

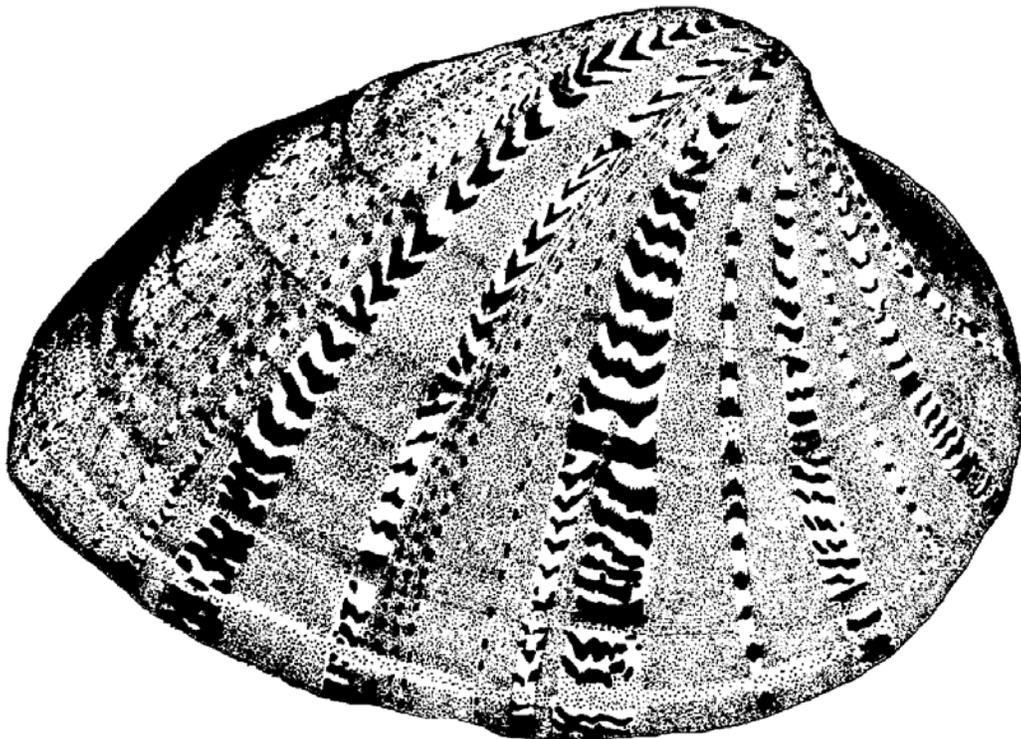
# *Ellipsaria*

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**The Newsletter of the Freshwater Mollusk Conservation Society**

**Volume 4 - Number 1**

**April 2002**



# ***Ellipsaria* – Volume 4, Number 1 – April 2002**

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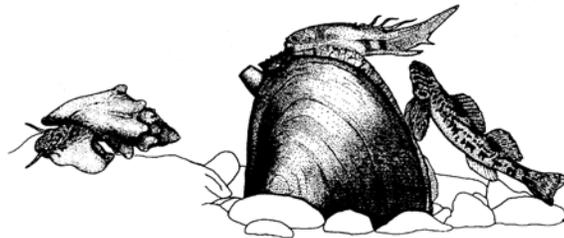
# Ellipsaria – Volume 4 – Number 1 – April 2002

## Table of Contents

### FMCS Reports:

2002 Officers	2
2002 Workshop	2
2003 Symposium Announcement	2
Board Meeting Minutes	3
General Business Meeting Minutes	4
Committee Reports	5
News	6
Job Announcements	7
Publications	8
Contributed Articles	9

Freshwater Mollusk Conservation Society



## ***FMCS Reports***

### **2002 Election Results for President-Elect and Treasurer**

It is part of the constitutional process of the FMCS to hold a yearly election for the office of president-elect. Our constitution stipulates that any member can nominate another member for office and those with the most nominations from the membership, and who agree to be nominated, become an official candidate. The names of the nominees are then placed on a ballot and are elected by the society membership; the winner will become the society president the following spring. The new president-elect for 2002 is:

G. Thomas Watters, The Ohio State University

In addition, we hold an election for the society treasurer every two years. The new (and former) treasurer is:

Heidi Dunn, Ecological Specialists Inc., Missouri

The 2002 FMCS Officers are:

President - Richard J. Neves

President-Elect - G. Thomas Watters

Past President - Kevin S. Cummings

Secretary - Rita Vilella

Treasurer - Heidi L. Dunn

*Submitted by Leroy Koch, Nominations Committee*

### **2002 Propagation and Restoration Workshop Wrap-up**

The FMCS mussel propagation workshop was held at the National Conservation Training Center at Shepherdstown, WV on March 14-15. In attendance were 110 biologists from 27 states, as well as Canada and England. Speakers addressed topics ranging from habitat requirements to nutrition to regulatory issues and provided an excellent program to an enthusiastic audience. Among the highlights of the meeting were a display of live juvenile mussels from Virginia Tech and two reports of field recaptures of propagated mussels that were released in year 2000, *Lampsilis higginsii* from Genoa National Hatchery and *Lampsilis rafinesqueana* from Chesapeake Hatchery and Southwest Missouri State University. Abstracts of workshop presentations and other propagation-related documents are available on the workshop website at <http://unionid.smsu.edu>.

*Submitted by Chris Barnhart*

## **2003 FMCS Symposium Announcement and First Call for Abstracts**

**Location:** Sheraton Imperial Hotel and Convention Center, Research Triangle Park, Raleigh, North Carolina. Free shuttle from Raleigh-Durham International Airport provided by the Sheraton Imperial Hotel for registered guests.

**Dates:** March 16 - 19, 2003

**Rates:** \$90 single or double rooms; check-in time is 3 p.m. and checkout time is 12 noon.

**Request:** PLEASE PLAN TO BOOK YOUR ROOM WITH THE SHERATON IMPERIAL HOTEL. FMCS meeting room rental costs are based upon the number of hotel rooms booked by members. We need to book at least 100 ROOMS EACH NIGHT from 3/16 to 3/18. Early hotel registration will help in planning a quality symposium. Please call (919)-941-5050 for reservations.

**TODAY IS A GOOD DAY TO BOOK YOUR ROOM!**

**Theme:** Connections . . . A Focus on Habitat Conservation

**Rationale:** A small army of professionals is constantly working to conserve the habitats of freshwater mollusks; however, they often need "scientific evidence" to support their recommendations or conditions associated with project related permits or certificates. These folks need your help! Think critically about YOUR research (and its association with other research projects) and its suggestions relative to the following interrelated topics:

Width of wooded riparian corridors

Large woody debris input

Coarse and fine particulate organic matter input

Maintenance of stream and riparian microclimates (including stream temperatures)

Control of sediments and contaminants

Minimum flows

. . . and other topics related to habitat conservation

**First Call for Abstracts:** We are requesting abstracts associated with the above theme and others associated with the following topics: Conservation Initiatives, Range-wide Status (co-authorship encouraged), Life History and Ecology, Life History and Ecology of Fish Host Species, Evolution and Phylogenetics, Outreach, and Propagation.

Abstracts should be e-mailed to Judith Johnson at [johnsonj5@mindspring.com](mailto:johnsonj5@mindspring.com) and John Alderman at [aldermjm@mindspring.com](mailto:aldermjm@mindspring.com) as an attachment in MS Word format. The file name should include the presenter's last

name and initials (e.g., jonesjm.doc). Abstracts must be received by November 30, 2002.

All abstracts must adhere to the following guidelines:

1. **TITLE (BOLD, CAPITAL LETTERS)**, author(s) name(s), presenter's name underlined, address, phone, email address of contact person, and keywords.
2. Clear summary of presentation including objectives, results, and conclusions.
3. Indicate type of presentation—poster or oral.
4. Total abstract should not exceed 300 words.
5. Type should be Times New Roman – 12 pt font.

Additional symposium information will appear in the August issue of *Ellipsaria*.

## Outgoing President's Message

Just a quick note to thank the FMCS membership for the distinct honor and pleasure of serving as your President. I am very pleased with the progress the Society has made during the past three years. This past year the Guidelines and Techniques Committee has been very active and has successfully acquired funds to publish replacement cost values for mussels to be included with fishes in an American Fisheries Society (AFS) manual. Also, the new on-line database of mussel/fish hosts put up by Tom Watters and the Information Exchange Committee is a great resource for all of us. After looking over the activity reports of the committees, there is much on the horizon as well. The group will only move forward with the hard work and dedication of its members. I urge you to push, prod, and cajole the committee chairs to keep things moving. Finally I want to give a special thanks to Chris Barnhart for tackling the Propagation Workshop and all that it entailed this past March. Thanks also to Andy Roberts and Heidi Dunn for occupying the hot seats at the registration desk. Our thanks to the U.S. Fish & Wildlife Service for allowing us to use their wonderful facility. I urge all members to try and attend a future meeting at NCTC and experience your tax dollars at work.

*Submitted by Kevin Cummings*

## Board Meeting March 13, 2002 Shepherdstown, West Virginia

### Treasurer's Report

The society has a balance of \$47,825.22. This total includes funds for the symposium. The first three months of 2002 we have taken in over \$5000 in membership dues and \$7,070 in registration for the propagation/restoration workshop. We anticipate making approximately \$5000 on the workshop after expenses.

### Mussel Valuation Replacement Cost Document

The advisory committee were chosen and they will meet with Rob Southwick to work on the document. The advisory group will consist of the following members: Dick Neves, John Schmerfeld, Steve Ahlstedt, Paul Johnson, Jim Layzer, Don Hubbs, Kurt Welke, and Bill Posey. For the initial meeting the group will ask Roger Gordon to sit in for Kurt who can not make this meeting. The committee will meet with Rob on March 14. Steve Ahlstedt will chair the advisory team. The board recommended addressing commercial species the same as non-listed species. This document will be published under the guidelines and techniques committee. Kevin received an email from Illinois DNR that they will contribute \$20,000 to this project.

### Committee Reports

#### *Symposium Committee*

As long as most participants room at the hotel the meeting space will be at no cost to the society. John had no further updates at this time. The symposium will be held at the Sheraton Imperial at Research Triangle Park, March 16-19, 2003. The focus will be on habitat and John is open to suggestions for a special session. Single and double rooms are \$90. The call for papers will be in the summer *Ellipsaria* (out by September). Future symposia need to consider coordinating with a fisheries group such as Southeast Imperiled Fishes group. The board suggested possibly inviting a group to participate in the 2005 symposium. The suggestion was made to invite some of the organizers of the Southeast Imperiled Fishes group to the North Carolina symposium. John will contact Dick Biggins for contact information.

#### *Guidelines and Techniques Committee*

A draft of a mussel kill assessment manual will be ready to review this summer. John Van Hassel will also sit in on the meeting with Rob Southwick. The manual will initially be reviewed by members of the committee that have volunteered to work on the manual, and a second draft will be sent for a wider review.

The board decided to keep the commercial committee inactive until commercial activity rebounds. Though it has picked up it doesn't appear it will come back strong. Part of the Illinois River will be opened to commercial mussel activity.

Dave Strayer and David Smith have prepared a draft paper entitled *An Introduction to Sampling Freshwater Mussel Populations*. The plan is to submit it for publication by the American Fisheries Society (AFS). The board agreed to approach AFS about FMCS being part of the external manuscript review. Further discussion was tabled until Dave Strayer provides an update at the general business meeting. There was discussion that copies can be part of the FMCS membership if the member requests a copy on their membership form.

#### *Information Exchange Committee*

Host database has been put on OSU mollusk division web site and linked from the FMCS website. Kevin will be putting up a type specimen database. He will try to have the North American taxa done later this year. Dr. Burch has a few issues of *Walkerana* to be completed before turning the journal over to FMCS, hopefully in 2003.

#### *Mussel Status & Distribution Committee*

Nothing new to report.

#### *Gastropod Status & Distribution Committee*

"The Biology and Conservation of Freshwater Gastropods" will be the centerpiece of the American Malacological Society Symposium August 3-7, 2002, in Charleston, South Carolina. The committee had not heard anything back on the workshop proposal. The committee plans to have a draft national strategy for freshwater gastropods ready in June for review. A FMCS freshwater gastropod workshop was proposed for 2004.

#### *Outreach Committee*

Nothing new to report.

#### *Propagation, Restoration, and Introduction Committee*

Chris Barnhart plans to expand the website and will post the abstracts from the workshop. The next big project for the committee is a propagation workbook, which they hope to begin working on after this workshop. The committee will work in cooperation with the Guidelines and Techniques Committee. A suggestion was made to have this be a single issue for *Walkerana*.

#### *Water Quality/Habitat/Zebra Mussels Committee*

Greg Cope is developing a review document of what is already available or has been developed (cleaning, holding, quarantine, etc.) to provide recommendations for controlling and preventing the spread of zebra mussels. Greg hopes to have a draft ready for review by the end of the month. Members of the water quality committee will review the draft. USFWS wants FMCS to publish this as an FMCS document.

#### **Other Business**

##### *Nominations*

Leroy Koch is the sole member of this committee. Tom Watters is the new president-elect and Heidi Dunn was re-elected as treasurer. Getting nominees has been difficult.

##### *Student Travel Award*

Dick Neves will focus on ways to improve student membership and participation in the society.

##### *Potential Advocacy Committee*

Letters from the society will be published in *Ellipsaria* for the membership to read. Right now there is no formal process for deciding which issues FMCS will become involved with or a process for responding to issues. The

board recommended that, at a minimum, letters are to be circulated through the board for review.

##### *Liability Insurance*

It is believed the expense will be too high to consider. The board recommended that Paul Johnson complete the application form to get a quote of the potential costs. Further discussion was tabled until costs can be evaluated.

#### **New Business**

It was agreed the one year term of the president is too short. It was proposed to the board the term be changed from a one year to a two year term and the president be elected the same year as the office of secretary. The nominee would serve one year as president-elect, two years as president, and one year as past-president. This requires a change to the by-laws. According to the by-laws, an amendment must be put in writing and presented to the membership 60 days prior to the next annual meeting. The board voted to draft an amendment to put before the membership in the fall issue of *Ellipsaria*.

The state of Georgia is considering an accreditation/certification for consultants. Should the society form a policy for states to use as a guideline or provide input to the states on a process for accrediting or quality assuring the work of consultants? John Alderman described the process in North Carolina - the person proposing to do the work and applying for a state permit must have a letter from a known expert stating the person is qualified to do the work. Ohio offers courses on fish and invertebrates in which participants can be certified. The board agreed this topic would provide a good paper/presentation for the 2003 symposium - a review of state procedures and how they handle the issue of accreditation.

##### *Waiving fees*

FMCS needs a policy for waiving fees for symposium and workshop invited speakers. Currently, registration fees are waived for plenary speakers. A final policy decision will be made at the next board meeting.

The next board meeting will be held in Crittenden, Kentucky, November 6-7, 2002.

*Submitted by Rita Vilella, Secretary*

## **General Business Meeting March 15, 2002 Shepherdstown, West Virginia**

Kevin Cummings introduced the committee chairs and board members in attendance: Bob Anderson, Paul Johnson, Chris Barnhart, John Alderman, John Van Hassel, Dick Neves and Heidi Dunn. Kevin briefly reviewed current FMCS projects.

## **Committee Reports**

### *Guidelines and Techniques Committee*

(Chair-John Van Hassel, co-chair Steve Ahlstedt)

Mussel replacement cost evaluation. Rob Southwick is heading up the effort to draft the cost evaluation. A team met with Rob on March 14 to decide on direction for the effort.

Mussel kill evaluation. The Guidelines and Techniques Committee is drafting guidelines for evaluating mussel kills. Janet Clayton mentioned that state regulators check on their states legislation for implementing cost values.

David Strayer and Dave Smith have prepared a sampling techniques booklet that offers practical advice and guidelines for sampling freshwater mussels. AFS will publish the booklet as part of their fish series. David gave an overview of the paper and answered questions. He is asking the society for assistance with publication costs. In exchange for support, we would assist with peer review of the document and have the society logo on the cover. We will also ask for 300 copies that will be distributed to the membership. After some discussion, Mark Hove motioned to support publication in the amount of \$4300. The motion was seconded and voted on. The vote was unanimous. David will talk to Dave Smith for his ok, then contact AFS and let them know we will be contacting them. Heidi Dunn will contact AFS and arrange the details.

### *Water Quality Committee*

(Chair Bob Anderson)

Currently working on a zebra mussel cleaning protocol.

### *Gastropod Status & Distribution Committee*

(Chair Rob Dillon, Co-chair Ken Brown, committee report by Paul Johnson)

This committee will meet at the AMU meeting later this summer and draft a strategy for gastropods similar to the mussel strategy.

### *Symposium Committee*

(Chair John Alderman, Co-chair Judith Johnson)

Next years symposium will be March 16-19, 2003 at the Sheraton in Raleigh, NC. There will be a free shuttle from the airport to the hotel. John is talking with the museum about hosting a mixer one night. The theme for the symposium has not been finalized. In general, the theme is conservation and habitat. John would welcome any suggestions for special sessions. One suggestion John had was a session on project review. Right now we are not using much science when commenting on projects. We need information on buffer widths for riparian corridors, impervious surface limits, minimum flows, etc. If you have any thoughts or suggestions, please contact John Alderman.

### *Information Exchange Committee*

The web site has links to a mollusk bibliography and Tom Watters recently added a fish host database.

## **Journal**

John Burch has offered *Walkerana* to the society. Kevin has met with Jack to discuss some of the details. We will need to set up an editorial board. Membership fees will need to be increased to cover publication costs.

## **New Business**

The FMCS meeting dates have conflicted with UMRCC meeting dates for the past three years. Members of both organizations would like to see this addressed in future scheduling.

A suggestion was made that the society might want to do a demographic analysis of population growth, and think about which streams are in peril or will be in danger due to urban sprawl.

Now that we have some money in the bank, we should seriously address student awards and travel.

SETAC has approved a book addressing the current state of unionid toxicity testing. Jerry Farris and John Van Hassel are working on this. Maybe we need a session or workshop on toxicity protocols.

A question was raised about the current Farm Bill and its implications for stream degradation.

## **Election results**

Tom Watters was elected President and Heidi Dunn was re-elected as treasurer.

## **Pass the hat**

Kevin passed the President hat to Dick Neves. Dick said a few words about his intent to further the student awards committee and environmental affairs committee. He would like to get the society more active in environmental issues.

Kevin motioned to adjourn. Seconded and voted.

*Submitted by Heidi Dunn, Treasurer*

## **Additional Committee Reports**

### **Gastropod Status & Distribution Committee**

The Status and Distribution of Gastropods Committee will meet during the annual meeting of the American Malacological Society on Sunday evening, August 4. Our agenda will focus on a review of the national strategy for freshwater gastropod conservation, as well as plans for the still-nascent Freshwater Gastropods of North America project.

<http://www.cofc.edu/~dillonr/fwgnahome.htm>

*Submitted by Rob Dillon*

## Guidelines & Techniques Committee

Rob Southwick from Southwick and Associates has been funded by the U. S. Fish and Wildlife Service to develop procedures for determining the value of freshwater mussels that are destroyed from a pollution event. Robb will present his thoughts and ideas to the FMCS board meeting that will be held at the mussel workshop at Shepherdstown, WV, in March. This will give board members a chance to provide comments or insights into this process. Southwick and Associates have done fish values for the American Fisheries Society and are currently in the process of re-doing fish values for AFS. The AFS would like this to be all in one document (both fish and mussels) and have waived their fee.

*Submitted by Steve Ahlsted*

## News

### Tennessee River at Muscle Shoals Threatened

Of concern is a proposal by the Retirement Systems of Alabama (RSA) to build a golf course on land adjacent to the Tennessee River at Muscle Shoals. The property, proposed for conversion into another golf course, is currently public and will essentially be donated by TVA. The land is wooded (~70-year-old hardwoods) and contains walking trails (handicap accessible), Civilian Conservation Corps structures, latent Native American archaeological sites, Confederate earthworks, etc. At least five federally protected species of mussels occur in the adjacent Muscle Shoals area of Tennessee River. Information on the issue can be found at:

<http://www.dreamwater.net/edu/trailsavers/>

*Submitted by Stuart McGregor*

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

“The Biology and Conservation of Freshwater Gastropods” will be the centerpiece symposium at the 68th meeting of the American Malacological Society August 3–7, 2002 in Charleston, South Carolina. Symposium participants will include S. Ahlstedt, J. Alderman, A. Bogan, K. Brown, M. Glaubrecht, R. Guralnick, P. D. Johnson, S. G. Johnson, E. Jokinen, C. Lydeard, R. McMahon, T. Stewart, F. G. Thompson, J. Todd, and A. Wethington. In addition, Amy Wethington has organized a special satellite session entitled, “Pulmonate Gastropods in the Laboratory” which

will focus on the importance of this group as experimental models.

The FMCS Committee on the Status and Distribution of Gastropods will meet Sunday evening August 4. Our agenda will focus on a review of the national strategy for freshwater gastropod conservation, as well as plans for the still-nascent Freshwater Gastropods of North America project.



The five day meeting is being hosted by the College of Charleston's Lightsey Conference Center, in the heart of one of the most beautiful cities in America. A block of rooms has been reserved at the Westin Francis Marion Hotel adjacent to the Lightsey Center, and dormitory housing will be available at a very modest rate.

On-line registration and a call for papers are available on the conference web site:

<http://www.cofc.edu/~dillonr/AMS2002.htm>

If you prefer to register by mail, materials may be obtained by contacting AMS President Rob Dillon, or as a PDF download from the AMS web site:

<http://erato.acnatsci.org/ams/>

*Submitted by Rob Dillon*

### Outreach Materials Available

North Carolina State University, in cooperation with the North Carolina Museum of Natural Sciences, has recently developed educational materials on freshwater mussels including a workbook and two posters (41 x 71 cm). The workbook is aimed at approximately 4th - 6th graders and teaches mussel basics through 24 pages of activities like word-finds, crosswords, coloring, etc. and text that accompanies these activities. Subjects addressed in the workbook include habitat, filter-feeding, anatomy, life cycle, and mussel imperilment and conservation. The first poster is a magnificently illustrated life cycle poster with text geared toward the same approximate age group. The

second poster depicts the freshwater mussels of North Carolina using shell photographs.

<b>Posters</b>	\$1.00		
	<b>1-99</b>	<b>100-499</b>	<b>500+</b>
<b>Workbooks</b>	\$0.75	\$0.70	\$0.65

To order materials, email Chris Eads at [chris\\_eads@ncsu.edu](mailto:chris_eads@ncsu.edu)

*Submitted by Chris Eads*

## ***BioScience***

*BioScience*, ranked 5th out of 51 journals in the Biology category of ISI Journal Citation Report, is the preeminent journal for overviews of research in the biological sciences, with strong suits in organismal and environmental biology and ecology. In addition to research overviews we also publish essays in a variety of areas pertinent to biology and its practice. With a paid circulation of about 8,500 copies per month, we reach an extremely broad readership, ranging from advanced high school students and teachers to professional biologists and policymakers.

The member organizations of the American Institute of Biological Sciences represent a largely untapped source of authors, who may not always be aware of *BioScience's* broad reach and unique audience. I am therefore writing you directly, to ask for your help in making your membership aware of this publishing opportunity.

Instructions for manuscript preparation may be found at <http://www.aibs.org/bioscienceguide/resources/contributors.html>. Authors may also contact me by phone or e-mail:

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## ***Ellipsaria* - Submissions for August Issue**

Submissions for the August issue of *Ellipsaria* can be sent in at any time but are due by July 19, 2002. Anyone may submit an article but you must be a member of FMCS to receive *Ellipsaria*. Categories for contributions include news (new publications, meetings, current issues affecting mollusks, and the like), job postings, contributed articles (including ongoing research projects), abstracts, society

committee reports, etc. Electronic submissions are preferred; please send submissions to:

[cmayer@inhs.uiuc.edu](mailto:cmayer@inhs.uiuc.edu)

or

Chris Mayer  
Illinois Natural History Survey  
607 E. Peabody Dr.  
Champaign, IL 61820

## ***Job Announcements***

### **Maryland Department of Natural Resources**

TWO FIELD TECHNICIANS needed, one during June to September 2002 and one during June to November 2002, to assist in freshwater mussel surveys. Work will involve snorkeling and bucket surveys in streams throughout Maryland, with a focus on potential habitat for rare, threatened and endangered species in the Piedmont and Coastal Plain. Other duties will include landowner contacts and habitat evaluation. The longer-term position will also assist with data entry and management, specimen curation, and report writing. Experience with freshwater mussel identification and surveys is preferred but not required. Salary is \$11-12.93 per hour, depending on experience, plus reimbursement for travel expenses. Please send a cover letter, resume, and the names and phone numbers of three references to:

James M. McCann  
Natural Heritage Program, MD Dept. Natural Resources  
P.O. Box 68  
Wye Mills, MD 21679  
PH: (410) 827-8612; Email: [jmccann@dnr.state.md.us](mailto:jmccann@dnr.state.md.us)

### **EnviroScience, Inc., Ohio**

#### **Ecological Services Department**

EnviroScience's Ecological Services Department performs a variety of ecological surveys including freshwater mussels, reptiles, amphibians, birds, fish, benthic macroinvertebrates, and wetlands throughout the eastern and Midwestern U.S.

Job Description: We are currently taking applications for 3-5 full time-temporary or intern positions. The number of positions will be based on awards of pending contracts. Job duties will include data collection and interpretation as part of an experienced field team.

Qualifications: Applicants must have or currently be working on a degree in biology or related field, advanced degrees a plus. Job duties will include strenuous field work. Applicants must work well with others, enjoy working in the outdoors, and be willing to travel with overnight stays for up to five days at a time. Desirable experience includes boat handling, snorkeling, SCUBA, GPS/GIS, and/or taxonomic knowledge of freshwater mussels, plants, fish or benthic macroinvertebrates. Positions are considered seasonal, starting in May and ending in August.

### Lake Management Department

EnviroScience's MiddFoil program is also taking applications for paid summer internships.

Job Description: Summer interns will assist in maintenance of insect cultures and analysis of plants at EnviroScience's lab, collection of insects and plants at local lakes, and insect stocking. Interns must work well with others, enjoy working in the outdoors, and be willing to travel long distances with overnight stays, possibly on weekends. Not all positions require travel. Positions will be considered seasonal starting in May and ending in August.

Qualifications: ALL applicants MUST be able to swim. Applicants with experience in laboratory environments, field biology and snorkeling are preferred, but not required.

Send resume and cover letter to:

Human Resources  
EnviroScience, Inc.  
3781 Darrow Road  
Stow OH 44224  
Phone: 330-688-0111 Fax: 330-688-3858

For more information contact Mr. Jamie Krejsa  
jkrejsa@enviroscienceinc.com  
or visit the website  
<http://www.enviroscienceinc.com>  
Submitted by Gregory Zimmerman

## Publications

Garner, J. T. and S. W. McGregor. 2001. Current status of freshwater mussels (Unionidae, Margaritiferidae) in the Muscle Shoals area of Tennessee River in Alabama (Muscle Shoals revisited again). *American Malacological Bulletin*, 16(1/2): 155-170.

Henley, W. F., L. L. Zimmerman, and R. J. Neves. 2001. Design and evaluation of recirculating water systems for maintenance and propagation of freshwater

mussels. *North American Journal of Aquaculture* 63: 144-155.

Neves, R. J. and S. A. Ahlstedt. 2001. The status of species and recovery programs for endangered freshwater mussels in the Southern Appalachians. Pages 67-72 In: D. B. Adams et al., U. S. Geological Survey Appalachian Region Integrated Science Workshop Proceedings, Gatlinburg, Tennessee, October 22-26, 2001.

Rogers, S. O., B. T. Watson, and R. J. Neves. 2001. Life history and population biology of the endangered tan riffleshell (*Epioblasma florentina walkeri*) (Bivalvia: Unionidae). *Journal of the North American Benthological Society* 20(4): 582-594.

Graf, D.L. 2002. Molecular phylogenetic analysis of two problematic freshwater mussel genera (*Unio* and *Gonidea*) and a re-evaluation of the classification of Nearctic Unionidae (Bivalvia: Palaeoheterodonta: Unionoidea). *Journal of Molluscan Studies* 68: 65-71.

Graf, D.L. 2002. The historical biogeography and late glacial origin of the freshwater pearly mussel (Bivalvia: Unionidae) faunas of Lake Erie. *Occasional Papers on Mollusks* 6: 175-211. Available from Mollusk Department, MCZ, Cambridge MA 02138.

Graf, D.L. 2001. The Cleansing of the Augean Stables, or a lexicon of the nominal species of the Pleuroceridae (Gastropoda: Prosobranchia) of Recent North America, north of Mexico. *Walkerana* 12: 1-124. Available from Mollusk Division, UMMZ, Ann Arbor MI 48109.

Graf, D.L. and D. Ó Foighil. 2000. Molecular phylogenetic analysis of 28S rDNA supports a Gondwanan origin for Australasian Hyriidae (Mollusca: Bivalvia/ Unionoidea). *Vie Milieu* 50: 245-254.

Note: Please send requests for reprints of Graf (2002) and Graf & Ó Foighil (2000) to my new address: Academy of Natural Sciences, 1900 Benjamin Franklin Parkway, Philadelphia, PA 19103. Interest in the other two papers should be directed towards their respective publishers.

For host fish collectors:

Ensign, W. E., A. J. Temple, and R. J. Neves. 2002. Effects of fright bias on sampling efficiency of stream fish assemblages. *Journal of Freshwater Ecology* 17(1): 127-139.

## Contributed Articles

### Freshwater Mussel Survey of the Upper Mississippi (Dayton, MN to Lock and Dam 3), Lower St. Croix, and Lower Minnesota rivers, 2000-01

Abstract submitted to the Mississippi River Research Consortium, April 25-26, 2002, LaCrosse, WI.

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In 1999, a survey was begun to determine the distribution and abundance of unionoid mussels in Minnesota. During 2000 and 2001, as part of this effort, 167 sites were sampled along an 83 mile (134 km) stretch of the Upper Mississippi River (UMR) that extends from approximately 20 miles (32 km) north of the Twin Cities near Dayton, MN. (RM 880), through the Twin Cities to Lock and Dam 3 near Red Wing, MN. (RM 797). Five pools were surveyed within this stretch and include from upstream to downstream; Coon Rapids Pool (above Coon Rapids Dam), St. Anthony Falls Pool (above St. Anthony Falls [SAF]), and Pools 1, 2, and 3. During 2001, 20 sites along a 24 mile (39 km) reach of the lower St. Croix River (LSCR) from Stillwater, MN to its confluence with the UMR at Prescott, WI, and 13 sites along a 4 mile (6 km) reach of the lower Minnesota River (LMNR) to its confluence with the UMR were also surveyed. Sample methods were consistent throughout the study and included timed searches and hand collection of mussels while wading, snorkeling, and diving. One-person hour/site was targeted as the search time and sites were typically spaced no more than 1 mile (1.6 km) apart. Quantitative samples were also collected and mussel bed boundaries were mapped at five sites within the UMR. Zebra mussel (*Dreissena polymorpha*) density was determined from quantitative samples and zebra mussels attached to unionids collected from timed searches were counted.

Over 25,000 live mussels representing 30 species were collected with an additional 11 species collected as empty shells. A total of 27 live species was collected in the UMR proper, 25 in the LSCR, and 9 in the LMNR. Mussels in the LSCR were more abundant and the assemblage appeared to more closely support its historic complement of mussel species as compared to the UMR and LMNR. Exclusive to the LSCR mussel assemblage was the federally endangered *Lampsilis higginsii*. The mussel fauna of UMR Pools 1, 2, 3 appear to be recolonizing from its reported decimation by pollution during the early 1900's. The survey provided clear evidence of recent and ongoing

recruitment; many of the individuals collected were less than 10 years old. Relatively high numbers of several state listed species were collected including two listed as endangered in Minnesota (*Arcidens confragosus* and *Quadrula nodulata*). Neither species was collected in the LSCR or LMNR. Recolonization is probably due to improved water quality conditions over the past 15-20 years. Furthermore, mussels may be expanding their range above SAF, which historically served as a faunal barrier to upstream dispersal but now are circumnavigated by locks. A total of 16 live species was collected from the St. Anthony Falls Pool including 10 species previously not reported above SAF, and the community closely resembles the communities of Pool 1 and upper Pool 2 in species composition. Zebra mussels were absent above SAF and nearly absent from UMR Pools 1-3 and LMNR (<0.1% unionids infested and density < 0.1/m<sup>2</sup>). Nearly 1% of the unionids in the LSCR were infested with zebra mussels, many of which were <10mm in length. These UMR pools differ from those downstream (Pool 4 and below) where zebra mussels are extremely abundant and are decimating the native mussel communities and from the LSCR where zebra mussels have recently invaded and appear to be reproducing. Ironically, this reach of the Mississippi River between the Twin Cities and Red Wing, MN, once nearly a dead zone, may now constitute one of the last big river mussel refuges in the Midwestern United States.

Keywords: freshwater mussel, Mississippi River drainage, unionidae, Minnesota, *Dreissena polymorpha*

### Mussel Surveys: Obed River and Big South Fork Cumberland River

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#### Obed River

A two-year freshwater mussel survey of the Obed Wild and Scenic River was recently completed for the National Park Service. Only nine live mussel species were found including federally listed *Villosa perpurpurea*. The report is currently in draft form and is in the process of being reviewed. Only four extant populations of *V. perpurpurea* are known to exist.

#### Beech Creek – tributary to Holston River

Gravid specimens of *V. perpurpurea* were collected in January 2002. Specimens were collected under federal permit and transported by Jess Jones to the Virginian Tech mussel culture facility in Blacksburg for cultivation and propagation. Co-horts produced will augment existing populations in Beech Creek and some individuals will be reintroduced into the North Fork Holston River in Tennessee.

## Big South Fork Cumberland River

Recent sampling in February 2002 produced gravid specimens of federally listed *Epioblasma brevidens*, *E. walkeri*, *Pegias fabula*, and *Villosa trabalis*. Specimens were collected under federal permit and transported by Jess Jones to the Virginia Tech mussel culture facility in Blacksburg for cultivation and propagation. Co-horts produced will augment existing populations in the Big South Fork.

## Juvenile mussels may be recovered from fresh-dead fishes

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Juvenile mussel propagation is a promising tool for conserving rare species. However, juveniles may be lost if fish die prior to the excystment period. The objective of this study was to determine if juvenile mussels could be recovered from recently deceased fishes

Studies were conducted at the USFWS Genoa National Fish Hatchery, WI (Genoa) and University of Minnesota (UMN). In 2000, largemouth bass were artificially infested at Genoa with Higgins eye (*Lampsilis higginsii*) glochidia but some fish died just prior to the juvenile excystment period. In the fall channel catfish were artificially infested with winged mapleleaf (*Quadrula fragosa*) glochidia, and during spring 2001 fishes naturally infested with glochidia were collected from the St. Croix River and held in the wet laboratory where several died during the juvenile excystment period. Gills were excised from fresh-dead fish and placed in a well-aerated container and checked every 2-8 days for juvenile mussels. A mussel was considered a juvenile when foot movement or valve closure was observed.

Juveniles may or may not be recovered from excised gills. At Genoa 335 juvenile Higgins eye were recovered from sixteen largemouth bass. At the UMN no juvenile winged mapleleaf were recovered from six artificially infested channel catfish that died during the excystment period. However, seven Anodontine juveniles were collected from a naturally infested northern hognose sucker that jumped from an aquarium and had laid on the floor for at least 8 hours before the gills were excised. No juvenile mussels were recovered from the following deceased, naturally infested fishes: northern pike (1), walleye (1), smallmouth bass (5), white bass (1), yellow perch (1), and burbot (1). Most juvenile mussels were recovered the first week after gills were excised.

Support for this work came from a variety of sources. We thank John Frank, Roger Hugill, Al Linder, and Craig

Supiour, Minnesota Department of Natural Resources, and Nick Rowse and Dave Warburton, U.S. Fish and Wildlife Service, for their electrofishing assistance. Funding and support for this work was provided by the St. Croix National Scenic Riverway, National Park Service, U.S. Fish and Wildlife Service, the University of Minnesota's Undergraduate Research Opportunities Program, and Macalester College.

## Revisited: Effects of a Low-head Dam Replacement on a Unionid Population, Steel Dam, Rock River at Milan, Illinois

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A recent discussion of the effects of dam removal on unionids warrants a review of a 1988 photo-documented project. A unionid salvage survey was conducted before and after the construction of a cofferdam in the S channel (364 m wide) of the Rock River, Rock Island County, Milan, IL, prior to replacement of the S half of a spillway-dam. Unionid density and diversity was known to be high. Immediate construction effects were drastic; the cofferdam washed out twice, and a 3 m deep, L-shaped scour hole developed in rocky substrata, downstream of the dam. These effects must be considered in similar projects. Only 6 living unionids were found in a meter-by-meter search of 968 m<sup>2</sup> of the lower leg of the cofferdam on the S side of the channel (6-21 unionids/m<sup>2</sup> in the N side of the channel, September 1987). Apparently live unionids were blasted from the bedrock-cobble-sand substrata by the force of the water, when the channel was cut in half for the 1987 replacement of the N half of the dam. We also sampled downstream of the dam, to determine how far unionids had been affected. We utilized mostly 4-0.25 m<sup>2</sup> samples every 3 m, on 6-35 mm transects. Starting 16 m downstream of dam, and 2 m offshore, no live unionids were found until the 160 m transect downstream of dam, where some mussels were laying on the substrate. These mussels had marl on the upper portion of their shells only. At the 192 m transect, the current increased noticeably, and unionids were at every site. At the 224 m transect, unionid populations appeared normal (actual densities to 88/m<sup>2</sup>). At 464 m downstream of the dam, we sampled every 6 m across the channel (112-0.25m<sup>2</sup> quads); live unionids were found at each of 34 sites. The mean density of that transect was 22/m<sup>2</sup>; maximum density was 42/m<sup>2</sup>. We found a total of 38 species including 8 river records: 21 live species (total 1141), 3 fresh-dead species, and 14 species were represented by 5349 sub-fossil shells. Immediately upstream of the dam, 5 live and 18 dead species were found in the lumber supports of the old dam, including a live

juvenile *Tritogonia verrucosa*. *Obovaria olivaria* greatly resembled 9 sub-fossil valves of *Lampsilis higginsi*. Other Rock River records included sub-fossil *Potamilus capax*, *Cumberlandia monodonta*, and *Elliptio crassidens*. The shallow, one km-long river area between Steel Dam and the Hwy 67 bridge deserves sanctuary status since 3 large *L. higginsi* were found alive during summer 1988 low water levels: 1 had been killed for bait, 1 was stranded on a gravel bar, and 1 was returned to the river alive. Sixteen live *Pleurobema sintoxia* were found in an all sand area. Sub-fossil *Amblema plicata* were old, heavy, and elongate, compared to quadrate living specimens (20.7%). Old *Leptodea fragilis* found near the dam were square and stunted, while young *L. fragilis* were more normal appearing (elongate). There was reproduction in less than half of the species, which was probably more apparent than real due to the cobble-sand substrata. 40 species have been recorded from the Rock River since Baker (1926), including 2 species we found in 1986, but not in 1988. Live species diversity was down 33% at the site and present-day growth rates are faster than historic growth rates. No follow-up was done.

## **The Chinese Pond Mussel *Sinanodonta woodiana* Continues its Conquest of Europe**

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The Chinese Pond mussel *Sinanodonta woodiana* (Lea, 1834) is native to East Asia. The most important hosts for its glochidia are the Grass Carp *Ctenopharyngodon idella* (Valenciennes, 1844) and the Silver Carp *Hypophthalmichthys molitrix* (Valenciennes, 1844). Both species of Carp are natives of China and their food consists respectively of submerged vegetation and phytoplankton. Both species of carp are now used in many parts of the world as a means of biological control of excessive growth of aquatic weeds and an over development of phytoplankton in artificial and here-and-there even in natural freshwater habitats.

The first record of the presence of the Chinese Pond mussel in Europe dates back to Petro (1984), who mentioned it from fishponds used for rearing Grass, Silver and Big head carp in Hungary. The latter: *Aristichthys nobilis* (Richardson, 1845) comes from China too and is a zooplankton feeder. Soon the presence of *Sinanodonta woodiana* was also discovered in fishponds in Romania (Sárkány-Kiss, 1986) and since then it started its siege of large parts of Europe: France, Italy, Slovakia, Czech Republic, Poland and Austria (for a compilation of the literature see: Watters, 1999; Mienis, 1999 & 2000).

The Chinese Pond mussel was expected to be present elsewhere in Central- and Eastern Europe due to the presence of it and its host fishes in the Danube. In the meanwhile this has become true for Germany and Ukraine.

GERMANY: In 1998 Reichling (1999) has collected the Chinese Pond mussel in the Seilersee near Iserlohn, Sauerland. The mussels reached this artificial lake by means of infected Grass – and Silver carps, which had been released in the lake for control of an outbreak of Canadian waterpest *Elodea canadensis*. The carps had been imported from Hungary. Based on this record *Sinanodonta woodiana* has been included in the checklist of land- and freshwater molluscs of North Rhine-Westphalia, Germany (Kobialka, regularly updated list on the internet). A note concerning this find reached also the local press (Bremschey, 1999). An additional report dealing with the alleged occurrence of this mussel species in Bavaria (Tappenbeck, 2000) is based on a misunderstanding (Colling, in litt.). Although this species can be expected in backwaters of the Danube, so far it has not been encountered in either Baden-Wuerttemberg or Bavaria.

UKRAINE: Yuryshynets (2001) has reported briefly on the presence of *Sinanodonta woodiana* in the Danube-Sasyk Channel, S.W. Ukraine, without giving any further details.

Records are still lacking from Croatia, Serbia, Bulgaria and Moldavia in spite of the fact that the Danube is crossing or bordering these countries. The Chinese Pond mussel may occur also elsewhere in Europe where some of its host-fishes have been introduced (for example in the Netherlands). I hope to keep you informed concerning additional developments.

I like to thank Manfred Colling (Unterschleissheim), Hajo Kobialka (Höxter) and Hans-Jürgen Reichling (Hagen-Hohenlimburg) for providing me with valuable information concerning the status of *Sinanodonta* in Germany.

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## Records of Ampullariidae from Israel

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### Introduction

The Ampullariidae (formerly Pilidae) is a family of medium to very large freshwater prosobranch snails, which are confined in their distribution to (sub-)tropical areas in America, Africa and Asia. Especially the large Apple snails (*Pomacea*) from South America are rather popular among aquarium-keepers and are now on sale in so-called petshops all over the world. Since they are also edible, they have been introduced to the Far East, but only here-and-there they have become a popular food item. Unfortunately escaped specimens managed to start colonies under natural conditions in many countries outside their original range of distribution and have turned into real pests of rice in S.E. Asia and rice and taro on the Hawaiian Islands (Cowie, 1995; Perera & Walls, 1996).

Ampullariids are not native in Israel, nevertheless numerous samples of seven species encountered in Israel are present in the National Mollusc Collections of the Hebrew University of Jerusalem (HUJ) and the Tel Aviv University (TAU). All records are enumerated and discussed from the point of view of the conservation of the indigenous freshwater molluscs.

### Records of Ampullariidae from Israel

*Lanistes boltenianus* (Röding, 1798) [= *L. bolteni* (Chemnitz, 1786), a non-binominal name, and *L. carinatus* (Olivier, 1804)]  
Dredged in Haifa Bay, leg. M. Tom, 1965 (TAU/1); Haifa, Carmel beach, leg. Y. Ben Uri, January 1969 (TAU/1); Haifa, Hayat beach, leg. Z. Lewy, 20 April 1962 (TAU/1); Ma'agan Mikhael, beach, leg. Zuaretz, April 1965 (TAU/1); Tel Aviv, beach of Tel Barukh, 15 October 1961 (TAU/1 with operculum); ibidem, leg. Z. Lewy, 15 February 1962 (TAU/1); Tel Aviv-Yafo, beach, leg. A. Hadar, 1948-1968 (TAU/1); off Ashdod, 20 fathoms, 26 October 1960 (TAU/1). Additional record from the literature: Ashqelon, leg. D. Stam, June 1974 (Mienis, 1976).

*Marisa cornuarietis* (Linnaeus, 1758)  
Jerusalem, Hebrew University, Dept. Parasitology, aquarium, leg. I. Paperna, 1957 (HUJ 3641/32 and TAU MO 30142/6).

*Pila ovata* (Olivier, 1804)  
Haifa, Bat Galim beach, 5 October 1961 (TAU/1); Tel Arshaf (=Apollonia), beach, leg. H.K. Mienis, January 1989 (HUJ 39175/1 fragm.); Gaza, Gush Katif, beach, leg. M. Ra'anani, January 1991 (HUJ 2246/1 fragm.).

*Pomacea bridgesii* (Reeve, 1856)  
Mazkeret Batia, in dredgings of local fishpond, leg. B.S. Singer, January 1999 (HUJ 6999/7).

*Pomacea canaliculata* (Lamarck, 1819)  
Nahsholim, in pond, leg. P. O'Donovan, 1986 (HUJ 36204/1); Ha'Ogen, pond, leg. A. Peled, 1998 (HUJ 7017/1); Ma'abarot, pond, 1986 (HUJ 40636/1); Tel Aviv, Tel Aviv University, Dept. Zoology, aquarium, leg. L. Fishelson, November 1986 (TAU/1 and HUJ 36230/2).

*Pomacea insularum* (d'Orbigny, 1839)  
Ha'Ogen, pond, leg. A. Peled, 17 November 1998 (HUJ 6839/2); Tel Aviv, Tel Aviv University, Dept. Zoology, alive in aquarium (observation H.K. Mienis, March 2002).

*Pomacea paludosa* (Say, 1829)  
Ramla, bought in petshop, leg. H.K. Mienis, April 1997 (HUJ 6210/4).

### Discussion

The seven species of Ampullariid snails encountered in Israel can be divided into two groups: species which arrived

in Israel by means of a natural way and those which have been introduced intentionally.

Two species, *Lanistes boltenianus* and *Pila ovata*, are known only from empty shells found on the Mediterranean beach of Israel or from dredgings carried out off shore. Both are African species known to inhabit the river Nile. These species reach occasionally the coast of Israel in the form of empty shells after flash-floods in the Nile or after the Egyptian authorities have released large amounts of water into the Nile by opening one or more of the dams.

In the past Avimelech (1956) has recorded a shell of *Pila ovata* filled with kurkar (a local sandstone) from just north of the mouth of the river Yarqon near Tel Barukh and speculated whether *Pila ovata* was once living in that river when it was still connected with the Nile delta. However, kurkar is a terrestrial formation and not a fluvial one. Most probably Nilotic shells have drifted always towards the Levant coast and some might have become embedded in the local kurkar formations like other shells which were laying on the beach (especially *Glycymeris*). Of course they can not be considered as species belonging to the fauna of Israel as Barash (1965) stated.

The five other species are all of American origin. They were intentionally imported for one purpose or another. *Marisa cornuarietis* was used in trials of out competing the local intermediate hosts of two types of Schistosomiasis: *Bulinus truncatus* (Audouin, 1826) and *Biomphalaria alexandrina* (Ehrenberg, 1831). These trials remained confined to the laboratory. No specimens were released in the field and when the trials were aborted, the remaining stock of *Marisa cornuarietis* was destroyed.

All four species of *Pomacea*: *bridgesii*, *canaliculata*, *insularum* and *paludosa*, reached Israel by means of the aquarium trade this in spite of the fact that the import of living snails is not allowed. In many petshops these so-called Apple snails are still for sale either in their wild colour form (*bridgesii*, *canaliculata* and *paludosa*) or in the cultivated "golden" form (*insularum*). Since they are easily kept under conditions in the laboratory, Apple snails are regularly cultivated for research projects at the Tel Aviv University.

In addition (so far unsuccessful) trials have been carried out to grow Apple snails on a commercial scale as a potential export product as a food item. However, one thing has become clear: most of the *Pomacea* species managed to breed successfully in open ponds without extra care and heating.

### Conclusion

All finds of the Nilotic species *Lanistes boltenianus* and *Pila ovata* in Israel were in the form of empty shells. They do not form a danger for the local freshwater mollusc fauna. The trials with *Marisa cornuarietis* were confined to the laboratory and the remaining stock has been destroyed. The presence of four species of *Pomacea* in Israel and the fact that they are readily available in petshops, has created an alarming situation. Although rice and taro are not cultivated in Israel, escaped or intentionally released specimens may start populations in the few remaining unpolluted natural aquatic habitats in Israel. Their appetite for submerged aquatic weeds may upset the whole ecosystem in these wetlands and they may turn literally into giant competitors of the already suffering indigenous aquatic mollusc fauna.

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## Comparative Feeding of Two Species of Applesnails (*Pomacea*)

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Applesnails (Family Ampullariidae) of the genus *Pomacea* have been popular in aquarium culture for several decades. *Pomacea bridgesii* (spiketop applesnail) has been the primary species handled by the pet trade; however, other species occasionally appeared as well. Recently, *P. canaliculata* (channeled applesnail), and possibly other species, have become more readily available from trade sources. *Marisa cornuarietis* (giant rams-horn), another member of this family, has also been a popular aquarium species for quite some time.

*Pomacea bridgesii* is established in southern Florida (Thompson 1984), but without reports of significant impacts on macrophytes. *Pomacea canaliculata* was introduced in Southeast Asia around 1980 (Halwart 1994), Hawaii in 1989 (Lach and Cowie 1999), and outside native ranges in the Americas (D.G. Robinson, Philadelphia Academy of Natural Sciences; pers. comm.) including Florida in 1997, California in 1997, and Texas earlier in the 1900s and again since 1989. Because *P. canaliculata* is a voracious general macrophyte feeder, these introductions resulted in extensive damage to rice *Oryza sativa* and other crops in many regions. Releases of *P. canaliculata* in Florida (F.G. Thompson, Florida Museum of Natural History) and California (A. Hardy, California Department of Food and Agriculture; pers. comm.) were outside major agricultural areas. However, in 2000 and 2001 *P. canaliculata* populations were found at several locations in Texas, including sites in the Texas rice-production belt (Howells 2001a, b).

Texas Parks and Wildlife Department subsequently listed *P. canaliculata* in April 2001 as a harmful exotic shellfish, making possession, sale, and distribution illegal. Unfortunately identification problems among applesnail species remain problematic and *P. canaliculata* continues to appear for sale in the aquarium trade. Therefore, it may be wise to expand legal restrictions to include other members of the family. However, *P. bridgesii* is sold in large numbers and restrictions on it would likely be resisted by the industry. It does not appear to be exceptionally cold tolerant, based on a failure to expand northward from peninsular Florida or to become established elsewhere. It is also generally assumed to be microphagous or feed on soft and decaying vegetation, thus posing less of an environmental threat if released than does *P. canaliculata*. However, formal food habits studies of *P. bridgesii* are apparently lacking.

In an effort to better define acceptable food items of *P. bridgesii*, comparative trials with it and *P. canaliculata* were initiated in summer 2001. Both species were obtained from pet trades sources and additional *P. canaliculata* were captured in Brazoria County, Texas. Macrophytes (16 taxa) were obtained from locations in the Guadalupe River Drainage, Texas, or were cultivated specimens. Additionally, *O. sativa* seeds were obtained from local growers in southeastern Texas, germinated, and sprouts allowed to grow to ca 10-12 mm in length; and small stones covered with algae and other aufwuchs were obtained from a local stream. Snails were unfed for 24 hours, then groups of two individuals (30-50 mm shell height) each were placed in 3.8-liter jars of water containing measured amounts of selected macrophytes. Test animals and plants were examined 24 hours later. If no significant feeding occurred in either group, the test was continued for an additional 48 hours. The extent of depredation on plants was recorded by either measuring (decrease in stem or blade length) or estimating (irregular sections) the amount eaten.

All macrophytes and sprouted *O. sativa* offered were rejected by *P. bridgesii*, except for minor nibbling of damaged leaf tips of *Cabomba* (Table 1). It immediately approached aufwuchs-covered stones and completely cleaned them of surface growths within a few hours. Conversely, *P. canaliculata* partially or wholly consumed all macrophytes offered as well as *O. sativa* sprouts (Table 1). Some plants that were not aggressively attacked within the first 24 hours were typically damaged by 72 hours. *Pomacea canaliculata* only briefly examined aufwuchs-covered stones, appeared to eat very limited amounts of material, then ignored them further.

Feeding of *P. bridgesii* was consistent with expectations based on behavior of aquarium-held specimens. *Pomacea canaliculata* has been reported to consume *Azolla* spp. (Mochida 1991), *Chara* sp. (Mochida), *Colocasia esculenta* (Mochida 1991; Cowie 1995), *Cyperus monophyllus* (Mochida 1991), *Eichhornia crassipes* (Laup 1991), *Ipomoea aquatica* (Laup 1991; Mochida 1991), *Juncus decipiens* (Mochida 1991), *Lemna* sp. (Halwart 1994), *Nelumbo nucifera* Laup 1991; Mochida

Table 1. Comparative feeding of the applesnails *Pomacea bridgesii* and *P. canaliculata* offered aquatic and emergent macrophytes under laboratory conditions.

Plant offered	Amount offered	Results after 24 - 72 hours	
		<i>Pomacea bridgesii</i>	<i>Pomacea canaliculata</i>
<i>Oryza sativa</i>	10 grains with 10-12 mm sprouts	none eaten	all eaten within 3 hrs
<i>Hydrilla verticillata</i>	395 mm stem and leaves	none eaten	105 mm of stem and nearly all leaves eaten
<i>Cabomba caroliniana</i>	225 mm stem and leaves	slight nibble on leaf tips only	all but 70 mm of stem eaten
<i>Ceratophyllum demersum</i>	400 mm stem and leaves	none eaten	100 mm eaten, remainder broken into pieces
<i>Hygrophila polysperma</i>	375 mm stem and leaves	none eaten	only tiny fragments remain
<i>Linnophila sessiflora</i>	135 mm stem and leaves	none eaten	85 mm eaten; distal 50 mm of stems and leaves remain
<i>Potamogeton illinoisensis</i>	250 mm stem and leaves	none eaten	only slightly nibbled in 24 hrs; completely eaten in 72 hrs
<i>Pistia stratiotes</i>	1 small rosette	none eaten	roots nibbled in 24 hrs; 80% eaten in 72 hrs
<i>Ceratopteris thalictroides</i>	1 small cluster	none eaten	all eaten
<i>Typha minima</i>	2, 250 mm blades	none eaten	all eaten
<i>Sagittaria</i> sp.	150 mm stem and leaf	none eaten	only minor nibbling on leaf edge in 24 hrs; 50% eaten in 72 hrs
<i>Marsilea macropoda</i>	2 stems and fronds	none eaten	all eaten
<i>Nymphaea mexicana</i>	1 stem and pad	none eaten	33% of stem and 50% of leaf eaten
<i>Nymphaea odorata</i>	1 stem and pad	none eaten	70% of leaf and stem eaten
<i>Iris pseudacorus</i>	1, 200 mm blade	none eaten	slight nibbling along blade edge
<i>Acorus calamus</i>	1, 100 mm blade	none eaten	70% eaten
<i>Eichhornia crassipes</i>	1 small plant	none eaten	all eaten, except tiny fragments
<i>Colocasia esculenta</i>	1, stem and leaf	none eaten	not eaten in 24 hrs; completely eaten in 72 hrs
Aufwuchs covered stone	ca 50 mm x 40 mm	completely cleaned	minor initial nibbling, then ignored

1991), *Oenanthe javanica (stolonifera)* (Mochida 1991), *O. sativa* (Halwart 1994 and many others), *Pistia* sp. (Laup 1991), *Rorippa* spp. (Laup 1991), *Scripus californicus* (Cazzaniga and Estebenet 1992), *Trappa bicornis* (Adalla and Morallo-Rejesus 1989), *Vallisneria* sp. (Puchon 1977), and *Zizania latifolia* (Mochida 1991). Current findings are in agreement with these previous reports.

Although *P. canaliculata* consumed *E. crassipes* in Hong Kong and in the present study (Texas specimens), Lach et al. (2000) found this plant was not preferred by *P. canaliculata* in Hawaii. Indeed, Hawaiian *P. canaliculata* have been known to starve to death rather than consume *E. crassipes* (R.H. Cowie, University of Hawaii; pers. comm.). Texas snails did not attack *E. crassipes* aggressively, but did consume it when no other food was available. It should be noted that there are several species of “channeled” applesnails in addition to *P. canaliculata* and that introductions in the Indo-Pacific and Asia have been reported under several species names (Cowie, in press). It is possible more than one *Pomacea* species with differing food preferences may be involved.

These data suggest that continued sale of *P. bridgesii* by the aquarium trade is probably not a significant threat to wild macrophytes or agricultural crops. Distribution to date suggests the probability of *P. bridgesii* becoming established at other locations in the continental U.S. or Canada is also likely limited. However, confusion between it and *P. canaliculata* means both may continue to appear in pet stores and other outlets wherever *P. bridgesii* is available. Similarly, continued importation of *P. bridgesii* represents a potential source of new parasites and diseases not already associated with it in the U.S. Ideally, the aquarium industry would be best advised to restrict sales of *Pomacea* to domestically-produced *P. bridgesii* from correctly identified stocks, or to exclude this family entirely.

\*\* Special thanks to Dr. Rob Cowie, Dr. David Robinson, and Dr. Alys Haugen for their input.

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# Host fish identification for three freshwater mussel species endemic to the Altamaha River, Georgia.

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Host fish were identified for three endemic freshwater mussel species in the Altamaha River system: Altamaha arc mussel (*Alasmidonta arcula*), Altamaha slabshell (*Elliptio hopetonensis*), and Altamaha pocketbook (*Lampsilis dolabraeformis*) (Johnson, 1970). Gravid mussels were searched for using SCUBA in the Altamaha River, Appling Co., GA. Host fish were determined by laboratory experiments as outlined by O'Brien and Brim Box (1999).

Gravid *Alasmidonta arcula*, *Elliptio hopetonensis*, and *Lampsilis dolabraeformis* were collected during a single visit on April 25, 1998. Table 1 summarizes the results of this experiment.

Table 1. Host suitability test of three fish species with glochidia of *Alasmidonta arcula*, *Elliptio hopetonensis*, and *Lampsilis dolabraeformis*. Average water temperature during experiment was  $23.0 \pm 1.5$  °C.

Mussel species	Fish species	No. fish	No. Juvenile mussels	Days to metamorphosis
<i>Alasmidonta arcula</i>	<i>G. holbrooki</i>	6	30	8-10
	<i>L. macrochirus</i>	6	0	NA
	<i>M. salmoides</i>	6	0	NA
<i>Elliptio hopetonensis</i>	<i>G. holbrooki</i>	6	108	11-12
	<i>L. macrochirus</i>	10	926	9-13
	<i>M. salmoides</i>	6	0	NA
<i>Lampsilis dolabraeformis</i>	<i>G. holbrooki</i>	6	3	8-11
	<i>L. macrochirus</i>	6	0	NA
	<i>M. salmoides</i>	6	78	15-17

*Gambusia holbrooki* served as a host fish for all three mussel species tested in this study, but may not be the reliable host because *G. holbrooki* are found in slow current and along the edge of streams, areas not frequented by the mussel species tested in this study. This was a limited study and many other fish species found in the Altamaha drainage should be tested in order to thoroughly investigate all host fish possibilities for *Alasmidonta arcula*, *Elliptio hopetonensis*, and *Lampsilis dolabraeformis*. However, if time and money are an issue, *E. hopetonensis* could be tested with other fish species of the genus *Lepomis* and *Lampsilis dolabraeformis* could be tested with other fish species of the genus *Micropterus*. Narrowing down a few fish species to test for host suitability with *A. arcula* glochidia may be difficult. One approach would be to test as many different fish species from as many different genera.

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# Unionids impacted by Milwaukee River drawdown

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## INTRODUCTION

In December 1990, a longstanding dam across the Milwaukee River in the City of Milwaukee was opened to provide a more natural flow to the river, resulting in a considerable drawdown of the upstream water level north of the dam site in Milwaukee County. The resulting mud flats covered an estimated total area of 92 acres on both sides of the river. Due to the relatively sudden decline in water level subsequent to the opening of the dam in December 1990, many mollusks especially bivalves were unable to relocate to deeper water and could be seen stranded on the exposed, gently sloping muddy margins of the former river bottom during the following spring.

## METHODS

On 11 April 1991, an attempt was made to assess the impact of the drawdown on freshwater mollusk populations. Specimens collected from the mud flats were those recently dead and thus were assumed to have been alive at the time the water was drawn down. Paired valves of the most abundant unionid were measured with a dial caliper, to the nearest tenth of a millimeter, for the following traits: 1) length overall, 2) height, 3) width, and 4) right valve anterior-to-beak length.

## RESULTS AND DISCUSSION

The three most abundant species in the April 1991 survey area, listed in order of abundance, most to least, were: *Lasmigona complanata*, *Pyganodon grandis*, and *Toxolasma parvus*. Morphometric shell traits for 23 of the larger *Lasmigona complanata* were analyzed using SAS Software, Version 6.12 (Table 1).

Table 1. Milwaukee River *Lasmigona complanata* (Milwaukee County, Wisconsin), measurements to the nearest 0.1 mm.

	N	Minimum	Maximum	Mean
Width	23	35.4	51.6	43.2
Height	23	96.4	116.0	105.3
Length	23	133.2	154.1	144.6
Anterior	23	34.1	54.4	44.7

*Lasmigona complanata* was termed a common species in Wisconsin by Mathiak (1979), who found it at 74 sites during his 1973 through 1977 statewide survey. The genus *Lasmigona* was monographed by Clarke (1985), whose taxonomic description of *L. complanata* was supported to a significant degree by Milwaukee River specimens, including the descriptions of the whole animal and the glochidium, taken from a 24 May 1980 Milwaukee River collection by Harold Mathiak.

Table 2 compares Milwaukee River *L. complanata* data in Clarke (1985), at a slightly more northerly and less urbanized site in Thiensville, to that from the 1991 Milwaukee site. The Milwaukee mean length is smaller, but is within the range from Clarke (1985). Clarke (1985) used height/length to indicate this species' degree of maturity, with immatures having values close to 0.90 but matures having values close to 0.75. The maturity of the 1991 specimens is shown by the low mean value of 0.729.

The susceptibility of *Lasmigona complanata* to stranding is emphasized by Baker (1928), who described its habitat as shallow water ranging from a few centimeters to only a meter deep. Loss of freshwater mussel populations due to stranding after water drawdowns has been documented by Samad and Stanley (1986). However, the loss in this situation may be of a more permanent nature because, although flow in this stretch of the Milwaukee River may be more natural since the opening of this dam, the river and banks in the vicinity have now several years later been lined with gridding to maintain the channel. It is therefore doubtful that this area currently provides habitat similar to that formerly suitable for unionids.

Table 2. *Lasmigona complanata*: shell measurements from two Milwaukee River sites.

Feature	N	Range	Mean	S
<u>Thiensville, Ozaukee County (Clarke, 1985)</u>				
Length (mm)	17	130.8-182.0	161.8	13.54
Height/Length	17	0.627-0.739	0.660	0.0268
Width/Length	17	0.285-0.352	0.312	0.0604
Anterior/Length	17	0.190-0.291	0.243	0.0347
<u>Milwaukee, Milwaukee County (1991 survey)</u>				
Length (mm)	23	133.2-154.1	144.6	5.49
Height/Length	23	0.683-0.819	0.729	0.0307
Width/Length	23	0.261-0.339	0.298	0.0188
Anterior Length	23	0.242-0.353	0.309	0.0293

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## Helpful Hints from Hoppy:



Sampling tip:

"Winter sampling with dry suit is a great way to find rare mussels"

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*Submitted by Steve Ahlstedt*

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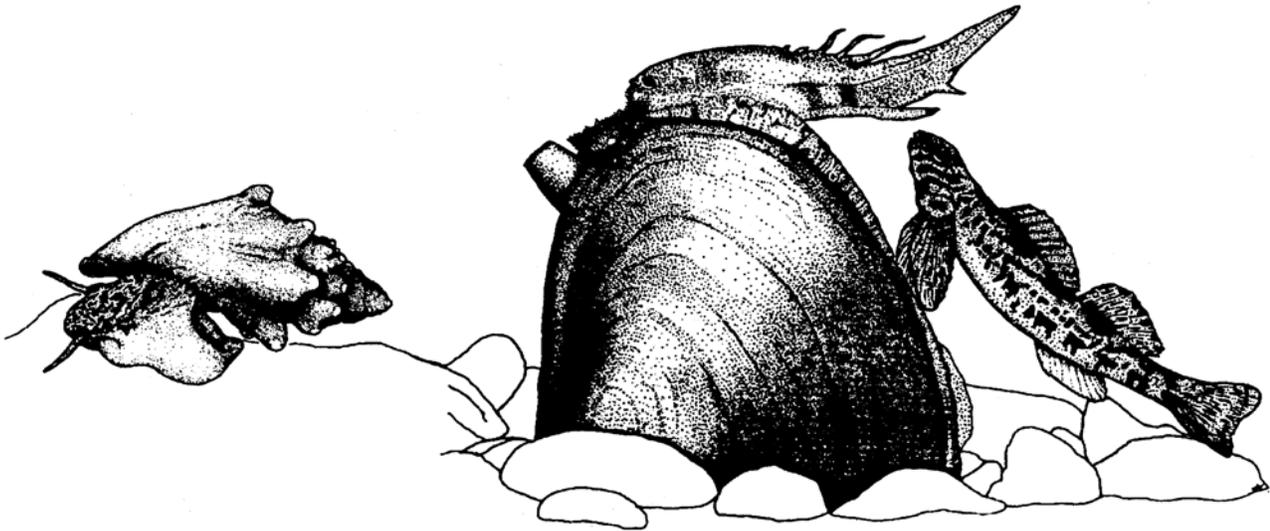
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