough, IL	82	76	3.71	18.42	611
19	Ft. Madison, IA	163	257	6.31	9.34	813

PHYSICAL AND BIOLOGICAL PARAMETERS AND SPECIES COMPOSITION OF UNIONID MUSSELS IN THE WOLF RIVER, WESTERN TENNESSEE

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The status of native unionid mussels in Tennessee is presently on the decline, with 75% of the reported species considered either endangered or threatened. The Wolf River, a primary Tennessee tributary to the lower Mississippi River, supports freshwater mussels, but little is known about the composition, abundance, or distribution of this community or critical abiotic parameters. We propose to initiate a study to examine the Wolf River mussel community at landscape, macrohabitat, and microhabitat scales in order to assess the relative influence of various abiotic factors on mussel distribution and growth. Qualitative sampling for species composition and distribution along the river gradient began in 1997; quantitative sampling to assess macro- and microhabitat parameters as well as mussel movement patterns will begin this year. This study is designed to provide information critical to assessing the present status and directing potential conservation and restoration efforts of freshwater mussels in the Wolf River.

POSTER PRESENTATION ABSTRACTS
ALPHABETICAL LISTING

BIOENERGETIC EFFECTS OF ZEBRA MUSSELS ON A LARVAL FISH: AN EXPERIMENTAL TEST OF THE TROPHIC BOTTLENECK HYPOTHESIS

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Large populations of zebra mussels *Dreissena polymorpha* have been shown to reduce water column plankton, including many types of phytoplankton and small bodied zooplankton (especially rotifers, *Bosmina sp.*, and some *Daphnia sp.*). Coincidentally, these zooplankton are an important food source for larval fish. A common effect of zebra mussel colonization is an increased standing stock of many benthic invertebrates, including amphipods, isopods, chironomids, and ephemeropterans. These are the prey items required by many juvenile fishes. In a newly infested water body, one might expect a depletion of zooplankton and an enhancement of benthic macroinvertebrates in zebra mussel beds. As a result, larval fish could be at significant risk of starvation, while fish, able to reach juvenile stages, could accrue a significant benefit by feeding on enhanced benthic invertebrate populations. If such a trophic bottle neck exists for larval fish we would expect reduction in growth and the number of fish surviving their first year of life. However, those fish that do survive, may eventually exhibit elevated growth and survival rates. To examine potential effects of *Dreissena* on growth and timing of ontogenetic diet shifts in an early life stage of fish we conducted a 48-d outdoor mesocosm experiment. We used a 2X2 factorial design with 4

treatment combinations (3 replicates/treatment) including the presence or absence of *Dreissena* (0 or 5000/m^2) and a larval fish *Pimephales promelas*, (0 or 350/ tank, age 1-d old). Gut contents showed that rotifers initially made up 50-90% of the diet; as fish grew, diet shifted more toward benthic micro- and macroinvertebrates. Cumulative population prey-consumption rates were significantly lower in the presence of zebra mussels than without zebra mussels (P=0.026, mean 157 versus. 92 g). Temporal patterns of prey consumption varied between the treatments: initially individual consumption and growth was lower in zebra mussel tanks. After day 20, as fish shifted to benthic prey, consumption and growth was highest with zebra mussels. The initial bioenergetic disadvantage incurred by the larval fish was later offset by increased availability of benthic prey in zebra mussel tanks. Ultimately, the final biomass and survival of fish with and without zebra mussels was not different. These results do support aspects of the trophic bottleneck hypothesis. The increased growth rates associated with the ontogenetic shift to benthic prey was predicted, the similarity in fish biomass and survival was not. The initial reduction in growth of fish in the presence of zebra mussels may place these larval fish at a disadvantage when faced with other stressors (e.g., chemical, thermal, or predation).

UPPER MISSISSIPPI RIVER AND EFFECTS OF PREDATOR EXCLUSION CAGES

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During 1997, we assessed the effects of predator exclusion cages on zebra mussels demographics in Navigation Pool 8 of the Upper Mississippi River. Concrete blocks were deployed from May 22 to October 29, 1997, at two sites, in two habitat types (main channel border and backwater) of the Upper Mississippi River. At each site, two blocks were deployed, one of which was enclosed in a cage (60 cm long X 31 cm wide X 31 cm high, mesh size 7.3 cm X 5.0 cm); the other block was uncaged. At the end of the 159-day colonization period, zebra mussels were found at both sites. Densities (number/m^2) and biomass (g dry wt/m^2) of zebra mussels were higher on caged blocks than uncaged blocks. Mean mussel biomass on uncaged blocks was reduced by 81% relative to caged blocks across both sites and habitat types in Pool 8. In addition, mussel length-frequency distributions differed between caged and uncaged blocks at both sites. Interestingly, the more sheltered surfaces (i.e., holes) of uncaged blocks had substantially higher densities of mussels than the exposed surfaces (i.e., top and sides). The mean total length was greater for mussels found in holes (13.1 mm) of uncaged blocks than exposed surfaces (5.7 mm, top and sides). However, on caged blocks no differences in mean length of mussels occurred between holes (15.6 mm) and exposed surfaces (16.0 mm). Our preliminary results suggest that predation may have an effect on zebra mussel demographics in Navigation Pool 8 of the Upper Mississippi River based on artificial substrate samplers deployed in sentinel sampling sites.

EFFECT OF CHLORPYRIFOS ON ACETYLCHOLINESTERASE ACTIVITIES OF THE UNIONID MUSSEL *AMBLEMA PLICATA*

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Populations of freshwater mussels in North America have declined greatly over the past 30 years. Studies have demonstrated that effects of pesticides on freshwater mussels may be significant, especially in highly agricultural areas. Depletion of mussel populations in the Upper Mississippi River (UMR), for example, may have been partly caused by extensive use of organophosphorus compounds (OPs), such as chlorpyrifos. However, relatively little is known about sublethal effects of chlorpyrifos to native unionid mussels in the UMR. The effects of chlorpyrifos on the acetylcholinesterase activities of *Amblema plicata* will be determined. *A. plicata* will be exposed in duplicate to a control and five concentrations of chlorpyrifos in flow-through aquaria with sand substrate at 15 C. After 12, 24, and 96 h of exposure, the anterior adductor muscles of four randomly chosen mussels from each exposure chamber will be analyzed for acetylcholinesterase activity, a bioindicator of exposure to OPs. After 24 h of exposure, six randomly

chosen mussels will be removed, marked, and transferred to a flow-through tank containing clean water and sand. After 7 and 21 d of exposure to clean water, the anterior adductor muscles of two organisms from each treatment will be analyzed for acetylcholinesterase recovery.

EXTERNAL AGING OF UNIONIDS REVISITED: HEIGHT VERSUS AGE OF 4800 *MEGALONAIAS NERVOSA* (RAFINESQUE 1820), MISSISSIPPI RIVER REACHES 9-19, LANSING - FORT MADISON, IA, JULY-SEPTEMBER, 1997

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The Shell Exporters of America (SEA) sponsored an extensive Mississippi River commercial unionid mollusk survey using modified 0.25 m^2 Surber samplers. We sampled from River Mile 663.0-386.0, Reaches (Pools) 9-19, with an emphasis on *M. nervosa*. Over 20,400 unionids were processed during 252 random and 692 quadrats samples (944 dives). Over 4800 living M. nervosa were scrubbed to remove *Dreissena polymorpha* debris, measured, and aged. The mean density/Reach was 2.7-7.6/m^2. The mean height/age class/Reach, and the mean age/height class/Reach were analyzed. Age does not equal size. The large 10-13 year old age classes probably represent the species' response to the mid-1980's die-off, or else indicate a peak period of reproduction, although this was not apparent in a 1986 study. Commercial *M. nervosa* (101.6 mm height) ranged from 9-38 years of age. In most reaches 2.4-10.8% (mean 7.8%) of a bed is of commercial size with age ranges from 9-38 years. The youngest *M. nervosa* was 2 yrs (10 mm height). The most legal unionids were in Sylvan Slough Sanctuary (18.5%) indicating little illegal harvest. 3.18% of *M. nervosa* were less than 50 mm (2-7 years). Growth rates generally increase further south. The 6 year class had the largest height range; 130-6 year olds varied 65 mm in height; 118-21 year olds varied 37 mm in height. The mean difference in each size class was 31 mm in height, and 54 mm in length. Number/size class for *M. nervosa* showed bell curves, but every reach showed a marked shift to the left with the number/age class, usually with peaks around 10-13 years of age. Reach 14, and to a lesser extent Reach 19 had bimodal age distributions.

CHANGES IN NUTRITIONAL STATUS IN *LAMPSILIS CARDIUM, QUADRULA PUSTULOSA,* AND *ELLIPTIO DILATATA* EXPOSED TO AIR.

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Freshwater mussels are emersed (exposed to air) during conservation activities, such as status surveys, relocations and re-introductions. Success of these activities depends upon their ability to survive emersion and burrow into the substrate. Sublethal effects of emersion were determined by changes in nutritional status of mussels. Three species of unionid mussels (*L. cardium, Q. pustulosa* and *E. dilatata*) were acclimated in water at 25 C and exposed to five aerial temperatures (15 to 45 C) for 15, 30 or 60 min. After emersion, mussels were returned to water at 25 C. Burrowing and survival were observed for 14 d; mussels were then sacrificed and mantle tissue was analyzed for total lipid, protein, and carbohydrate content. Although analyses are incomplete, preliminary results suggest that carbohydrate and protein content of mantle tissue from *L. cardium* increased with increasing aerial temperatures while lipid content decreased. Lipid content of mantle tissue from *Q. pustulosa* increased with increased aerial temperatures while carbohydrate and protein content decreased with exposure temperatures above and below acclimation temperature. Changes in above variables suggest an altered nutritional status in response to emersion.

SELECTIVE FEEDING BY FRESHWATER DRUM AND CARP ON ZEBRA MUSSELS ABOVE AND BELOW LOCK AND DAM 19, MISSISSIPPI RIVER

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Several studies have indicated that some species of fish inhabiting North American waters may feed on zebra mussels. The freshwater drum and common carp are 2 such species and both occur abundantly in the Lock and Dam 19 area of the Mississippi River. Zebra mussel populations have increased substantially in the Pool 19 tailwaters since 1994 yet few of these mussels occur in the area immediately above the lock and dam. The gut content of fish collected from above and below Lock and Dam 19 were examined for the presence and abundance of zebra mussels. Zebra mussels occurred only rarely in either drum or carp collected above the dam. Most of the fish gut content was midge larvae, burrowing mayfly nymphs and detritus in this area. Frequency of occurrence of food items was similar to what occurred in the benthos. However, a large proportion of individuals of both drum and carp collected in the tailwaters were found to contain zebra mussel shell fragments. However, the frequency of occurrence of zebra mussels in the fish was much lower than that in substrate samples from this area. All of the fish collected in the tailwaters contained caddisfly larvae and other insects. Thus, in spite of the prevalence of zebra mussels in the habitat they may occur in the diet of these fish only incidentally if the fish removes some of the mussels while actively feeding on other more traditional food organisms.

POPULATION DYNAMICS OF *DREISSENA POLYMORPHA* IN MAIN CHANNEL AND BACKWATER HABITATS OF THE UPPER MISSISSIPPI RIVER

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The zebra mussel, an exotic sedentary benthic invertebrate, was first discovered in the upper Mississippi River in 1991. Since then, zebra mussel densities have increased almost exponentially throughout the river. Much of the work on zebra mussels in large rivers has focused on main channel habitats, with little consideration of possible impacts in other riverine habitats. This study examined population dynamics of zebra mussels in the main channel and backwaters of the upper Mississippi River to determine if population structure varies between these two very distinct mesohabitats. Zebra mussels were collected from snags and rocks in Pools 5 and 6 of the upper Mississippi River. Snag samples were obtained using a DTH sampler whereas rocks were randomly selected by hand. Zebra mussels from each sample were placed in mm size categories using vernier calipers. Samples were placed in aluminum envelopes and into a drying oven for 48 hr, weighed, and then into the muffle oven for no more than 6 hr. Samples were stored in dessication chambers until weighed. Differences were observed in abundance and size-class distribution of zebra mussels from main channel vs. backwater habitats. Variation in population dynamics between habitats indicates that future studies of this exotic species should incorporate heterogeneous habitats found in large river ecosystems.

A SURVEY OF MUSSEL SPECIES DIVERSITY AND ABUNDANCE IN THE CANNON RIVER, NORTHFIELD, MINNESOTA

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Southeastern Minnesota's Cannon river was once home to a diverse and abundant population of freshwater mussels. Shell and pearl harvesting, plus reductions in the river's water quality in the early part of the 20th century have lead to a loss of species and abundance. A study by Davis (1988) showed the section just below Northfield to contain 13 species. Our survey of 21 randomly selected sites, within the same section, showed mussel species diversity to be lower than those found by Davis. We found six species; *Lasmigona complanata, Proptera alata, Ligumia recta, Lampsilis ovata ventricosa,* and *Lampsilis siliquoidia.* In response to a suggestion that the Ames Mill dam in Northfield may someday be removed we estimated the volume of accumulated sediment upstream of the dam.