



Newsletter of the Freshwater Mollusk Conservation Society
 Volume 13 – Number 1
 March 2011

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President’s Message

Looking Back While Moving Forward

While the title of this President’s Message might sound like a dangerous proposition to most people, I am a firm believer that in order to know where you are going, you must first know where you have been. This perspective ensures that any changes or course corrections have kept you on track to meet a stated vision for future success. As this is my last opportunity to write the President’s Column for *Ellipsaria* before turning over the helm to incoming President Caryn Vaughn, I reflect upon all of the completed projects, milestones achieved, and progress made for the betterment of FMCS and our molluscan resources during my brief tenure. This look backward leaves me with the knowledge and gratitude that FMCS is indeed on the right course, but also with the certainty that there is a lot more to accomplish as we move forward. I am confident that with our combined efforts and clear-minded purpose, we will continue to achieve. Briefly, some of the major accomplishments that I’d like to highlight from the past two years include the following:

- * The transition to a new and improved web site and internet presence. This change has increased our visibility to the general public and has also facilitated greater flexibility for member services through a member-only portal. We are now able to communicate among ourselves more

efficiently through our member e-mail list, subscribe and renew memberships, access the newsletter and journal, and register and pay for workshops and symposia. Although we've had some growing pains, a steep learning curve (especially for me), and a few glitches along the way, this service will continue to improve and will allow us to increase efficiency and become more environmentally sustainable. Many thanks to Andy Roberts, Sophie Binder, Greg Zimmerman, Heidi Dunn and the many others on the Board who contributed time and content to the site.

- * The transition to this, our first electronic-only issue of *Ellipsaria*, our newsletter. This change will increase timely communication and substantially save on paper and mailing costs. Many thanks to Chris Mayer for her years of past service as Editor and many thanks to John Jenkinson for shepherding us into the new age.
- * The publication of our own Society Journal, *Walkerana: The Journal of the Freshwater Mollusk Conservation Society*. While all aspects are not completely in place at the time of writing this article, we are getting very close to issuing the first call for manuscripts. Please stay tuned and contribute your work to this important outlet. Many thanks to Editor Tom Watters and his team for their efforts and commitment in getting the Journal initiated.
- * A highly successful Workshop in October 2010 on Regional Fauna Identification and Sampling in Kirkwood, MO organized by Steve McMurray, Heidi Dunn, and their dedicated program committee—a sincere thanks!
- * Submitting critical and timely scientific comments on topics directly related to the protection and conservation of mussels and snails, and especially the monumental effort commenting on a proposed revision by the U.S. Environmental Protection Agency to the Water Quality Criteria for Ammonia. Many thanks to Ryan Evans, Steve McMurray, and the many member-experts who contributed their time and knowledge to these activities.
- * A thorough review of the Society By-Laws and proposed amendments to reflect current operation and changes in technology. The membership will vote on approval of these amendments, as published in the December 2010 issue of *Ellipsaria*, at our Business Meeting to be held in Louisville, KY on Thursday, April 14, 2011. Please plan to attend and cast your vote.
- * And finally, the outstanding upcoming program for the 7th Biennial Symposium of the FMCS to be held in Louisville, KY from April 11-15, 2011. See (and copy !) the poster about the Symposium on Page 3, then plan to attend and participate. For those of you paying attention, you will be pleased to see that the title of this President's Message cleverly (or not) parallels the theme of this year's symposium "Managing Your Mollusks: Reflecting on the Past, Preparing for the Future". Many thanks to Monte McGregor, Leroy Koch, Jacob Culp, and the rest of the Symposium Committee for their hard work in helping to bring the "FMCS Family" back together once more for a reunion in KY.

I express my sincere appreciation to the members of the EXCOM, the Board, and the members for all of your hard work and dedication to the Society. Your tireless efforts continue to strengthen the foundation and progress of the Society.

Thank you for the opportunity to serve as your President. I appreciate all of your support during this most rewarding experience. I look forward to seeing all of you in April at the Symposium.

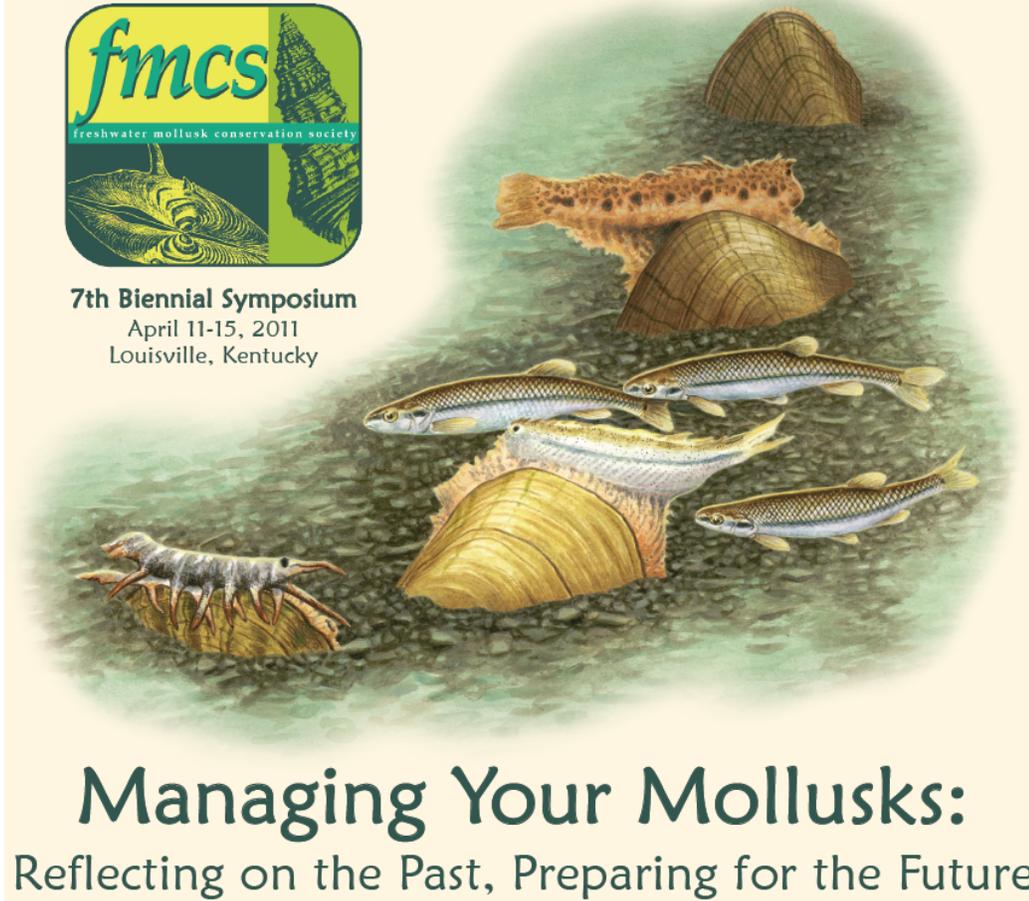
--- All the best,

Greg

Freshwater Mollusk Conservation Society



7th Biennial Symposium
 April 11-15, 2011
 Louisville, Kentucky



Managing Your Mollusks: Reflecting on the Past, Preparing for the Future

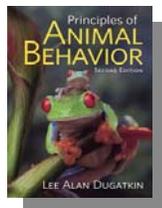
This year, the focus will be on state and regional management of mollusks. A plenary session will open the meeting and provide updates freshwater mollusk conservation and habitat restoration. Other platform and poster session categories covering all taxa of freshwater mollusks (gastropods and bivalves) will include:

- * Advances in Propagation of Mollusks
- * Regional/State Management of Mussels
- * Life History & Population Ecology
- * Physiology and Reproductive Biology
- * Systems and Community Ecology
- * Habitat Restoration
- * Water Quality and Ecotoxicology
- * Evolution and Systematics

For More Information/Registration:
<http://www.molluskconservation.org/Events.html>

**Come and join us
 in Louisville !**

Dr. Lee Alan Dugatkin



Wednesday Evening Banquet Speaker:
 Dr. Lee A. Dugatkin is a professor, author, speaker, and distinguished scholar at the University of Louisville. You can see his information at
<http://louisville.edu/faculty/laduga01/>



Historic Seelbach Hilton

Officer Election

Every other year, we need to elect new officers for our society. This year, we think we've made the process faster, easier, less expensive, and more environmentally friendly (NO Paper). Biographies of the two candidates for President Elect, and the single candidates (each) for Secretary and Treasurer are presented on this and the next two pages. Voting will occur online. Once you are ready to vote, just follow this link: <http://tiny.cc/2011FMCSballot> All voting must be completed by Sunday March 20.

Candidate for President Elect



Dan Hornbach

I am a Professor at Macalester College in St. Paul, MN with a joint appointment in Biology and Environmental Studies. I first started studying mollusks (snails) as an undergraduate student at the University of Dayton over 35 years ago. I completed my PhD at Miami University (OH) working on the population energetics of fingernail clams. Since then I have also published work on the introduced Asian clam and zebra mussels. However, my main interest over the past 20 years, and most of my publications, have been on the population dynamics of unionid mussels in river systems. I have been involved in studies dealing with population genetics, mollusk physiology, population and community structure and hydraulic habitats of mussels. The National Park Service has funded my most recent work, with past funding from the EPA, FWS, Army Corps of Engineers and MN state funds. I have been a member of the endangered species recovery teams for the Winged Mapleleaf and Higgins' Eye Pearly Mussel.

I became a member of FMCS at its inception. I am also a member of the American Malacological Society, Malacological Society of London, AIBS, ESA and NABS. I have some administrative experience
(Continued on Page 5, left)

Candidate for President Elect



Patricia Morrison

I have had the distinct privilege of working with many of you in this Society, from its early steps back in 1996 as the National Native Mussel Conservation Committee, to its current robust standing as a strong community of kindred spirits advocating for the conservation and recovery of native mollusks. My path has led me to become a candidate for President of FMCS. By way of background, I have a B.S. in Biology from M.I.T., with an emphasis on community ecology. I also hold a J.D. from WVU College of Law, with an emphasis on environmental law. My work with the USFWS began in 1978 in Massachusetts. I then moved to Elkins, WV, and now I am the refuge biologist on the Ohio River Islands National Wildlife Refuge, Williamstown, West Virginia.

I served the Society on the "old" Water Quality, Habitat, and Zebra Mussel Committee (yes, there was such a thing); the Techniques and Guidelines Committee, and co-chaired the Environmental Quality and Affairs Committee. From 2005 through 2007, I served as Secretary of FMCS, and in 2008-2009, I was a member of the committee for the 2009 Symposium in Baltimore, and the Program Chair. I have also been active in ecosystem level mussel
(Continued on Page 5, right)

(Hornbach, continued)

that could be helpful if I am elected President. Currently I chair the Environmental Studies Department. In the past I also chaired the Biology Department and served 8 years as the College's Provost and Dean of Faculty. I teach Aquatic Ecology and Environmental Science at Macalester. I find in these courses that both introductory and advanced students are intrigued when they learn more about the biology and conservation of freshwater mollusks. If elected President, I would use my interest in environmental science, ecology and teaching to encourage the FMCS in developing mechanisms that would allow more students to become familiar with mollusks and mollusk conservation. It is these students who will become future scientists, civic leaders and citizens.

Candidate for Secretary

**Greg Zimmerman**

I am an Ohio native and I was first introduced to freshwater mussels during my undergraduate years at Hiram College through Dr. Marty Huehner. For three summers, I helped Marty survey over 100 miles of Ohio's Grand River for mussels; after that I was hooked. I graduated with a degree in Environmental Biology and was hired shortly thereafter by EnviroScience in Akron, OH where I am now Vice President. I have been with the same company for the past 13 years and the majority of my work involves freshwater mussels and commercial diving all over the country. While working I received a graduate degree from Kent State University and my thesis looked at how freshwater mussels might affect substrate compaction and erosion, and GIS.

(Continued to right of picture)

(Morrison, continued)

teams since 1995, as a member and chair of the very active Ohio River Valley Ecosystem Mussel Group.

We should all be proud of the great strides we have made as a Society over the past 14 years. And where do we go from here? I would like to see us continue to forge a new shared vision. Under Steve Ahlstedt's and Greg Cope's leadership, we have begun to revise and update "The National Strategy for the Conservation of Native Freshwater Mussels," developed in 1997 and published in 1998. It is encouraging to look back and see that so many of the original strategies and research needs outlined in that document have actually been met. But of course, more challenges are ahead. I would hope to lead us towards a more landscape level conservation focus.

My other focus would be bringing in new recruits, new faces, and new ideas. Committees are the "work horses" of any organization, and ours is no exception. I will invite input from all members as to how to energize our committees, build up participation, and do whatever we can as a Board to make your tasks more efficient. Won't you join me?

(Zimmerman, continued)

I truly believe FMCS is a very special and unique organization. I don't think you will find a more open, friendly, knowledgeable, eccentric or dedicated group of people under one banner. I am amazed by what we have accomplished in a relatively short amount of time, and excited by what's to come. Here in Ohio, we may have lost two, possibly three species of riffleshell in the last ten years and these advances cannot come at a more critical time.

I would like to continue to work to coordinate the improvement of the following aspects of FMCS: 1) keep and expand our membership, 2) improve the efficiency of our membership database and dues management, 3) improve the on-line availability of FMCS documents, and 4) better organize and empower the FMCS committees with the tools they need to succeed. I will be the first one to admit that we have not quite achieved the items on the above-list these past two years, but the system is now on-line and we are making significant progress.

Candidate for Treasurer



Heidi L. Dunn

I was first introduced into the world of freshwater mussels in 1979 while working for the USFWS. I have been working with this unique group of organisms ever since and am continually amazed at their adaptations. I received a BS from Purdue University in 1979, and my MS from Southern Illinois University at Edwardsville, IL in 1991. I have worked in environmental consulting since 1980, and founded Ecological Specialists, Inc. in 1990. As a consultant, I work with government, private industry and regulatory agencies conducting inventories and impact analysis for freshwater mussels and other aquatic organisms.

I was one of the founding members of the Freshwater Mollusk Conservation Society and have been its Treasurer since its inception. As treasurer, I ensure the books are balanced, the bills are paid, and the taxes are filed, and assist with other FMCS activities as needed. I have assisted with most of the FMCS symposia and workshops, and was chair of the Habitat Workshop in 2007 and co-chair of the Fauna Identification Workshop in 2010. I was also chair of the Guidelines and Techniques Committee in 1999 through 2001. I have truly enjoyed working with the other officers, the Board of Directors, and society members. I hope you will give me the opportunity to continue working as Treasurer in 2011-2013.

Now that you've read through the biographies of the candidates, its time for **you to vote**. Just follow this link: <http://tiny.cc/2011FMCSballot>

All voting must be completed by
Sunday March 20.

Committee Elections

When we assemble in Louisville, two Standing Committees will be looking for volunteers to serve as chairs or co-chairs. If you are interested in helping David Berg by becoming a co-chair of the **Genetics Committee** or would like to serve as a co-chair of the **Guidelines and Techniques Committee**, please contact the present chairs of those committees (listed on page 30) or any of the Society Officers (listed on page 29).

Walkerana

Walkerana – The Journal of the Freshwater Mollusk Conservation Society

We are now accepting manuscripts for the electronic journal *Walkerana*. Our proposed first issues will be the end of June and the end of December, 2011. Please note that only FMCS members may submit manuscripts. Non-members will be assessed a page charge fee that includes membership. Details forthcoming.

Getting *Walkerana* to this stage has been a long and complex process and required the efforts of many people. At this time we are finalizing the Editorial Review Board and a few other items are still under construction; however, we hope to have everything up a running as soon as possible. We ask our members for patience and please let us know if something is not working correctly.

Important ! Manuscripts *must* be submitted through the Author Portal on the FMCS website. Hard copy or emailed papers will not be considered. Please read the Instructions for Authors concerning manuscript preparation and file uploading conventions. Manuscripts must represent original research and must not be currently considered for publication elsewhere. All material published in *Walkerana* is the property of the Freshwater Mollusk Conservation Society.

Articles including all aspects of the biology of freshwater molluscs are welcome: ecology, physiology, toxicology, reproduction, etc. Survey results are acceptable if they have heuristic value and are used to compare previous studies and results; a simple list of taxa encountered is not acceptable. Brief notes and observations of a parochial nature are not acceptable and should continue to be submitted to *Ellipsaria*. New taxa cannot be described in a purely electronic journal such as *Walkerana* according to the International Commission of Zoological Nomenclature.

If you have questions about submissions for *Walkerana*, please contact the editor, Tom Watters, at watters.1@osu.edu.

Board Meeting Minutes

Meeting Minutes

FMCS Fall 2010 Board Meeting

Powder Valley Nature Center in St. Louis

October 18, 2010

Call to Order and Roll Call (Greg Cope)

Attendance

Greg Cope
 Heidi Dunn
 Greg Zimmerman
 Andy Roberts
 Tony Brady
 Tom Watters
 Steve Ahlstedt
 Paul Johnson

Ryan Evans
 Steve McMurray
 Paul Johnson
 Art Bogan
 Caryn Vaughn

Approval of 4-22-2010 Board Meeting Minutes

A motion was proposed (by Tony Brady) and carried to approve the minutes of the 4-22-2010 Board Meeting.

2010 Treasurer Report - Heidi Dunn

Income

Interest	\$311.93
Memberships	\$12,565.00
Extraneous hats, tshirts, notebooks, etc	\$175.00
2011 Symposium income (500 in sponsorships)	\$820.00
2010 Workshop income (5000 in sponsorships)	\$20,172.50
Total income	\$34,044.43

Expenses

Webpage	\$2,237.79
Newsletters	\$6,347.32
Annual registration fee	\$40.00
Credit card fees	\$1,218.65
Paypal fees	\$234.89
Donations (Frieda Schilling memorial)	\$100.00
2010 Workshop expenses	\$15,575.21
Walkerana set up costs	\$5,250.00
Total expenses	\$31,010.86

Net Income **\$3,033.57**

Retained earning	\$82,533.26
Total in bank accounts	\$87,251.15

The 2010 workshop was a success, due to donations from several organizations. We made a profit of \$4,597.29.

During 2010, the board of directors voted to hire Sophie Binder to maintain our web page. A member database was set up through the web page for members to log on, pay memberships, register for symposia and workshops, etc. Although some

expenses were involved with setting this up and will be on-going for maintenance, newsletters will now be on-line, saving the cost of publishing and mailing.

The conversion from a 1-year to a two year membership was discussed to reduce the frequency of processing. The discussion also included the need to increase dues to account for the costs of publishing the journal. Heidi Dunn proposed increasing two-year membership dues to \$80 for a regular member and \$40 for students. The motion carried. Once costs from the journal are realized the due structure can be further adjusted.

Secretary Report – Greg Zimmerman

In cooperation with Heidi Dunn, Chris Mayer, and Sophie Binder there's been an ongoing effort to fine-tune the membership database and convert to an on-line system that is synced with the treasurer's records. The conversion has not been without problems. However, the system should be more and more self-service in the future so long as on-line forms and options are set up correctly. Based on past activity, the website seems to be driving up membership and, with to the new 2-year structure, we should retain members longer.

One area that still needs attention is committee membership. Anyone who wants to join a committee should email the committee chair or go on-line and select their committee(s) of choice.

2011 Louisville Kentucky Symposium Update – see the website for the latest news and schedule. [also see “poster” on page 3]

Outreach – Andy Roberts

The Missouri Department of Conservation's Powder Valley Nature Center in St. Louis was a great outreach platform during the 2010 workshop. The Outreach Committee set up the FMCS display along with a shell matching game for kids, live mussel filtering demo, mussel conservation videos, and a shell collection from Missouri. FMCS members were available at these displays during the entire workshop to

interact with visitors of the nature center. A special event was held for the public during the last evening of the workshop. A slide and video presentation was given in the auditorium by Dr. Chris Barnhart entitled: *Wonders Down Under: the Amazing World of Freshwater Mussels*. After the presentation Dr. John Harris made his Ozark Highland shell display available to everyone for viewing and "shell and tell". A special thank you goes to Dr. Chris Barnhart and Dr. John Harris for their time and effort to make this happen and to all those who helped with outreach activities during the workshop.

Information Exchange – Tom Watters, John Jenkinson, Greg Cope
Walkerana

The new journal and how it will integrate within the new website was discussed. We will want the journal to be indexed by BioOne. Abstracts will be available to any user, full articles only to subscribers.

Walkerana is still seeking editors. Please send nominations to Tom Watters at watters.1@osu.edu for the editorial board, including nominations for yourself!

A Call for Walkerana papers will be advertised in the next Ellipsaria [see item on page 6] and on Unio.

Ellipsaria

Our newsletter, *Ellipsaria*, will now be posted in an on-line format. John Jenkinson has offered to head up *Ellipsaria* and was appointed Editor by the EXCOM.

Awards – Teresa Newton, Emy Monroe, Greg Cope

Nothing new to report. [A call for symposium judges was recently sent to members and everything is on track.]

Environmental Quality and Affairs - Ryan Evans, Steve McMurray

Our Committee has developed a public comment on Ohio River mussels, requesting Kentucky DOW consider the importance of T&E species when granting a

project water quality certification. Also, Steve is working on a support letter for listing Sheepnose and Spectaclecase.

Gastropod Status and Distribution - Paul Johnson, Jeff Powell

We need gastropod content for the website pages ASAP – Paul Johnson will provide. [Status on this is below, edited from an email from Paul Johnson to Greg Zimmerman 9-02-2010:

Paul is working on the web content, as well as an AFS article, which he hopes to finish drafting in a few weeks. As part of this process, he'll have plenty of extra shots for the FMCS webpage.

Paul also wants to place the AFS checklist on the FMCS website. Both he and Jim Williams are making this same recommendation to AFS, so I don't want to include the list just yet. The list will have 700 + species in 14 different families with NA freshwater snails.]

Genetics - David Berg

No report.

Guidelines and Techniques - Chuck Howard, Janet Clayton

Not present / nothing to report – requesting new chairs and members.

Mussel Status and Distribution - Arthur Bogan, Jim Williams

Art discussed NSF work, and development of computerized taxonomic apps for computers / iPhone, etc.

Propagation, Restoration, and Introduction - Tony Brady, Rachel Mair

List of propagation facilities and capabilities still in the works, going into a spreadsheet. Noted that we need a master database of where mussels are moved from and to ASAP. Possible future role of FMCS website.

New/Continuing Business

The board voted to develop a Facebook page, Kevin Cummings will develop.

National Strategy Update

FMCS needs to continue to work to revise the strategy. We are looking for a person to lead the effort that was involved since the beginning of the strategy to help with its revision. Please see Steve Ahlstedt of Greg Cope for details.

Future Meetings

FMCS is looking for sponsors and topics for the 2012 FMCS workshop and a host location for the 2013 FMCS symposium. Please contact a board member with proposals, sponsorship, etc. The location will be in Alabama, likely Birmingham, but other locations such as Mobile, Guntersville St. Park, and Tuscaloosa were discussed. Paul Johnson has the lead. Possible topics include Health issues and water quality, toxicity, and culture and propagation. It was also noted that NABS may be having a workshop on freshwater mussels in 2012.

Auction Items Needed

We are in urgent need of items for the auction to be held during the FMCS 2011 Symposium in Louisville. Money generated during the auction helps defray costs for students attending our meetings and awards. Suggested items include: books, published papers, diving-snorkeling gear, pictures, paintings, fishing-hunting items, and unusual oddities (river booty). Please bring these items to the Symposium. If you have questions, contact Steve Ahlstedt, Lisie Kitchel, or Jacob Culp.

Announcements

Maryland Mussel Workgroup Meeting

On January 19th, 2011 the third meeting of the Maryland Mussel Workgroup was hosted by Matt Ashton (DNR) and Julie Devers (FWS) at the Maryland Department of Natural Resources in Annapolis, MD. Participation has increased from 8 people in 2009 to just about 20. Additionally, we have expanded outside of Maryland to facilitate communication among researchers and managers working in the Chesapeake Bay drainage. Presentations were made by a variety of people and varied from updates of unionid records from the Maryland Biological Stream Survey, to archaeological records of *Elliptio complanata* in southern Maryland, and the bivalve aquaculture action item within the recently released Chesapeake Bay Restoration Executive Order.

We would also like to announce a session on freshwater mussels is being developed for the third Maryland Streams Symposium. The symposium will take place from August 11th-13th at the Carroll County Community College in Westminster, MD.

For further information, including PDF's of presentations, meeting minutes, or information about the streams symposium contact Matt Ashton at mashton@dnr.state.md.us or (410) 260-8604.

News from North Carolina:

North Carolina held its 8th annual NC Mussel Meeting on January 5-6, 2011 in Raleigh, NC. The meeting was attended by 60 individuals, with representatives from 4 state agencies, 2 federal agencies, 3 universities, 2 environmental consulting firms, 1 energy company, and the NC Museum of Natural Sciences. Participants provided updates from the previous year's work and anticipated studies for the coming year. Several topical presentations were given including, "Mussels and the Media: Helping the World Recognize that Mussels Matter" and "Effects of Transportation-Related Pollutants in Road Runoff on Native Freshwater Mussels". Updates were provided on mussel propagation work within the state and efforts to make the endangered species permitting and reporting process more web-based. A discussion on dams, dam removals, and effects on mussel species engaged participants and directed thoughts toward the potential need of a state restoration plan. Discussion also revolved around an interest in hosting a FMCS workshop or symposium in the future.

Submitted by: Angie Rodgers, NC Natural Heritage Program

Publications

Martel, A.L., D.F. McAlpine, J.B. Madill, D.L. Sabine, A. Paquet, M.D. Pulsifer, & M.F. Elderkin. 2010. Freshwater mussels (Bivalvia: Margaritiferidae, Unionidae) of the Atlantic Maritime Ecozone. Pages 551-598 *In: Assessment of Species Diversity in the Atlantic Maritime Ecozone. Edited by: D.F. McAlpine & I.M. Smith.* NRC Research Press, Ottawa, Canada.. Contact Dr. André Martel (e-mail: amartel@mus-nature.ca) to request a pdf of the article.

Upcoming Meetings

March 22 & 23, 2011 – Spring Meeting Rivers & Streams Technical Committee, North Central Division, American Fisheries Society, Rock Island Conservation Club, Milan IL [will include working session on freshwater mussels] Chairperson: Kraig McPeck, USFWS, 740-670-5312, kraig_mcpeek@fws.gov

April 11 - 15, 2011 - FMCS 7th Biennial Symposium, Seelbach Hilton, Louisville, KY, USA theme: *Managing Your Mollusks: Reflecting on the Past, Preparing for the Future.* http://www.molluskconservation.org/2011_7BiennRegistration.html

May 22 - 26, 2011 – Annual Meeting, North American Benthological Society, Rhode Island Convention Center, Providence RI, USA Theme: *Responding to the Global Water Crisis.* <http://www.benthos.org/annual-meeting.asp>

July 23 - 28, 2011 – Annual Meeting, American Malacological Society, Duquesne University, Pittsburgh, PA, USA <http://www.malacological.org/meetings>

November 13 - 17, 2011 – 32nd North American Annual Meeting, Society of Environmental Toxicology and Chemistry (SETAC) Hynes Convention Center, Boston, MA, USA. Theme: *Navigating Environmental Challenges: Historical Lessons Guiding Future Directions* <http://boston.setac.org/>

November 28 - December 2, 2011 – International Congress for Conservation Biology, Christchurch NZ Theme: *Engaging Society in Conservation.* <http://www.conbio.org/Activities/Meetings/2011/index>

Contributed Articles

2010 St. Croix River Research Rendezvous Abstracts

The following nine abstracts were selected from presentations and posters given at the 2010 St. Croix River Research Rendezvous. This meeting brings together scientists, resource managers, agency staff, high school teachers and students, and interested public to learn about research in the St. Croix River watershed. The meeting was held on October 13, 2010 at the Warner Nature Center near Marine on the St. Croix, Minnesota and was sponsored by the Saint Croix Watershed Research Station. For more abstracts from the meeting as well as abstracts from previous meetings and information about the next meeting visit

<http://www.smm.org/scwrs/programs/rendezvous/>

Submitted by **Mark Hove**, Macalester College

BED SEDIMENT GRAIN SIZE DISTRIBUTION AND FLOW DYNAMICS OF INDIANHEAD RESERVOIR, ST. CROIX RIVER, MN/WI

Karen Jackson, Kelly R. MacGregor, Daniel J. Hornbach, and Mark C. Hove. Macalester College

Dams alter sediment transport and flow dynamics in rivers by acting as a physical barrier to the downstream movement of bed sediment, by slowing water velocity, and allowing suspended material to settle into the reservoir. Interstate Park, located several kilometers below the St. Croix Falls Dam, is host to a large population of native mussels, including threatened and endangered species. Over the past 20 years Hornbach and others (2009) have documented a 90% decrease in juvenile mussels at this same location, as well as a gradual decrease in the grain size from mixed sand/gravel to sand at the riverbed. One hypothesis is that the Indianhead Reservoir above the dam may be a significant source of the fine sediment found at Interstate Park. The build up of sediment behind the dam could allow sand size particles to be transported over the dam. Changes in dam operation to run-of-river in the last decade may also affect sand transport across the dam. We aim to quantify grain size distribution at the bed, measure suspended and bedload sediment in transport across a range of water discharges, and characterize flow dynamics of Indianhead Reservoir in an effort to understand spatial and temporal variability in hydrology and sediment transport. Our objective is to determine if the sediment at Interstate Park could originate from the river upstream of the dam.

Reservoir samples were collected from Lions Park boat ramp to the safety line just above the dam. This 2 km portion of the reservoir was divided into 13

evenly spaced transects. Grab samples and gravity cores of bed sediment, suspended sediment concentration (SSC) samples, vertical water velocity profiles using an Acoustic Doppler Current Profiler (ADCP), and high resolution bathymetry readings were collected at three points along each transect. Bathymetric data demonstrate a deeper thalweg exists in the reservoir, with depths ranging from 2-15 m. Vertical velocity profiles reveal flow velocities between 0 and 32 cm/s during the summer low flows. Bed sediments get finer closer to the dam, however, evidence from long cores reveals stochastic deposition of coarse sand and woody debris. The amount of sediment in SSC samples increases with depth in the water column. As water discharge increases, calculated shear stresses increase, thus increasing the likelihood of sediment transport. One site under moderate water discharge (8,050 cfs) exhibits basal shear stress measurements similar to fluvial systems (14.84 dynes/cm²). However, at low discharges (3,100 cfs) ADCP profiles show little vertical variation in water velocity. During spring or flood stages (~25,000 cfs), the larger shear stresses would allow the sand grain size fraction to likely reach and breach the dam. Results demonstrate sand is present in the reservoir close to the dam even during summer low flow discharges. Calculations of settling velocities for available bed sediment, and estimates of residence time for water in the reservoir will further illuminate our understanding of sand transport behind the dam. Additional electron microscopy to compare grain size, composition, and grain morphology of reservoir and Interstate Park bed sediment will improve our understanding of possible sediment transport from the reservoir to mussel beds downstream.

SUSPENDED SOLIDS TRANSPORT ON THE ST. CROIX: IMPACTS OF THE ST. CROIX FALLS DAM

Carl Skarbek, Kelly MacGregor, Dan Hornbach, and Mark Hove. Macalester College

Transport of inorganic and organic particles in the water column is a key process for the 40 species of filter feeding freshwater mussels that inhabit the St. Croix River, nearly half of which are endangered or threatened. Structures like the St. Croix Falls Dam can impede suspended solid transport, affecting downstream habitat. Due to a decline in juvenile mussel density below the St. Croix Falls Dam over the past two decades (Hornbach and others, 2009) we are interested in spatial variability in suspended matter as well as how suspended solid concentrations change during the annual hydrologic cycle. This project examines the quantity of suspended sediment and organic matter in the river at four sites, two above and two below the St. Croix Falls hydroelectric dam, during the annual flow cycle from 2008-2010. We are interested in locating sources and sinks of suspended material between Nevers Dam and Franconia, and seek to understand

factors controlling the entrainment and transport of suspended material. We considered rainfall events and water discharge as possible drivers of variability in suspended solids concentration. Analysis of suspended solids samples from the past two years demonstrate there is not one single factor controlling the transport of suspended solids. Between January 2008 and June 2009, suspended sediment concentration (SSC) closely tracked water discharge at all four sites. However, between Summer 2009 and Summer 2010 water discharge was not a good predictor of SSC, with peak concentrations occurring at relatively low discharges. Overall we found water discharge to be the best predictor of SSC, though the concentrations in 2009 and 2010 suggest that there are also other factors at work. Rainfall records from Wild River State Park were examined to see if the amount of rain, which is associated with sediment runoff and SSC flux, was a good predictor of SSC spikes. There were some loose associations, but no strong correlation. There were no statistically significant differences found in surface SSC at the four sites examined, suggesting that the dam practices being implemented have limited impact on the transport of the finest suspended materials. The average amount of total suspended solids (TSS) through the two year period of this study was 0.0086 g/L, nearly 36% of which was found to be organic. The TSS increased from 2008 to 2009 by 0.0005 g/L, a significant amount, considering the size of the St. Croix. Looking more closely at weather records and other possible variables including development practices and storm events will allow us to better constrain the controls on suspended solids transport over the past two years.

Suggestions for Reading

Hornbach, D.J., Hove, M.C., MacGregor, K.R. 2009. Mussel density at Interstate Park, St. Croix River, MN and WI: A new equilibrium? International Symposium of the Freshwater Mollusk Conservation Society, Baltimore, MD, April 19-24, 2009.

ASSESSING THE THREAT AND PREDATOR CONTROL OF A NON-NATIVE, AQUATIC INVADER (ZEBRA MUSSEL *DREISSENA POLYMORPHA*) IMPACTING ENDANGERED NATIVE MUSSEL RESOURCES IN THE ST. CROIX NATIONAL SCENIC RIVERWAY (SACN): AN UPDATE

Lynn Bartsch¹, Michelle Bartsch¹, William Richardson¹, Steve Zigler¹, Byron Karns², and Brenda Moraska Lafrancois³

¹ U.S. Geological Survey, Upper Midwest Environmental Sciences Center

² National Park Service, St. Croix National Scenic Riverway

³ National Park Service, St. Croix Watershed Research Station

Invasions of aquatic non-native species are increasing and can result in catastrophic changes in community composition and ecosystem function. The St. Croix National Scenic Riverway (SACN) is one of the last best refuges for rapidly declining populations of native unionid mussels in the United States. National Park Service (NPS) monitoring in the SACN shows that zebra mussel (ZM: *Dreissena polymorpha*) populations are rapidly increasing in lower Lake St. Croix, yet there is evidence that benthivorous fish are using ZM as a food source, potentially decreasing the rate of ZM colonization within this system. However, the benefit of ZM consumption by these benthivorous fish might be partly offset by an increase in predation pressure on juvenile unionid mussels. Our research objectives are to quantify the effects of the ZM invasion in the SACN by assessing 1) the mechanisms of impact on native adults and juveniles (*e.g.*, direct impact via encrustation, indirect via competition for seston food resources); 2) the extent of ingestion of ZM by local populations of benthivorous fish; and 3) efficacy of mitigation efforts such as mechanical removal of ZM by hand-scrubbing native mussels. We will quantify unionid condition using sensitive biochemical metrics of tissue glycogen (quantity) and lipids (quality and quantity), including essential fatty acids. We will also use less sensitive but more easily measured indices of condition — body mass change, shell growth, and individual survival. Analysis of lipids in the seston, as well as the concentration of chlorophyll *a*, volatile and total suspended solids, will quantify the quality of food available for mussels; differences in quality and quantity of seston related to variation in ZM density will indicate the effect of ZM filtering on food resources. Results of this study should provide critically needed information to guide and justify management actions necessary for the protection and restoration of imperiled populations of native mussels in the SACN and other park units experiencing invasion of ZMs.

EFFECTS OF FISH HOST AVAILABILITY, WATER TEMPERATURE, AND DISCHARGE ON TWO POPULATIONS OF MUSSELS IN THE ST. CROIX RIVER, MN

Brandon Sansom¹, Daniel J. Hornbach, and Mark Hove.² ¹ Washington and Jefferson College

² Macalester College

Population stability and growth of freshwater mussels are dependent upon a number of biotic and abiotic factors. Population stability is reliant upon juvenile recruitment, which is mainly controlled by fish host availability. Some mussels are considered host generalists, having many host fish species, while other mussels are host specialists, having only one or a few host fish. Annual growth is largely controlled by water temperature and discharge. Population densities of a host specialist mussel, *Truncilla truncata*, are declining at a location below a

hydroelectric power dam in the St. Croix River, MN. However, densities of a host generalist, *Actinonaias ligamentina*, remain constant both above and below the dam. The objectives of this research were to detect whether differences in host availability is contributing to the differences in mussel density, and to determine how water temperature and discharge are impacting annual growth both above and below the dam. *A. ligamentina* and *T. truncata* were collected at sites above and below the dam; mussel length and growth (annual) rings were measured for each mussel. Since shells were eroded, we used x-intercepts (i.e. prediction of eroded area = 0) and their 95% confidence intervals from regressions modeling eroded area with each respective ring to estimate the most likely length of each annual ring. The ring measurements were adjusted accordingly, and mussel age was determined by summing the total number of rings. We used the relationships between shell length and age to convert shell-length frequency histograms to age distributions and used these to examine patterns of recruitment. Host fish CPUE (catch per unit effort) for each species was collected from various state agencies in MN and WI. *A. ligamentina* has multiple fish hosts and had higher host fish CPUE at both sites, which may be related to the more consistent density noted. Lower abundances of the host fish, *Aplodinotus grunniens*, for *T. truncata* were found below the dam, which may imply that the sporadic mussel recruitment noted is closely linked to high year classes of host fish. Annual growth varied between and within species, across sites, and was influenced by the interaction of mussel age and year. Growth variation for *A. ligamentina* above the dam was related to discharge and water temperature. Below the dam, neither discharge nor water temperature significantly influenced growth for *A. ligamentina* nor *T. truncata*, suggesting that other factors, such as water quality or food quantity and/or quality, may be more important in controlling growth rates.

LIFE HISTORY OF *QUADRULA NODULATA*: WHICH HOST SPECIES OF FISH DOES IT DEPEND ON?

Derek J. Ochi, Jessica N. Ramirez, Daniel J. Hornbach, and Mark C. Hove. Macalester College

Freshwater mussels are one of the most imperiled groups of animals in North America, with 43% of taxa now extinct, endangered, or threatened. Their benthic life history makes the group particularly vulnerable to human activities. Larval metamorphosis occurs on the gills of a host fish. Conservation efforts could be improved by identifying life history needs of *Quadrula nodulata*.

To better understand the life history of *Quadrula nodulata* we collected glochidia from several gravid females of this species from the Mississippi River and compared them with glochidia from gravid females of *Actinonaias ligamentina*, *Lampsilis higginsii*, and *Quadrula pustulosa* from both the St. Croix and

Mississippi Rivers (*Q. nodulata* is not found in the St. Croix). We used these glochidia to conduct host suitability trials using standard methods. Glochidia and juvenile mussels from our host trials as well as juveniles released by naturally infested fishes were measured using scanning electron microscopy. Discriminant analysis using hinge/length ratio, height/length ratio and length alone, allowed us to do a reasonable job of classifying glochidia into species. Evidence suggests that the juvenile from the channel catfish is a *Quadrula* species, most likely *Quadrula pustulosa* (71.8%) or *Quadrula nodulata* (28.2%). However, the naturally infested catfish was caught at Spring Lake, Mississippi River near the mouth of the St. Croix River during early summer. Channel catfish move about in the spring followed by a more sedentary lifestyle in the summer. If the data set is restricted to glochidia from the Mississippi, where the channel catfish was caught, then it is *Quadrula nodulata*, as valve height values for the two species do not overlap in this river. We plan to use molecular analysis to assist us with juvenile mussel identification in these difficult situations.

WHY ARE MUSSELS LARGER IN THE SUNRISE RIVER THAN IN THE ST. CROIX RIVER?

Elise Griffin, Daniel J. Hornbach, Mark C. Hove, and Kelly R. MacGregor. Macalester College

Evidence suggests that some small low-head dams benefit and increase growth rates for downstream filter-feeding guilds (Singer, 2010). The purpose of this study was to study why mussels of the species, *Actinonaias ligamentina* are larger in the Sunrise River below a small low-head dam than above and below the larger hydroelectric dam on the Saint Croix River at St. Croix Falls, WI. We addressed this question by collecting water samples to determine total suspended solids of organic matter, inorganic matter, and chlorophyll levels (indicators of food quantity and quality) above and below the Kost Dam on the Sunrise River and the St. Croix Falls Dam on the St. Croix River. We found that mussels in the Sunrise River below the Kost Dam are growing at a faster rate than mussels on the St. Croix; however, there is no statistically significant difference in food available or quality between locations. We continue to seek temperature data for the Sunrise River to examine whether temperature differences are important. It is essential to understand how dams may benefit, degrade and alter river mechanisms and habitat characteristics that determine the well being of mussel communities in Minnesota and globally so that we can better make intelligent and informed decisions about dam construction and removal where mussels and other aquatic species reside.

Suggestions for Reading

Singer, E. E. 2010. Mill dam effects on freshwater mussel growth in a small Alabama (USA) stream. Master's Thesis, Appalachian State University, 40 p.

Feminella, J., M. Gangloff, E. Hartfield, Brian Helms, David Werneke, Kevin White, and Jack W. Feminella. 2009. Alabama Mill Dam Inventory Final Report. Appalachian State University, Auburn University, Appalachian State University, 24 p.

SURVEY OF UNIONID MUSSELS NATURALLY INFESTING WALLEYE IN THE ST. CROIX RIVER

Nathan W. Juergens, Sarah L. Boyer, Mark C. Hove, Jordan B. Eckstein, and Jessica N. Ramirez. Macalester College

Freshwater mussels in the family Unionidae have an intricate life history in which their larvae parasitize the gills of vertebrate hosts in order to metamorphose and disperse to new habitats. Many host-mussel relationships are unknown and at the parasitic stage the animals are too small to easily morphologically distinguish between species. Therefore, we utilized "DNA barcoding" of the ND1 mitochondrial locus to identify juvenile mussels collected from naturally infested St. Croix River walleye (*Sander vitreus*). We successfully sequenced 62 unknown juvenile mussels, and identified 42 as being of the species *Lampsilis cardium*, 17 as either *Lampsilis higginsii* or *Actinonaias ligamentina*, two as *Pyganodon grandis*, and one as *Lasmigona compressa*. Phylogenetic analysis identified all of the juveniles with high enough posterior probability values to definitively say that they grouped with their indicated species, but those that grouped with either *L. higginsii* or *A. ligamentina*, could not be distinguished from one another, due to high genetic similarity between the two species. Of the *Lampsilis cardium* juveniles, 31 were collected from one walleye individual, and interestingly, all 31 of these sequences were identical. This is consistent these juveniles being the offspring of one mother, but two or more genetically identical mothers cannot be discounted. Our reference data set of 76 *L. cardium* adult sequences had 22 different haplotypes, so clearly there is some genetic diversity within this species in the St. Croix. The suspected *Lasmigona compressa* individual is curious because adult *L. compressa* are not found where the walleye was caught, but rather much further upstream in the St. Croix. That said, *L. compressa* have been shown to be generalists when it comes to metamorphosing on a fish-host, and walleye are known to travel several kilometers in the spring when this fish was caught, so our result is within the realm of possibility.

USING SCANNING ELECTRON MICROSCOPY TO IDENTIFY MUSSEL LARVAE

Jessica N. Ramirez, Sarah L. Boyer, Mark C. Hove, and Daniel J. Hornbach. Macalester College

Freshwater mussels in North America are of special interest to conservationists because nearly 70% of all known species are listed as special concern, threatened or endangered. This project focuses on distinguishing two species, *Actinonaias ligamentina* and *Lampsilis higginsii*, found in the Mississippi and St. Croix rivers. Identifying *L. higginsii* is of particular importance because this species is federally endangered.

At the larval stage freshwater mussels are hard to distinguish morphologically, because of their minute size, so DNA barcoding is a useful method for species identification. Unfortunately, using mitochondrial DNA has proven to be ineffective in distinguishing between *L. higginsii* and *A. ligamentina*, as is shown by their placement in previously generated phylogenetic trees. Since DNA barcoding is not an effective tool in this case, an alternative approach is needed. Morphology of these animals can be described using scanning electron microscopy (SEM), which allows imaging and measurement of minute specimens.

Glochidia were studied from five *A. ligamentina* females and four *L. higginsii* females. Several hundred glochidia from each female were mounted onto a stub and studied using SEM. The following measurements were made from approximately ten glochidia from each stub: hinge length, height, length, hinge:length ratio, height ratio and length:height ratio. We used JMP software to identify statistically significant differences between the species in size and shape.

The results indicated that there were significant differences between *A. ligamentina* and *L. higginsii* glochidial length ($p=0.02$), height ($p=0.0005$) and hinge:length ratio ($p\leq 0.04$). In addition, discriminate analysis was performed using JMP software to demonstrate the efficacy of using shell measures to distinguish the species. A discriminate analysis attempts to predict a classification variable (species) based on known continuous responses (glochidial size and shape). According to our analysis, there is a 90% probability of correctly classifying an unknown specimen as *A. ligamentina* and an 86% probability of correctly classifying an unknown specimen as *L. higginsii* using the glochidial measurements we made.

SURVIVAL AND GROWTH OF JUVENILE UNIONID MUSSELS IN THE ST. CROIX NATIONAL SCENIC RIVERWAY: EFFECTS OF FOOD QUALITY

Michelle Bartsch¹, William Richardson¹, Lynn Bartsch¹, Jon Vallazza¹, Brenda Moraska Lafrancois²

¹ U.S. Geological Survey, Upper Midwest Environmental Sciences Center, La Crosse, WI

² National Park Service, St. Croix Watershed Research Station

Recent increases in nutrient and sediment loading have caused observable shifts in algal composition and have potentially altered the quality of mussel food in the St. Croix National Scenic Riverway. Juvenile *Lampsilis cardium* and *L. siliquoidea* were deployed in cages for 28 d at four riverine and four lacustrine sites. Mussel tissue and food resources (seston fractions: whole water, <63, <32 and <10 μm and surficial sediment) were analyzed for total lipids (TL) and quantitative fatty acid (FA) composition. Riverine sites were dominated by Chlorophyta, whereas Cyanophyta generally dominated lacustrine sites. Overall mussel survival was 95% and mean growth rates for both species were higher at riverine (3 and 23 $\mu\text{m}/\text{d}$) than lacustrine sites (-10 and 6 $\mu\text{m}/\text{d}$) for *L. cardium* and *L. siliquoidea*, respectively.

Total lipids were similar between mussel species and sites (averaged $10.5 \pm 1.1\%$); however, seston TL ranged from 5.6 to 11.0% at riverine and 11.7 to 14.3% at lacustrine sites. Sediment TL averaged 0.031% at riverine and 0.047% at lacustrine sites. Mussel growth may be more dependent on dietary FA quality than quantity.

Results From Ongoing Freshwater Mussels Surveys in the Susquehanna River and the First Collection of *Dreissena polymorpha* Below Conowingo Dam, Maryland.

Matt Ashton, Maryland Department of Natural Resources, Monitoring and Non-tidal Assessment Division, 580 Taylor Avenue, C-2, Annapolis, MD 21401

As previously reported (Ashton 2009), Marshall (1930) provided the only published account of unionids in the Susquehanna River below Conowingo Dam, although the Maryland DNR's Natural Heritage Program has unpublished data. In 2010, our survey effort primarily consisted of timed-snorkel searches in suitable mussel habitat at locations from 1.5 Rkm below Conowingo Dam downstream to 2.2 Rkm below Port Deposit, MD. We also haphazardly searched for mussels in the vicinity of surveys being conducted for FERC relicensing of the Conowingo Dam. Ashton (2009) also noted the potential for up to 13 unionid

species to be present, but we question the inclusion of *Elliptio lanceolata* as it appears no valid specimens from the state exist (Jim McCann pers. comm.) and its range may have never included the Susquehanna River (Bogan et al. 2009).

In 2010, the presence of unionids was noted at 11 sites that were surveyed for a total of 44 person-hours. At two additional sites, we noted mussel presence through informal visual searches. Mussel richness ranged from one to six species. *Elliptio complanata* was the most frequently encountered unionid, followed by *Anodonta implicata* and *Pyganodon cataracta*. Three species, *Lampsilis cariosa*, *L. radiata radiata*, and *S. undulatus* were collected in 2010, but were not encountered in the past two years (Table 1). We also found a pair of valves tentatively identified as *E. fisheriana*. Catch-rates ranged from 25 to > 300 mussels/person-hour. While a majority of the *E. complanata* visible at the substrate surface were large (> 80 mm in length), smaller (20 – 60 mm) *E. complanata* were frequently found under unembedded cobble and boulder substrate.

At five sites, we found 11 live *Dreissena polymorpha*. This represents the first time they had been collected in the Susquehanna River, below Conowingo Dam. They ranged in length from 23 to 38 mm indicating that they were likely present for several years, albeit in extremely low numbers. We observed that all live *D. polymorpha* were attached to the downstream side of very large boulders, where they are sheltered from high velocities from the operation of Conowingo Dam.

Table 1. Freshwater mussels potentially occurring in the Susquehanna River below Conowingo Dam, Maryland and recent accounts of their presence or absence. "L" indicates live individuals were collected, "D" indicated spent valves were collected, and "N" indicates none were collected.

Species	2008	2009	2010
<i>Alasmidonta undulata</i>	N	N	N
<i>Alasmidonta varicosa</i>	N	N	N
<i>Anodonta implicata</i>	L, D	L, D	L, D
<i>Elliptio complanata</i>	L, D	L, D	L, D
<i>Elliptio fisheriana</i>	N	N	D
<i>Lampsilis cariosa</i>	N	N	L
<i>Lampsilis r. radiata</i>	N	N	L, D
<i>Lasmigona subviridis</i>	N	N	N
<i>Leptodea ochracea</i>	L, D	L, D	L, D
<i>Ligumia nasuta</i>	N	N	N
<i>Pyganodon cataracta</i>	L, D	L, D	L, D
<i>Strophitus undulatus</i>	N	N	D

The increase in mussel richness in 2010 can directly be attributed to the increase in survey effort compared to the previous years. Not only did we increase the amount of effort expended, but we sampled across a wide spatial extent. We found that mussel richness and catch-rates increased the further downstream of the dam we surveyed. In addition, the predominant substrate became less

coarse and tidal influence more pronounced. The frequency of small *E. complanata* under coarse substrate highlights the need to include subsurface mussels in survey designs to adequately assess mussel populations in the Susquehanna River. The most recent collection of *E. fisheriana* in the vicinity came from the Conowingo Dam pool in 1961. If the valves collected in 2010 can be confirmed as *E. fisheriana* it would be a fairly notable record. We hope to soon have our identification independently confirmed or refuted to help answer this lingering question. The collection of live *L. cariosa* is also fairly significant given the fact serious questions about the species status in the Potomac River basin exist, due to the presence of the non-native *L. cardium*, and because they have not been reported from the Susquehanna River, below Conowingo Dam, in eight decades (Marshall 1930, Jim McCann unpublished data). Due to the potential importance of this population, we retained three whole specimens and deposited them with the North Carolina State Museum. We hope to continue freshwater mussel surveys in 2011 in light of our discovery of *D. polymorpha* in the Susquehanna River downstream of Conowingo Dam and the potential threats this invasive species poses to the unionid fauna and ecology of the river and Chesapeake Bay.

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Recent Discovery of a Population of Spiny Riversnails (*Io fluviialis*) in the Holston River, Hawkins County, Tennessee 2010: Probable Colonization from Translocations Done in the North Fork Holston River in the Late 1970s and Successful Translocations 15 KM Downstream (1996-2003)

Steven Ahlstedt, P. O. Box 460, Norris, TN 37828

Recent mussel sampling was completed in the Holston River at an abandoned railroad bridge slated to be torn down. The railroad bridge crosses the Holston River at river mile 137.8 (km 86) and is located on restricted military property (Holston Ordnance). A large island in the river (Clay Islands) is bisected by this bridge. It is unknown if this reach of river had ever been surveyed for mussels since becoming a restricted military installation in the 1940s. The river is blocked off to river traffic “no admittance” and monitored by remote camera as a restricted zone upstream and downstream from the boundary of the military facility. The Holston River has a sordid history of industrial pollution from upstream sources in the South Fork Holston near Kingsport, Tennessee, and from pollution from a now defunct chemical plant located on the North Fork Holston at Saltville, Virginia.

Sampling consisted of snorkel line transects the full width of the river which was approximately 185 m on the left side of the island and 140 m on the right side. Sampling extended downstream approximately 300 m on both sides of the island. The Holston River is shallow and flows are managed by the Tennessee Valley Authority (TVA) at Ft. Patrick Hendry Dam located on the South Fork Holston at river mile 8.2 (km 5). Habitat consists of wide swaths of gravel, rubble, and bedrock with large concentrations of vegetation anchored into the bedrock crevices. All live mussels were found in the depositional areas between bedrock crevices and rock piles.

This Intensive sampling resulted in finding only three live mussel species: *Lampsilis fasciola* (5), *Medionidus conradicus* (1) and *Villosa iris* (21). Relict mussels found included five species: *Actionaias ligamentina*, *Amblema plicata*, *Cyclonaias tuberculata*, *Fusconaia subrotunda*, and *Lampsilis ovata*.

During the mussel sampling, large concentrations of pleurocerid river snails were observed, mostly *Leptoxis virgata* and *Pleurocera uncialis*. Mixed in with these snails were specimens of the spiny riversnail, *Io fluviialis*, which occurred throughout the sampling site. A total of 102 live individuals of various size lengths (not measured) were counted along the transect lines.

It is the opinion of the author that this population in the Holston River is a result of migration, or individuals being washed downstream, from successful translocations done in the lower North Fork Holston River in the late 1970s. The North and South forks of the Holston form the mainstem Holston River at river mile 142.2 (km 88) and the upstream distance between the sampling site where *Io* was found and the North and South Forks are approximately two kilometers. There are no physical barriers in the Holston upstream from Holston Ordnance and habitat remains riverine upstream to the confluence of the North and South Forks. It is reasonable to assume that this is one contiguous population that probably extends downstream in the Holston.

As a side note to finding spiny riversnails in the Holston River at Holston Ordinance, spiny riversnails have successfully colonized the Holston at Cox Island, river mile 118 (km 73) near Surgoinsville, a distance of approximately 15 km downstream from the Holston Ordinance site. Spiny riversnails were successfully translocated to Cox Island beginning in 1996. A total of 7,955 live individuals were collected from the Clinch River from 1996-2003. Only the smallest individual was measured during each translocation year. During the time period of translocating spiny riversnails, egg-laying was observed on numerous occasions. In 2003, the first small individuals were observed as evidence by individuals measured being smaller than what was translocated. The spiny riversnail is currently relatively common at this location but a pollution event upstream could imperil restoration efforts in the Holston River. A more detailed report of spiny riversnail translocations is pending.

Another Riddle from Israel: How Can We Explain the Presence of a *Pyrgophorus* Species in the Tanninim River Basin?

Henk K. Mienis¹, Oz Rittner² and Svetlana Vaisman³

¹ National Collections of Natural History, Department of Zoology, Tel Aviv University, IL-69978 Tel Aviv, and National Natural History Collections, Berman Building, Hebrew University of Jerusalem, IL-91904 Jerusalem, Israel. E-mail: mienis@netzer.org.il

² National Collections of Natural History, Department of Zoology, Tel Aviv University, IL-69978 Tel Aviv, Israel E-mail: israelbutterflies@gmail.com

³ Plant Protection & Inspection Services, Ministry of Agriculture, P.O. Box 78, IL-50250 Bet Dagan, Israel. E-mail: svetak@moag.gov.il

Abstract

Numerous specimens of a *Pyrgophorus* species, Family Cochliopidae, have been collected recently from the Tanninim or Crocodile River basin including the Timsah Springs in Israel. All members of that genus are confined in their distribution to a restricted area in the New World. It is not ruled out that this species reached the Tanninim River with the invasive Water lettuce/cabbage *Pistia stratiotes*, which was found floating on the river.

The Tanninim or Crocodile River in Israel is so called because up to the beginning of the 20th Century Nile crocodiles *Crocodylus niloticus niloticus* were still living in this Mediterranean coastal river and the nearby Kebara swamps (Schmitz, 1921; Werner, 1988; Bouskila, 2004). They became extinct because of overhunting.

In the meantime the Kebara swamps, originally situated between the Carmel Mountain ridge in the east and the dunes along the Mediterranean coast in the west, were drained, but the Tanninim River remained more-or-less the only unspoiled river in Israel's coastal area.

Yet also the Tanninim River has suffered during the last quarter of the 20th Century when the freshwater of its springs in the hills was diverted towards the water reservoirs of the Menashe Regional area. The lower part of the Tanninim River has therefore become more-and-more influenced by the brackish water springs of the Timsah complex adjacent to the river where it crosses the drained Kebara swamps.

The up-and-downs of the mollusc fauna of the Tanninim River during the period 1865-1986 has been described by Mienis & Ortal (1996). They reached the conclusion that a total of 29 species had ever been recorded from this river and its tributaries, but 18 species were only recorded during an extensive survey in 1986. Among the latter we noted only two invasive species: one, *Ferrissia clessiniana* (Jickeli, 1882) which probably reached Israel by natural means through the air as hitchhikers on migrating aquatic insects from the River Nile or its delta, and an introduced North-American species, *Haitia acuta* (Draparnaud, 1805), which is now considered the most common species in Israel.

Casual observations dealing with the mollusc fauna of the Tanninim River since 1986 have shown that the number of living species is slowly but steadily dwindling this in spite of the fact that the water is not exploited because of its brackish character and the major part of the river and the Timsah Springs form part of a Nature Reserve.

During the last two months of 2010 Dolev Kentis, a student of Dr. Menachem Goren, and Dr. Frida Ben-Ami and her students, all from the Tel Aviv University, brought back mollusc samples from both the Tanninim River and the Timsah Springs. This material was sorted, identified and preserved for permanent storage in the Mollusc Collection of the National Collections of Natural History of the Tel Aviv University.

To our surprise or maybe it is better to say to our dismay the material contained a few living specimens of the invasive species *Thiara scabra* (Müller, 1774), which had so far only been recorded in Israel from the Sea of Galilee and several streams and springs in the Bet She'an Valley (Mienis, 2008; Mienis & Mienis, 2008a-b), but not in any of the coastal streams or springs.

However, we were utterly perplexed by the presence of hundreds of small Hydrobiid shells showing faint, widely spaced spiral striae and many of them carrying regularly spaced, broad, conical spines emerging from a sub-sutural keel-like peripheral spiral ridge (Fig. 1).

The invasive New Zealand mudsnail *Potamopyrgus antipodarum* (Gray, 1843) (Fam. Hydrobiidae) was ruled out because in the spiny



Figure 1. *Pyrgophorus* species from the Timsah Springs, Tanninim River basin, Israel, actual height 3.9 mm (Photograph: Oz Rittner).

forms occurring often in populations of the latter the spines are formed by the organic layer forming the periostracum and do not constitute an integrated part of the shell.

A search among the samples of Risssoidea present in the Mollusc Collection of the Hebrew University of Jerusalem revealed that we were most probably dealing with a member of the New World genus *Pyrgophorus* Ancey 1888 (Fam. Cochliopidae). This identification has become even much more likely after reading the review of the genus *Pyrgophorus* by Hershler & Thompson (1992). The snails encountered in the Nahal Tanninim basin show the same range of variation in shell morphology as the *Pyrgophorus* species figured by Hershler & Thompson (1992: figs. 59a-d).

However, at the same time it has become clear that a specific identification will take still some time. The species-level systematics of the genus *Pyrgophorus* is in a chaotic state (Hershler & Thompson, 1992). They mention 45 names referable to *Pyrgophorus*, but most probably only a handful can be recognized as representing valid species.

Our material consisted of the following samples:

Pyrgophorus species

ISRAEL: Timsah Springs, leg. D. Kentis, 1 November 2010 (TAU MO 72195/more than 600 specimens!); idem, leg. F. Ben-Ami et al., 29 November 2010 (TAU MO 72092/187); Tanninim River, Nature Reserve, leg. F. Ben-Ami, 23 December 2010 (TAU MO 72094/39); idem, Bank 5, leg. F. Ben-Ami, 23 December 2010 (TAU MO 72093/5).

The more than 600 specimens collected from the Timsah Springs by Dolev Kentis were extracted from a washed bottom sample with a weight of only 250 gram and mainly consisting of shells!

The most astonishing fact from this story is that the natural distribution of the genus *Pyrgophorus* is confined to fresh- and brackish water streams in the

coastal areas of the southern states of North America, both sides of Central America, the northern countries of South America and most of the islands forming the West Indies in the Gulf of Mexico and the Caribbean Sea (Hershler & Thompson, 1992). How did this species reach Israel and find a hideout in a river, the Tanninim or Crocodile River, which fits exactly the requirements of the biotope in its natural range?

After we mentioned the find of a *Pyrgophorus* species to an aquatic biologist and ecologist of Israel Nature Reserves and National Parks Authority, one of its rangers discovered the invasive Water lettuce/cabbage *Pistia stratiotis* in the Tanninim River. This highly invasive floating aquatic weed has been removed in the meantime from the river basin without knowing whether it functioned as a carrier for the *Pyrgophorus* snails. If this is indeed the case then we may expect this species to turn up in other places in Israel because at the moment *Pistia* is still freely sold in so-called garden centres throughout Israel.

Acknowledgements

We like to thank Dr. Frida Ben-Ami and her students, and Dolev Kentis (all of the Tel Aviv University) for collecting the discussed material.

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The Reintroduction of the Northern Riffleshell (*Epioblasma rangiana*) in Illinois

Jeremy Tiemann (Illinois Natural History Survey), **Robert Szafoni** (Illinois Department of Natural Resources), **Joseph Kath** (Illinois Department of Natural Resources), and **Kevin Cummings** (Illinois Natural History Survey)

Beginning in 2005, Illinois partnered with the U.S. Fish & Wildlife Service (USFWS) and state agencies in Pennsylvania and Ohio to implement portions of the USFWS Northern Riffleshell (*Epioblasma rangiana*) and Clubshell (*Pleurobema clava*) Recovery Plan. To date, no actions relative to clubshell recovery have occurred. All actions reported here reference the northern riffleshell.

The northern riffleshell is federally endangered, historically present in the upper Ohio River and Lake Erie drainages. Current populations are known from Pennsylvania, West Virginia, Ohio, Kentucky, Indiana and Ontario, Canada. In Illinois, the northern riffleshell was historically present in the Wabash River drainage but has not been seen alive in approximately 100 years and was considered extirpated from the state. As such, it was not on Illinois' endangered and threatened species list prior to the time of release.

Illinois was targeted for a re-introduction of 150 live adult northern riffleshells. With a minimum single re-introduction population of 50, this allocation would allow for 3 translocations. Plans were made to select one re-introduction site each in the North Fork, Middle Fork, and Salt Fork of the Vermilion River. These rivers currently support diverse and highly-valued mussel assemblages and populations of the known fish hosts, as well as have multiple areas in conservation ownership. Late in the process, the release site in the North Fork Vermilion River was deemed not suitable and with insufficient time to locate a new site, the decision was made to make 2 releases – one each in the Salt Fork and Middle Fork Vermilion River.

A salvage project in Pennsylvania on the Allegheny River provided an opportunity for the translocation of 150 specimens. These individuals were collected on 6 August 2010 and quarantined for a month at the Freshwater Mussel Conservation and Research Center at the Columbus Zoo and Aquarium in Ohio before being translocated to Illinois. Four individuals died in captivity. On 7 September 2010, staff from the Illinois Natural History Survey and USFWS transferred 146 northern riffleshells to Illinois, where they were held in an in-stream enclosure in the Salt Fork Vermilion River. A week later, staff from IDNR and University of Illinois attached a PIT (passive integrated transponder) tag to the right valve and a uniquely numbered plastic shellfish tag to the left valve of each live animal (Figure 1). PIT tags were attached with marine-grade

epoxy, whereas numbered tags with a “super glue” product. In the following days, 10 individuals died, and IDNR staff moved 69 live mussels (38 males and 31 females) to a gravel riffle in the Salt Fork and another 67 (36 males and 31 females) to a gravel riffle in the Middle Fork River. The Salt Fork site is owned by the University of Illinois and the Middle Fork site is owned by the Champaign County Forest Preserve District.



Figure 1 – Northern riffleshells marked with PIT tags (left) and plastic numbered tags (right).

Since the release of the mussels, no further mortality of NRS has been noted. Upon this reintroduction, the species was added to the Illinois List of Endangered and Threatened Species. All federally listed species that occur in the state are automatically listed as Illinois endangered or threatened and added to the Illinois list without notice or public hearing (Illinois Compiled Statutes - 520 ILCS 10/7). Future plans include regular monitoring of both sites several times over the next 5 years. Animals will be documented via a PIT tag reader and a small percentage will be excavated to assess survival.

Occurrence of amphibian slugs *Omalonyx* (Gastropoda: Pulmonata: Succineidae) in the "Serra do Tabuleiro" Ecological State Park region, Santa Catarina's State, SC, Southern Brasil

A. Ignacio Agudo-Padrón, Project “Avulsos Malacológicos - AM”, P.O. Box 010, 88010-970, Florianópolis, Santa Catarina, SC, Brasil
ignacioagudo@gmail.com
<http://www.malacologia.com.br>

The present report characterizes the first confirmed record of an amphibian slug in the coastal territory of the “Serra do Tabuleiro” Ecological State Park, Santa Catarina’s State, the smallest geographical portion of the Southern Brazil region. Our previous malacological regional inventory (Agudo-Padrón & Bleicker 2009) did not include amphibian slugs species of the genus *Omalonyx* d’Orbigny, 1837, representative of the Family Succineidae Beck, 1837, in their relationship. This brings to 45 your number of known non-marine forms (Agudo-Padrón 2009 b: 10):

On January 07-08 2011, one lot of 6 specimens of *Omalonyx* cf. *convexus* (Heynemann, 1868) were collected by us in a straight sandbank stream (drainage channel with several polluted waters) close to human residences on “Praia do Sonho” (Dream Beach), Rodovia (Highway) SC 433 – entrance to “Açaraí Street”, Palhoça Municipal District, to the South of Santa Catarina Island (Agudo-Padrón & Bleicker 2009), densely populated by riverside aquatic plants (macrophytes *Hydrocotyle ranunculoides*), with presence of limnic snails Planorbidae *Biomphalaria t. tenagophila* (d’Orbigny, 1835) and Hidrobiidae *Potamolithus* sp., the little freshwater clam *Eupera klappenbachi* Mansur & Veitenheimer-Mendes, 1975 – single limnic Veneroida known in the region (Agudo-Padrón 2008: 168; Agudo-Padrón & Bleicker 2009: 10) – and abundant small native tropical fishes Poeciliidae, characteristic of this type of aquatic environment in the locality. The specimens were preserved in liquid by the searching malacologists, Dra. Janine Oliveira Arruda, specialist in Succineidae gastropods (Malacology Laboratory, Museum of Science and Technology - MCT, PUCRS, Porto Alegre, RS).

General information about the known distribution of this peculiar little species in the State’s coastline, between the Atlantic slope of “Mampituba” (to the South) and “Camboriú” (to the North) river basins, are concentrated in the contributions of AGUDO-PADRÓN (2008, 2009 a-b).

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Additional New Records on Continental and Marine Molluscs of Santa Catarina State, SC, Southern Brazil Region: Synthesis and Check List

A. Ignacio Agudo-Padrón & Mário Saraiva Bleicker, Project “Avulsos Malacológicos”, Caixa Postal (P.O. Box) 010, 88010-970, Centro, Florianópolis, Santa Catarina, SC, Brasil E-mail: ignacioagudo@gmail.com / msbleicker@terra.com.br <http://www.malacologia.com.br>

After publication of the basic listings concerning the forms of marine, freshwater and terrestrial mollusks of Santa Catarina’s State, Southern Brazil region (Agudo-Padrón 2008 b, 2009 a; Agudo-Padrón *et al* 2009; Agudo-Padrón 2010 c), new species registrations, relevant observations and some necessary “corrigendas” were incorporated into the general inventory, accompanying the dynamics of our field and bibliographical researches.

Particularly, discounting the uncertain status of *Turbonilla* sp (GASTROPODA) and *Spinospella* sp (BIVALVIA), previously mentioned in AGUDO & BLEICKER (2005: 5), AGUDO-PADRÓN & BLEICKER (2008: 9) and AGUDO-PADRÓN *et al* (2009: 9, 14), the total rises to 696 in the marine species inventory, equivalent to 43% of the total registered to Brazil according to available estimates in SIMONE (1999: 133).

For other part, based on available estimates in the contribution of SIMONE (2006: 3), relative to the totality of continental malacological species estimated for the vast Brazilian territory, the State is today detainer of 184 specific forms, among them 67 limnic / freshwater ways (18%) – 41 gastropods & 26 bivalves – and 117 terrestrial (17%) – up to now known¹.

Still, a previous comprehensive statistical synthesis and general bibliographical compilation about the malacological research developed by us in

¹ Unhappily, numeric information contained in AGUDO-PADRÓN (2010 a, b) includes some mistakes of statistical appreciation in the freshwater and terrestrial items, for the that they should not be considered for the effects

the Santa Catarina's State territory in the last fourteen years (1996-2010) is concentrated in recent contributions of AGUDO-PADRÓN (2008 b, 2010 a, b)

SYSTEMATIC SPECIES LISTS

I. MARINE FORMS

Total of others new 50 species

Based on the contributions of AGUDO-PADRÓN & BLEICKER (2008, 2009 a-b), CAREGNATO *et al* (2009), CdB (2009), RIOS (2009), JARDIM & SIMONE (2010)

Class POLYPLACOPHORA (1 species)

Family HANLEYIDAE (1 species)

Hanleya brachyplax Simone & Jardim, 2009
Species confirmed with occurrence in the State (off Cape Santa Marta, 250 m depth) by JARDIM & SIMONE (2010: 624)

Class GASTROPODA (35 species)

Family TROCHIDAE (3 species)

Falsimargarita terespina Simone, 2008
Gaza compta Simone & Cunha, 2006
Solariella (Suavotrochus) lubrica Dall, 1881 = *S. iridea* Dall, 1889
Species confirmed with occurrence in the State by Roberta Aguiar dos Santos (CEPSUL - ICMBio, Itajaí, SC, 13/04/2010, Pers. comm..)

Family EULIMIDAE (1 species)

Niso aeglees Bush, 1895

Family CAECIDAE (1 species)

Caecum eliezeri Absalão, 1997

Family TURBINIDAE (2 species)

Arene microforis (Dall, 1889) = *Arene notialis* Marini, 1975 *
Arene variabilis (Dall, 1889)
Species confirmed with occurrence in the State by Roberta Aguiar dos Santos (CEPSUL - ICMBio, Itajaí, SC, 13/04/2010, Pers. comm..)

Family BARLEEIDAE (1 species)

Crassitoniela rubrooperculata (Castellanos, 1972)
Species confirmed with occurrence in the State by Roberta Aguiar dos Santos (CEPSUL - ICMBio, Itajaí, SC, 13/04/2010, Pers. comm..)

Family JANTHINIDAE (1 species)

Janthina pallida (Thompson, 1840)
Species confirmed with occurrence in the State by Roberta Aguiar dos Santos (CEPSUL - ICMBio, Itajaí, SC, 13/04/2010, Pers. comm..)

Family NOTARCHIDAE (1 species)

Bursatella leachii Blainville, 1817 = *B. I. pleii* rang, 1818; *B. I. lacinulata* Gould, 1852
Species confirmed with occurrence in the State by Roberta Aguiar dos Santos (CEPSUL - ICMBio, Itajaí, SC, 13/04/2010, Pers. comm..)

Family TURRITELLIDAE (1 species)

Turritella hookeri Reeve, 1849

Family CALYPTRAEIDAE (1 species)

Crepidula pyguaia Simone, 2006

Family TONNIDAE (1 species)

Eudolium bairdii (Verrill & Smith, 1881)

Family CERITHIOPSIDAE (1 species)

Cerithiopsis bicolor (C. B. Adams, 1845)

Family CORALLIOPHILIDAE (1 species)

Coralliophila caribaea Abbott, 1958

Family BUCCINIDAE (1 species)

Cantharus auritula (Link, 1807)

Family COLUMBELLIDAE (3 species)

Anachis veleda (Duclos, 1846)
Anachis fenneli Radwin, 1968
Mitrella pusilla (Sowerby, 1844)

Family COSTELLARIIDAE (1 species)

Thala crassa Simone, 1995

Family CONIDAE (2 species)

Conus lemniscatus Reeve, 1849
Conus carcellesi Martins, 1945

Family TURRIDAE (3 species)

Drilliola loprestiana (Calcara, 1841)
Gemmula periscelida (Dall, 1875)
Gemmula mystica Simone, 2005

Family TEREBRIDAE (1 species)

Terebra spirosulcata Simone & Costa, 1999

Family PYRAMIDELLIDAE (8 species)

Turbonilla goytacazi Pimenta & Absalão, 2004
Turbonilla atypha Bush, 1899
Turbonilla turris (d'Orbigny, 1840)
Turbonilla farrouphila Pimenta & Absalão, 2004
Turbonilla rushi Bush, 1899
Turbonilla brasiliensis Clessin, 1900
Turbonilla kaapor Pimenta & Absalão, 2004
Turbonilla multicosta (C. B. Adams, 1850)

Family CHROMODORIDIDAE (1 species)

Hypselodoris lagensis García, Troncoso & Urgan, 1998

Class BIVALVIA (7 species)

Family MYTILIDAE (1 species)

Crenella decussatta (Montagu, 1808) = *divaricata*

Family PECTINIDAE (2 species) (Fig. 1)
Chlamys felipponei (Dall, 1922)
Cyclopecten nanus Verrill & Bush, 1897



Figure 1.- Some PECTINIDAE species of the “Pinheira Bay” região, Santa Catarina’s State (Ref.: AGUDO-PADRÓN & BLEICKER 2009 a). From left to right: *Chlamys muscosus* (Wood, 1828); *Argopecten gibbus* (Linnaeus, 1758) (little upper); *Leptopecten bavayi* (Dautzenberg, 1900) (little below); *Lyropecten nodosus* (Linnaeus, 1758); *Cyclopecten nanus* Verrill & Bush, 1897; *Chlamys felipponei* (Dall, 1922); *Chlamys tehuelchus* (d’Orbigny, 1846) (small specimen); *Argopecten noronhensis* (E. A. Smith, 1885); *Chlamys tehuelchus* (d’Orbigny, 1846) (big specimen). **Photo:** Bruno Kadletz (Guarda do Embau Village, Palhoça, SC)

Family LUCINIDAE (1 species)
Codakia (Ctena) pectinella C. B. Adams, 1852

Family VERTICORDIIDAE (1 species)
Spinospella agnes Simone & Cunha, 2008

Family SPORTELLIDAE (1 species)
Basterotia elliptica (Recluz, 1850)

Family PANDORIDAE (1 species)
Pandora bushiana Dall, 1886

Class CEPHALOPODA (14 species)

Family SEPIOLIDAE (1 species)
Semirroslia tenera (Verrill, 1880)

Species confirmed with occurrence in the State by Roberta Aguiar dos Santos (CEPSUL - ICMBio, Itajaí, SC, 13/04/2010, Pers. comm..)

Family HISTIOTEUTHIDAE (1 species)
Histioteuthis meleagroteuthis (Chun, 1910)

Family THYSANOTEUTHIDAE (1 species)
Thysanoteuthis rhombus Troschel, 1857 (Fig. 2)



Figure 2.- Squid *Thysanoteuthis rhombus* Troschel, 1857 coming from the coast of Santa Catarina’s, captured by tuna fishing boat. **Source:** “DIVE – Amigos do Joe” <http://www.amigosdojoe.com/noticias-of-dive-44.html>

Family LYCOTEUTHIDAE (1 species)
Lycoteuthis lorigera (Steenstrup, 1875) =
Lycoteuthis diadema

Species confirmed with occurrence in the State by Roberta Aguiar dos Santos (CEPSUL - ICMBio, Itajaí, SC, 13/04/2010, Pers. comm..)

Family ONYCHOTEUTHIDAE (1 species)
Moroteuthis ingens (Smith, 1881) (Fig. 3)

Family ENOPLOTEUTHIDAE (2 species)
Abralia veranyi (Rüppel, 1844) *
Abralia redfieldi Voss, 1955
 Species confirmed with occurrence in the State by Roberta Aguiar dos Santos (CEPSUL - ICMBio, Itajaí, SC, 13/04/2010, Pers. comm..)

Family ANCISTROCHEIRIDAE (1 species)
Ancistrocheirus lesueuri (d’Orbigny, 1942)
 Species confirmed with occurrence in the State by Roberta Aguiar dos Santos (CEPSUL - ICMBio, Itajaí, SC, 13/04/2010, Pers. comm..)

Family OMMASTREPHIDAE (2 species)
Ornithoteuthis antillarum Adam, 1957 *
Ommastrephes bartramii (Lesueur, 1821) *

Family OCTOPODIDAE (4 species)
Octopus tehuelchus d’Orbigny, 1834 *
Eledone massyae Voss, 1964 *
Eledone gaucha Haimovici, 1988 *
Vosseledone charrua Palacio, 1978
 Species confirmed with occurrence in the State by Roberta Aguiar dos Santos (CEPSUL - ICMBio, Itajaí, SC, 13/04/2010, Pers. comm..)



Figure 3.- Squid *Moroteuthis ingens* (Smith, 1881) coming from the coast of “Campeche Beach”, Santa Catarina Island, SC. Source: Local journalistic report (“Diário Catarinense”) <http://www.clicrbs.com.br/diariocatarinense/jsp/default.jsp?uf=2&local=18§ion=Geral&newsID=a2676513.xml>

II. FRESHWATER AND TERRESTRIAL FORMS

Total of others new 22 species
 Based on the contributions of MIQUEL *et al* (2007), THOMÉ *et al* (2007), AGUDO-PADRÓN (2008 a-b, 2009 a-b), SIMONE (2008) and OHLWEILER *et al* (2009)

Class GASTROPODA (20 species)
SubClass PROSOBRANCHIA (5 species)

Order CAENOGASTROPODA

- Family HELICINIDAE (1 species)
Helicina cf. *angulata* Sowerby, 1873
- Family HYDROBIIDAE (3 species)
Littoridina australis (d’Orbigny, 1835)
 Presented in AGUDO-PADRÓN (2009 a: 3) under the status *Littoridina* (= *Heleobia*) *piscium* (= *australis*)(d’Orbigny, 1835). Adjust of the species based on SIMONE (2006: 89, 91)
Littoridina piscium (d’Orbigny, 1835)
Potamolithus lapidum (d’Orbigny, 1835)
- Family THIARIDAE (1 genus & species)
Aylacostoma sp (Fig. 4)



Figure 4.- Native freshwater snails *Aylacostoma* sp Photo: Agudo-Padrón (Itajaí-Açu middle river basin, West of Blumenau city, SC)

SubClass GYMNOPHILA (1 species)

- Family VERONICELLIDAE (1 species)
Belocaulus willibaldoi Ohlweiler, Mota & Gomes, 2009 (Fig. 5)



Figure 5.- Native slug *Belocaulus willibaldoi* Ohlweiler, Mota & Gomes, 2009 Photo: Paulo Lenhard / Agudo-Padrón (Cachoeirinha, Great Porto Alegre, RS)

SubClass PULMONATA (14 species)

- Family ANCYLIDAE (3 species)
Hebetancyclus moricandi (d’Orbigny, 1846)
 Previously presented in AGUDO-PADRÓN (2008 b: 169) under the taxonomic status *Gundlachia moricandi* (d’Orbigny, 1846) ...
Laevapex sp
Uncancyclus concentricus (d’Orbigny, 1835)
- Family MILACIDAE (1 species)
Milax valentianus Férussac, 1821 (Fig. 6)

Previously presented in AGUDO-PADRÓN (2008 b: 170) under the taxonomic status *Lehmannia valentiana* (Férussac, 1823), and confirmed for the State in AGUDO-PADRÓN (2008 a)



Figure 6.- Exotic invasive european slugs *Milax valentianus* Férussac, 1821 Photo: Paulo Lenhard / Agudo-Padrón (Cachoeirinha, Great Porto Alegre, RS)

Family BULIMULIDAE (4 species)

Drymaeus acuminatus Da Costa, 1906

Drymaeus muelleggeri Jaekel, 1927

Based in "MCNU-S 034" (1 specime of "Pinheira", Palhoça Municipal District). See AGUD-PADRÓN *et al* (2010)

Drymaeus poecilus (d'Orbigny, 1835)

Referred in HAAS (1959: 365) for "Nova Teutônia", Western region of the State ...

Leiostracus vimineus (Moricand, 1833)

Family ODONTOSTOMIDAE (1 species)

Macrodontes thielei Pilsbry, 1930

Family VERTIGINIDAE (1 species)

Vertigo ovata Say, 1822

Referred in HAAS (1959: 365) for "Nova Teutônia", Western region of the State

Family STREPTAXIDAE (1 species)

Streptaxis pfeifferi (Pilsbry, 1930)

Family SYSTROPHIIDAE (1 species)

Happiella grata (Thiele, 1927)

Family PUNCTIDAE (1 species)

Paralaoma servilis (Shuttleworth, 1852)

Previously presented in AGUDO-PADRÓN (2008 b: 171)

Family GASTRODONTIDAE (1 species)

Zonitoides arboreus (Say, 1816)

Class BIVALVIA (2 species)

Order UNIONOIDA

Family MYCETOPODIDAE (1 species)

Anodontites elongatus (Swainson, 1823)

Order VENEROIDA

Family CORBICULIDAE (1 species)

Cyanocyclus (= *Neocorbicula*) *limosa* (Maton, 1809)

III. COMPLEMENTAL INFORMATIONS - CONTINENTAL FORMS

Class GASTROPODA

SubClass PROSOBRANCHIA

Order CAENOGASTROPODA

Family AMPULLARIIDAE

Pomacea lineata (Spix, 1827)

Previously presented in AGUDO-PADRÓN (2008 b: 151)

Family HYDROBIIDAE

Potamolithus kusteri (Ihering, 1893)

Previously presented in AGUDO-PADRÓN (2008 b: 152)

SubClass GYMNOPHILA

Family VERONICELLIDAE

Phyllocaulis boraceiensis Thomé, 1972

Native giant slug species (the largest from the Americas), conveniently described in SIMONE (2006: 95) and THOMÉ *et al* (2006: 52), it was already included previously in the inventory presented AGUDO-PADRÓN (2009 a: 3). Rare in the State territory, she presents few known occurrence registrations, including the Municipal Districts of Joinville (remaining German colony of Hansa), Blumenau (North to the State), and two localities in the Metropolitan region of the "Great Florianópolis" (capital thirst of the State) (Fig. 6): "Praia da Galheta" Municipal Ecological Park, in the Center-East coast of the Santa Catarina Island (two specimens presenting 180 length mm and 50 width mm) (Padrón 1999: 96; Agudo-Padrón 2008 b: 153), and most recently, in the urban continental neighborhood of "Capoeiras", city of Florianópolis (one specimen presenting 130 length mm, strolling among fruits, green vegetables and other agricultural products inside of commercial public establishment) (Fig. 7).



Figure 7.- Rare native giant slug *Phyllocaulis boraceiensis* Thomé, 1972 with its eggs, collected by us in the continental urban neighborhood of "Capoeiras." **Photo:** Agudo-Padrón (Capoeiras, Florianópolis, SC)

SubClass PULMONATA

Family SUCCINEIDAE

Omalonyx convexa (Heynemann, 1885)
Presented in AGUDO-PADRÓN (2009 a: 4) under the status *Omalonyx convexa* (Martens, 1868). Adjust of the species autor based on ARRUDA & THOMÉ (2008) ...

Family CHILINIDAE

Chilina fluminea (Maton, 1809)
Presented in AGUDO-PADRÓN (2009 a: 4) under the status *Chilina fluminea* (d'Orbigny, 1835). Adjust of the species autor based on SIMONE (2006: 97)

Family BULIMULIDAE

Drymaeus papyrifactus (Pilsbry, 1898)
Previously presented in AGUDO-PADRÓN (2008 b: 159)

Family HELMINTHOGLYTIDAE

Epiphragmophora semiclausa (Martens, 1868)
Presented in AGUDO-PADRÓN (2008 b: 166, 2009 a: 8), this species is a "mistaken geographical registration" that it doesn't correspond to the State (discarded), presented in SIMONE (2006: 248) and THOMÉ *et al* (2007: 22). Adjust based on correction of own SIMONE (2008: 31)

Class BIVALVIA

Order UNIONOIDA

Family MYCETOPODIDAE

Anodontites cf. moricandi (Lea, 1860)
Previously presented in AGUDO-PADRÓN (2008 b: 171)

Family HYRIIDAE

Diplodon parallelipedon (Lea, 1834)
Previously presented in AGUDO-PADRÓN (2008 b: 168)

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Suitable Host Fishes for the Rock Pocketbook, *Arcidens confragosus*

Nicole Ward¹, Bernard Sietman¹, Mark Hove², Karen Baumann¹, Andrew Edgcumbe¹, Cara Weggler¹

¹ MN Dept. of Natural Resources, Div. of Ecological & Water Resources, 500 Lafayette Road, Saint Paul 55155; nicole.ward@state.mn.us

² Univ. of Minnesota, Dept. of Fish., Wild. & Cons. Biol., St. Paul, MN 55108; mark_hove@umn.edu

The rock pocketbook (*Arcidens confragosus*) is an endangered species in Minnesota, with extant populations occurring in the Mississippi River below Saint Anthony Falls and the lower Saint Croix River. Channel catfish is the only species known to transform *A. confragosus* glochidia (Howells 1997), although rock bass, white crappie, gizzard shad, American eel and freshwater drum were reported to be naturally infested (Surber 1914; Wilson 1916).

To determine what fish species are potential hosts for the rock pocketbook, we ran laboratory trials on 47 fish species in 12 families using standard procedures (Neves *et al.* 1985). Gravid mussels were collected from the Mississippi River (RM 819) on 5 October 2010 and held in the laboratory until mature glochidia were released or extracted. Fishes were collected in various rivers and streams in central and southern Minnesota and southeastern Missouri, or obtained through hatcheries or the aquarium trade. We placed fish and glochidia in an aerated bath, and glochidia attachment to gills or fins was confirmed for at least one individual of each fish species tested. Three and six days after inoculation, we re-examined fish for encapsulated glochidia. If gills and fins were free of glochidia, the trial for that species ended. If glochidia were attached after day 6, all individuals of that fish species were placed together in a separate aquarium for monitoring. Aquarium floor water was siphoned every 3-4 days through a 125 μ mesh sieve. Siphonate was examined for juveniles with a dissecting microscope.

Twenty fish species (8 families) facilitated metamorphosis of *A. confragosus* glochidia, with Catostomidae and some Cyprinidae producing relatively more juveniles per fish. Our results with *A. confragosus* are similar to some other andontines (e.g. *Pyganodon*, *Strophitus*, and *Lasmigona*) that have been shown to have a broad spectrum of host suitability (Host/Parasite Database, 2010). We plan to continue *A. confragosus* host suitability trials in 2011.

Table 1. Fish species that facilitated metamorphosis of *Arcidens confragosus* glochidia.

<u>Fish Species*</u>	<u>No. Fish</u>	<u>No. of Juveniles Recovered</u>	<u>Fish Species*</u>	<u>No. Fish</u>	<u>No. of Juveniles Recovered</u>
<u>Catostomidae</u>			<u>Fundulidae</u>		
<i>Carpoides cyprinus</i>	1	92	<i>Fundulus diaphanus</i>	7	8
<i>Catostomus commersoni</i> [†]	5	102	<i>Fundulus olivaceus</i> ^{MO} (trial 1)	3	4
<i>Ictiobus bubalus</i>	1	620	<i>Fundulus olivaceus</i> ^{MO} (trial 2)	2	25
<i>Moxostoma macrolepidotum</i> [†]	3	37	<u>Ictaluridae</u>		
<i>Erimyzon oblongus</i> ^{MO}	2	43	<i>Ictalurus punctatus</i> ^{HR}	4	13
<u>Centrarchidae</u>			<u>Percidae</u>		
<i>Lepomis cyanellus</i>	2	1	<i>Sander vitreus</i> ^{HR} (trial 1)	11	2
<i>Lepomis humilis</i> (trial 1)	2	6	<i>Sander vitreus</i> (trial 2)	6	32
<i>Lepomis humilis</i> (trial 2)	6	1	<u>Umbridae</u>		
<u>Cyprinidae</u>			<i>Umbra limi</i>	2	32
<i>Notemigonis crysoleucas</i>	8	224	<u>Poeciliidae</u>		
<i>Rhinichthys cataractae</i>	8	7	<i>Poecilia sphenops</i> ^{AT}	12	8
<i>Semotilus atromaculatus</i>	1	82	<i>Poecilia reticulata</i> ^{AT}	13	1
<i>Luxilus zonatus</i> ^{MO}	1	2	<i>Xiphophorus maculatus</i> ^{AT}	12	5
<i>Luxilus chrysocephalus</i> ^{MO}	2	5			

MO—Fish wild caught in southeastern Missouri

HR—Fish obtained from Hatcheries

AT—Fish obtained through Aquarium Trade

EX— Exotic Species, wild caught in MN,

*Fishes that did not facilitate metamorphosis (n)

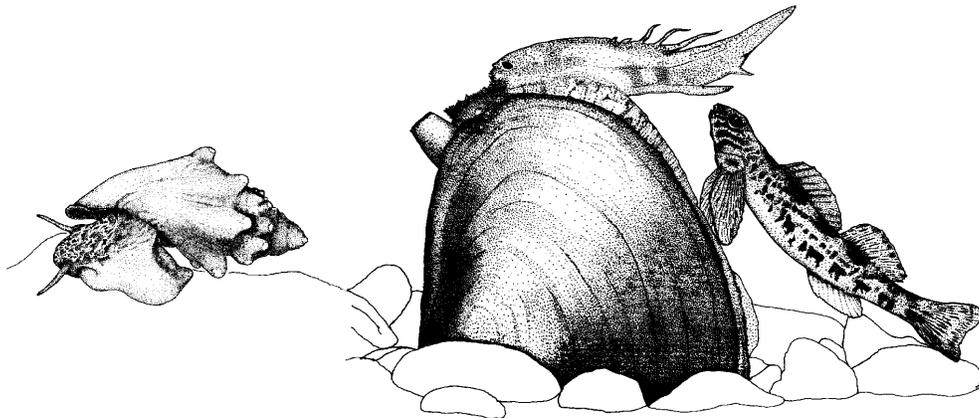
- **Centrarchidae:** *Ambloplites rupestris* (4), *Lepomis gibbosus* (3), *Lepomis macrochirus* (10), *Lepomis megalotis*^{MO} (3), *Lepomis microlophus*^{MO} (2), *Micropterus dolomieu* (3), *Micropterus salmoides* (13), *Pomoxis nigromaculatus*^{HR} (9)
- **Cyprinidae:** *Carassius auratus*^{EX} (14), *Cyprinella galactura*^{MO} (2), *Cyprinella spiloptera* (11), *Cyprinus carpio* (3), *Notropis nubilus*^{MO} (1), *Notropis volucellus* (1), *Pimephales notatus* (4)
- **Gasterosteidae:** *Culaea inconstans* (4)
- **Ictaluridae:** *Ameiurus melas* (10), *Noturus exilis* (3), *Noturus flavus* (4)
- **Lepisosteidae:** *Lepisosteus osseus* (2)
- **Percidae:** *Etheostoma exile* (6), *Perca flavescens* (4), *Percina caprodes* (10), *Sander canadense* (1)
- **Salmonidae:** *Oncorhynchus mykiss*^{HR} (1)
- **Sciaenidae:** *Aplodinotus grunniens* (2)
- **Poeciliidae:** *Gambusia affinis*^{MO} (3).

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North Carolina State University
Dept. of Environ. & Molecular Toxicology
Box 7633
Raleigh, NC 27695-7633
919-515-5296; Fax -7196
greg_cope@ncsu.edu

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University of Oklahoma
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Norman, OK 73019
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cvaughn@ou.edu

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636-281-1982; Fax: -0973
Hdunn@ecologicalspecialists.com

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PO Box 460
Norris, TN 37828
USGS: 865-545-4140 Ext 204
Cell: 865-776-9510
Home: 865-494-7389
ahlstedt@usgs.gov

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Awards

W. Gregory Cope
North Carolina State University
919-515-5296; Fax -7196
greg_cope@ncsu.edu

Teresa Newton
Upper Midwest Env't. Science Center
608-781-6217
tnewton@usgs.gov

Emy Monroe
University of South Dakota
emy.monroe@usd.edu

Environmental Quality & Affairs

Ryan Evans
Kentucky State Nature Preserves Comm.
502-573-2886; Fax -2355
Ryan.Evans@ky.gov

Steve McMurray
Missouri Dept. of Conservation
573-882-9909
stephen.mcmurray@mdc.mo.gov

Gastropod Status and Distribution

Paul D. Johnson
Alabama Aquatic Biodiversity Center
334-683-5000
paul.johnson@dcnr.alabama.gov

Jeff Powell
USFWS Daphne, AL
251-441-5181
jeff_powell@fws.gov

Genetics

David J. Berg
Miami University
513-785-3246
bergdj@MUOhio.edu

Guidelines and Techniques

Chuck Howard
TVA Biological Compliance
865-632-2092
cshowar1@tav.gov

Janet Clayton
West Virginia Div. Of Natural Resources
304-673-0245
janetclayton@wvdnr.gov

Information Exchange

G. Thomas Watters
OSU Museum of Biological Diversity
614-292-6170
Watters.1@osu.edu

John Jenkinson
Clinton, TN
865-457-0174
jjjenkinson@hotmail.com

Mussel Status and Distribution

Arthur E. Bogan
N.C. Museum of Natural Sciences
919-733-7450 Ext 753
arthur.bogan@ncmail.net

James D. Williams
Gainesville, FL
352-737-3743
fishwilliams@gmail.com

Outreach

Andy Roberts
USFWS Columbia MO
573-234-2132 Ext 110
andy_roberts@fws.gov

Tom Jones
Marshall University
304-389-5832
jonest@marshall.edu

Propagation, Restoration, & Introduction

Tony Brady
Natchitoches Nat. Fish Hatchery
318-352-5324
tony_brady@fws.gov

Rachel Mair
White Sulphur Spr. Nat. Fish Hatchery
304-536-136_
Rachel.Mair@fws.gov

Obituary -- Herbert David Athearn (1923 – 2011)



Herb Athearn at home in 2001 after receiving the FMCS William J. Clench Memorial Award.

Herbert David Athearn was born July 3, 1923, in Fall River, Bristol County, in the Commonwealth of Massachusetts. He was the oldest of 3 boys (William Dean Athearn and Thomas Athearn) born to Eleanor (Lown) Athearn and Roy Coombs Athearn. Roy Athearn worked at the Glenwood Range Company of Taurton, Massachusetts. Eleanor was a housewife but interested in nature and an avid birdwatcher. It was Eleanor who passed along a passion for the natural world to her son. Eleanor also had a small marine shell collection that she maintained until her death in the 1980's. Herb's father, Roy, was an avid collector of Native American arrowheads which were donated to the Somerset Chapter of the Massachusetts Archaeological Society. Herb attended grade school at the Wiley School in Fall River, and middle school at James Madison Morton Junior High School. Herb graduated in the spring of 1941 from the B.M.C. Durfee High School in Fall River, Massachusetts.

It was in early 1939 when Herb was 16 that he met James R. Miller who was employed by the Cambosco Scientific Company (Cambridge Botanical Society), a supplier of biological specimens for schools and universities. Herb worked as a field assistant to J.R. Miller for several years, and in fact skipped his high school graduation ceremony to complete a collecting trip in Louisiana. Over the next few months Herb traveled all over the country with J.R. Miller collecting specimens for Cambosco. These collections ranged from amphibians and reptiles in Louisiana to marine echinoderms off the Florida Keys. It was at this early age that Herb began his familiarity with the geography and rivers of the Southeastern United States. When they were not on a collection trip, J.R. Miller a member of the Boston Society of Natural History (BSNH), began taking Herb to their meetings.

Following the Japanese attack on Pearl Harbor, Herb volunteered for service in the Army Air Corps on December 26, 1941. He completed basic training at Keesler Field in Mississippi, then advanced training in gun turret operation in South Bend, Indiana. Additional training followed in anti-submarine warfare at Langley, Army Air Corps Base in Hampton, Virginia. Herb was trained to hunt for submarines and operate defensive guns from B-17's and B 24's. After the completion of anti-submarine training, Herb traveled to England aboard the Queen Elizabeth and was stationed in Newquay, England at the old St. Eval Field. At this time it was the original field, as the new St. Eval field was under construction about 7 kilometers away.

In early 1943, Herb was sent to North Africa and was stationed at Port Loutley, about 30 km northeast of Rabat, Morocco. He became part of the 1st anti-submarine squadron that contained about 25 crews. Herb's duties were to load and prepare aircraft for antisubmarine missions. He loaded and unloaded depth charges, cleaned and maintained guns, in addition to other general aircraft maintenance. His squadron lost a total of 4 - B-24's, but only 1 of these losses was to combat. The squadron managed to sink several German submarines in the waters surrounding the Straights of Gibraltar. In October, 1943 the US Navy took control of the anti-submarine operations from the US Army Air Force.

After his discharge from the US Army in 1944, Herb was employed by the Engineering Department of the Glenwood Range Company in Taunton, Massachusetts. The company manufactured heating, cooking, and combination stoves fueled by coal, gas, and wood. Herb's job was as sheet metal model maker constructing prototype stoves from design blueprints. Herb moved from his home in Fall River to a boarding house in Webster, Massachusetts for a short period of time before purchasing a 40-acre tree farm west of Camp Miles Standish in

Taunton. He also served as the post adjutant of the VFW Post 611 in Taunton, Massachusetts. Herb remained employed by the Glenwood Range Company until he moved to Cleveland, Tennessee in 1955.

From 1947 to 1954 Herb worked as a volunteer at the Museum of Comparative Zoology (MCZ) at Harvard University, Cambridge, Massachusetts. He was assigned the duties of a Curatorial Assistant and worked under the tutelage of William J. Clench and Ruth D. Turner. During his time at MCZ, Herb processed some of the historic Bryant Walker collection [MCZ accession number 941] that contained many of Walker's duplicate lots. This collection had been acquired in 1936, and was cataloged into the MCZ general collection. In addition to curatorial duties of historical material, Herb also completed many original field collections for the MCZ. Among the collections was material collected during extreme drought conditions in Louisiana (1953-54). During that period Herb also continued to periodically assist J.R. Miller with collections focusing on taxa other than freshwater mollusks for the Cambosco Scientific Company.

In 1945, Herb Athearn married Doris Rita DeYoung Wells from Halifax County, Nova Scotia. Herb met Doris during his brief stay at the Webster boarding house in 1944. The couple had an infant child die before their daughter, Marjorie Ann Athearn, was born in 1950; and another infant died before their son, Martin DeYoung Athearn, was born in 1953. Herb and Doris separated in 1970 and later divorced; however, they remained on good terms until Doris's death from a stroke in 2001. In fact, Herb purchased a house for Doris in the early 1980's, after she had remarried (to John Meyers). Herb married again in 1978 to Beatrice Ma Lyles of McMinn County, Tennessee but they divorced within a year. Beatrice died in the late 1990's.

Having made several trips to the South during his time at MCZ, Herb decided to relocate to the southeastern United States. In July 1955, Herb moved to Cleveland, Tennessee. He remained in the stove construction business, landing a job with Dixie Products, a private manufacturing company. Herb was in charge of quality control for manufacturing. Shortly after Herb began working for Dixie Products, it acquired the Magic Chief name and he remained an employee until late 1958. Herb was self-employed and worked at odd jobs for about 18 months, before he was hired by the U.S. Postal Service in March 1960. He was a letter carrier responsible for the City of Cleveland Route 4 for about 5 years, Cleveland City Route 13 for 2 years and then moved to City Route 17 for 16 years before retiring in 1983. He worked for the US Postal Service a total of 23 years. Herb was allowed to take leave of absences from his duties at the Postal Service to pursue long collection trips. It was during this time from 1955 to 1985 the bulk of his collection housed in what he named the Museum of Fluvial Mollusks (MFM) was collected. Herb also collected stamps and was fascinated by trains and trolleys.

History of the Collection

With some MCZ reference specimens and 7 years of curatorial experience, H.D. Athearn began to build a large freshwater mollusk collection of his own. The first specimens were cataloged into his collection on July 30, 1940. After a pause associated with the war, he began collecting freshwater mollusks again in 1946. These collections were focused primarily in the northeastern states, and Massachusetts in particular. Herb began intensively collecting freshwater mollusks of the southeast after moving to the Cleveland area in 1955. This collection would focus solely on freshwater snails, mussels, and fingernail clams, collected primarily from creeks and rivers. Herb was the first collector since Richard Ellsworth Call to complete such extensive collections in smaller drainages. As a consequence, much of the MFM collection is represented by headwater forms of mussels and snails. The cataloged collection contains 23,344 lots of specimens, the majority of which is freshwater mussels (\approx 13,200 lots). Many collections were also completed in drainages undergoing profound change from reservoir construction. It is not uncommon to find collection records from rivers before, during, and after dam construction (i.e. Caney Fork, Coosa River, Duck River, Elk River) in the MFM collection.

The collection was housed Herb's home in Bradley County, Tennessee. Large cabinets were constructed in four rooms to accommodate the freshwater mussel collection. An additional room was added in the late 1980's to house the remainder/majority of the mussel collection. The mussel cabinets were custom constructed of wood with thin steel slats to hold the trays. Individual trays were made of wood, and are identical in configuration to the system used at MCZ. Other than a reference collection of freshwater snails, only mussel lots were placed in the large wooden trays and were very accessible. Fingernail clams and snails were stored inside individual boxes and not easily accessible. All collection materials in the MFM are dried shell specimens.

Curation of specimens into the general collection was slowed by the continued collection of new materials. By 1980, curation had fallen a decade behind. As a result, a data gap exists from 1971-72 to 1980, representing specimens collected from nearly 800 localities. However, all materials collected by H.D. Athearn from 1946-71 and 1980-95 have been accessioned in the MFM collection. By 1980, Herb decided to give priority to cataloging newly collected specimens in an effort to keep up with newly acquired specimens. As a result, approximately 100 boxes of unprocessed collections from 1971-1980 remain un-cataloged. It is likely at least 25% of the collections have yet to be curated. All specimens in the cataloged collection have been recorded in a Master Catalog (9 Volumes) in addition to 2 separate card catalogs. One set of card files (3" x 5" note cards) details the species collected by state, and the other details the collection records by species. The note cards are a marvelous resource and the 3-fold reference system speaks to the detail of the curation. The MFM collection is exceptionally well curated, far better than most state museum collections. Another card catalog lists all of his freshwater molluscan reprints in alphabetical order.

Herbert D. Athearn is generally regarded as the most widely traveled and prodigious collector of freshwater mollusks in the 20th Century. No other individual made such widely dispersed and prolific collections of freshwater

mollusks. His collection records are often the first or only species locality data recorded for many water bodies. Among his most memorable collections were those made in Mexico (1966 and 1969) and his collections for the National Museum of Canada (1963 and 1965). Herb literally collected freshwater mollusks from Hudson Bay to the Yucatan Peninsula and from Nova Scotia to British Columbia. Also, he traded specimens with other collectors around the world to obtain representatives of additional species. As a result, the MFM contains mollusks from Europe and the Middle East, representing about 70 countries in the snail collection. It should be noted that of all the collections made by H.D. Athearn, he listed Choccolocco Creek, a tributary of the Coosa River in Alabama, as his favorite historical sampling location. It was not uncommon for Herb to collect more than 50 species of freshwater mollusks at several locations in that drainage.

The Freshwater Mollusk Conservation Society established the William J. Clench Memorial Award in 2000 to recognize outstanding contributions to the field of Malacology, including significant collections. Herb received the Clench Memorial Award in 2001 in recognition of his efforts to collect freshwater mollusks of the southeastern United States and his magnificent collection.

Interestingly, Herb did not keep his most valuable specimens. He deposited the type specimens of the three species he described in 1964 (*Alasmidonta mccordi*, *Lampsilis haddeltoni*, and *Villosa choctawensis*) in the National Museum of Canada. Additionally, duplicate lots of the earliest materials were sent to MCZ and Ohio State University Museum (OSUM) but the deposition of this material at other institutions slowed in the early 1960's. The collection contains 10 paratype and 6 syntype lots, mostly of freshwater snails. Herb has been honored with 4 patronyms: *Athearnia* Morrison, 1971; *Goniobasis athearni* Clench and Turner, 1956; *Physa jennessi athearni* Clarke, 1973 and *Pleurobema athearni* Gangloff, Williams and Feminella, 2006.

Initially, approximately 2000 lots of duplicate specimens of lots cataloged into the collection were transferred to the North Carolina State Museum of Natural Sciences, Raleigh in 2004. In July 2007, all of the 23,344 cataloged lots of freshwater mollusks from over 6800 localities and about 100 boxes of uncataloged collections were transferred to the North Carolina State Museum of Natural Sciences. The collection included a very large collection of topographic sheets used during Herb's collecting with locality annotations. He also donated his cross index card files, his collection of reprints, and copies of freshwater Malacological literature.

It is clear that Herbert D. Athearn's most tangible legacy to freshwater malacology is his collection. Herb passed away January 9, 2011 at age 87. He is greatly missed.

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Arthur E. Bogan¹ and Paul D. Johnson²

¹Research Curator of Aquatic Invertebrates, North Carolina State Museum of Natural Sciences, MCS
1626, Research Laboratory, Raleigh, NC 27699-1626 USA

²Program Supervisor, Alabama Aquatic Biodiversity Center, Alabama Department of Conservation and Natural Resources, 2200 Highway 175, Marion, AL 36756-5769

Parting Shot



Part of the **Falls of the Ohio**, originally a series of rapids where the Ohio River dropped 26 feet over a distance of two and a half miles. This was the only navigation hazard along the length of the Ohio River that was formed by rock outcrops. His 1820 Monograph indicates that Rafinesque collected here. Photograph taken by John Jenkinson in July, 2007 from the (State of Indiana) Falls of the Ohio State Park, I-65 Exit 0, just across the river from downtown Louisville.

If you would like to contribute a freshwater mollusk-related photograph for use as a **Parting Shot** in *Ellipsaria*, e-mail the picture, caption, and photo credit to jjjenkinson@hotmail.com.

