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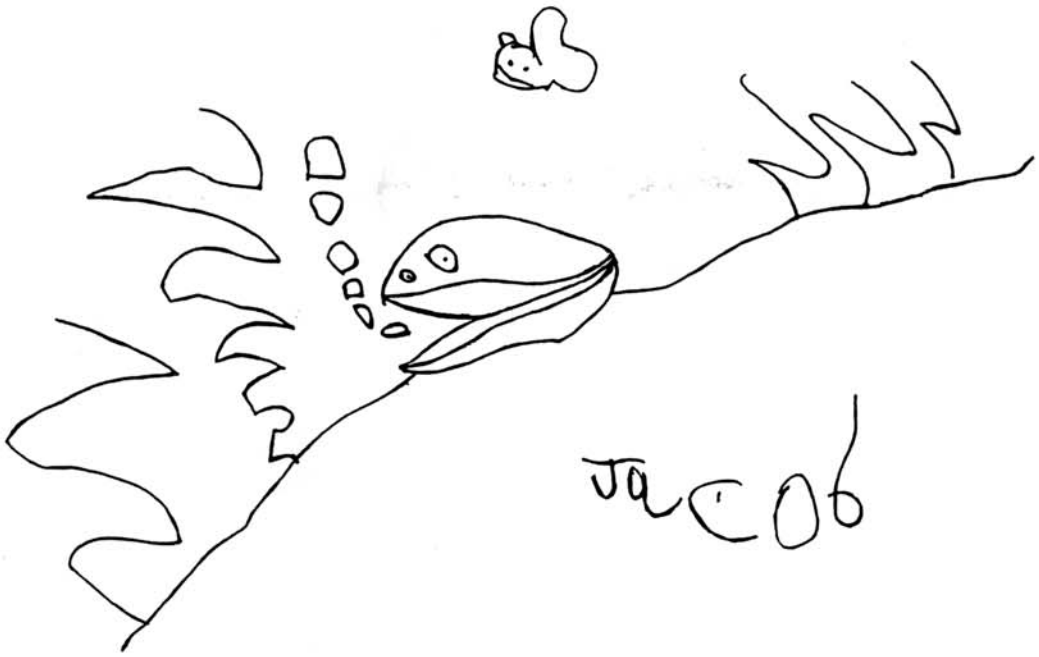
TRIANNUAL UNIONID REPORT

Report No. 13

November 1997

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.

COVER: THANKS TO JACOB GARNER, MUSCLE SHOALS, ALABAMA, FOR THE MUSSEL ART.

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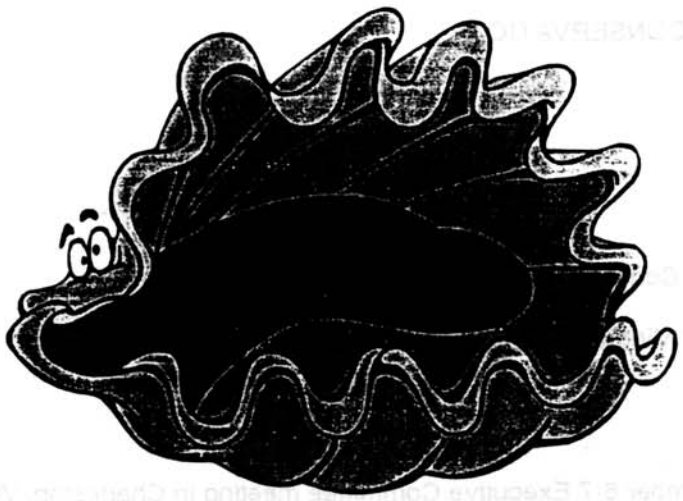

YIKES!

It's a contest!

Be a big winner--
maybe a ball cap
or a T-shirt??

The Outreach Committee of the National Native Mussel Conservation Committee (NNMCC) has been charged with developing a logo and slogan for the NNMCC, and we'd like to pass that charge on to you in the form of a contest. Entries can be funny or serious, just as long as mussels are the focus. So, put your creative minds to work! What's the prize for such a prestigious contest? The winner from each category (slogan and logo) will have the honor of seeing the product of his or her ingenuity used by the NNMCC and will receive the first ball cap or T-shirt printed (if we have ball caps and T-shirts!).

Contest deadline is December 31, 1997. Please send all entries to

Kari Duncan
U.S. Fish and Wildlife
400 East Main Street
White Sulphur Springs, WV 24986
(Please write "NNMCC Contest" on the envelope.)

Phone: 304/536-1361
Fax: 304/536-4634
E-mail: kari_duncan@fws.gov

MISSOURI DEPARTMENT OF CONSERVATION

MEMORANDUM

Date: November 18, 1997

FROM: Al Buchanan

TO: National Native Mussel Conservation Committee

SUBJECT: Executive Committee Minutes

Attached are the minutes of the November 6-7 Executive Committee meeting in Charleston, West Virginia. The Executive Committee consists of the chairs of the subcommittees, myself, and a representative of each of the regional mussel groups. Also attached is a copy of the agenda for the recent meeting and a copy of the *Call For Papers* for the March 6-8 Mussel Symposium on *Conservation, Captive Care, & Propagation*. We have scheduled the next Native Mussel Conservation Committee Meeting (NNMCC) for the afternoon of March 5 at the same location as the mussel symposium.

A lot has happened since the February meeting of the NNMCC. Several of the subcommittees have plunged into their projects and most have had at least one meeting. There is an incredible amount of work to be done so if you feel like becoming involved in one or more of the projects discussed in the minutes, contact the person(s) listed under each subcommittee or give me a call and I can hook you up with the right person. There may also be aspects of mussel conservation and management which aren*t yet being handled under existing committees so if you so desire, give me a call and we can discuss forming another subcommittee or working group.

One of the things I have not done a particularly good job of during the nine months since the formation of the NNMCC is keep the members informed of all of the things that are going on. Part of this is because, like everyone else, I*m busy and another part is because there is so much happening in the subcommittees that I*m not keeping up with all of it. One of my personal goals is to do a better job of communicating activities, progress, and accomplishments during the coming year. One of the avenues is to begin updates to the committee via the Triennial Report produced by Dick Biggins. If you are not receiving the Triennial Report and wish to, call (704/258-3939) or send an email (richard_biggins@fws.gov) to Dick Biggins and he will add you to the mailing list. The minutes of the recent EXCOM meeting will be included in the Triennial Report and on the UNIO server on the internet.

Another of the needs identified during the EXCOM meeting is for the subcommittee chairs to keep the people who volunteered to work on projects within their respective subcommittees involved in and informed about those projects. If you haven*t heard from the chair of the subcommittee you volunteered to work on, give him/her a call. If that doesn*t work, give me a call and we*ll work on it. There is a lot to do, your talents are needed, and your involvement is important. In some cases, you volunteering to get involved may jump start a project that hasn*t gotten off of the ground yet. Everyone is busy but if we work together and keep communicating, things will get done. I*m impressed at how much has already gotten done and at the amount of work some of the subcommittees have taken on and moved forward

on. You*re doing great!One of the areas needing a lot of attention and energy is funding. Some of the larger projects, such as producing the Mussel Atlas, are going to take a fair amount of money and it*s going to take some innovative approaches and collective funding from several different entities to complete those projects. Kurt Welke volunteered in February to take on the Funding Working Group, and has acquired a copy of Environmental Foundation Grant Making Catalogue and plans to put together a list of potential funding sources for each subcommittee/project. We need volunteers to work on that working group with Kurt and especially need folks who may have some knowledge about and/or experience with writing grant proposals. If you are interested give Kurt a call (608/326-8818).

Jerry Rasmussen agreed during the February meeting to include items needing advocacy in River Crossings, so if you have issues such as dredging projects, etc. which are likely to impact mussels contact Jerry (319/359-3029, phone or fax; email: ijrivers@aol.com).

bc via email: Norm Stucky, Gary Novinger, Steve Weithman, Sue Bruenderman, Travis Moore, Janet Sternburg,

Lastly, we are beginning to work on the agenda for the March meeting so if you have items that need to be on the agenda give me a call (573/882-9880,X3257) or send me an email (buchaa@mail.conservation.state.mo.us). Present ideas for the agenda compiled at the EXCOM meeting are 1) Background/Progress. 2) Subcommittee Reports. 3) Accomplishments. 4) Organizational Review. 5) Subcommittee review re: fleshing out subcommittees and reviewing the need for additional subcommittees or working groups. 6) Feedback on direction and progress.

One more note. I can not emphasize enough the importance of us all working together. With the nation*s mussel fauna in serious decline we are going to have to work hard just to maintain what we have; to make progress in reversing the trend of decline is going to take innovation and cooperation. I see my primary role as Chair of the NNMCC as fascilitating communication, cooperation, and networking. I tend to be an optimist but also have a fairly thick skin so if something is not working, please let me know. If we work together with the talent and energy I see in all of you we will succeed in reversing the declines in the mussel fauna. So take care, have fun, and keep up the good work.

NNMCC EXCOM Meeting -- November 6-7, 1997
MINUTES

Thursday, November 6, 1:00 pm - 6:00 pm.

The National Native Mussel Conservation Committee Executive Committee Meeting began at 1:00 pm on Thursday, November 6 at the Elk River Town Center Inn in Charleston, West Virginia. In attendance were Steve Ahlstedt (USGS), Dick Biggins (USFWS), Alan Buchanan (MO DOC), Kevin Cummings (INHS), Kari Duncan (USFWS), Heidi Dunn (Ecological Specialists), John Jenkinson (TVA), Paul Johnson (TN Aquarium), Madeleine Lyttle (USFWS), Debbie Mignogno (USFWS), and Patti Morrison (USFWS). Richard Tankersley (U. of Maryland) joined us on the second day. An agenda accompanies these minutes.

The meeting began with introductions and an introduction by Al Buchanan, the Chair. Since the February meeting, Al sent a letter to Bill Reeves, Tennessee Wildlife Resources Agency, supporting standardization of commercial clamming regulations; Tennessee, Alabama, Kentucky, and other neighboring states are pursuing standardization of regulations.

Stated goals of this meeting were: 1) Review National Native Mussel Conservation Committee (NNMCC) structure, including roles of the chair and subcommittee chairs, and general operation of the Committee. 2) Review ways to improve communication. 3) Develop the focus and agenda for the March 5, 1998 meeting of the overall committee. 4) Review subcommittee progress. 5) Discuss future symposia. 6) Discuss future activities and goals.

Debbie Mignogno took over as facilitator for the remainder of the meeting. She began with a review of goals and the committee structure as outlined at the February meeting. Presently the NNMCC is a subcommittee of the Mississippi River Interstate Cooperative Resource Association (MICRA). The

NNMCC Executive Committee consists of the Chair, Chairs of the eight Subcommittees, and one representative of each of the regional groups. This evolved into a discussion of the structure and operation of the NNMCC. We discussed the need for structure but agreed not to get too structured. We agreed that the role of the Executive Committee will be to steer or coordinate the activities of the NNMCC, facilitate information exchange, review the goals and direction of the subcommittees, and organize meetings. Most of the overall committee work will be accomplished within the subcommittees or working groups. There is a need to poll the membership to determine if further subcommittees and working groups are approp
riate and to ensure that anyone interested in participating on a subcommittee has the opportunity to do so. The whole group is too big to include in decision/direction-making meetings but there is a need for membership input. We decided that the best approach is for the Executive Committee to decide issues based on input from the membership through the subcommittee chairs and subgroup representatives; major issues will probably require a poll of the members. Meetings of the overall committee will involve updates from the subcommittees and discussions of major issues as appropriate.

We also discussed membership and how a person identifies as a member of the NNMCC. Minimal dues with the member receiving a hat or t-shirt seems the best way to go. Outreach will work on development of a logo with a goal of having the logo and hats or t-shirts available before the Mussel Symposium on March 6-8, 1998 in Columbus, Ohio. The Outreach Subcommittee will coordinate a logo design contest with the winning design becoming the logo for the NNMCC. We also discussed forming a mussel society but tabled that idea for the time being.

Better communication was identified as a need. Avenues for future communication included 1) Chair memo with minutes of this meeting to the membership. 2) Inclusion of the minutes in the Triennial report, and on the Unio server, the NABS Journal, and in River Crossings, the MICRA newsletter. 3) More frequent contact between the chair and subcommittee chairs and the membership.

SUBCOMMITTEE REPORTS:

SYMPOSIUM: There will be a Freshwater Mussel Symposium in Columbus, Ohio on March 6-8, 1998. Therefore the scheduled Fall, 1998 symposium at Chattanooga, Tennessee was moved to 1999 (March or April) because it was felt that two symposia in the same year might dilute interest and reduce attendance. Most of this discussion was put off until Friday morning when Richard Tankersley, one of the organizers of the Columbus symposium would be in attendance. To get involved contact Steve Ahlstedt (423/545-5331; email: ahlstedt@usgs.gov) or John Jenkinson (423/751-6903; email: jjjenkinson@tva.gov).

STATUS/DISTRIBUTION: (Kevin Cummings) : The Mussel Atlas Working Group (Art Bogan, Sue Bruenderman, Kevin Cummings, Tom Muir, Doug Smith, Tom Watters, and Jim Williams) met in Arlington, Virginia on October 20 & 21 to 1) compile lists of regional coordinators, compilers, and species. 2) Develop the format. 3) Identify funding needs and potential sources. 4) Develop a timetable for completion. 5) Develop a mission statement. 6) Develop an itemized budget. Kevin handed out a prototype species account, regional map, and a list of compilers. Sue Bruenderman facilitated meeting in Washington. 320 species are divided by region. Each species account will be two pages. GIS also: each compiler will be asked to compile a database but GIS project will be an adjunct project. At the Arlington meeting it was decided to do a historical account/distribution for the first printing. We discussed the problem of having old records when species are no longer there. TNC doing a parallel project that is mo
re hydrologic unit oriented. This committee*s effort will be dot-maps for entire range. Time Frame: Year 2000, and budget is about $250,000.00 to $300,000.00. Recommend getting feedback from compilers. Sue Bruenderman is steering the effort and Kevin is Chair. Next Step: regional contacts will be contacted. Need software for compilers soon. Need money; need to identify sources. Atlas will be 600-700 pages. Final product will probably be about $50.00 per hard copy. The Atlas will include an introduction, species accounts, appendices of historical names (synonymy), a glossary, etc. Also will be CD ROM versions ($3.50 ea; 5,000 copies estimated). Another objective would be to ID areas of national significance. Put in Triennial Report and on UNIO listserver. If you are interested in participating in this project, please contact Sue Bruenderman (573/882-9880; email:

bruens@mail.conservation.state.mo.us) or Kevin Cummings (217/333-1623; email: ksc@mail.inhs.uiuc.edu).

OUTREACH: (Kari Duncan): The Outreach Subcommittee has had two conference calls. The following products have been completed or are in the works: 1) Outreach Strategy has been completed. 2) An Outreach product survey conducted--sent out in Triennial Report. 3) Developed a Draft Memorandum of Understanding for Federal agencies for implementation of the National Strategy for the Conservation of Native Mussels. We discussed the idea of developing a similar MOU to be sent with a cover letter to each of the 50 states; the Outreach Committee will pursue the idea further and also look at other federal agencies to include (present list includes the Departments of Agriculture, Defense, Army, Commerce, Interior, and EPA). 4) Mussel video development and distribution ideas. Kurt Welke compiled a list of *sport fishing* shows for distribution of mussel video. The goal is to promote the need for mussel conservation and need for a national effort to protect and manage mussels on sport fishing shows--idea is a
video for showing on weekend sportsfishing/outdoor shows. Will be soliciting video footage from people who may have it with the idea of pulling together, cutting and splicing existing video. Steve Ahlstedt contacted Heartland Shows and they will not put out their copyrighted video or let it be cannibalized. We discussed the idea of developing a slogan to reflect the strategy. USFWS developing *America*s Hidden Treasures: Don*t Let America Lose Its Mussels*. Outreach will coordinate a request for a logo design and a slogan. Another suggestion was to identify mussel speakers in various areas who can provide presentations on mussels. A travelling display and/or travelling program on freshwater mussels was another idea. American Sportfishing Association, International Association of Fish and Wildlife Agencies, TVA, EPA, COE, and other agencies/entities are potential audiences for these presentations. Susan Mangin compiled a list of funding partners. The World Wildlife Federation interested in producing/
sponsoring shows on various nature issues. George Benz (TN Aquarium) trying to get them interested in mussels and producing a mussel show. Need to focus on extinctions in this country instead of going elsewhere for material. Go to public radio programs=PSAs? To get involved contact Linda Drees (913/539-3474; email: linda_drees@fws.gov) or Mike Davis (612/345-3331; email: mike.davis@dnr.state.mn.us).

INFORMATION EXCHANGE: (Madeleine Lyttle): Al Buchanan reported that there hasn't been much progress in getting the National Strategy finalized and printed. Need a cover design. Will approach Dick Neves re: getting the art work done & possibly publishing. Cover must be color. Madeleine Lyttle will develop a list of who it should go to. Governors, National congressman, etc. should be included. The Strategy needs to be completed before the March symposium in Columbus. WEB Site (Kevin Cummings): have not developed a website as such for this committee; presently putting information out on UNIO and Illinois Natural History Survey (INHS) list servers. Compiled a list of mussel specialists across country (on INHS website). Need for a committee logo reiterated. Compiled a list of mussel collections worldwide (also on INHS website) (can send to Chris Mayer to get it on list--on a disk would be ideal). Link to UNIO listserver. Abstracts from AMU on there. Bibliography: Joint project of Kevin Cummings,
Tom Watters, and Art Bogan. Need funding ($30,000 - $40,000) but otherwise ready to go. Debbie suggested that EPA may be interested in funding it to get it out since they are looking at doing more work with mussels. Bibliography includes about a 25-category search function. Kurt Welke*s Funding Report (Buchanan): Not much progress. Kurt has a copy of the Environmental Foundation Grant-Making Catalogue and wants to put together lists of likely/appropriate funding sources for each subcommitte/project. Already been done (Kari Duncan) in Regions 4 & 5: Kari will send to Kurt. Triennial Report (Dick Biggins): going out regularly; need more reports and input from researchers et al. The call for papers went out recently and the next Triennial Report will go out about the middle of November. List Of Adverse Projects: Sunflower River project has occurred in MICRA publication a couple of times. White River Project probably dead (Buchanan: information from Steve Filapek). Information Exchange Subcommi
ttee is handling this right now (i.e. getting to River Crossings). Madeleine will talk to Jerry Rasmussen re: getting information in River Crossings--send out reminder with this summary memo (i.e. if you have projects w/adverse impacts report to Jerry Rasmussen). To get involved contact Madeleine Lyttle

(802/951-6313; email: r5ffa_lcfwro@gov.us).

WATER QUALITY/HABITAT ALTERATION/ZEBRA MUSSELS: (Buchanan et al. for Tom Muir): Meeting was held in Atlanta last spring to put together white paper on impacts of activities on freshwater mussels. Presented at NABS in May. Being compiled & can be reviewed by contacting Tom Muir. Will be published in J. NABS if it meets their standards. Can get spiral bound copy from Jerry Diamond (Tetra Tech). To get involved contact Tom Muir (703/648-5114; email: tmuir@usgs.gov).

PROPAGATION/RESTORATION/INTRODUCTION (Dick Biggins): Columbus symposium will be a focus on this subject. Not much to report. Dick needs help chairing this subcommittee. Richard Tankersley has agreed to cochair this. Will address reintroductions genetic guidelines at next meeting of TN subgroup. Bob Butler & Dick Biggins interested in developing guidelines for when or where things can be moved under X conditions. Dave Berg a good contact re: guidelines. Need East Coast participation. USFWS draft document on propagation and genetics (=a procedural guidance); need something a little less strict. Dick will be coming to group at a later time with this issue. An issue for inriver refugia, transplants, etc. To become involved contact Dick Biggins (704/258-3939; email: richard_biggins@fws.gov).

GUIDELINES/TECHNIQUES (Heidi Dunn): Met w/Diane Waller, Lisie Kitchel, & Bernard Seitman in WI. Decided on a series of guideline/techniques papers which would review literature and recommend guidelines. Designed to be spirally bound, passed out, etc. Looked at list of volunteers from February meeting. Has emailed those folks and gotten responses from 13 folks. Will go through strategy plan and ORVE plan and send list of issues needing guidelines to those folks for comments before end of the year and go from there. Goal to get list prioritized and create list of 5 top priorities for producing guidelines and then developing those guidelines. Good subject for a symposium (Jenkinson). Paul Johnson: have only invited speakers at such a symposium. Need to ensure that papers are based in good science. To become involved contact Heidi Dunn (314/447-5355; email: ecologists@aol.com).

COMMERCIAL (Buchanan): Due to SEA's sponsoring and coordinating a mussel survey on the Upper Mississippi River, little progress has been made. To become involved contact Cheryl Ballenger (319/264-2033; email: cherlyb@muscanet.com).

OHIO RIVER ECOSYSTEM MUSSEL SUBGROUP (Patti Morrison): Formed in April, 1995. Have had 5 meetings so far. Most recent meeting on November 5/6. Up to 40 partners who participate in group. Draft Mollusk Conservation Plan by group. Meet twice per year. Work on components of the report. Will add us (EXCOM) to mailing list. Will have revised draft by the March meeting. Includes the Ohio River watershed minus the TN/Cumberland which has its own group. Group is developing focus areas. To become involved contact Patti Morrison (304/422-0752; email: r5rw_ohrinwr@mail.fws.gov).

TENNESSEE/CUMBERLAND RIVER SUBGROUP (Dick Biggins): Meeting next month. Working on experimental population designation for 17 species below Wilson Dam. Moved Io to two new places in Holston & French Broad (historical places).

ST. CROIX GROUP: (Heidi Dunn): Population viability assessment coming up for Quadrula fragosa (in January). Trying to keep zebras out of St. Croix River but found at Taylor Falls this summer. Going to try drawing down the pool and search for zebras. Teams found gravid Q. fragosa in September. Still in habitat; trying to decide what to do with it. Only known population of Q. fragosa.

UMRCC MUSSEL AD HOC COMMITTEE (Al Buchanan): Kurt Welke is presently chair of this committee. UMRCC Mussel Ad Hoc Committee has recently been focused on two projects/issues. The first is standardization of commercial mussel regulations between the five member states (IL, IA, MN, MO, WI). We have achieved agreement on minimum size limits for mussels, harvest season, gear limitations, legal species, sanctuaries, and bait limits, and on a standard report form for both clammers and shell buyers. The second issue is a proposed closure of washboard harvest on the Upper Mississippi River (UMR). The five UMRCC states have proposed closure of the washboard harvest because of declines in recruitment, densities of adults, and densities of legal-size washboards, and a decline in

pounds of shell harvested in spite of high prices for shell. Shell Exporters of America (SEA) funded a survey of mussels at select sites in seven UMR pools this summer and that data is being analyzed and included in the decision making p
rocess.

Other regional groups which could not attend or the Chair forgot to notify include the New England group (Susi VonOettingen), SEA (Cheryl Ballenger), the Alabama group (Jeff Garner), the Western Zebra Mussel Task Force (Linda Drees), and the Lake Champlain group (Madeleine Lyttle). As new groups form, they need to contact the NNMCC Chair so they can be added to the Executive Committee.

FUNDING:

Need a bigger funding group. The working group includes Kurt Welke and Linda Drees. Concept: A group to keep track of funding entities and knowing where funds might be available for various aspects of what we do. Two different issues: 1) Identify funding sources. 2) Identify money handling mechanism. MICRA has agreed to handle money for the NNMCC. MICRA charges 10% overhead which is cheaper than other money handlers. MICRA needs a contact who approves checks but MICRA will not exert any control over where the money goes. What about when we produce hats or something for sale (i.e. how do we handle the money)? Same for posters, symposia, dues, tshirts, donations, etc. Get a volunteer to be a Treasurer or advise us on treasury stuff. We would need a tax exempt number, treasurer, etc. Invite a person to the next meeting to help us out on this issue. Heidi Dunn volunteered to try to set it up for the committee and serve as Treasurer. We need volunteers to help Kurt Welke on the listing c
ommittee. Have a group write grants? Put together subcommittee w/Kurt as chair and request volunteers to help work on grant application preparation for various projects. Need people to draft and review grant proposals. Need to look for matching funds and act as a liaison. Bring in benefactors to talk to group. Training in grant writing. Ask for suggestions on sources of funding. Kari will send some information to Kurt. If you are interested in becoming involved contact Kurt Welke (608/326-8818).

Friday Nov. 7, 1997, 8:00 am - 11:30 am.

The Executive Committee reconvened at 8:00 am on Friday, November 7. Richard Tankersley joined us to update us on the Columbus Mussel Symposium and to provide input during the symposium discussion.

SYMPOSIUM DISCUSSION

Columbus Symposium (Richard Tankersley): This symposium came about as a result of contact with Stewart Keefer of the American Zoo Association (AZA). It is an effort to combine AZA and malacologists* interests in a symposium. The focus is on propagation and captive care of freshwater mussels. MOU between several federal agencies and AZA. Columbus Zoo wanted to host the symposium. In the works as of January, 1997. Program : Oral presentations on propagation & captive care and open posters to general mussel papers. Call for papers on internet on Monday of this week. Lot of interest. Brought copies of call. Workshops: 1) Tom Watters on Taxonomy. 2) Aquarium Association on Captive Care. Dave Stansbery is the keynote speaker at the banquet on Saturday night. Looking for help reviewing papers for the proceedings. Considering another speaker for Friday evening (AZA Cooperative programs). AZA really wanting to become involved in propagation of invertebrates. Size of Facility: Can handle about 200
people at banquet. We will put the announcement in my summary, in Triennial Report, and in River Crossings. Other journals? Will encourage exhibitors. Still looking for sponsors. Hotel Contact: Penny Tiller (Sales & Catering Account Manager; 614/431-4459). Columbus Zoo really been helpful on this project. We may be able to sell hats or T-shirts if we have such a thing; Paul Johnson, Dick Biggins, and the Outreach Committee will work on this. Paul Johnson: the TN aquarium can do logo and printing of T-shirts and is willing to do so. Outreach is putting out call for design of logo with a January 1

deadline. Will decide whether to produce caps or T-shirts after logo design is complete.

The plan is to have the next NNMCC meeting the day before the mussel symposium, on March 5, with the Executive Committee meeting in the morning and the overall committee meeting in the afternoon. The tentative agenda would include subcommittee reports and a discussion of whether we wish to remain a committee or form a society.

A copy of the call for papers is attached.

NNMCC Sponsored Symposia: Chatanooga, TN in 1999 and AFS 2000 in St. Louis, Missouri.

March/April, 1999 Symposium at Chattanooga: The TN Aquarium has excellent media connections & is very good at getting the word out. Aquarium will do the local arrangements. Paul Johnson: need to bring in high profile groups (e.g World Wildlife Fund, etc.) to get them involved with mussels; get other groups involved. TN Aquarium considering doing a series on endangered fauna, etc.; this symposium may fit very well into that concept. Suggested format is Plenary ssession with high profile speakers and then technical sessions. Symposium Committee will work with TN Aquarium to set up meeting for March/April of 1999. Symposium Committee will have a first announcement ready by Columbus meeting with dates, some idea of program boundaries, etc. Biggins: Have the 1999 conference in Chatanooga & then have a focus w/invited papers at AFS 2000.

AFS 2000: The annual AFS meeting typically has 1,200 to 1,500 attendees, including many state and federal agency chiefs. There is a need to bring more attention to native mussels and educate fisheries administrators about mussel problems, needs, and opportunities. Have focus papers in a technical session and coordinate flashy posters to get attention on mussel issues. How many slots can we get at AFS? Can we publish the mussel part of meeting in our own proceedings? Buchanan will find out the rules and possibilities, theme, etc. for AFS 2000. Try to get Jim Williams, Dick Neves, or someone (Jamie Clark) else in the Plenary Session. I will report back to committee in March.

We also discussed having/sponsoring symposia on focus areas and maybe start having annual symposia/meetings.

Other Symposia: We recently learned from Kerry Lippincott (307/235-8952) that a Freshwater Mussel Symposium is planned in conjunction with the October 14-17, 1998 Plains Anthropological Conference in Bismarck, ND. The plan is for a 1-day symposium on mussels. Contact Kerry for further information.

Goals & Objectives for 1998:

1) National Strategy completed and distributed. 2) Columbus meeting coordination 3) Group meeting at Columbus. 4) Atlas Committee progress. 5) Outreach will pursue MOU, get speakers index produced, Logo/slogan done and T-shirts or hats produced. 6) Guidelines/Techniques will pursue identifying primary needs re: protocols & workshops. 7) Propagation Subcommittee will get their tasks identified & Rick Tankersley will become cochair. 8) Al Buchanan will contact Jerry Rasmussen re: getting stuff into River Crossings, 9) Determine who and what we are. 10) Ahlstedt will touch base w/Cheryl Ballenger re: Commercial Committee & where it is going. 11) Prepare a one page summary about the NNMCC, its structure, and its goals, and solicit membership/participation. 12) Develop a mailing list of people interested in participating in mussel issues and programs. 13) Find someone to serve as Secretary for the NNMCC to record minutes, help with mailings, etc.

Future Meetings: March 5 in Columbus, March 1999 Symposium. On the 4th we will meet the EXCOM in the morning and overall in the afternoon. Committee Reports. Discussion of whether or not to evolve into a society. Ahlstedt has some real concerns about excluding the folks who are doing the on-the-ground work. Afternoon session on what has been accomplished, do committee reports, and then talk about our structure & identity. Have the structure/society discussion at the fall meeting of 1998 subsequent to the March Meeting direction. In morning session work on logistics, etc.

AGENDA items for March NNMCC Meeting: 1) Background/Progress. 2) Subcommittee Reports. 3) Accomplishments. 4) Organizational review. 5) Subcommittee review re: further fleshing out of subcommittees and reviewing the need for additonal subcommittees or working groups. 6) Feedback on direction and progress.

FALL 1998 MEETING: Concurrent with ORVE in October or November or other Fall Meeting.

Other Business: We need a Secretary. Me poll the membership. Ask Rita Villella? We agree on need for Secretary and Al will find one by next meeting. Bob Hatcher another possibility.
Have the Triennial Report become the Output/Newsletter for the Committee. Have Secretary help with that also. Put logo on it. Agreed.

What*s Working and What*s Not:

1) Need to communicate with the membership more.
2) Need to ensure that regional groups are at EXCOM meetings.
3) All subcommittee chairs will touch base with their volunteers before the next meeting
4) Subcommittees are moving along very well and are to be complimented on accomplishments & progress.
5) Need to better define what our membership is and recruit more people into the membership and to help with various activities. Ensure that people working with mussels know that this is an open committee where anyone who wants to participate can. Al will draft a one page *Call for Members* to be place in the Triennial Report and other media.
6) Need to develop a mailing list/membership list.
7) Need to solicit list of adverse projects for Madeleine to get to Jerry Rasmussen. Dick Biggins can ask for it in the Triennial Report. Madeleine will put together some guidelines for submission of those reports and email to EXCOM for input. Evolve to web site for input (when web site is completed).
8) Do subgroup chairs stay forever? Probably too early to decide that but need to discuss chair/officer rotation; probably at March meeting in general discussion.

Freshwater Mussel Symposium

March 6-8, 1998 ◆ Holiday Inn-Worthington ◆ Columbus, OH

The Columbus Zoo, the Ohio Biological Survey, and the Ohio Division of Wildlife are hosting a special symposium on March 6-8, 1998 focusing on the captive care and propagation of freshwater unionid mussels. The purpose of the meeting is to provide a forum for the discussion and dissemination of information on the rearing, maintenance, and long-term care of juvenile and adult mussel populations under artificial conditions. The symposium will be held at the Holiday Inn Columbus/Worthington Conference Center in Columbus, OH and the program will include oral and poster presentations, workshops, and an evening banquet and keynote address. Scientists, researchers, and professionals from industry, academia, public aquaria, and federal and state agencies are encouraged to participate.

Registration Information

Complete the enclosed form to preregister for the symposium. Additional registration forms, abstract information, and meeting updates are also available on the UNIO web page at ***http://www.umbc.edu/unio***. Please complete all the required information requested on the enclosed registration form. Incomplete information may cause a delay in the processing of your form.

To qualify for early registration (see fee structure below), all forms and payments must be received by January 5, 1998. All payments should be made in U.S. currency (US$). Checks and money orders should be made payable to the ***Columbus Zoo/ Mussel Symposium***.

Registration Fees:

Early Registration (Before Jan. 5, 1998)	
Faculty/Professionals/Aquarium Personnel	$ 130.00
Student (Graduate/Undergraduate) (w/ID)	$ 75.00
Late Registration (After Jan. 5, 1998)	
Faculty/Professionals/Aquarium Personnel	$ 160.00
Student (Graduate/Undergraduate) (w/ID)	$ 90.00
One-Day Registration (Before Jan. 5, 1998)	
Faculty/Professionals/Aquarium Personnel	$ 90.00
Student (Graduate/Undergraduate) (w/ID)	$ 70.00

Registration fees include a printed program and abstract book, a name badge, admission to all paper (oral) and poster sessions, workshops, coffee breaks, lunches, and a copy of the symposium proceedings. Late registrants will not be guaranteed a copy of the abstracts. Tickets for the Banquet/Keynote Address scheduled for Saturday night are US$ 30 and are sold separately. Banquet tickets are limited and will be sold on a first come, first serve basis. One-day registration fees are also available for participants interested in attending the symposium only on Friday or Saturday. All one-day registration forms and fees must be received by the early registration deadline (Jan. 5, 1998). One-day registration fees will not be available after Jan. 5 or at the door.

If you register early (by Jan. 5, 1998), you should receive a receipt and written acknowledgment of your registration by January 20, 1998. Late registrants will receive a confirmation receipt on-site.

Tentative Schedule

Friday, March 6	
8:00 am-12 noon	Registration
9:00 am-9:10 am	Introduction
9:10 am-10:30 am	Paper Session I
10:30 am-10:50 am	Coffee Break
10:50 am-11:50 am	Paper Session II
12 noon-1:15 pm	Lunch
1:20 pm-2:40 pm	Paper Session III
2:40 pm-3:00 pm	Coffee Break
3:00 pm-4:20 pm	Paper Session IV
4:30 pm-6:00 pm	Poster Session and Mixer
Saturday, March 7	
8:30 am-9:50 am	Paper Session V
9:50 am -10:10 am	Coffee Break
10:10 am-11:50 am	Paper Session VI
12 noon-1:20 pm	Lunch
1:30 pm-4:30 pm	Workshops
6:30 pm	Banquet/Keynote Address
Sunday, March 8	
8:30 am-9:50 am	Paper Session VII
9:50 am -10:10 am	Coffee Break
10:10 am-11:50 am	Paper Session VIII

Special Events

Workshops

Symposium attendees are encouraged to sign-up for one of two workshops scheduled for Saturday afternoon. The first will be held at the Ohio State University Museum of Biological Diversity and will cover identification of unionid mussels and glochidial transformation techniques using fish hosts and artificial culture media. The second workshop will be held concurrently at the Holiday Inn and will focus on the design and construction of facilities for rearing and maintaining freshwater mussels in captivity.

Banquet & Keynote Address

A special buffet banquet is scheduled for Saturday night. The banquet is not covered by the registration fee but tickets can be purchased for US$ 30 per person. The highlight of the banquet will be a keynote address by **Dr. David H. Stansbery**, Curator of Mollusca, Ohio State University Museum of Biological Diversity. The title of Dr. Stansbery's address will be *"Unionid Transitions"*.

Hotel Reservations

We have reserved a block of rooms at the Holiday-Inn Worthington for March 5-8, 1997. The hotel is conveniently located at the intersection of I-270 and U.S. 23 in the Crosswoods Center. The hotel offers easy access to Downtown Columbus, Ohio State University, and Port Columbus Airport. The Columbus Zoo has arranged special rates for symposium attendees. All rooms (singles, doubles, triples) are US$79.00 per night (plus tax). Reservations should be made as soon as possible, but no later than Feb. 15, 1998. Reservations can be made using the enclosed housing card or by calling the hotel directly and indicating you are affiliated with the Freshwater Mussel Symposium sponsored by the Zoo. Reservations are confirmed directly by the hotel. If you need to cancel or change your reservations, contact the hotel directly.

Holiday Inn Columbus/Worthington
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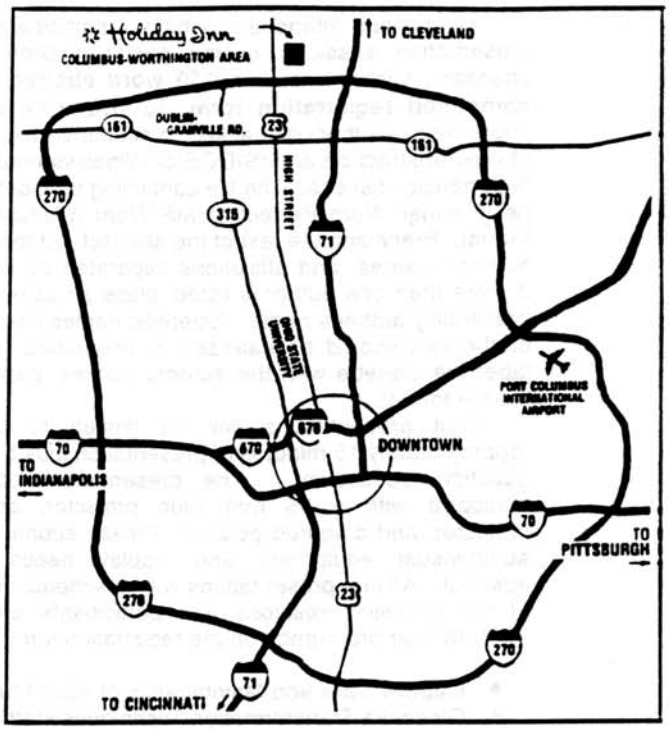

Travel Information

Port Columbus International Airport is located approximately 20 miles from the Holiday Inn-Worthington. Columbus is served by American, US Airways, Continental, Delta, Northwest, Southwest, and United airlines. The Holiday Inn provides a free shuttle service to and from the airport between 7:00 a.m. and 11:00 p.m. Upon reaching the airport, contact the hotel shuttle service using the courtesy phone located in the baggage claim area. Transportation from the airport to the Holiday Inn and other local hotels is also available through Airport Shuttle Service (Tel: 614-476-3004) for $22/person one-way and $42/person for a round-trip ticket. The Holiday Inn is also accessible by automobile via interstate highways I-70, I-270 and I-71. Free parking is provided.

Symposium Sponsors

OHIO DEPARTMENT OF NATURAL RESOURCES DIVISION OF WILDLIFE

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Presentations, Posters & Abstracts

Symposium attendees wishing to participate in the oral presentation sessions or the poster session on Friday afternoon should submit **a 250 word abstract with their completed registration form.** To insure the accuracy of publication, authors are asked to submit an electronic copy of their abstract on an MS-DOS or Windows readable 3.5 in. high density diskette. The file containing the abstract should be in either Word Perfect or MS-Word (Windows or DOS) format. Preceding the text of the abstract, list the paper title, authors' names, and affiliations separated by hard returns. If more than one author is listed, place an asterisk after the presenting author's name. Scientific names used in the title or the text should be italicized or underlined. Be sure to label the diskette with the authors' names, paper title, and the file format.

Oral presentations will be limited to 20 minutes (approximately 15 minutes of presentation plus 5 minutes for questions/discussion). The presentation room will be equipped with a 35 mm slide projector, an overhead projector, and a lighted podium. Please submit any special audio-visual equipment and display needs with your abstract. All oral presentations will be scheduled during one of the following sessions and participants are asked to indicate their preference on the registration form.

- Captive Care and Maintenance of Adult Mussels
- Glochidia Transformation Techniques/Methods
- Juvenile Rearing, Propagation and Reintroduction
- Mussel Physiology and Nutrition
- Public Outreach and Conservation Programs

Attendees wishing to present material on other mussel related topics are encouraged to submit an abstract for the poster session. Presentation space is on a first-come, first served basis, so please submit your meeting registration form and abstract by January 5, 1998. If space for oral presentations becomes limited, some participants may be asked to present posters instead. Instructions for poster presentations will be distributed in January. Poster sessions will be set-up following lunch on Friday and authors are strongly encouraged to be by their posters during the 4:30-6:00 p.m. session on Friday afternoon.

Symposium Proceedings

Attendees participating in the oral and poster sessions are encouraged to submit a paper for inclusion in the symposium proceedings to be published by the Ohio Biological Survey. Authors should follow the guidelines outlined in the ***Instructions for Authors*** section. All manuscripts will be reviewed by members of the editorial board prior to being accepted for publication. ***The deadline for manuscript submission is March 8, 1998.***

Instructions for Authors:

All parts of the manuscript must be typed (12 pt type), double spaced, with margins at least 2.5 cm. Number all pages, except the cover page, at the bottom. The original plus four copies should be submitted to facilitate reviewing and editing. The form of the manuscript must follow that outlined in the *Council of Biology Editors Style Manual* (6th edition, 1994).

The cover page should contain the title of the paper, the name(s), address(es), and affiliation(s) of the author(s). The telephone and fax number and email address (if available) of the corresponding author should also be indicated. The second page of the paper should contain a concise abstract summarizing the objectives, main findings and conclusions of the paper. The Introduction should start on page 3 and should be followed by the Materials and Methods, Results, Discussion, and References. Acknowledgements should be placed between the Discussion and References. Figure Legends, Figures and Tables should follow the References. Line drawings and graphs should be camera ready or similar quality. Half-tone figures must be mounted and ready for the printer (*i.e.*, no photocopies).

All cited works and theses should be listed in the References, in alphabetical order. Papers that have been accepted for publication should be listed as *in press* (*e.g.*, Smith, *in press*). Citations in the text should be listed in chronological order (separated by commas) as follows: (Smith 1985, Jones 1987, Smith & Jones 1998). Use "*et al.*" after the name of the first author for citations having more than two authors. Use the following styles for listing citations in the Reference section:

Bauer, G. 1992. Variation in the life span and size of the freshwater pearl mussel. Journal of Animal Ecology 61: 425-436.

Green, R.H. 1979. Sampling design and statistical methods for environmental biologists. John Wiley and Sons, New York.

Fuller, S.L.H. 1977. Freshwater and terrestrial mollusks. *In* J.E. Cooper, S.S. Robinson, and J.B. Funderburg (*eds*). Endangered and threatened plants and animals of North Carolina. North Carolina State Museum of Natural History, Raleigh.

Page charges will be waived for the first 6 printed pages (1 printed page = 2.5 double-spaced manuscript pages). Authors will be charged US$ 50 per page for each additional printed page. Authors will receive 50 free reprints. Additional reprints may be purchased at the time of publication.

Questions?

If you have any questions about the symposium please contact:

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1997 records of Alabama endangered species

Notable records from 1997 field work in the Tennessee River include three possible *Plethobasus cicatricosus* (verification pending) which were collected in the vicinity of Sevenmile Island (Lauderdale County, Alabama). A total of 13 *Lampsilis abrupta* were collected from the tailwaters of Guntersville and Wilson dams. Also notable were one *Plethobasus cyphyus* and one *Ptychobranchus fasciolaris*, both also collected in the vicinity of Sevenmile Island.

Endangered species encountered during one day on the Paint Rock River in 1997 include *Fusconaia cuneolus* (1 live, 2 fresh dead), *Fusconaia cor* (1 fresh dead), *Lampsilis virescens* (2 fresh dead) and *Toxolasma cylindrellus* (1 fresh dead). One fresh dead *Epioblasma brevidens* was collected from Bear Creek, Colbert County, Alabama.

In field work on the Alabama River, eight *Pleurobema taitianum* and one *Pleurobema decisum* were collected near Selma. According to Paul Hartfield (U.S. Fish and Wildlife Service) *P. taitianum* had not been collected alive since 1987 (from the Buttahatchee River, Mississippi).

During a snail survey of Locust Fork, one fresh dead *Lampsilis perovalis* and one fresh dead *Ptychobranchus greeni* were collected in Jefferson County.

Mussels of Muscle Shoals

Alabama Game and Fish Division recently requested that the U.S. Fish and Wildlife Service attempt to establish nonessential experimental populations of extirpated endangered freshwater mussels and one snail in the tailwaters of Wilson Dam on the Tennessee River in northwest Alabama. In order to facilitate decisions on which species to consider, the following list of mussels which historically occurred at Muscle Shoals was drafted. Included are their current abundance or the last dates on which they were observed in the area. Muscle Shoals extended from the upper reaches of what is now Pickwick Reservoir through Wilson Reservoir into Wheeler Reservoir. Included on the list are recent records from the entire areas of the three reservoirs. If anyone has additional data (*e.g.* new species to add to the list or more recent observations) I would greatly appreciate the information to include on the table.

Mussel species documented from Muscle Shoals*, Tennessee River, Alabama

Species	pre 1976	1976-1997	Remarks
Actinonaias ligamentina	X		last record 1931[6]
Actinonaias pectorosa	X		last record ca. 1925[2]
Amblema plicata	X	X	common[3]
Anodonta suborbiculata	X	X	common, lentic habitat[4]
Arcidens confragosus		X	uncommon[3]
Cumberlandia monodonta	X	X	very rare, several coll. 1995[6]
Cyclonaias tuberculata	X	X	common[3]
Cyprogenia stegaria *	X	X	last record 1976-78[1]
Dromus dromas *	X		last record 1931[6]
Ellipsaria lineolata	X	X	common[3]
Elliptio crassidens	X	X	common[3]
Elliptio dilatata	X	X	rare[3]
Epioblasma arcaeformis	X		last record ca. 1925[2]
Epioblasma biemarginata	X		last record ca. 1925[2]
Epioblasma brevidens *	X		last record ca. 1925[2]
Epioblasma capsaeformis *	X		last record ca. 1925[2]
Epioblasma florentina florentina *	X		last record ca. 1925[2]
Epioblasma haysiana	X		last record ca. 1925[2]
Epioblasma obliquata obliquata	X		last record ca. 1925[2]
Epioblasma personata	X		last record 1931[6]
Epioblasma torulosa torulosa*	X		last record 1931[6]
Epioblasma triquetra	X		last record ca. 1925[2]
Epioblasma turgidula *	X		last record ca. 1925[2]
Fusconaia barnesiana	X		last record ca. 1925[2]
Fusconaia cor *	X		last record ca. 1925[2]
Fusconaia cuneolus *	X		last record ca. 1925[2]
Fusconaia ebena	X	X	abundant[3]
Fusconaia subrotunda	X	X	rare[3]
Hemistena lata *	X		last record ca. 1925[2]
Lampsilis abrupta *	X	X	rare[3]
Lampsilis fasciola	X	X	last record 1978[1]
Lampsilis ovata	X	X	rare[3]
Lampsilis teres	X	X	rare[3]
Lampsilis virescens *	X		last record ca. 1925[2]
Lasmigona complanata		X	very rare[3]
Lasmigona costata	X		last record ca. 1925[2]
Lemiox rimosus *	X		last record ca. 1925[2]
Leptodea fragilis	X	X	uncommon[3]
Leptodea leptodon	X		last record ca. 1925[2]
Lexingtonia dolabelloides	X		last record 1963[5]
Ligumia recta	X	X	rare[3]

Species	pre 1976	1976-1997	Remarks
Medionidus conradicus	X		last record ca. 1925[2]
Megalonaias nervosa	X	X	common[3]
Obliquaria reflexa	X	X	common[3]
Obovaria olivaria	X	X	last record 1978[1]
Obovaria retusa *	X	X	very rare, 1 coll. 1992[4]
Plethobasus cicatricosus *	X	X	very rare, 3 coll. 1997[4]
Plethobasus cooperianus *	X	X	last record 1978[1]
Plethobasus cyphyus	X	X	very rare, 1 coll. 1997[4]
Pleurobema clava *	X		last record ca. 1925[2]
Pleurobema coccineum	X	X	last record 1976-78[1]
Pleurobema cordatum	X	X	uncommon[3]
Pleurobema oviforme	X	X	last record 1976-78[1]
Pleurobema plenum *	X	X	very rare, coll. 1996[b]
Pleurobema pyramidatum	X	X	very rare, coll. 1997[4]
Potamilus alatus	X	X	common[3]
Ptychobranchus fasciolaris	X	X	very rare, 2 coll., 1995 & 1997[4]
Ptychobranchus subtentum	X		last record ca. 1925[2]
Pygonodon grandis	X	X	common, lentic habitat[3]
Quadrula cylindrica	X		last record 1931[6]
Quadrula fragosa *	X		last record 1960[4]
Quadrula intermedia *	X		last record ca. 1925[2]
Quadrula metanevra	X	X	rare[3]
Quadrula nodulata		X	very rare, coll. 1995[c]
Quadrula pustulosa	X	X	abundant[3]
Quadrula quadrula	X	X	common[3]
Strophitus undulatus	X		last record 1931[6]
Toxolasma lividus	X	X	rare[3]
Toxolasma parvus	X	X	rare[3]
Tritogonia verrucosa	X	X	uncommon[3]
Truncilla donaciformis	X	X	uncommon[3]
Truncilla truncata	X		last record 1931[6]
Utterbackia imbecillis	X	X	uncommon, lentic habitat
Villosa nebulosa	X		last record ca. 1925[2]
Villosa taeniata	X		last record ca. 1925[2]
Villosa trabalis *	X		last record ca. 1925[2]
Villosa vanuxemensis	X	X	very rare, 2 coll. 1996[4]

* Records from the areas which are now Pickwick, Wilson and Wheeler reservoirs are included in this list.

abundant - ten specimens can be collected with very little effort, usually without moving from a position.

common - ten specimens can be collected easily, but a little searching is required.

uncommon - ten specimens can usually be collected, but considerable effort must be expended.

rare - not likely that ten specimens will be encountered in a day's work.

very rare - only a few specimens have been encountered during recent work.

a. Jeffrey T. Garner, personal observation, field work 1995-1997
b. Paul Yokley, Jr., personal communication, 1997
c. Steve Ahlstedt, personal communication, 1997
d. Terry Richardson, personal communication, 1997, collected by commercial mussel harvester, identified by Richardson.
e. Jeffrey T. Garner, personal observation, in mussel harvester's catch
f. Jeffrey T. Garner, identification verification pending.

1. Gooch, C.H., W.J. Pardue and D.C. Wade. 1979. Recent mollusk investigations on the Tennessee River, 1978. Tennessee Valley Authority, Water Quality and Ecology Branch, 126 pp.

2. Ortmann, A.E. 1925. The naiad fauna of the Tennessee River system below Walden Gorge. The American Midland Naturalist, 9: 321-372.

3. Richardson, T.D. 1993. Colonization of Tennessee River bivalves by the invading zebra mussel, *Dreissena polymorpha* (Pallas): final report for FY 1993, 38 pp.

4. Scruggs, G.D. 1960. Status of freshwater mussel stocks in the Tennessee River. U.S. Fish and Wildlife Service, Special Scientific Report, Fisheries, 370: 1-40.

5. Stansbery, D.H. 1964. The Mussel (Muscle) Shoals of the Tennessee River revisited. Annual Reports for 1964 of the American Malacological Union: 25-28.

6. Van der Schalie, H. 1931. Additional notes on the naiades (fresh-water mussels) of the lower Tennessee River. The American Midland Naturalist, 22: 452-457.

Obovaria retusa: Confirmation of an extant population in the upper Green River, Kentucky

Robert S. Butler, Ronald R. Cicerello, and Ellis L. Laudermilk
U.S. Fish and Wildlife Service, 160 Zillicoa Street, Asheville NC 28801 (RSB) and Kentucky State Nature Preserves Commission, 801 Schenkel Lane, Frankfort KY 40601 (RRC & ELL)

Obovaria retusa (Lamarck, 1819) was described from the Ohio River at Cincinnati. Historically, it occurred in large river shoals throughout the Ohio River basin. Widespread population losses from habitat alteration led to its Federal listing as endangered in 1989. Only four populations remain: two each in Kentucky and Tennessee. According to the 1991 recovery plan, it is doubtful that any of them are experiencing successful reproduction and recruitment.

The upper Green River harbors one of the few populations of this critically endangered species. *Obovaria retusa* was first collected from the Green River at Mammoth Cave by R.E. Call (ca. 1900). The 34+ specimens Call collected (Cicerello & Hannan 1990), coupled with Ortmann's (1926) assertion that it was "not rare" at a nearby site, would seem to indicate that it was relatively common over 75 years ago. Although several freshly dead specimens have been reported since, the last verified live specimens were collected in the 1960's.

The Kentucky State Nature Preserves Commission (KSNPC) is conducting an assessment of the mussel populations in the Green River between Green River Reservoir and Mammoth Cave National Park (MCNP) in conjunction with a riparian habitat stress analysis and impending watershed protection effort by the Kentucky Chapter of The Nature Conservancy. In September 1997, KSNPC discovered a live specimen of *Obovaria retusa* completely exposed in a shallow gravel shoal upstream of MCNP. After the specimen was measured (63 mm), aged (16+ years), and photographed, it was returned to the substrate. Two other federally endangered species, *Cyprogenia stegaria* (Rafinesque, 1820) and *Pleurobema plenum* (Lea, 1840), were found during the recent assessment. Several specimens of *C. stegaria* were found live at several sites in the project area, while a single specimen of *P. plenum* was found live in Green County, which represents the upstream-most record for this globally rare species.

There are records for 71 species from the Green River system (Cicerello & Hannan 1990), including 59 species in the project area. Thirty-four live or freshly-dead species were located this year, 17 of which were represented by at least one specimen deemed a juvenile or sub-adult. An additional six species were found only as weathered or subfossil shells. This information indicates that the Green River continues to harbor a relatively healthy and diverse mussel fauna. Seven federally listed mussel species and 14 other species considered rare in Kentucky are known from the project area underlying the importance of the upper Green River as a mussel refugium.

Cicerello, R.R., & R.R. Hannan. 1990. Survey of the freshwater unionids (mussels) (Bivalvia: Margaritiferidae and Unionidae) in the Green River in Mammoth Cave National Park, Kentucky. Kentucky State Nature Preserves Commission unpublished report to the U.S. Department of the Interior, National Park Service. 44 pp.

Ortmann, A.E. 1926. The naiades of the Green River drainage in Kentucky. Annals of the Carnegie Museum 17:167-188.

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Report: Missisquoi National Wildlife Refuge Native Mussel Quarantine Facility - 1997

The Lake Champlain Native Mussel Working Group identified Lewis Creek Delta, located on the Vermont side of Lake Champlain, as an area with a unique native mussel population. The Delta is highly colonized by zebra mussels (*Dreissena polymorpha*). This document summarizes removal and quarantine of several rare species from Lewis Creek and provides information on the quarantine results.

The quarantine facility, located on the Missisquoi NWR, consists of a 17x13.5 ft. fenced-in area large enough to house a holding tank, three drainage barrels, and any periphery equipment needed for the project. The five foot diameter, 12" deep tank was equipped with a small fountain aerator. The water used in the quarantine was taken from the Missisquoi River.

On July 1, 1997, with a crew of 11 people, rare native mussels were recovered from the Lewis Creek Delta. The native mussels were cleaned three times - on the boat, before loading them into the truck, and when they arrived at the quarantine facility. The mussels collected were: *Leptodea fragilis* (62), *Pyganodon grandis* (2), *Potamilus alatus* (144), *Lampsilis ovata* (3), and *Alsmidonta undulata* (14).

Over the next month, the mussels were inspected weekly for five weeks. The water was changed in conjunction with the inspections. Periodically, the tank water was drained through a filter and examined for any evidence of zebra mussel veligers. The water temperature in the holding tank was maintained at approximately 21°C to promote the growth of zebra mussels and help sustain the native mussels. Additionally, algae, cultured by the Vermont Department of Environmental Conservation, was regularly added to the tank.

No adult zebra mussels or veligers were found on the native mussels, or in the water samples taken from the tank drainage. However, some mortalities did occur. Of the 225 collected, 16 died while in quarantine.

On August 11, 1997, biologists from the U.S. Fish and Wildlife Service and the Vermont Department of Environmental Conservation returned the native mussels to Lewis Creek, above the zebra mussel infested delta. These sections were selected because the mussels could be easily monitored and the areas have a low potential for zebra mussel infestation. The mussels will be monitored in Spring 1998.

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Malacology-Related Publications:

Lydeard, C., and R. L. Mayden. 1995. A diverse and endangered aquatic ecosystem of the Southeast United States. *Conservation Biology* 9:800-805.

Lydeard. C. 1996. U.S. Biodiversity Status Report. *Conservation Biology* 10:1480- 1482.

Lydeard, C., M. Mulvey, and G. M. Davis. 1996. Molecular systematics and evolution of reproductive traits of North American freshwater unionacean mussels (Mollusca: Bivalvia) as inferred from 16S rRNA gene sequences. *Philosophical Transactions of the Royal Society of London Series B* 351:1593-1603.

Lydeard, C. W. E. Holznagel, J. Garner, P. Hartfield, and J. Malcolm Pierson. 1997. A molecular phylogeny of Mobile River drainage basin pleurocerid snails (Caenogastropoda: Cerithioidea). *Molecular Phylogenetics and Evolution* 7:117-128.

Mulvey, M., C. Lydeard, D. L. Pyer, K. M. Hicks, J. C. Brim-Box, J. D. Williams, and R. S. Butler. 1997. Conservation genetics of North American freshwater mussels *Amblema* and *Megalonaias*. *Conservation Biology* 11:868-878.

Roe, K. J., A. M. Simons, and P. Hartfield. 1997. Identification of a fish host of the inflated heelsplitter *Potamilus inflatus* (Bivalvia: Unionidae) with a description of its glochidium. *American Midland Naturalist* 138:48-54.

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Spiny Riversnail (*Io fluvialis*)

Spiny riversnail reintroduction sites in the lower French Broad (Campbell Island) and upper Holston River (Surgoinsville) were searched in July 1997 for adult survival of specimens transplanted in 1996. Thirty-three live specimens were found in the French Broad and none were found in the Holston. No reason could be given for the disappearance of the snails in the Holston because other pleurocerid riversnails were abundant.

During August 1997, 600 more measured and marked spiny riversnails were reintroduced into the French Broad and Holston River at the same 1996 locations. Both sites will be evaluated in FY 1998 for adult survival. Evidence of reproduction is a long-term process and may be 4-6 years away from determining if transplants were successful. The disappearance of the snails in the Holston is not unusual because they could have been distributed downstream during high flows and/or the small number transplanted makes finding them difficult.

Funding for this project was provided by Dick Biggins, USFWS, Endangered Species Field Office, Asheville, North Carolina. Help in collecting specimens was provided by students of Dr. Jim Lazer, Tenn Tech University, Fisheries Coop Unit, TVA, TWRA, and TNC.

First Release of Cultured Juvenile Mussels in Tennessee

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The first release of juvenile freshwater mussels, cultured at the Mussel Research Center at Virginia Tech, occurred on September 24, 1997. A total of 52 endangered tan riffleshells (Epioblasma f. walkeri) and 360 wavy-rayed lampmussels (Lampsilis fasciola) were released immediately upstream of the Route 68 crossing of the Hiawassee River, within Cherokee National Forest, North Carolina. Other participants in this first release included Ed Stiles and Leigh McDougal (USFS), Janice Cox (TVA), Dick Biggins (FWS), and Steve Ahlstedt (USGS). The tan riffleshells were 2-3 months old and less than 1 mm in length. The wavy-rayed lampmussels were 6-12 months old and ranged from 2-5 mm in length. These mussels were surplus from culture experiments completed in summer 1997. The State of Tennessee has recently funded a project for us to produce juvenile mussels of a suite of species for release into historic habitats within the state. Cooperators in this project include the Tennessee Wildlife Resources Agency (TWRA), U.S. Fish and Wildlife Service, and Virginia Cooperative Fish and Wildlife Research Unit. A listing of potential release sites for each species is being prepared for TWRA approval.

Cyclonaias tuberculata glochidia transform on catfish barbels

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Ictalurids probably encounter glochidia as they search for food on the river bed when mussels are releasing their young. A preliminary study suggests *Cyclonaias tuberculata* glochidia can transform on the barbels of channel catfish. Host suitability trials were conducted this spring using methods similar to those described in Neves et al. (1985). Juvenile *C. tuberculata* were collected from four of seven Ictalurids tested (Tables 1 and 2). One group of channel catfish had only their lower barbels exposed to *C. tuberculata* glochidia. Although this trial ended prematurely due to an outbreak of Ich, we plan to repeat barbel infestation tests in the future.

Table 1. Attachment period of unsuitable hosts for *Cyclonaias tuberculata* glochidia.

Common name	Scientific name	Number of individuals inoculated	Number of inoculated survivors	Glochidia attachment period (days)
brown bullhead	*Ameiurus nebulosus*	7	0	*
black bullhead	*Ameiurus melas*	1	0	*
black bullhead (barbels only)	*Ameiurus melas*	7	0	*
stonecat	*Noturus flavus*	8	8	17
tadpole madtom	*Noturus gyrinus*	8	8	22-24

* - Incomplete trial, test subjects died before completion of the study.

Table 2. Fish species that facilitated *Cyclonaias tuberculata* glochidia metamorphosis.

Common name	Scientific name	No. of individuals inoculated	No. of inoculated survivors	Juvenile recovery period (d)	No. of juveniles recovered
channel catfish	*Ictalurus punctatus*	4	0*	29-31	61
channel catfish (barbels only)	*Ictalurus punctatus*	4	0*	17-19	2
yellow bullhead	*Ameiurus natalis*	6	3	24-38	87
black bullhead	*Ameiurus melas*	9	6	29-33	3
flathead catfish	*Pylodictus olivaris*		0*	29-33	16

* - Incomplete trial, test subjects died before completion of the study.

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Northern Minnesota river holds three state-listed mussels

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The mussel assemblage of the Lake of the Woods watershed in northern Minnesota is among the least studied unionoid faunas in the state (Graf 1997). The Big Fork River, a subdrainage in the watershed, flows north over rolling moraines, across the flat bed of Glacial Lake Agassiz, to the Rainy River; Minnesota's border with Canada. Much of the Big Fork River watershed is relatively pristine. Most of the land is covered by second growth aspen and pine forests, and a small number of ranches (Waters 1977).

Twenty-five sites were surveyed in the Big Fork River basin. *Lampsilis siliquoidea*, *Pyganodon grandis*, and *L. cardium* were regularly found throughout the watershed. *Lasmigona compressa* was found in the lower two-thirds of the basin. *Utterbackia imbecillis*, *Anodontoides ferussacianus*, *Lasmigona complanata*, *Strophitus undulatus*, and *Ligumia recta* had scattered distributions. *L. costata* was represented by a single valve from a headwater tributary. *Lasmigona compressa*, *L. costata*, and *Ligumia recta* are listed as special concern species in Minnesota. Mussel densities ranged between 0-32 mussels/m^2 (Figure 1).

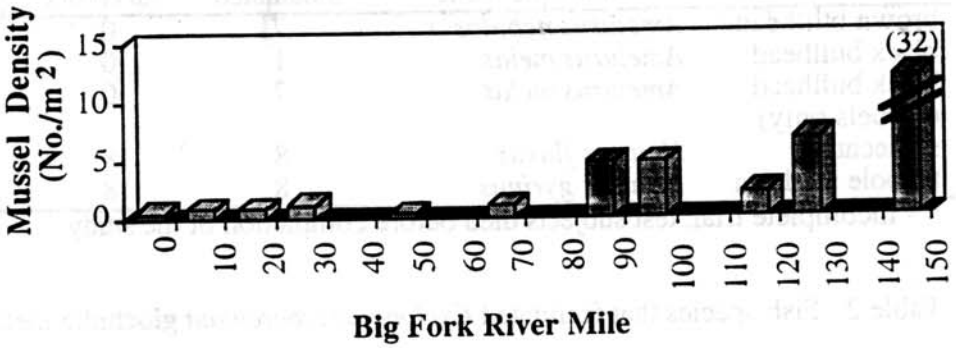

Figure 1. Mussel densities in the Big Fork River, Minnesota.

During the survey we observed an interesting color variant of *Ligumia recta*. Most *L. recta* in the St. Croix and upper Mississippi rivers have gray and black mantles with white-tipped papillae. However, two displaying *L. recta* in the Big Fork River had a much lighter, yellow-gray mantle. These mussels, like other brooding *L. recta* we've witnessed, were lying out on top of the river bed occasionally waving their mantles.

This survey was made possible with support from: the Legislative Comm. on Minnesota Resources, Chantel Cook and Richard Buech of the National Park Service, Jay Hatch, Joanne Iskerka, Cindy Lee, and Susan Weller of the Bell Museum of Natural History, Dan Hornbach of Macalester College, and Anne Kapuscinski of the University of Minnesota.

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1997 Mississippi River Research Consortium abstracts

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The following abstracts were selected from presentations made at the 29th annual meeting of the Mississippi River Research Consortium (April 24-25, 1997). The next meeting will take place at La Crosse, WI on April 23-24, 1998.

SECONDARY PRODUCTION OF *HYALLELA AZTECA* AS INFLUENCED BY *DREISSENA POLYMORPHA*, LARVAL FISH, AND NUTRIENTS

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Beds of zebra mussels typically contain greater densities of benthic macroinvertebrates than adjacent areas, but little data exists on the effect of zebra mussels on benthic secondary production. We tested the hypotheses that (1) benthic production would increase where zebra mussels and elevated nutrients were present, but decrease in the presence of a vertebrate predator; and (2) the presence of both zebra mussels and elevated nutrients would offset the negative effects of fish on benthic production. In a 35-d mesocosm experiment we manipulated the presence or absence of (1) Dreissena (1500/m2), (2) larval fathead minnows (*Pimephales promelas*: 250/m^3), and (3) nutrients at 2x supply water concentrations (0.44 mg/L N and 0.035 mg/L P). These factors were cross-classified, resulting in 8 treatment combinations; N=3. Benthic samples were collected weekly, and the amphipod *Hyalella azteca* removed from the samples to estimate secondary production (cohort growth increment summation method). We also measured chlorophyll concentration, zooplankton density, and fish diet and growth. Production of *H. azteca* increased in the presence of zebra mussels, nutrients, and larval fish in comparison to controls, however production decreased in the combined treatment of zebra mussels and larval fish. The results suggest that (1) secondary production is elevated in the presence of zebra mussels, and (2) because zebra mussels effectively outcompete the larval fish for zooplankton prey, the fish are forced to feed on the benthos more intensely than when zebra mussels were not present.

EFFECTS OF *DREISSENA POLYMORPHA* (PALLAS 1771), ZEBRA MUSSEL, ON 1996 UNIONID MOLLUSK TRANSLOCATION PROCEDURES: MISSISSIPPI RIVER MILE 697.5, HWY 14/16/61, CASS STREET BRIDGE, LA CROSSE, WI

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In July and August 1996, prior to routine riprap placement around three bridge piers, 12,698 unionids (27 species) including five endangered *Lampsilis higginsi* (Lea 1857), and 580 other Wisconsin special status unionids, such as 39 *Ellipsaria lineolata* (Rafinesque 1820), 29 *Arcidens confragosus* (Say 1829), and 234 *Pleurobema sintoxia* (Rafinesque 1820) were translocated, mostly from about 900 m^2 around each of two piers. Densities and number of species per pier were: Pier 6, 2.81/m^2 (22 species); Pier 7, 0.07/m^2 (12 species); and Pier 8, 10.65/m^2 (27 species). The mean density was 4.65 mussels/m^2. This unionid translocation was probably the first to have been conducted in an area seriously impacted by *Dreissena polymorpha*, 6-44 mm long. Some unionids, mainly from sand substrata, were devoid of this exotic, although many showed evidence of previous *D.*

polymorpha attachment (byssal threads). At Piers 6 and 7 there were a small number of *D. polymorpha* on most unionids, but at Pier 8, on the left descending bank and 320 m downstream of a barge facility, the river substrata was blanketed with zebra mussels 25-75 mm deep, and up to 120 or more adults on 80% of the unionids. Depths at Pier 8 were 6-9 m with very strong currents, and a cobble, gravel, and sand substrata. The number of *D. polymorpha* greatly slowed unionid collection by experienced divers. Many unionids were nearly covered with *D. polymorpha*, but few appeared to have been killed by this exotic. The saving factor may be the strong current at Pier 8, on outside of a large, river bend. Processing time was doubled because visible *D. polymorpha* were hand stripped, like shucking popcorn, before unionids were marked or numbered on each lower anterior valve. A local waste management company required *D. polymorpha* to be bagged, and advance disposal notice given to facilitate immediate landfill burial. The first records for La Crosse since 1907, and for the Upper Mississippi River since 1930, included three *Alasmidonta marginata* (Say 1818) and four *Lasmigona costata* (Rafinesque 1820). Depths of 6-9 m were probably records for these two generally small stream species. *Amblema p. plicata* (Say 1817) was 39.75% of the fauna. The most suitable translocation area for special status unionids was 4 miles upstream. A nearby site was used as the translocation area for some common species. Several species reported alive nearby by Havlik (1983) were not found, including *Anodonta suborbiculata* (Say 1831), however the habitat was not typical for this species. All special status specimens appeared to be doing well on 6 October 1996, except that #131, *Ligumia recta* (Lamarck 1819) (160 mm long) was found dead with about 50 - 5 mm long juvenile *D. polymorpha* attached to this shell. These small *D. polymorpha* represented the 1996 August-September cohort.

CHANGES IN DENSITY AND SIZE DEMOGRAPHY OF THREERIDGE MUSSELS (*AMBLEMA PLICATA PLICATA*) IN LAKE PEPIN, MINNESOTA, AND WISCONSIN

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Density and size demography of unionid mussel populations were quantitatively sampled at several mussel beds in Lake Pepin, beginning in 1990. Densities of the commercially harvested threeridge mussel, *Amblema plicata plicata* (Say, 1817), declined at 5 of the 7 mussel beds sampled. The most dramatic decline occurred at the Hok Si La, MN, bed where average densities of *A. p. plicata* equaled 21.7/m^2 during 1993, declining to 6.0/m^2 in 1995 and 5.0/m^2 in 1996 ($F=8.820$, $P=0.0001$). Densities of non-harvested mussel species increased or remained stable at all seven beds. Average shell height of *A. p. plicata* significantly decreased at 4 beds, remained stable at 2, and increased at 1. These data implicate commercial harvesting as a contributing factor in the decline of this mussel species. During this study, zebra mussels, *Dreissena polymorpha*, became established in Lake Pepin. The greatest density of zebra mussels was found at the King's Coulee bed in 1995 (1750/m^2), decreasing to 971/m^2 in 1996 ($T=2.366$, $P=0.021$). Although densities of zebra mussels decreased at this bed, infestations of zebra mussels upon *A. p. plicata* did not. The average number of live zebra mussels per live *A. p. plicata* equalled 44 in 1995 and 48 in 1996. With the large percentage of infested *A. p. plicata* at the King's Coulee bed in 1996 (91%), an increase in zebra mussel induced mortality could soon become evident. While zebra mussels can not be controlled by resource agencies, the impacts of commercial harvesting can. An attempt is being made to model safe levels of harvesting, thus ensuring a sustainable yield of *A. p. plicata*.

SUITABLE FISH HOSTS FOR GLOCHIDIA OF THREE FRESHWATER MUSSELS: STRANGE FLOATER, ELLIPSE, AND SNUFFBOX

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Of 297 freshwater mussel species living in North America, 213 are either endangered, threatened, or of special concern. The identification of fish hosts is listed in the National Strategy for Freshwater Mussel Conservation as an urgent research objective. We conducted laboratory studies to determine suitable fish hosts for three species of freshwater mussels: strange floater (*Strophitus undulatus*), ellipse (*Venustaconcha ellipsiformis*), and snuffbox (*Epioblasma triquetra*). Various fish species were exposed to mussel larvae via artificial infestation. A fish was considered a suitable host when larval metamorphosis to the juvenile stage was observed. Juvenile strange floater were collected from five of seven species tested: largemouth bass, green sunfish, black bullheads, bluegills, and yellow perch. Of nine fish species exposed to ellipse glochidia, only blackside darters were suitable hosts. Snuffbox glochidia metamorphosed on logperch and blackside darters. Host requirements for strange floater glochidia appeared to be quite general, whereas ellipse glochidia were more selective. Species-specific molecular markers are being developed for use in the identification of glochidia collected from naturally infested fish.

EFFECT OF INCREASED ZEBRA MUSSEL DENSITIES ON MACROINVERTEBRATE COMMUNITY STRUCTURE OF SNAGS IN THE UPPER MISSISSIPPI RIVER

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Studies of the zebra mussel *Dreissena polymorpha*, in Europe suggest that we can expect this exotic species to reach an equilibrium with native invertebrates in the upper Mississippi River, but at a cost. Some documented on native invertebrates include a decrease in the availability of hard substrata and lower phytoplankton abundance. We collected samples of woody debris (snags) from backwater and main channel habitats of the upper Mississippi River to determine if increasing zebra mussel densities were affecting the density and diversity of native benthic invertebrates. Our data were compared to those of a similar study conducted in 1993, prior to any substantial snag colonization by zebra mussels. Samples were collected from two sites (near RK 1155 and 1172) in September 1996 using a DTH snag sampler. Zebra mussel densities on snags were low in both the main channel and backwaters in 1993. By 1996, densities in excess of 200 individuals/m^2 were not uncommon. Of particular note were the densities observed in backwaters, which were in the same general locations were zebra mussels were first observed in 1993. The invertebrate community in 1996 was characterized by an abundance of Chironomidae and small to marked reductions in the abundance of heptageniid mayflies and several groups of Trichoptera. Comparison of data from 1993 to 1996 suggest that the same trends observed in other areas, including the Great Lakes, will hold true for the upper Mississippi River. Benthic invertebrates which can use zebra mussel byssus and pseudofeces as habitat and possible food source, respectively, (*e.g.*, Chironomidae) will take advantage of the new conditions, whereas, organisms competing with mussels for space (*e.g.*, some Trichoptera and Ephemeroptera) will see a reduction in overall densities.

USE OF A DYNAMIC POPULATION MODEL TO EVALUATE MANAGEMENT STRATEGIES FOR NATIVE MUSSELS

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Currently, management of native mussels is hampered by our inability to quantitatively assess the impacts of natural and anthropomorphic stresses, such as natural and harvest mortality, on populations of this economically and ecologically important resource. Sound science-based management requires a tool that combines data on current populations with knowledge of population dynamics to predict future conditions under various management scenarios. Using Stella II software running on a personal computer, we developed a dynamic, single-species population model that can be used as one tool to help evaluate effects of different management strategies on native mussel populations. Input parameters include initial mussel density (number per m^2), age-frequency distribution, growth rate, age or size at maturity, and age-specific mortality rates. In our model, recruitment is density dependent and can be calculated either as a percentage of the reproductive population or by using a submodel which incorporates fecundity rate, sex ratio, density-dependent fertilization rate, and glochidial attachment, transformation, and survival rates. The primary output from the model is live mussel standing stocks (numbers per m^2) of different age classes over time. In our model, harvest can be regulated by various management strategies including minimum shell height (the current management practice in Upper Mississippi River [UMR] states), harvest allowed only when a specific mussel density is exceeded, maximum harvest rate (number per m^2), assorted closure regimes, or combinations of these. Model outputs include annual and cumulative harvest (numbers and/or pounds per m^2). The model also can use mussel weight- or size-dependant price estimates to calculate dollar values for standing stocks and annual, mean, and cumulative harvest. We used data for the threeridge mussel (*Amblema plicata*) collected from Reach 15 of the UMR near Rock Island, IL, and compared 100-year simulation runs of the model using two types of regulation strategy. The first strategy produced a set of five runs with harvest regulated by minimum harvest heights of 1.50, 1.90, 2.50, 2.75, and 3.00 inches. The second strategy used a constant minimum harvest height of 2.75 inches (the limit in most UMR states) and five different minimum harvest densities, allowing harvest of legal-size mussels only when their densities exceeded 0.5, 1.0, 2.5, 5.0, or 10.0 per m^2. Using the minimum harvest height regulations alone, the total 100-year harvest ranged from 5.3 to 5.8 live mussels harvested per m^2, and the 100-year mean mussel density (standing stock) ranged from 0.8 to 2.8 mussels per m^2. Regulation by minimum harvest density resulted in total 100-year harvests from 4.0 to 12.9 mussels per m^2 and mean densities of 1.5 to 12.8 mussels per m^2. Use of this or similar models should aid in the development and implementation of improved management strategies to protect or even enhance our native mussel resources (*e.g.*, provide higher standing stocks) while contributing to a sustained harvest at an increased rate and/or value.

BELL MUSEUM OF NATURAL HISTORY: ORGANIZING MINNESOTA'S FRESHWATER MOLLUSKS INTO A GIS-COMPATIBLE DATABASE

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The Bell Museum of Natural History is Minnesota's repository for freshwater mollusks. The museum collection includes 5737 lots; 5146 from states surrounding and including

Minnesota. Freshwater bivalves constitute 92% of the collection, including 250 lots collected before 1910. Specimens collected beyond Minnesota and adjacent states include freshwater mussels from 22 states (n=188 lots) and 2 other countries (n=2 lots), and snails from 31 states (n=369 lots) and 11 other countries (n=32 lots). Most of these collection records are entered into a computer database (Filemaker Pro customized by Daniel Graf). In addition to active acquisition of specimens, we are expanding our computer database on Minnesota mollusks to include a review of species locality data collected from journal articles and federal reports. In collaboration with the US Forest Service, we are in the process of converting our literature database to a GIS-friendly format. With GIS capability, it is possible to visualize collection needs, changes in fauna over time, and the correlation of mussel species' distributions with geoclimatic and vegetation records. This database and GIS capability will provide distribution information in an accessible format to resource managers, and facilitate efforts to identify and conserve rare species.

CURRENT STATUS OF THE BENTHIC COMMUNITY OF POOL 19, MISSISSIPPI RIVER

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Benthic samples have been collected at standard sites in Pool 19, Mississippi River for over 25 years. During this period benthic density and diversity has fluctuated substantially. During this period sedimentation, extreme droughts and floods have also occurred. When evaluating the benthic data in terms of habitat changes brought about by these extreme events some specific relationships are apparent. Burrowing forms of benthic organisms occur in the channel border habitat of most of the lower reach of Pool 19. Dense populations (1-10 X 104/m^2) of some of these burrowing benthic organisms, particularly fingernail clams (*Musculium*) and burrowing mayflies (*Hexagenia*), occur in soft sediments in association with vegetation but not directly in vegetated habitats. When areas of soft substrate develop vegetation, such as during droughts or when sedimentation decreases water depths, populations of these benthic organisms are greatly reduced (>100/m^2). However, if flooding removes the vegetation the *Musculium*, *Hexagenia* dominated benthic community is quickly reestablished an appears to persist until dense stands of aquatic macrophytes again develop. The aquatic macrophytes produce unsuitable conditions in the substrate below the plants but provide a good food source in adjacent benthic habitat. Once sedimentation rates stabilize in an impounded reach of a navigation pool, density of fingernail clams and burrowing mayflies may fluctuate in relation to flooding or drought events of sufficient magnitude to alter patterns of aquatic macrophyte development.

EFFECTS OF FOOD LIMITATION BY ZEBRA MUSSELS (*DREISSENA POLYMORPHA*) AND FISH PREDATION ON LIFE HISTORY CHARACTERISTICS OF *DAPHNIA PULEX*

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Life history strategies of organisms have evolved to maximize the fitness of the individual and may be influenced by the environment of the species. Competition and predation are interspecific interactions that may alter life history characteristics. Zooplankton (*e.g.*, *Daphnia* spp.) subject to intense fish predation, generally shunt energetic resources into reproduction rather than growth and produce large clutches of small eggs at an early age. In contrast, *Daphnia* subject to invertebrate predation and competing for food with other

filter feeders grow quickly, delay reproduction, and produce small clutches with large eggs. Since its introduction into the Laurentian Great Lakes in 1986, the zebra mussel (*Dreissena polymorpha*) has spread throughout the Great Lakes region and now occurs within the upper Mississippi River. Although several studies have demonstrated that zebra mussels effectively filter phytoplankton and compete with zooplankton, no studies have assessed the effects of this exotic mussel on the life history characteristics of native zooplankton. The objectives of this mesocosm study were to determine the effect of resource depression due to filter-feeding zebra mussels and the effect of fish predation on life history characteristics of *Daphnia pulex*. A two factor cross-classified experimental design was used to assess the main and interactive effects of the presence or absence of zebra mussels and fish. There were four treatment combinations, with three units per treatment. Intrinsic rate of increase, instantaneous birth and death rates, clutch size, size at first reproduction, and population size of the *Daphnia* were estimated weekly during the eight-week study. Preliminary results suggest that zebra mussels increased clutch size and increased death rates. Fish increased death rates and decreased population size and size at first reproduction of *Daphnia*. When co-occurring, zebra mussels and fish decreased population size and increased the average clutch size of *Daphnia*. These results suggest that zebra mussels may alter zooplankton life history characteristics and depress population growth in *Daphnia*.

MODIFICATION OF THE ALKALINE DIGESTION AND PHENOL-SULFURIC ACID METHOD FOR THE DETERMINATION OF GLYCOGEN IN AQUATIC INVERTEBRATES

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The amount of glycogen in animal tissue is often used as an indicator of energetic status of the organism. In long-lived invertebrates, such as unionid mussels, where short-term measures of growth are unrealistic, repeated analysis of glycogen content may provide a valuable tool to assess changes in physiological condition of individuals. Recently developed biopsy techniques make it possible to repeatedly remove from an individual organism small tissue samples (10-30 mg) that can be analyzed for constituents such as glycogen. Methods for measuring glycogen, however, are numerous, and the method detection limits are usually unreported or unknown. Our objectives were to modify the alkaline digestion and phenol-sulfuric acid spectrophotometric method for the analysis of glycogen in small (10 mg) samples and to determine the accuracy and method detection limit of the modified method. Based on 10 batches of analyses, the method is rapid, has high precision (mean RSD of triplicate analyses=9.4%), low bias (mean percent recovery of known additions=109%), and has a method detection limit of 0.02 mg glycogen. Thus, the modified method can accurately measure glycogen in small tissue samples, allowing the repeated measurement of glycogen in individual organisms over time.

SPATIAL AND TEMPORAL VARIABILITY IN GLYCOGEN CONTENT IN *HEXAGENIA* MAYFLIES AND FINGERNAIL CLAMS IN THE UPPER MISSISSIPPI RIVER

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Recently, physiological indicators of condition, such as glycogen concentration, have been used to assess the relative health of benthic invertebrates in laboratory studies. However,

data on the spatial and temporal variability in glycogen concentration from field populations are lacking. We assessed the glycogen concentration in 5 male and 5 female mayflies (*Hexagenia* spp.) and 5 fingernail clams (*Musculium transversum*) obtained monthly (May-Oct.) from 4 sites in Navigation Pool 8 of the Upper Mississippi River in 1994 and 1995. In fingernail clams, glycogen concentration ranged from 0.3 to 51.8 mg/g wet weight (mean 11.8) and did not differ significantly between years, or among sites or months. In mayflies, glycogen concentration ranged from 1.1 to 14.0 mg/g wet weight (mean 4.9) and differed significantly among months ($p=0.001$), but not between sexes or years, or among sites. In mayflies, glycogen was highest in late spring and declined throughout the summer and fall. In both organisms, glycogen content (mg) was positively correlated with length and weight. These data suggest that the variability in glycogen concentration is driven by temporal, rather that spatial, patterns. Thus, glycogen concentration may be a useful indicator of physiological and reproductive condition in field and laboratory studies if temporal variation is accounted for.

CHARACTERIZATION OF DREISSENID MUSSELS FROM THE MISSISSIPPI RIVER USING SPECIFIC DNA MARKERS FROM MITOCHONDRIAL CYTOCHROME C OXIDASE

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In a recent study of Dreissenid mussels in the Mississippi River, Krumanocker (1996) reported that, in addition to *Dreissena polymorpha* (zebra) and *D. bugensis* (quagga), *Mytilopsis leucophaeata* (dark false mussel) has become established in the Mississippi. Identification of the three purported taxa based upon morphology and electrophoretic studies of those specimens appeared to corroborate the identification of those species. In an attempt to confirm the presence of all three species, a different molecular technique has been utilized to establish whether the three species are present. Baldwin *et al.* (1996) utilized the Polymerase Chain Reaction (PCR) to amplify an approximately 710 bp fragment of the cytochrome c oxidase subunit I gene (COI0 from *D. polymorpha*, *D. bugensis* and *M. leucophaeata*. They demonstrated three very distinct restriction fragment length polymorphic (RFLP) patterns when the PCR product was digested with the restriction endonuclease NlaIV. We have successfully extracted DNA from all three of the morphologically identified Dreissenids and have amplified a DNA fragment utilizing the same set of PCR primers reported in Baldwin *et al.* (1996). The RFLP results of PCR product from all three morphological types will be presented.

FIVE YEARS OF MACROINVERTEBRATE SAMPLING ON THE UPPER MISSISSIPPI RIVER

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The temporal variability in mayflies (Ephemeridae), fingernail clams (Sphaeriidae), and midges (Chironomidae) in six study reaches of the Upper Mississippi River System was examined. Spatial distribution also is discussed for these organisms along with the Asiatic clam, *Corbicula fluminea*, and the zebra mussel (*Dreissena polymorpha*). Sample allocation was based on a stratified random design which was based on aquatic area. No significant linear trends across years were determined in estimated mean number of organisms. However, the overall test for differences in intercepts among study reaches was statistically significant ($P<0.05$) for mayflies, fingernail clams, and midges. Overall, the impounded aquatic areas and silt/clay substrates tended to support higher numbers of the select macroinvertebrates.

PREDATION OF ZEBRA MUSSELS, *DREISSENA POLYMORPHA*, BY RIVERINE FISHES IN THE UPPER MISSISSIPPI RIVER

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Previous studies of zebra mussels, *Dreissena polymorpha*, in the upper Mississippi River have indicated that fish are actively feeding on this exotic species. Furthermore, these studies suggest that fish are selectively removing zebra mussels larger than 8-mm. The objective of this study was to analyze gut contents of fish to determine what fish are consuming zebra mussels and to verify size selectivity of mussels larger than 8-mm. Samples were taken by boat with an electroshocker along three 400-m transects from backwater and main channel shoreline habitats in Pool 6 of the upper Mississippi River. Fish were identified, weighed, measured, and the stomachs were examined for the presence of zebra mussel shells. Septum width and total length, when possible, were measured. A regression model was developed to estimate total length using septum length when damage to the shell made it impossible to measure the former. Several species of fish were found to consume zebra mussels. Major predators in the main channel included redhorse (*Moxostoma* spp.), carp (*Cyprinus carpio*), and freshwater drum (*Aplodinotis grunniens*). All three species were also found to consume zebra mussels in addition to bluegill (*Lepomis macrochirus*). Bluegill exhibited a preference for zebra mussels of 4 - 7 mm total length whereas other predators consumed zebra mussels most frequently of 5 - 20 mm total length. Fish predators in the main channel appeared to prefer zebra mussels > 6 mm. The results of this study suggest that differences in size preference exist between main channel and backwater habitats, with the composition of fish assemblages being a major factor. As a result, zebra mussel population dynamics may differ in main channel and backwater areas of the upper Mississippi River.

FRESHWATER BIVALVES OF TENNESSEE, In Press.

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This volume presents basic biological information on freshwater bivalves of the family Unionidae in Tennessee, including shell structure, growth, development , general ecology, distribution (prehistoric and present), aboriginal and historic commercial utilization, and current status. The synonymy, general and Tennessee distribution, shell description, life history and ecology, and status are presented for each of the 129 native species reported from the state. A color plate showing two specimens of each species and a Tennessee distribution map with an insert map showing the total species distribution, accompanies the discussion of each mussel species.

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AGE AND SIZE STRUCTURE OF COMMERCIAL UNIONIDS, WITH EMPHASIS ON Megalonaias nervosa (Rafinesque 1820), UPPER MISSISSIPPI RIVER, REACH 9-19, LANSING - FORT MADISON, IOWA, JULY - SEPTEMBER, 1997.

In 1997 the Shell Exporters of America Inc. (SEA) began the most extensive survey ever done on commercial unionids. From 1 July-14 Sept. we sampled 8 Reaches (Pools) of the Mississippi River, Mile 663.0-386.0, Reaches 9-12, 14-16, 19, with emphasis on M. nervosa. Sites were identified by divers, the malacologist and clammer/buyer's experiences, and a Resource Inventory. I designed a modified 0.25 m^2 Surber sampler with an attached mesh bag, a 15 m rope, and an inflatable buoy. 11 quads were made by Tennessee Shell, Camden, TN. One or 2 major and several minor sites were sampled in most Reaches. The Sylvan Slough Sanctuary, Moline, IL, was sampled in both Reaches 15 and 16. 252 random timed dives were done starting near shorelines; results are given as a CPU. 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 = 2.7-7.6/m^2; quad densities ranged from 0.0-68.0/m^2. 4800 living M. nervosa were measured and aged after being scrubbed with steel bristled paint stripping brushes to remove Dreissena polymorpha byssal debris. Few M. nervosa were fresh-dead from D. polymorpha. The youngest M. nervosa was 2 yrs (10 mm ht). The apparent lack of young M. nervosa reported in 1986 was not real as evidenced by large numbers of 10 to 13 year old age classes in 1997, apparently a response to the 1982-1986 Mississippi River die-off. In some areas 5-7 year age classes were 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, and within a bed, especially from upstream to downstream in the Mississippi. 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 size (101.6 mm). The highest number of legal sized 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 malacologists 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.Mn	Total Legal
9 Lynxville, WI	101	192	7.60	1394	2.08%
10 Praiaie du Chien, WI	69	65	3.77	526	10.77%
11 Platte River, WI	130	88	2.71	823	10.23%
12 Dubuque,IA	-			62	
14 Princeton IA	147	109	2.97	330	12.84%
15 Moline, IL	-			245	
Sylvan Slough, IL	82	76	3.71	611	18.42%
19 Ft. Madison, IA	163	257	6.31	813	9.34%

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A UNIONID MOLLUSK SURVEY IN AN UPPER MISSISSIPPI RIVER SIDE CHANNEL NEAR GREY CLOUD ISLAND, MILE 820.0 - 821.5, COTTAGE GROVE, MN.

No federally endangered unionids were found at the above site, during a survey done 22-24 September 1997 just downstream of the metropolitan St. Paul, MN area. However, the first two random dives, each covering about 3 m X 15 m, yielded one Minnesota endangered Quadrula nodulata (Rafinesque 1820) and one Minnesota threatened Tritogonia verrucosa (Rafinesque 1820) among 130 unionids (11 species). Both of these special status unionids are probably the first live representatives of these species in the Minnesota portion of the Upper Mississippi River for many years. The source of Q. nodulata is unknown, but T. verrucosa lives in the nearby St. Croix River. Random dives throughout the site yielded seven more Q. nodulata, each representing different age classes (3, 4, 6, 7, 8, 9, 10, 13 years old) indicating nearly yearly reproduction of Q. nodulata in the area.

At total of over 700 unionids were found representing 14 living species at a mean density of about 2.0/m^2. An additional 11 species were represented by empty shells, four of which were represented by fresh shells, while the remaining 7 species were represented by sub-fossil shells. All living unionids were measured and aged. There was recent reproduction of most species. Living unionids were in excellent exterior condition with well preserved beak sculpture and no evidence of any erosion, even at 10 to 20 years of age; this phenomena is almost never seen. Only one living Dreissena polymorpha (Pallas 1771) was found attached to a Quadrula quadrula (Rafinesque 1820). One fresh-dead D. polymorpha was also found. The host fish for Quadrula nodulata apparently has not been confirmed in recent times, but the early 1900's literature indicate the host may be the channel catfish, flathead catfish, bluegill, or smallmouth bass (Fuller 1978). Q. nodulata was not found alive in 1996 among over 6,000 unionids we handled at Winona, MN, nor among nearly 13,000 unionids handled at La Crosse, WI, about 100 and 125 river miles downstream respectively of the Grey Cloud Island site. Q. nodulata is nearly unknown from the nearby St. Croix River (Havlik 1987). The Tritogonia verrucosa was 11 years of age. Studies for the host of T. verrucosa have been done recently (Hove 1997). Improvements to the sewage treatment plants in the Twin Cities, MN, area, along with the general cleanup of industrial contamination, have apparently improved water quality conditions to the extent that unionids have begun to re-populate areas downstream of the Pig's Eye Sewage Treatment Plant, including the area near Grey Cloud Island. This site is also near the upstream limits of the commercial navigation channel. Apparently nearby barge traffic has little recent effect on this Mississippi River side channel unionid mollusk population.

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New Distribution Record for *Toxolasma parva* in Pennsylvania

In July 1996, a specimen of *Toxolasma parva* was collected for the first time in the Monongahela River, Alleghney County, Pennsylvania. A composite of five (5) sediment samples were collected with a petit ponar. The samples were taken from depths of 0.5 - 1.5 m. in a mud substrate near river mile 5 within the city of Pittsburgh. The *T. parva* specimen measured 25 mm long and is therefore larger than is typical for this species. Age has not been determined. The specimen was deposited in the Carnegie Museum of Natural History (Catalog number 47.389).

Toxolasma parva has been documented only once from Pennsylvania. Several specimens were collected at Conneaut Lake Outlet, Crawford Co., Pa. (Ortmann, 1919). The habitat typically associated with this species has very low stream velocity and silt substrate. The habitat at the collecting site in the Monongahela River has these characteristics.

The Monongahela River has a history of severe degradation but has exhibited recovery in recent years. This river is maintained for commercial navigation for its entire length and is effected by acid mine drainage, extensive industrialization, sewage, and urban runoff. The macro-biotic community has been reduced and was previously virtually eliminated. The loss of the entire unionid community in this river segment occurred a century or more ago (Ortmann, 1909). The re-colonization of the lower Monongahela River by a unionid mussel follows a significant recovery of the fish community of the Monongahela River, Allegheny River, and upper Ohio River since the mid-1960's.

The sample was collected as part of the National Water Quality Assessment (NAWQA) Program that assesses water quality through the analysis of surface-water and ground-water chemistry, stream habitat, and biotic measurements in numerous basins nationwide. This assessment is designed to intensely focus on relatively few sites in each basin for a period of three years in the initial phase to be repeated in 5-year cycles. The Allegheny-Monongahela Study Unit in western Pennsylvania, West Virginia, Maryland, and New York completed the initial year of sampling in 1996.

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Submission to the November 1997 Triannual Unionid Report

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Report:

Fish Host Identification for Virginia Listed Unionids in the Upper Tennessee River Drainage

Fish hosts were identified for two Virginia state listed freshwater mussel species, the black sandshell (*Ligumia recta)* and Tennessee heelsplitter (*Lasmigona holstonia)* during 1996 and 1997. Both species exhibited low degrees of host specificity in laboratory tests. Host fish identified for the state threatened *L. recta* were largemouth bass, green sunfish, redbreast sunfish, rockbass, white perch, yellow perch, platy, and convict cichlids. Non-indigenous fish species were tested for potential use in the captive production of mussels. Host fish identified for the state endangered *L. holstonia* were the banded sculpin and rockbass. Central stonerollers, striped shiners and warpaint shiners were identified as potential hosts, with numerous encysted glochidia observed on fish that died at ten days post-infestation. The average water temperature was 21.5°C. The following table summarizes our results- note that some species exhibited limited success and may require further testing.

	Mussel Species				
	L. holstonia			*L. recta*	
Host fish (#)	# juveniles	Days to transform	# encysted (days post-infestation)	# juveniles	Days to transform
Micropterus salmoides (12)				198	(11-30)
Lepomis cyanellus (1)				4	(19-29)
Ambloplites rupestris (3)	1	14		4	23
Lepomis auritus (2)				2	11
Morone americana (1)				1	27
Perca flavescens (1)				18	(10-21)
Chichlasoma nigrofasciatum (1)				58	(15-26)
Xiphophorus maculatus (20)				21	24
Luxilus chrysocephalus (2)			75 (10)		
Cottus carolinae (1)	19	(12-14)	28 (15)		
Campostoma anomalum (5)			24 (10)		
Luxilus coccogenis (1)			49 (10)		

Fish hosts of the federally endangered pink mucket, *Lampsilis abrupta*.

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Herein we report the results of laboratory tests for suitable fish hosts of *Lampsilis abrupta* (Say, 1831). The distribution and taxonomy of this species, [formerly known as *Lampsilis orbiculata* (Hildreth, 1828)] were reviewed in the Recovery Plan (USFW 1985). Both *Lampsilis abrupta* and its near relative, *Lampsilis higginsi*, are federally classified as endangered. A single gravid female and 3 male pink muckets were found on May 9, 1997 in the Osage River in Cole County, Missouri. At the time of collection (midday) the female was displaying the mantle flap lure. Both glochidia and undeveloped eggs were present in the marsupia. The proportions of undeveloped eggs in two fragments of conglutinate were 30/80 (37.5%) and 27/60 (45%).

We tested 19 species of fishes as potential hosts of pink mucket. Of these, four species supported transformation of the glochidia. Suitable hosts were largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropteris dolomieui*), spotted bass, (*Micropterus punctulatus*), and walleye (*Stizostedion vitreum*). Time from encystment to the peak of excystment was 12-14 days at 25 C. Glochidia failed to transform on the following species: long-nose gar (*Lepisosteus osseus*), bleeding shiner (*Notropis zonatus*), red shiner (*Notropis lutrensis*), central stoneroller (*Campostoma anomalum*), bluntnose minnow (*Pimephales notatus*), fathead minnow (*Pimephales promelas*), checkered madtom (*Noturus flavater*), black bullhead (*Ictalurus melas*), channel catfish (*Ictalurus punctatus*), banded sculpin (*Cottus carolinae*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), longear sunfish (*Lepomis megalotis*), redear sunfish (*Lepomis microlophus*), and orangethroat darter (*Etheostoma spectabile*).

The fish hosts of the closely related *Lampsilis higginsi* were investigated previously (Waller and Holland-Bartels 1988). In that study, nine species of fishes were tested as hosts. Of these, four were found to support transformation: largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieui*), walleye (*Stizostedion vitreum*), and yellow perch (*Perca flavescens*). The use of piscivorous hosts such as bass and walleye by these mussels is consistent with the display of a relatively large, fish-like lure to attract the hosts. Additional female pink muckets were located this summer during survey work in the Meramec River in Missouri. Three individuals have been caged for the winter and will hopefully provide glochidia for further host work and rearing studies next year.

Special thanks to Sue Bruenderman and Paul McKenzie. This study was supported by the U.S. Fish and Wildlife Service and the Missouri Department of Conservation.

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Reinfection of host fishes with glochidia of the fat pocketbook, *Potamilus capax*.

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As we reported previously, twenty-nine species of fish were tested as possible hosts of the endangered fat pocketbook pearly mussel in 1996. Of these, glochidia transformed to juveniles only on the freshwater drum, *Aplodinotus grunniens* (Barnhart and Roberts 1997). The individual drum used in our host tests were retained and were reinfected with *P. capax* this year, 12 months following the initial exposure, in order to test whether they would again support transformation or whether immunity might have been acquired and sustained. Acquired immunity may be an important consideration in the artificial propagation of mussels, particularly for those species that use hosts such as drum, for which there is no established hatchery culture protocol.

The fishes were infected with relatively large numbers of glochidia, and their gills were visibly affected for several days. Grey areas appeared on the gills, apparently due to tissue hypertrophy and mucus production. Similar responses are sometimes observed in incompatible hosts. However, the glochidia remained encysted and the condition of the gills improved after about 1 week. Several thousand juveniles were eventually recovered from the six re-infected fish. Transformation was also successful upon two individuals that, in addition to the previous exposure to *P. capax*, had been infected with and had rejected the glochidia of *Cyprogenia aberti* 8 months earlier.

Little is known of the induction and persistence of host immunity to glochidia, and further studies are clearly needed. In laboratory tests, several successive infections with glochidia may be necessary to induce immunity (e.g. Luo 1992, Watters 1996). However, in a natural situation, serial infection of an individual fish within a single season by a given species of glochidia may be highly unlikely, because 1) the period of glochidial release by most mussel species is brief, and 2) the probability that any particular individual will be infected is probably small. The possibility of serial infection of an individual host with glochidia over a period of several years is perhaps greater. However, there is little information to indicate whether successive infections at annual or longer intervals might induce or sustain immunity. We hope to reinfect these drum with *P. capax* again in 1998.

This study was supported by the U.S. Fish and Wildlife Service and the Missouri Department of Conservation.

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Barnhart, M.C. and A.D. Roberts 1997. Reproduction and fish hosts of the fat pocketbook mussel, *Potamilus capax*. Triannual Unionid Report 11:24.

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Watters, G.T. 1996. And immunity for all. Triannual Unionid Report 10: 14.

Conglutinates and fish hosts of the Ozark shell, *Fusconaia ozarkensis* (Call, 1887).

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The Ozark shell is restricted in its distribution to the Ozark uplifts, where it is found in rivers of the Arkansas, White, Eleven Point and Current River drainages (Oesch 1995). Gravid *F. ozarkensis* were collected on July 18, 1997 in the Spring River in Lawrence County, Missouri. Release of the conglutinates was readily induced by mild hypoxia. The average number of conglutinates released per individual was 238 (S.D. 35, n=8). The conglutinates were spindle-shaped and subcylindrical in section, with average length of 6.1 mm and width of 1.1 mm. The ova were not packed in distinct layers. Both the eggs and developing embryos were usually pink to red in color. However, two of 14 gravid individuals examined had white eggs and embryos. Individuals of *F. flava* and *F. ebena* in Missouri and Arkansas likewise produce either red or white eggs (personal observations).

The conglutinates of *F. ozarkensis* included a large proportion of sterile eggs, which may serve to attract host fishes. Among 8 individual females, the mean proportion of undeveloped eggs was 40% and varied from 15% to 51%. Glochidia are relatively transparent, so that the color and opacity of conglutinates was a function of the color and relative proportion of sterile eggs, were are opaque. Eggs containing glochidia ruptured easily, and it was possible to release the mature glochidia by drawing the conglutinate in and out of a Pasteur pipette. This action is similar to that of host fish feeding on prey. The sterile eggs were not broken by this treatment, and the conglutinates remained intact even when drawn rapidly and repeatedly through a narrow aperture. The mature glochidia each deployed a larval thread upon release from the egg.

Twelve species of fishes were tested as potential hosts of *F. ozarkensis*. Of these, transformation was observed on 3 cyprinids: bleeding shiner (*Notropis zonatus*), cardinal shiner (*Notropis cardinalis*) and southern red-belly dace (*Phoxinus erythrogaster*). Species on which glochidia failed to transform included *Notropis lutrensis*, *Campostoma anomalum*, *Pimephales notatus*, *Pimephales promelas*, *Micropterus salmoides*, *Lepomis macrochirus*, *Lepomis megalotis*, *Etheostoma caeruleum*, and *Etheostoma flabellare*. Recent studies of other *Fusconaia* species have also implicated cyprinids as hosts (Bruenderman and Neves 1993, Kitchel 1984). Interestingly, older studies indicated that the clupeid *Alosa chrysochloris* is the primary host of *Fusconaia ebena* and tentatively suggested centrarchids as hosts of *F. flava* (Howard, 1914).

This study was supported by the U.S. Fish and Wildlife Service and the Missouri Department of Conservation.

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Howard, A.D. 1914 Experiments in the propagation of freshwater mussels of the *Quadrula* group. Bureau of Fisheries Doc. 801:1-52.

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1. Identification of potential hosts.
All studies funded by the US Fish & Wildlife Service and the Ohio Division of Wildlife.

a. *Elliptio fischeriana* (Lea, 1838) - Tar River drainage

Laboratory infections have identified the following potential hosts:

Johnny darter	Largemouth bass	Bluegill	White shiner

The following fish species did not appear to be hosts:

Creek chub	Perch	Roanoke darter	Bluehead chub
Goldfish	Redbreast sunfish	Glassy darter	Satinfin shiner

b. *Fusconaia masoni* (Conrad, 1834) - Tar River drainage

Laboratory infections have identified the following potential hosts:

Bluegill	Shield darter

The following fish species did not appear to be hosts:

Creek chub	Swallowtail shiner	Roanoke darter	Bluehead chub
Jumprock	Silver redhorse	Johnny darter	Glassy darter

c. *Fusconaia flava* (Rafinesque, 1820) - Scioto River drainage

Laboratory infections have identified the following potential hosts:

Silver shiner	Creek chub

The following fish species did not appear to be hosts:

Largemouth bass	Bluegill	Rainbow darter	Johnny darter
Longear sunfish	Logperch	Goldfish	Blackside darter

d. *Pleurobema clava* (Lamarck, 1819), federally endangered - Scioto River drainage

Laboratory infections have identified the following potential hosts:

Striped shiner	Blackside darter	Central stoneroller	Logperch

The following fish species did not appear to be hosts:

Largemouth bass	Bluegill	Rainbow darter	Tippecanoe darter
Longear sunfish	Goldfish	Greenside darter	Rockbass
Variegate darter	Green sunfish	Golden redhorse	

2. No acquired immunity against a congener

In Triannual Report (10), we reported that largemouth bass achieving acquired immunity against *Lampsilis cardium*, did not possess an immunity to subsequent *Utterbackia imbecillis* infections. This was not unexpected, given the phylogenetic distance between lampsilines and anodontines. We report here on a similar experiment using *Lampsilis cardium* and a congener, *Lampsilis fasciola.* Largemouth bass were infected with *L. cardium* (arrows) until an acquired immunity was demonstrated by the fourth infection. A control was again infected with *L. cardium* (fig. 1), and another bass was infected with *L. fasciola* (fig. 2). This bass had no immunity against the congener, suggesting that acquired immunity may be much more specific than previously thought.

Figure 1.

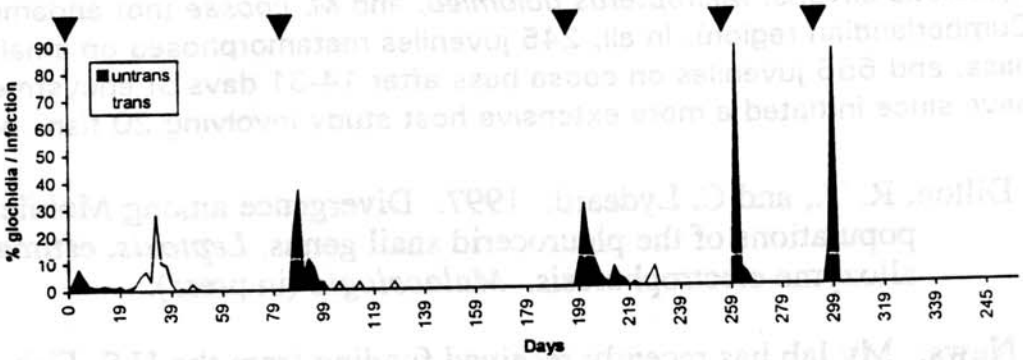
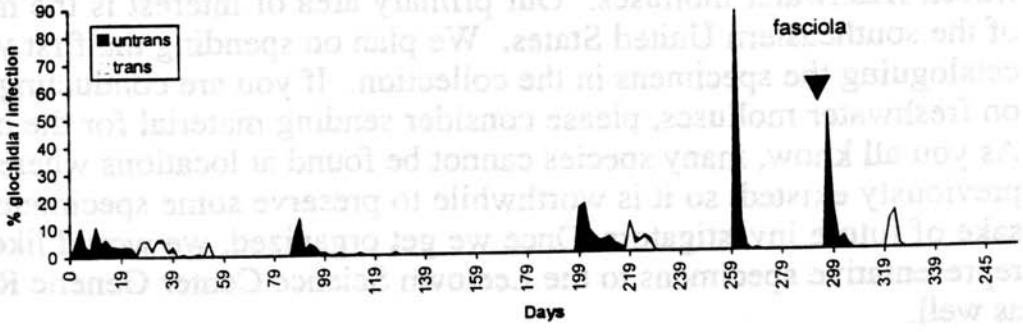


Figure 2.



3. *Utterbackia imbecillis* goes fishing with nets

Five specimens of *Utterbackia imbecillis* collected from an Ohio quarry in late July were placed in 10 gallon aquaria. Overnight, four had formed twisted mucus strands 12 to 24 cm long. These were still attached to the animals and contained numerous active glochidia embedded in the strands. Within hours the strands from all four individuals "merged" and formed an extensive, nearly transparent net covering over 100 sq. cm., containing hundreds of glochidia. Largemouth bass and spotfin shiner were released in the aquarium. After swimming through the net, the edges of all fins were parasitized with glochidia. Metamorphosis occurred in 7 days at 23°C. The largemouth bass had carried 143 glochidia, of which 20 metamorphosed (14%). The striped shiner had 22 glochidia, of which only a single one metamorphosed (4.5%).

Potential Hosts for *Actinonaias pectorosa*

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As part of a study to validate annulus formation, a previously-marked *Actinonaias pectorosa* was collected on September 4. The marsupium were excised, placed in a sealed plastic bag containing a small amount of water and kept in a cooler for about 30 hours before returning to the laboratory. We decided to take advantage of the opportunity and artificially infest the few species available at the time in our lab: *Etheostoma caeruleum, Pylodictis olivaris, Micropterus dolomieu,* and *M. coosae* (not endemic to Cumberlandian region). In all, 245 juveniles metamorphosed on smallmouth bass, and 655 juveniles on coosa bass after 14-31 days of encystment. We have since initiated a more extensive host study involving 20 fish species.

Dillon, R. T., and C. Lydeard. 1997. Divergence among Mobile Basin populations of the pleurocerid snail genus, *Leptoxis*, estimated by allozyme electrophoresis. *Malacologia* (in press).

News: My lab has recently received funding from the U.S. Fish and Wildlife Service to serve as a tissue depository for ethanol-preserved and frozen freshwater molluscs. Our primary area of interest is the molluscs of the southeastern United States. We plan on spending the first year cataloguing the specimens in the collection. If you are conducting studies on freshwater molluscs, please consider sending material for the collection. As you all know, many species cannot be found at locations where they previously existed, so it is worthwhile to preserve some specimens for the sake of future investigators. Once we get organized, we would like to send representative specimens to the Leetown Science Center Genetic Repository as well.

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Efforts to reach commercial mussel shell size limit parity among states bordering Tennessee near completion. Over the last several years the major shell producing states of Alabama, Arkansas, Kentucky and Tennessee have recognized disparity in shell size limits as a major contributing factor to illegal harvest of mussel populations. To rectify this situation, the states met in 1996 along with several other shell producing states and decided to work toward uniform size regulations for the major categories of commercial mussel shell.

To date, Tennessee and Kentucky have incurred the most opposition from the shell industry regarding proposed size limit increases due to potential loss of income to shell harvesters. Through a series of meetings between TWRA, Kentucky Game and Fish and shell industry representatives, the following proposal has been developed: washboard (*Megalonaias nervosa*) shell size limits will be increased 1\16" per year beginning in 1998 until 2001 when 4" is reached. Size limits on lake mix shells, primarily threeridge (*Amblema plicata)* and mapleaf (*Quadrula Quadrula*) will be increased 1/16" every other year until 2000 when 2 3/4" is reached. Ebony shell (*Fusconaia ebena*) and monkeyface (*Q. metanevra*) size limits will remain at 2 3/8". This proposal must still be presented to and approved by each respective state wildlife resources commission before being enacted.

Commercial musseling has remained lower than previous years and the prospects for next year are not encouraging for shell harvesters. As of September, Tennessee had sold approximately 620 commercial musseling licenses, down from 1,188 in 1996 and 1,397 in 1995. Shell industry sources expect to export approximately 1,500 tons of shell for 1997 compared to ~ 3,000 in 1996, and ~ 6,000 in 1995. Shell exporters also expect to receive orders for only about 700 tons in 1998. While the down turned market is devastating to shell harvesters, it certainly is not hurting the cropped condition of Tennessee's shell populations.

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Confirmation of the Former Occurrence of the Federally Endangered Unionid *Quadrula fragosa* (Conrad, 1835) in Kansas

In 1983, during a collecting trip to the Big Blue River in Marshall County, Kansas, a subfossil specimen of the endangered unionid *Quadrula fragosa* (Conrad, 1835) was recovered from a sandbar by the writer. Subsequent to this collection, in 1986, three additional specimens, also in subfossil condition, were recovered from two collection sites on the Little Blue River several miles from the former site and also in Marshall County, Kansas. The identifications of all four specimens were confirmed by Dr. David H. Stansbery of the Ohio State Museum of Biological Diversity at Columbus, Ohio.

This brings to an end a dispute which has continued for over one hundred years regarding the existence of this taxon in Kansas. Call (1885) reported *Unio fragosus* (Conrad) for Soldier Creek, a tributary of the Kansas River, in northeastern Kansas. Scammon (1906) reported *Quadrula fragosa* (Conrad) for the southern drainages in Kansas, but expressed the opinion that the record for Soldier Creek was probably an error. Murray and Leonard (1962) disputed the reports of both authors and listed *Quadrula fragosus* (Conrad) as invalidly recorded the state.

The recovery of specimens of *Quadrula fragosa* in northern Kansas from the Big and Little Blue Rivers, tributaries of the Kansas River, would tend to support the record reported by Call for Soldier Creek which is downstream from the mouth of the Big Blue River. Since Marshall County borders Nebraska and the Big and Little Blue Rivers flow south from Nebraska into Kansas, these records also provide some support for Aughey's (1877) unvouchered report of this taxon for the "Blue" River in Nebraska.

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FRESHWATER MUSSELS OF THE WICHITA RIVER SYSTEM, TEXAS

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The Wichita River is a tributary of the Red River in northwestern Texas. It flows through low plains from just south of the Panhandle roughly parallel to the Red River which it enters downstream of Wichita Falls, Texas. Soils in the region are largely clay and sand with some sites producing runoff waters with high chloride and conductivity levels (exacerbated by brine releases from local oil drilling operations). A chloride control project of the U.S. Army Corps of Engineers is currently attempting to reduce input of high-chloride waters and subsequently lower conductivity in the system.

Relatively little attention has historically been directed toward unioid populations in the Wichita River. Strecker (1931) reported pink papershell (*Potamilus ohiensis*) at one site and pondhorn (*Uniomerus tetralasmus*) at two sites in Wichita County. Howells (1996) reported mapleleaf sp. (*Quadrula* sp.), pink papershell, giant floater (*Pyganodon grandis*), paper pondshell (*Utterbackia imbecillis*), and Asian clam (*Corbicula fluminea*) from Lake Wichita, a tributary impoundment. Surveys were conducted by Texas Parks and Wildlife Department personnel 8-10 September 1997 in the Wichita River, its tributaries, and associated reservoirs. The following species were documented:

Species	Mainstream Wichita River (9 sites)	Tributary Streams (6 sites)
Yellow sandshell *L. teres*	3 (very long dead to subfossil)	12 (living to subfossil)
Fragile papershell *L. fragilis*	4 (recently dead to very long dead)	-
Pink papershell *P. ohiensis*	34 (recently dead to subfossil)	38 (living to subfossil)
Mapleleaf sp. *Quadrula* sp.	2 (subfossil)	35 (living to subfossil)
Giant floater *P. grandis*	-	1 (relatively recently dead)
Pondhorn *U. tetralasmus*	-	4 (living to very long dead
Asian clam *C. fluminea*	present in limited numbers	present, often common
	Lake Diversion (mainstream; 2 sites)	**Tributary Impoundments (5 sites)**
Pink papershell *P. ohiensis*	32 (living to recently dead)	15 (recently to very long dead)
Mapleleaf sp. *Quadrula* sp.	-	73 (living to subfossil)
Giant floater *P. grandis*	1 (recently dead)	74 (living to very long dead)
Pondhorn *U. tetralasmus*	-	5 (living)
Paper pondshell *U. imbecillis*	-	4 (living to relatively long dead)
Asian clam *C. fluminea*	-	present, often abundant

No living unionids were taken in the Wichita River itself; however, one pink papershell contained soft tissue and several others had not been dead for an extended period of time. Populations persist in tributary streams and impoundments (which can vary dramatically in conductivity levels). It appears mussels are periodically washed into the mainstream during flood events and then survive until conductivity (or other factors) increases to lethal levels. Only three living unionids were taken (one site) where conductivity averaged over 2,000 µS/cm. Conductivity values were unavailable for several sites with noteworthy numbers of living unionids, but for locations with corresponding conductivity data, living specimens were only present in significant numbers at one location where conductivity averaged less than 300. Mapleleafs in this and other Red River tributaries are taxonomically problematic. Although many are morphologically similar to southern mapleleaf (*Q. apiculata*), many show mapleleaf (*Q. quadrula*) affinities. Genetic analyses of local mapleleafs are planned. Mapleleaf sp. is known to be present in Lake Diversion, where they have been harvested commercially, but were not taken during the current survey.

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