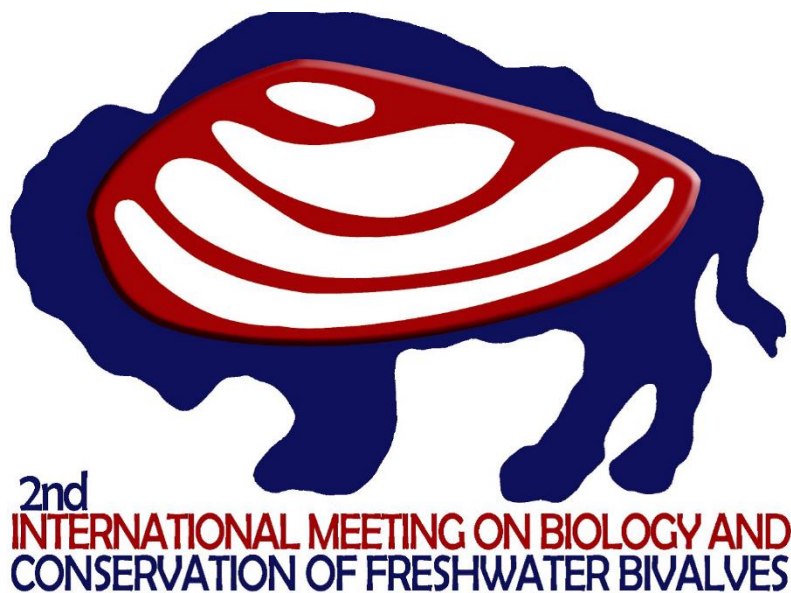




**Newsletter of the Freshwater Mollusk Conservation Society**  
**Volume 17 – Number 4** **December 2015**

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**Lyubov Burlakova, Knut Mehler, Alexander Karatayev, and Manuel Lopes-Lima**

On October 4-8, 2015, the Great Lakes Center of Buffalo State College hosted the Second International Meeting on Biology and Conservation of Freshwater Bivalves. This meeting brought together over 80 scientists from 19 countries on four continents (Europe, North America, South America, and Australia). Representation from the United States was rather low, but that was expected, as several other meetings on freshwater molluscs were held in the USA earlier in the year.

The First International Meeting on Biology and Conservation of Freshwater Bivalves was held in Bragança, Portugal, in 2012. That meeting was organized by Manuel Lopes-Lima and his colleagues from several academic institutions in Portugal. In addition to being a research scientist with the University of Porto, Portugal, Manuel is the IUCN Coordinator of the Red List Authority on Freshwater Bivalves. The goal of the first meeting was to create a network of international experts in biology and conservation of freshwater bivalves to develop collaborative projects and global directives for their protection and conservation. The Bragança meeting was very productive in uniting freshwater mussel biologists from European countries with their colleagues in North and South America. The meeting format did not include concurrent sessions, which allowed everyone to attend to every talk and all of the plenary talks by leading scientists. Among other things, the first meeting resulted in a paper "Conservation Status of Freshwater Mussels in Europe: State of the Art and Future Challenges" that was recently accepted for publication in *Biological Reviews*. During the first meeting, it was decided that a second international meeting should follow on a different continent. That goal was achieved at the Second International Meeting in Buffalo.

At the Buffalo Meeting, we followed the same format as before: avoiding concurrent sessions and inviting plenary speakers. The 56 oral talks and 26 posters presented by senior and young scientists in Buffalo covered



diverse topics including biogeography, genetics, impact of invasive species, physiology, systematics and taxonomy, parasitology, fish-host relationships, and conservation and threats to species and ecosystems. Art Bogan shared new data on unionid taxonomy, Jurgen Geist described important steps that can



improve mussel conservation success, and Daelyn Woolnough presented exciting research and beautiful pictures of her undergraduate students on variation in glochidia. Among many others, there were talks on unionids from Turkey, Romania, Australia, Indochina, Brazil, Malaysia, Russia, and Italy; about conservation efforts in Portugal and Sweden; and on the effect of dreissenids on unionids in the Hudson River, New York, and Lough Key, a lake in Ireland.

In the first of our four keynote talks, Caryn Vaughn (U of Oklahoma) presented a comprehensive review of ecosystem services provided by freshwater bivalves. Manuel Lopes-Lima provided a broad overview of IUCN conservation efforts. Kevin Cummings (Illinois Natural History Survey) reviewed the freshwater bivalve fauna of South America and shared his exciting experience and amazing images from the recent expedition in Brazil. Alexander Karatayev (Director of the Great Lakes Center) presented his findings on taxonomic comparison of endangered and exotic molluscs in North America, providing evidence that invasive molluscs cannot replace the taxonomic diversity we are losing because the rate of extinction is twice as high as the rate of introduction.



The conference was held in downtown Buffalo, the second largest city in New York State, located on the eastern shore of Lake Erie and at the head of the Niagara River. The hotel was a short distance from such prominent architectural jewels as St. Paul's Episcopal Cathedral (by Upjohn) and the Prudential Building (by Sullivan). Lunches were excellent, thanks to the Hyatt Regency chief. Dave Strayer kindly brought a bushel of delicious New York apples for all of us to munch on – thank you again, Dave!

During the sunny and warm fourth “field” day of the meeting, there were trips to Niagara Falls and Letchworth State Park – the magnificent “Grand Canyon of the East” -- with forests in beautiful autumn foliage and cascading waterfalls. Both field trips were completely sold out or, should we say, oversold. A miscount of the number of seats on the bus resulted in organizing committee member Knut Mehler providing a private tour for Ioan Sirbu from Romania. Fortunately, Ioan kept his humor and spent a great day with his colleague Ana and Knut at Niagara Falls.

The closing picnic for the Buffalo meeting was held at the Field Station on Lake Erie and Niagara River, where the well-known Buffalo chicken wings, pizza, and beer were served to the participants. Due to the great success of this meeting, the participants agreed to continue meeting together in the future.

International meetings such as this are very fruitful in exchanging knowledge and new ideas, and stimulating international research. Many scientists used the conference as an opportunity to enhance collaboration, and to start or accelerate ongoing projects. Selected communications presented at the Buffalo meeting will be published as a “*Special Issue on Ecology and Conservation of Freshwater Bivalves*” in *Hydrobiologia*, Springer. We also discussed further development of these meetings. The Freshwater Mollusk Conservation Society recently formed an International Committee to facilitate joint meetings between North American and other freshwater malacologists around the world.

We sincerely thank our conference sponsors: Freshwater Mollusk Conservation Society; EnviroScience; U.S. Fish & Wildlife Service; Great Lakes Research Consortium; New York Department of Environmental Conservation, and the Great Lakes Center. The Malacological Society of London provided travel funds for students.

This meeting was a success because of months of careful preparation and communications by the Organizing Committee (mostly by Knut Mehler), the dedicated help of our secretary Susan Dickinson, our photographer and digital manager undergraduate student Dilaikshan Rajendran, Great Lakes Center technicians Katie Hastings and Josh Fisher, and graduate student Jo Johnson.

For more information about this international meeting and access to abstracts of the presented papers, please visit our website: <http://greatlakescenter.buffalostate.edu/>.





Here are some candid images from the 2015 International Meeting in Buffalo, New York



## Society News

### 2016 FMCS Workshop Population Genetics and Freshwater Mollusk Conservation

February 16-19, 2016

National Conservation Training Center (NCTC), Shepherdstown, West Virginia

The 2016 FMCS Genetics Workshop has been designed for both biologists who are involved in the conservation and management of freshwater mollusks, and those pursuing research with imperiled mollusks. The emphasis of the workshop will be on understanding how genetic tools may inform conservation and management decisions. The speakers will presume that attendees have a background in biology, but may need to have their knowledge of basic genetics and related topics refreshed in order to become comfortable with conservation genetic principles and applications. Participants who complete this workshop will:

- 1) understand methods used to quantify genetic diversity within and among populations;
- 2) gain experience using software to quantify concepts such as genetic divergence, gene flow, and genetically effective population size;
- 3) be familiar with genetic methods for delineating populations and species;
- 4) be introduced to state-of-the-art advances and techniques in conservation genetics.

#### **Workshop Schedule**

Both days of the Workshop will include presentations on concepts of conservation genetics and laboratory sessions where participants will gain experience analyzing genetic data with user-friendly software. All sessions will emphasize the use of genetic data to inform management of imperiled species.

**Tuesday, February 16:** arrival at NCTC, registration, dinner, and social

#### **Wednesday, February 17**

##### Morning Session: *Introduction to Conservation Genetics*

Dr. David J. Berg, Department of Biology, Miami University

Dr. Kentaro Inoue, Department of Ecology and Ecosystem Management, Technical University of Munich

- Introduction and genetics refresher
- Genetic structure within and among populations  
allelic richness, heterozygosity,  $F_{ST}$ , and gene flow
- Laboratory Session I  
use of GenAlEx (Genetic Analysis in Excel)

##### Afternoon Session: *Big Trouble in Little Populations*

Dr. Curt L. Elderkin, Department of Biology, The College of New Jersey

Dr. Emy M. Monroe, Whitney Genetics Lab, U.S. Fish & Wildlife Service

- Loss of genetic variation in populations of conservation concern  
inbreeding, genetic drift, genetically effective population size ( $N_e$ )
- Laboratory Session II  
quantifying inbreeding, genetic drift, and  $N_e$

Evening Session

- Poster session: *Advances in Freshwater Mollusk Conservation*
- Social (concurrent with poster session)

**Thursday, February 18**Morning Session: *Phylogenetics and Species Delineation*

Dr. Kevin J. Roe, Department of Natural Resource Ecology and Management, Iowa State University

Dr. David M. Hayes, Department of Biological Sciences, Eastern Kentucky University

- Population and species delineation  
distinct populations and management units, phylogeography
- Laboratory Session III  
use of phylogeographic tools

Afternoon Session: *New Directions in Conservation Genetics*

- Environmental DNA (eDNA) for detecting biodiversity  
Emy Monroe & David Hayes
- Genetics and Captive Propagation of Freshwater Mollusks  
David Berg
- PLENARY PRESENTATION: Introduction to Conservation Genomics  
Dr. Gordon Luikart, Division of Biological Sciences, University of Montana
- “Review session”: How can these tools be used?

Evening Session

- Social, discussion of all the cool things learned

**Friday, February 19:** departure after breakfast**Plenary Speaker**

The Plenary Presentation speaker for this workshop is Dr. Gordon Luikart. After receiving his Ph.D. under Drs. Fred Allendorf and J. T. Hogg at the University of Montana, Dr. Luikart held several postdoctoral fellowships and research scientist appointments at the National Center for Scientific Research in Grenoble, France. In 2005, Dr. Luikart returned to the University of Montana, where he is Professor of Conservation Ecology and Genetics at Flathead Lake Biological Station in the Division of Biological Sciences. In 2014, he was named one of “The World’s Most Influential Scientific Minds” by Thomson Reuters for being one of the most highly-cited authors of peer-reviewed scientific papers published between 2002 and 2013.

Continuing to collaborate with Fred Allendorf and other colleagues at Flathead Lake Biological Station, Dr. Luikart’s research uses genetic principles and tools to address questions of conservation in natural, domesticated, and invasive populations. Recently, much of this work has focused on the application of genomics to questions of conservation. He has authored a seminal book, *Conservation and the Genetics of Populations*, the third edition of which will be released in 2016. Dr. Luikart has authored well over 100 papers in peer-reviewed journals such as *Science*, *Trends in Ecology & Evolution*, *Proceedings of the National Academy of Sciences*, *Conservation Biology*, and *Molecular Ecology*.



**Calling All Students!**

We need bodies to work the registration table, answer questions, and help out at the Workshop. Want to earn a little cash? Contact Curt Elderkin ([curtelderkin@gmail.com](mailto:curtelderkin@gmail.com)) or David Berg ([bergdj@miaohio.edu](mailto:bergdj@miaohio.edu)) for more information.

**Note to Attendees:**

Our intention is for this workshop to introduce you to the analysis of genetic data and the use of such data in support of conservation and management activities (i.e., this course has a lab). While NCTC can provide some computers for your use, please bring your laptop if possible. We will contact you in January with a list of free software to download onto your computer before the workshop.

**Registration:**

Much more information about the Workshop, the Poster Session, lodging and amenities at NCTC, and a registration form are available on the FMCS 2016 Workshop webpage: [http://molluskconservation.org/EVENTS/2016Workshop/2016\\_FMCS-Workshop.html](http://molluskconservation.org/EVENTS/2016Workshop/2016_FMCS-Workshop.html). Early registration ends on December 31, 2015. Registration rates are:

| Category            | Before Dec 31 | After Dec 31 |
|---------------------|---------------|--------------|
| FMCS Member         | \$160         | \$220        |
| Non-Member          | \$200         | \$260        |
| FMCS Student Member | \$140         | \$200        |
| Student Non-Member  | \$160         | \$220        |

We look forward to seeing you at NCTC.



Save the Date  
**COME TO CLEVELAND IN 2017**

**10<sup>th</sup> Biennial Symposium of the Freshwater Mollusk Conservation Society**

**Sunday, 03/26/2017 - Thursday, 03/30/2017**

Cleveland Marriott Downtown at Key Center  
127 Public Square, Cleveland, Ohio 44114

Symposium Theme and More Details Coming

*Event Chairs:*

Rebecca Winterringer – [rwinterringer@trcsolutions.com](mailto:rwinterringer@trcsolutions.com)  
Greg Zimmerman – [gzimmerman@enviromscienceinc.com](mailto:gzimmerman@enviromscienceinc.com)

### **Workshop Topics Still Needed for 2018!**

We are still looking for ideas to be addressed during the FMCS Workshop in calendar year 2018. We also will need volunteers to organize and help conduct that workshop. If you have a topic you would like to see addressed in a Workshop and/or would like to help with the 2018 Workshop, please contact Heidi Dunn at [HDunn@ecologicalspecialists.com](mailto:HDunn@ecologicalspecialists.com). Now is the time to speak up about what you would love to see covered in one of our workshops !

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### **Financial Advice Still Needed, Too!**

FMCS is forming a Finance Committee to consider how to best invest funds not being used for day-to-day operations. Some members also have expressed an interest in donating or bequeathing funds to the society. We are looking for expertise on potential tax issues and investments. Anyone interested in serving on this committee, please contact President-elect Heidi Dunn at [HDunn@ecologicalspecialists.com](mailto:HDunn@ecologicalspecialists.com)

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### **Update on the Revised National Strategy**

After several years of coordinated work by lots of FMCS members, the revised National Strategy for the Conservation of Freshwater Mollusks has been submitted for publication. Here is some history on this important benchmark and planning tool.

In 1998, A National Strategy for the Conservation of Freshwater Mussels was published by the National Native Mussel Conservation Committee (the precursor organization to FMCS). In 2005, the FMCS Executive Committee (EXCOM) decided to update the 1998 National Strategy and, in 2007, a presentation made at the symposium in Little Rock, Arkansas, reviewed what has occurred since the 1998 Strategy was published. In 2011, the President appointed an ad hoc committee to revise the National Strategy, including broadening the scope to include freshwater snails. In 2012, the ad hoc committee led a brainstorming session with the EXCOM at the Athens, Georgia, workshop, from which the committee developed a list of issues and goals in freshwater mollusk conservation which also was reviewed by the EXCOM. In January 2013, the committee hosted a series of four interactive webinars to solicit input from FMCS members on the draft issues, goals, and strategies in the developing document and, in March 2013, the committee consolidated all input and presented a revised set of issues, goals, and strategies to the FMCS membership at the symposium in Guntersville, Alabama. In 2014, the committee solicited FMCS members to draft specific sections addressing each of the issues. In July 2015, a draft manuscript, co-authored by 11 FMCS members, was submitted to the Society's new journal *Freshwater Mollusk Biology and Conservation* (FMBC) and, in September 2015, the authors received comments back from the editors. The authors are currently making revisions to the manuscript, intending to submit the revision to FMBC in December 2015. Stay tuned!! It is nearly done.

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## **FMCS is Helping to Update the 2003 AFS Fish and Mussel Kills Publication**

The American Fisheries Society (AFS) Special Publication 30 -- *Investigation and Monetary Values of Fish and Freshwater Mussel Kills* (SP30) is the hallmark reference for many agencies when they investigate and determine restitution for fish and mussel kills. The last update, published in 2003, included values for freshwater mussels for the first time. Because we are recognized as the authority on freshwater mussels, FMCS provided substantial support and input in developing the mussel values and methodology used in the 2003 document. SP30 has become the legal precedence, often codified in law and upheld by numerous court challenges, for assigning restitution in many states.

AFS and Southwick Associates, Inc. are in the process of updating the 2003 publication. There have been numerous advancements in mussel propagation over the past decade and this update is long overdue. The FMCS Guidelines and Techniques Committee has been tasked with advising Southwick Associates, Inc. on the update of AFS SP30. We will be forming a discussion group within FMCS to provide insight and guidance on how different states and regions handle freshwater mussel kills and pollution events, and what methodologies they have been using to successfully evaluate these events. The revised publication, unlike the one published in 2003, also may include values for affected gastropods.

The methodology to update values starts with a comprehensive survey of state, federal, and private aquaculture facilities. Our discussion group, with assistance from the Propagation Committee, will develop a list of propagation facilities, qualified individuals, and/or organizations that will be surveyed to provide the background data required to develop updated propagation costs. When these surveys are distributed (hopefully in January), please feel free to forward the request to other qualified persons throughout the nation; we want to make sure all qualified individuals and/or organizations get a chance to provide feedback. The discussion group also is looking for individuals to provide input on updating survey methodologies, statistical analyses, and application of the various economic scenarios that are also contained in SP30. Those interested in participating in this discussion group should contact Mary McCann at [Mary.McCann@hdrinc.com](mailto:Mary.McCann@hdrinc.com).

## **Regional Meetings**

### **FMCS Regional Mollusk Meeting Assistance Award Program**

As described in the December 2012 issue of *Ellipsaria*, the FMCS has established a Regional Mollusk Meeting Assistance Award Program to facilitate regional mollusk meetings that address local and regional concerns with freshwater mollusk conservation and management. Our interest in assisting with these meetings is to bring people together who work with freshwater mollusks to exchange information on how to conserve and protect this faunal group. These meetings are often attended by a variety of individuals, including agency personnel, academia, private citizens, scientists, and others, some of whom may not be FMCS members. Therefore, a secondary goal of this program is to increase the awareness of, and membership in, FMCS among individuals in these groups. Support is provided via a cash award of \$100 to the regional group to help defray the costs (e.g., meeting room rental, speaker travel, break refreshments, etc.) associated with holding their meeting. It is anticipated that about 15-20 awards will be made in a given calendar year.

The complete program description and application form may be obtained from the Awards Committee website at [http://www.molluskconservation.org/Mservices\\_awards.html](http://www.molluskconservation.org/Mservices_awards.html). One copy of the completed

application must be received by the Chair of the Awards Committee at least two months prior to the Regional Mollusk Meeting to allow for application and payment processing.

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### **Chesapeake Bay Freshwater Mussel Workgroup Meeting January, 2016, Annapolis, Maryland.**

The sixth meeting of the Chesapeake Bay Freshwater Mussel Workgroup will be held at the U.S. Fish & Wildlife Service, in Annapolis, Maryland. Traditionally, this meeting is held on the Wednesday or Thursday of the second full week in January (13<sup>th</sup> or 14<sup>th</sup> this year), but is dependent upon the availability of the web conferencing equipment. The need for a second, short, day of focused topic discussion is determined based upon participant interest and time. This meeting is open to anyone, but is primarily attended by resource agency biologists, consultants, and others interested in and working on freshwater mussels in rivers and streams of the Bay area. Teleconferencing and webcast capabilities will be available for those interested in participating but cannot travel. Light refreshments and pastries are provided in the morning. We particularly encourage students to attend who might be interested or involved to increase their exposure to the issues mussels face in the region. Past presentations and topics of discussion have included mussel ecology and propagation, basin-wide inventories, state and federal updates on species listing, FERC relicensing, plus more.

For more information, contact Julie Devers at [julie.devers@fws.gov](mailto:julie.devers@fws.gov) or Matt Ashton at [matthew.ashton@maryland.gov](mailto:matthew.ashton@maryland.gov). Further details are sent via email, including a call for presentations, attendees, and a request for those in need of conference capabilities. Information is primarily sent through a distribution list of past and interested attendees, but also will be posted on the Unio list-serve.

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### **Ohio River Valley Ecosystem Mussel Group Meeting October 20 – 21, 2015 Thomas More College, Kentucky**

Big Thanks to Dr. Chris Lorentz and Dr. Emily Imhoff for hosting us!  
[38 people listed on sign-up sheet]

#### **Day 1**

##### Dave Berg – Miami University of Ohio

Predicting the effects of climate change on *Cumberlandia monodonta*. Most are panmixic, but one population is isolated in the Ouachita system. Ecological niche model using climate and land use data. Predicting suitable habitat under two scenarios of temp increases due to climate change. By 2070, up to 70% range reduction. Increased isolation because of less dispersal. More population divergence occurs. Diversity declines are based on genetic drift only, under no climate change. Under two climate change conditions, many populations lose variation and genetic diversity. These will become separate management units. Still no known host fish. Kentucky came close to in vitro transformation this year.

Suggestions to look for more populations in under-sampled areas, take genetic samples. Do we want to mix, or allow natural selection? Need to identify the objective first: maintain historic diversity or acclimation?

##### Wendell Haag – US Forest Service

Effects of water and sediment factors on juvenile mussel survival, sites spanned gradient of conditions. Healthy, intermediate, and degraded. Used silos and cages as enclosures, *L. cardium* as test organism, 16 per silo, 5 silos per set, 12 week exposure in situ (May – Sept.), with water and sediment samples. Looked at ammonia also. Silo data looked at first. Pattern of survival not determinative, but growth data was interesting. Mean increase in length was clustered by stream category. Highest growth in Bluegrass Region, lowest in streams that had lost their fauna.

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Jacob Culp – Kentucky Division of Water

Early look at water quality (WQ) data, all 23 sites were at WQ sampling stations, with long term data sets. 165 analytes, 60 parameters had hits above detection limits. Ammonia data is hard to quantify. Negative correlation of growth with nitrates/nitrites, barium, and herbicides (atrazine and metalochlor). Positive with TOC, potassium. Sediment data also going to be analyzed. Plus diatoms. Food sources would be important. And metabolism impacts. Would like to repeat with different genera, and look at C13/C14 ratios.

Andy Johnson – Huntington District, Corps of Engineers

Maintenance dredging program update. History of coordination and monitoring, goal to avoid mussel impacts. Looking at sediment deposition and turbidity. Studies of steering currents and effects on different areas below the dams. New system records and transmits real time data.

Sept. 24 data, turbidity steering well. Then the water level dropped. On Sept. 25th, turbidity increased, DO dropped also to less than 3, sediment piled up quickly. Changed disposal location to previous day's location. Up to 3 cm deposition by the 26<sup>th</sup>. Refuge and State of West Virginia dive teams happened to be working in the Greenup Pool on the 25<sup>th</sup>, 4 miles below the dredge operation, and the river looked horrible, bank to bank turbid. Visibility was < one foot at the Butler ramp area, while it was eight+ feet upstream in the Belleville Pool. Finally, rain events helped flush out sediment. Better to dredge during the highest flow events. Clamshell dredge with dump scow better, (but upland disposal would be best!!) And they are looking for an engineering solution to the deposition. There is no nutrient monitoring at present.

Mike Miller, University of Cincinnati.

Zebra mussels in the Ohio River, long term trends and impacts. Origin, settlement, and then eventual crash in year 2000. Density and individual size relationships. Still not near the densities seen in the 1990s. Occasional spikes seen, but never to early levels. Impacts to native mussels well documented. Shell coverage, launching out of substrate, biomass load, starving, oxygen deprivation, etc. Impacts on the ecosystem? Carbon budget, plankton vs. FPOM driven. They are eating mostly C3 plants and detritus in winter, algae in summer. They can remove algae as pseudofeces, including *Microcystis*, reject it back into water unharmed. HAB in 2015 – what were the causative factors? Low flow, warm temps, nutrient concentration, zebra mussels? General conclusions – zebra mussels declined in 2000 and have not rebounded to their densities and life expectancy (size) of the early and mid-1990s. They seem to settle each year but not all survive overwinter. Predators are keyed into them now, too.

Jeremy Tiemann – Illinois Natural History Survey

Vermillion River (Wabash drainage). Recovery actions underway for the northern riffleshell and clubshell. Need to establish ten populations within historic range to lead to recovery. Process for translocation described. eight sites now established in the Vermillion over four years, 11 monitoring events. Detections 42% *E. t. rangiana* and 80% *P. clava*, and overall 94% monthly survival. Animals migrating downstream also. Recent manure spill accident with 100,000 gallons near relocation site. Killed fish, and found one dead mudpuppy. Few fresh dead mussels found, they probably clammed up and rode it out. Some dam removals being planned and are underway. News flash – seems to be new *Corbicula* species invading the Illinois River. *C. largillaerti* and *C. squalida*.

Patty Morrison – Ohio River Islands National Wildlife Refuge

2013 CRI grant update, we are three years into the four species recovery project. Recap of progress thus far and possible plans for the future follow-up 2016 CRI project with additional species and conservation actions.

Tyler Hern – White Sulfur Springs National Fish Hatchery

Dual focus of the hatchery – rainbow trout egg production and imperiled aquatic species recovery. Restart occurred when Tyler arrived last year. They house and culture fish, mussels, algae. Transitioning to more of a production facility to produce large numbers of individuals instead of research focus. Renovating ponds and using local ponds in county. Can use ponds as refugia also. Can mix water from ponds with well and spring water. Currently working with five species (two endangered), and grew out six other species produced earlier to stocking size this year. Started crayfish culture this year!!

Leroy Koch – US Fish and Wildlife Service, Frankfort, Kentucky

Three studies underway in Green River, *Pleurobema* genetics work. Another involves *Epioblasma* and what is required to establish an ark population. Collaboration with Paul Johnson in Alabama on seston component of food for mussels. Ohio River rabbitsfoot is now found up to mile 726 near Cannelton,



Kentucky, along Indiana side. *P. cyphus* being found at many sites looked at in the Ohio River, the Ohio may be the stronghold. One live *O. retusa* female in the Green River!! Need to look for more. Thomas More College cooperative project going on. Green River, removal of old defunct Corps dam are on the horizon. Monument Ave Dam being removed in Dayton, Ohio, along the Great Miami River.

#### Chad Lewis – Lewis Environmental

Ohio River surveys in Newburgh Pool. An average of 10-14 species found in historic brail surveys by Clarke in the early 1990s. All beds have 20 to 24 species now. *P. cyphus* present alive in 4 beds. A total of 30 species found. *L. abrupta* found below Kentucky Dam. On Green River, *Cumberlandia* and *O. retusa*, found in Pool 6.

#### Janet Clayton – West Virginia Division of Natural Resources

Pilot studies for *P. clava* and *E. t. rangiana* were monitored this year, and follow-up stockings done with PA mussels. A total of 400 *C. stegaria* stocked in West Virginia in 2010, only 13 have never been seen again. Elk River mark-recapture done this year. Evaluating long term populations and possible impacts of otter on small mussels. Dunkard Creek restoration involved releasing inoculated fish and translocating adults. So far, added 17 species and 3200 individuals. Monitoring turned up adults, but no juveniles yet.

West Fork River, in the Monongahela drainage, dam removal projects in development. Trying to remove three dams now near Clarksburg, West Virginia. One snuffbox found. Call for help for salvage. Criteria for salvage discussed. Air temp above freezing (most critical), water temp maybe not as important but flowing.

West Virginia Mussel Survey Protocols, please review and get comments in to Janet by Jan 1<sup>st</sup>.

#### Nevin Welte – Pennsylvania Fish and Boat Commission

Fish and Boat Commission settled with Murray Energy for \$2.5 million for Dunkard Creek kill. From follow up surveys this year, no live mussels yet found in the Pennsylvania portion. They are developing a Restoration Plan right now.

## **Day 2**

#### Jeff Thomas - ORSANCO

Pollution control standards. Mixing zone revisions underway. State by state management of prohibitions. Ammonia criteria is adopted and is more stringent. Site-specific criteria has table for areas with no mussels, burden is on applicant. Procedure not yet there. Impacts to dischargers unknown at this point. Should be on their website. New triennial review will include chloride and impacts to aquatics. New executive director on board. May be able to use mussel recovery as success story for the river.

#### Dave Hayes – Eastern Kentucky University

eDNA and identification of mussel communities. Detecting DNA from environmental samples. Uses short fragments, < 200 bp, can be single species specific. Difficult if organism occurs with close relatives in community. There are also community screens for multiple taxa. Meta bar coding. Lots of limitations too. Good tool for rare species detections, complements traditional surveys. Sources are sperm, feeding activity.

Determining feasibility. Sampled outflow from Frankfort hatchery. Tried to identify species present from water samples. Phase II will be here at Thomas More. May need to get local specimens rather than relying on Gen Bank. The longer the fragment, the more recent the DNA is.

#### Jordan Allison, PAFBC

Mussel re-introductions in Pennsylvania (PA) sourced from Hunter Station bridge replacement. Restoration of species into historic waterways in PA. Five sites in two rivers: Conewango and Shenango pilot studies with *P. clava* and *E. t. rangiana*. Did monitoring at one month (PIT tag reader) and one year (using excavations). Looked at survival and migration out of the cells. What is acceptable survival and out-migration of pilot animals to allow more to be stocked? Monitoring differs, age of animals moved differs. Sample area too.

#### Mike Compton, Kentucky (KY) State Nature Preserves

2015 work. *Villosa ortmanni* in KY. Thought it was only Green River endemic, but found in the Cumberland system also. Only Rough River has recruiting populations at this point, but some streams not looked at yet.

South Fork Kentucky River mussel assessment. Where are the hotspots? What else is going on in the system? Looked at 20-mile segment, 54 sampling events, 12-15 species per site, density ~ 30 per m<sup>2</sup>,

some visited multiple times. No evidence of rabbitsfoot. Round hickorynut found at 15 sites. Long solid at 12 sites, almost all old. Little spectaclecase at 3 sites. Snuffbox at 7 sites, 10 live.

Green River, looked at 25 mile section. Looking for clubshell and other rare species. Tagged four clubshell. No snuffbox, but rabbitsfoot at most sites, clubshell at 4 sites, one had 16 individuals.

Travis Bailey, Kentucky Department of Fish and Wildlife Resources

Purple catpaw mussel. Ten adults (males and females) and 40 juveniles in the hatchery system. Growing well. Some close to sexual maturity. What to do with them?

Took ~ 15,000 northern riffleshells and clubshells from PA. Held in Licking River water at KY State. 100 died right after shipping. Tagged there. Starting release after three weeks, into six sites in Licking River. Clubshell burrowed faster than riffleshell. 1% mortality clubshell to 19% mortality riffleshell while held in KY. Held too dense? Not enough water exchange? Too much handling? Animals already stressed? Review of KY sampling projects and mussel species propagated from 2011 – 2015. Discussion of populations and genetics implications.

Ryan Schwegman, Enviroscience, Inc.

Muddy Creek surveys on Erie National Wildlife Refuge, mussels doing well and widespread on the refuge. Recruitment of all listed species documented.

Hunter Station Mussel Salvage and Relocation Project.

Greg Zimmerman, Enviroscience

Background and roundtable discussion. Salvage began in August 2015 in crane pad areas first, will continue into 2017. Did quadrats to estimate density and surface animals. Multiple passes per cell. Nine entities received mussels. 10% PIT tagged, 15% Hallprint, the rest glitter tagged, blue this year. Average of 2000 to 3000 per day collected, held in river two days on average. Described transport and holding techniques, as they varied by state and cooperator. Should repeat pathogen and zebra mussel testing each year to be confident in skipping quarantine. Lessons learned to be summarized over winter. Need a better calendar of who gets what and when. Data summary for 2015 (preliminary) ~ 38,000 total mussels, *E. t. rangiana* 9,400, *P. clava* 18,000; the rest were common species and a few *V. fabalis* and *P. cyphus*.

Eric Chapman, WPC, QA/QC

They helped with some initial salvage and QA/QC in 50 cells. 2 passes get 90% of the mussels. Vegetation (eelgrass, *Valisneria americana*) had to be removed to get at the mussels. Great first year effort on site. All the data indicate the numbers will be the much higher than USGS data indicated in 2001.

Think about tagging requirements, and methods used for adhering PIT tags. Need to choose the best adhesive. Moving now into using dental bonding agent called Bondic. Need to have sufficient cover to protect the glass tag.

Stocking densities vary, 3 to 15 per M<sup>2</sup>. No one has found recruitment yet from pilot stockings. How far away to look?

Set up control study at the bridge site, under the bridge and just beyond.

Questions to answer: How many do we need per site for reproducing population? What is the best density? Do incremental stockings over time? Adults, then juveniles?

Need sites to stock, either by cooperators or Enviroscience, with back up sites when cooperators cannot stock themselves. Standby sites in PA very important.

Take fewer at a time, not too many to hold safely. KY experience may show that improvements are needed in how to hold. Stress in holding and tagging.

What is acceptable risk? What is acceptable mortality? (After year 1, for CRI, we set 50% as target for detection to proceed further.) For Kanawha Falls, found 26 pings of 100 stocked, and only two dead shells.

End of February 2016, be ready to discuss next steps.

Do manuscript as case study for this project. Some cooperators go out seasonally to check the mussels, others do annual checks. Maybe do overall section, then state by state write-ups. Address permitting, policy, etc. Recommend standard monitoring protocol, minimums at least.

**Next meeting: Nov. 2<sup>nd</sup> and 3<sup>rd</sup>, 2016. Miami University, Ohio (to be hosted by Dave Berg)**

Summary provided by Patty Morrison, Ohio River Islands National Wildlife Refuge

## Upcoming Meetings

**February 16 – 19, 2016** – FMCS Workshop: Population Genetics and Freshwater Mollusk Conservation, National Conservation Training Center, Shepherdstown, West Virginia  
<http://molluskconservation.org/Events.html>

**February 22 – 26, 2016** – National Shellfisheries Association 108<sup>th</sup> Annual Meeting, Las Vegas, Nevada, USA Theme: “*All in for Aquaculture*” <http://www.shellfish.org/annual-meeting> .

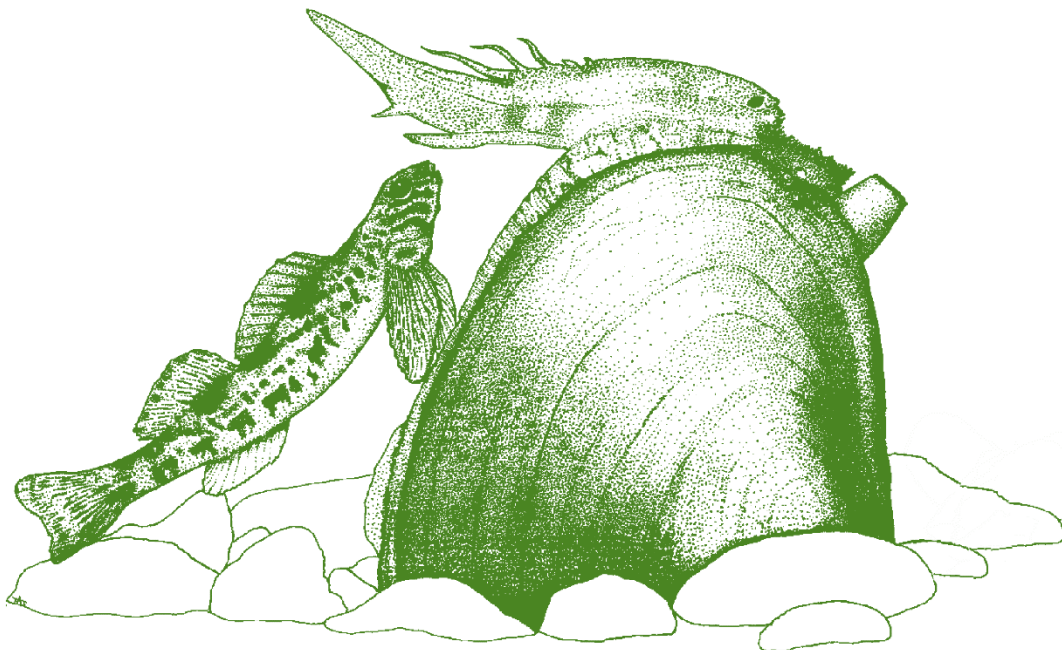
**May 21 – 26, 2016** – Society for Freshwater Science Annual Meeting, Sacramento Convention Center, Sacramento, California Theme: “*Running on Empty.*” <http://sfsannualmeeting.org/SFS2016.cfm>

**July 2016** – Society for Conservation Biology North American Sectional Meeting, Madison Wisconsin  
<http://scbnorthamerica.org/naccb2016/>

**Summer 2016** – American Malacological Society 82<sup>nd</sup> Annual Meeting, .  
<http://www.malacological.org/meetings.html>

**March 26 – 30, 2017** – FMCS 10th Biennial Symposium, Cleveland, Ohio theme yet to be determined

**Spring (?) 2018** – FMCS Workshop, Topic and location yet to be determined.





## Contributed Articles

*The following articles have been contributed by FMCS members and others interested in freshwater mollusks. These contributions are incorporated into Ellipsaria without peer review and with minimal editing. The opinions expressed are those of the authors.*

### Host Confirmed for *Potamilus amphichaenus* and *Potamilus metnecktayi*

**Ben Bosman<sup>1\*</sup>, Barrett Christie<sup>2</sup>, Michael Hart<sup>1</sup>, Jennifer Morton<sup>1</sup>, and Charles Randklev<sup>1</sup>**

<sup>1</sup> Institute of Renewable Natural Resources - Texas A&M University, College Station, Texas

<sup>2</sup> Dallas Zoo and Children's Aquarium at Fair Park, Dallas, Texas

\* [ben.bosman@ag.tamu.edu](mailto:ben.bosman@ag.tamu.edu)

The Texas heelsplitter (*Potamilus amphichaenus*) is endemic to the Sabine-Trinity Province of Eastern Texas and Western Louisiana (Haag 2012), while the Salina mucket (*Potamilus metnecktayi*) is endemic to the Rio Grande watershed (Howells et al 1996). Both are considered state-threatened by Texas Parks and Wildlife (TPWD 2010) and under consideration for listing under the Federal Endangered Species Act (USFWS 2009). Freshwater Drum (*Aplodinotus grunniens*) are thought to be the sole host for mussels in the genus *Potamilus* (Sietman et al 2009) and we tested that association explicitly for *P. amphichaenus* and *P. metnecktayi*.

Gravid *P. amphichaenus* females were obtained from Grapevine Lake (Denton Creek; Trinity River drainage) on November 5, 2014, and held in 10°C well water until the date of inoculation. Gravid *P. metnecktayi* females were collected from the Rio Grande near Dryden, Texas on May 15, 2015, and chilled at ~10°C in wet mesh bags until trial initiation on May 19 then moved to 10°C well water.

Two naïve Freshwater Drum (~23cm TL) from the Langston University Aquaculture ponds (Langston, Oklahoma) were inoculated in a 5K/L solution of *P. amphichaenus* glochidia at the Children's Aquarium at Fair Park on March 16, 2015. Glochidia were observed to be 100% viable per NaCl exposure upon extraction from two female mussels. Those fish were rinsed, then held in individual tanks at 23 ± 1°C following inoculation and monitored every 2-4 days until completion of transformation. Fewer than 10 untransformed glochidia were observed per fish during the study (99.85% ± 1.5% transformation); however, the axe-shaped glochidia may not have been captured by the 125µm mesh sieves that we used. Metamorphosis occurred 19 to 33 days post-inoculation, producing 1,982 and 1,435 juveniles per fish.

The same fish were inoculated again on May 19, 2015, in a 5K/L solution of 100% viable glochidia from two *P. metnecktayi* females. A third Freshwater Drum (~26cm TL) from a local hatchery pond was inoculated in a 3K/L solution of 100% viable glochidia from the same two *P. metnecktayi* females on May 21, 2015. All three fish were held in the same manner at 24.5 ± 1.5 °C and data collected as above. Metamorphosis occurred from 13 to 28 days post-inoculation. Transformation rates of *P. metnecktayi* glochidia were 50.0% ± 1.8% for the two previously tested fish (2,011 and 2,440 transformed juveniles each), and 27.6% for the naïve individual (626 juveniles transformed). Juveniles of both *Potamilus* species grew noticeably beyond the glochidial shell while encysted, as mentioned in Sietman et al (2009).

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### New or Confirmed Hosts for Freshwater Mussels

**T. Gibson, J. Halmbacher, and G.T. Watters**, The Ohio State University, and  
Columbus Zoo and Aquarium Freshwater Mollusc Research Facility

#### ***Actinonaias ligamentina ligamentina* (Lamarck, 1819)**

Laboratory transformations are reported for the Mucket, *Actinonaias ligamentina ligamentina* (Lamarck, 1819). The mussels were collected from French Creek, Pennsylvania. Glochidia were flushed from the female's gills using a water-filled syringe. The glochidia were then placed in a bucket of aerated water with potential host fishes listed in the table. A fathead minnow was also tested but did not transform any glochidia.

| Fish Species    | Days to transformation | # Juveniles | % transformed | Temp C | Date Infected |
|-----------------|------------------------|-------------|---------------|--------|---------------|
| Yellow Perch    | 13 days                | 61          | 17.33%        | 22     | 9/17/2015     |
| Largemouth Bass | 18 days                | 39          | 22.54%        | 22     | 9/17/2015     |
| Creek Chub      | 13 days                | 9           | 4.33%         | 22     | 9/17/2015     |
| Blacknose Dace  | 33 days                | 1           | 0.31%         | 22     | 9/17/2015     |

#### ***Villosa fabalis* (Lea, 1831)**

Laboratory transformations are reported for the Rayed Bean, *Villosa fabalis* (Lea, 1831), a Federally Endangered species. The mussels were collected by Envirosience, Inc. from the Allegheny River, Pennsylvania. Glochidia were flushed from the female's gills using a water-filled syringe. The glochidia were then placed in a bucket of aerated water with potential host fishes. In addition to the fish listed in the table, the following fish were tested but yielded no transformed glochidia: bluegill (two trials), fathead minnow (two trials), bluntnose minnow, blacknose dace, spotted darter, rainbow darter, largemouth bass, creek chub (two trials), common shiner (two trials), golden shiner, rockbass, variegated darter, guppy, and greenside darter.

| Fish Species    | Days to transformation | # Juveniles | % transformed | Temp C | Date Infected |
|-----------------|------------------------|-------------|---------------|--------|---------------|
| Logperch darter | 18 days                | 15          | 68%           | 22     | 6/1/2015      |

#### ***Lampsilis radiata luteola* (Lamarck, 1819)**

Laboratory transformations are reported for the Fatmucket, *Lampsilis radiata luteola* (Lamarck, 1819). The mussels were collected from a quarry in Prospect, Ohio. Glochidia were flushed from the female's gills using a water-filled syringe. The glochidia were then placed in a bucket of aerated water with potential host fishes. In addition to the fish listed in the table, the following fishes were tested but yielded no transformed glochidia: spotted darter, scarlet shiner, white hogsucker, guppies (three trials), blacknose dace, fathead minnow, variegated darter, and emerald shiner.

| Fish Species | Days to transformation | # Juveniles | % transformed | Temp C | Date Infected |
|--------------|------------------------|-------------|---------------|--------|---------------|
| Guppies      | 16                     | 7           | 11.29%        | 22     | 10/3/2015     |

***Lampsilis fasciola* (Rafinesque, 1820)**

Laboratory transformations are reported for the Wavy-rayed Pocketbook, *Lampsilis fasciola* (Rafinesque, 1820). The mussels were collected from the Allegheny River, Pennsylvania. Glochidia were flushed from the female's gills using a water-filled syringe. The glochidia were then placed in a bucket of aerated water with potential host fishes. In addition to the fishes listed in the table, the following fishes were tested but yielded no transformed glochidia: rockbass, striped shiner, sunfish, and creek chub.

| Fish Species     | Days to transformation | # Juveniles | % transformed | Temp C | Date Infected |
|------------------|------------------------|-------------|---------------|--------|---------------|
| Bluntnose minnow | 28 days                | 2           | 2.47%         | 22     | 9/25/2015     |
| Largemouth bass  | 19 days                | 10          | 8.67%         | 22     | 9/25/2015     |

All of these studies were funded by the Ohio Biological Conservation Partnership, the Columbus Zoo and Aquarium, and the US Fish and Wildlife Service.

### **Presence of *Alasmidonta varicosa* (Brook Floater) Nursery in Turkey Creek, Savannah River Basin: New Information on Brook Floater in the Slate Belt Region of South Carolina, USA.**

**Snehal S. Mhatre<sup>1</sup>, Alan Johnson<sup>1</sup>, and Morgan Wolf<sup>2</sup>**

<sup>1</sup> Department of Forestry and Environmental Conservation (FEC)- College of Agriculture, Forestry and Life Sciences, Clemson University, Clemson, South Carolina, 29634. [smhatre@clemson.edu](mailto:smhatre@clemson.edu) and [alanj@clemson.edu](mailto:alanj@clemson.edu)

<sup>2</sup> U.S. Fish and Wildlife Service, 176 Croghan Spur Road, Suite 200, Charleston, South Carolina 29407. [morgan\\_wolf@fws.gov](mailto:morgan_wolf@fws.gov)

The southeastern United States has a rich fauna of freshwater bivalves, particularly mussels in the family Unionidae. The Savannah River Basin contains at least 26 unionid species, most of which are listed as endangered, threatened, or of special concern at the state level, and a few of which are listed or under consideration for listing at the federal level (The Catena Group, 2007). The Brook Floater, *Alasmidonta varicosa*, is considered globally vulnerable (G3) and listed as critically imperiled (S1) in ten states in the USA (NatureServe, 2005). South Carolina is the only state known to have isolated populations of Brook Floater susceptible to decline which are not listed on the state's endangered species list (probably due to data and information gaps). In the Savannah River basin, Brook Floaters have experienced significant declines in recent years because of habitat loss due to hydrologic alterations and impoundments.

In August 2015, during the occupancy estimation study of unionids in the Savannah River conducted as a part of the senior author's PhD research project, we had the opportunity to sample freshwater mussels in Turkey Creek, in Sumter National Forest, Edgefield County, South Carolina. We used visual and tactile methods to look for the mussel species and encountered a nursery with recruiting population of *Alasmidonta varicosa* (Figure 1). The nursery consisted of nine Brook Floaters, three of which were juveniles (Figure 2). This nursery was located in a shallow pool that had good water quality, stable streambanks with firm substrate and moderate flow.

The Brook Floater, *Alasmidonta varicosa* (Lamarck, 1819), is a medium-sized freshwater mussel (50-65 mm long) with a kidney-shaped shell. The shell is relatively thin and has tiny ridges on the posterior edge that run perpendicular to the growth lines making the surface look corrugated. The shell is yellowish, greenish or brownish to black in color with dark rays running longitudinally from top to bottom. The Brook Floater has an orange colored foot (Figure 3) that is exposed when live individuals are removed from the substrate (Bogan and Alderman 2008).





Figure 1. Specimens of *Alasmidonta varicosa* from Turkey Creek, Edgefield Co., South Carolina



Figure 2. Juvenile *Alasmidonta varicosa* from Turkey Creek, Edgefield Co., South Carolina



Figure 3. Specimen of *Alasmidonta varicosa* from Turkey Creek, showing the orange-colored foot.

The range of the Brook Floater extends along the east coast from eastern Canada to the Savannah River basin in South Carolina and Georgia. The Chattooga River, near the South Carolina/Georgia state line supports the most viable southern population of this species. This is the first time that a recruiting nursery of Brook Floater has been found in the Slate Belt region of South Carolina, south of the Chattooga River. It is vital that shallow streams like Turkey Creek are surveyed and monitored on a regular basis to maintain the recruiting status of Brook Floater and prevent local extirpations of this state threatened species that is yet to receive federal protection.

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## Initial Survey of the Freshwater Bivalve Fauna of Peninsular Malaysia

Arthur E. Bogan<sup>1</sup>, Manuel Lopes-Lima<sup>2</sup>, Ronaldo Sousa<sup>3</sup>, and Alexandra Zieritz<sup>4</sup>

<sup>1</sup> North Carolina Museum of Natural Sciences, 11 West Jones St. Raleigh, North Carolina 27601.

[arthur.bogan@naturalsciences.org](mailto:arthur.bogan@naturalsciences.org);

<sup>2</sup> CIIMAR-UP – Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Rua dos Bragas 289, 4050-123 Porto, Portugal. [lopeslima.ciimar@gmail.com](mailto:lopeslima.ciimar@gmail.com);

<sup>3</sup> CBMA – Centre of Molecular and Environmental Biology, Department of Biology, University of Minho, Campos de Gualtar, 4710-057 Braga, Portugal. [rg.eco.sousa@gmail.com](mailto:rg.eco.sousa@gmail.com);

<sup>4</sup> School of Geography, University of Nottingham Malaysia Campus, Jalan Broga, 43500 Semenyih, Selangor, Malaysia. [alexandra.zieritz@nottingham.edu.my](mailto:alexandra.zieritz@nottingham.edu.my)

The freshwater bivalve fauna of peninsular Malaysia remains poorly known. This is particularly unfortunate, as pollution and changes in land-use are heavily impacting this imperilled faunal group. One major impact on the aquatic fauna is the expansion of the acreage of oil palm plantations and removal of tropical forest. Creeks and rivers become steep sided, flat bottomed canals to move the water off of oil palm plantations. Riparian buffers along these streams have been removed, altering the flow regime, water temperature and organic input into the streams. This will have consequences for important ecosystem functions and services.

We undertook this survey, partially funded by the Mohamed bin Zayed Species Conservation Fund, during two weeks in February, 2015, as the first of a series of planned surveys across Malaysia to determine the diversity and conservation status of the unionid bivalves. Two local students, Lye Hwei Mynn and Farah Najwa Mahadzir, of University of Nottingham, Malaysia Campus, Kuala Lumpur, participated in the trip as translators and to assist with collection of water quality data. We stayed at a variety of hotels and at the Kenyir Research Station, hosted by Dr. Sam Walton, University of Malaysia Terengganu.

In Malaysia, we did not find freshwater mollusks sold in markets, so we talked to local people about where they had seen freshwater mussels and used the limited known historical collection data to help direct our initial collecting efforts. This is different from the field experience in Vietnam by one of the authors (AB), where collecting was aided by talking to women selling freshwater bivalves in the markets as food.

This trip covered ca. 3,500 km, visiting 61 sites, to assess the freshwater bivalve fauna and to collect environmental data. We collected in 8 of the 11 provinces of peninsular Malaysia. In total, 19 of 61 sites (31%) produced representatives of eight species of Unionidae. Tissue snips were taken nonlethally from all live-collected specimens. Tissue snips were placed into vials with 100% ethyl alcohol for use in future research projects. All live unionid specimens were photographed and returned to their original habitat, with the exception of a small sample which was retained and preserved in 100% ethyl alcohol as voucher specimens. All specimens retained as vouchers and tissue samples were initially deposited with the Museum of Zoology, University of Malaysia, Kuala Lumpur, Malaysia. A subset of the preserved specimens were donated to the Mollusk Collection, North Carolina Museum of Natural Sciences. Specimens such as those of *Rectidens*, *Contradens* and *Hyriopsis* are being used in a current higher level study of the relationships of the subfamilies and tribes of the Unionidae of Asia.

Other freshwater mollusks that were encountered included a variety of shell forms of *Corbicula*, which were collected for planned genetic analyses, and introduced Apple snails of the genus *Pomacea* (Ampullariidae). We also collected the native thiarid gastropods, *Brotia* sp. and *Tarebia granifera*, and some viviparid gastropods.

Data collected during this trip will form the basis for our initial assessment of the distribution of each species and a preliminary conservation assessment of these Malaysian species to update the IUCN conservation status. In the near future, we plan to conduct freshwater bivalve surveys in the Malayan provinces of Sabah and Sarawak on the island of Borneo, to document the endemic unionid species.





An example of the impact of oil palm plantations on a small stream in central Malaysia.



Manuel Lopes-Lima collecting in the Pahang River in Pahang Province, holding our first specimen of *Hyriopsis bialatus*.



Field work in the mud with (left to right) Manuel Lopes-Lima, Renaldo Sousa, and Alexandra Zieritz.



Manuel Lopes-Lima, Lye Hwei Mynn, and Alexandra Zieritz preparing samples of *Contradens*, *Pseudodon* and *Rectidens* on the head of an island in the Perak River, Perak Province, Malaysia.

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**Additional Information Concerning the Conquest of Europe by the  
Invasive Chinese Pond Mussel *Sinanodonta woodiana*, 40.  
News from the Czech Republic, France, and Poland**

**Henk K. Mienis**, The Steinhardt Museum of Natural History – Israel National Center for Biodiversity Studies, Tel Aviv University, IL-6997801 Tel Aviv, Israel, and National Natural History Collections, Berman Building, Hebrew University of Jerusalem, Edmond J. Safra Campus, IL-9190401 Jerusalem, Israel. [mienis@netzer.org.il](mailto:mienis@netzer.org.il)

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Papers dealing with the presence of the invasive Chinese Pond mussel *Sinanodonta woodiana* (Lea, 1834) in Europe continue to appear. Here is some new information from the Czech Republic, France, and Poland.

### The Czech Republic

An international team consisting of Romanian and Czech scientists described the development of nine new polymorphic microsatellite loci for the Chinese Pond mussel (Popa *et al.*, 2015). They also combined new and previously described loci into three multiplex sets allowing reducing the time and money costs of genotyping.

Another international team consisting of scientists from the Czech Republic, Poland, Romania, and the United Kingdom studied the bitterling *Rhodeus amarus* – mussel *Sinanodonta woodiana* association among two populations of the invasive Chinese Pond mussel and four populations of the European bitterling (Reichard *et al.*, 2015). There were notable differences in the capacity of parasitic larvae of the invasive mussel to exploit *Rhodeus amarus* in a Danudian than on a Baltic lineage, while maladaptive oviposition by *Rhodeus amarus* into *Sinanodonta woodiana* varied among populations. They argue for a shift from a species-centred to population-centred perspective of the impacts of invasions.

### France

After a first specimen of the Chinese Pond mussel had been found in the Canal du Midi near Aiguevives in Haute Garonne in November 2013, more than 50 specimens ranging in size from 5 to 18 cm were discovered in another part of the same canal near Avignonet-Lauragais, Haute Garonne in January 2015 (Ticot & Bourdet, 2015). According to the authors, this and two other invasive mussel species: *Corbicula fluminea* and *Dreissena polymorpha*, may endanger the native mussels present in the Canal du Midi. Among these native mussels is the highly endangered *Margaritifera auricularia* (Spengler, 1793), which is often placed in the genus *Pseudunio*.

Costa (2015) reports the find of extremely large specimens (up to 30 cm and a weight of 800-900 grams) of the Chinese Pond mussel in the forest pond Romé, in the wood Forêt de la Reine in Lorraine, Northern France.

### Poland

Histological studies of the ovaries and testes throughout the reproductive cycle of *Sinanodonta woodiana* from the Konin Lake have shown that these invasive mussels are capable of spawning from March until October. However the highest reproductive activity in females occurred from March to April.

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## Molluscs on Water Lilies, 2: Snails and Mussels on *Nuphar lutea* in Monnickendam, the Netherlands

**Henk K. Mienis**, The Steinhardt Museum of Natural History – Israel National Center for Biodiversity Studies, Tel Aviv University, IL-6997801 Tel Aviv, Israel, and  
National Natural History Collections, Berman Building, Hebrew University of Jerusalem, Edmond J. Safra Campus, IL-9190401 Jerusalem, Israel. [mienis@netzer.org.il](mailto:mienis@netzer.org.il)

Some time ago, I published a short note on aquatic molluscs encountered on the leaves of Water Lilies in Edam, the Netherlands (Mienis, 2013). In the same year that I focused on that subject (1998), I also made some observations on the presence of snails and mussels on the floating leaves of the Yellow Pond lily *Nuphar lutea* in the nearby village Monnickendam. I have repeated such an observation at almost the same spot in Monnickendam a few weeks ago, in autumn 2015.

Both observations (made on 22 September 1998 and 10 September 2015) were carried out in a broad ditch running parallel the Vesting in Monnickendam, North-Holland, the Netherlands. The ditch was densely covered by the Yellow Pond lily, here and there with specimens of the White Water lily *Nymphaea alba* (Figure 1). Even the leaves of non-flowering plants could be easily identified because the stem of the *Nymphaea* leaf is always round, while that of *Nuphar* has a triangular shape. During both dates, 10 floating leaves were cut of the plant, taken out of the water, and inspected for the presence of freshwater molluscs. The results are presented in Tables 1 and 2.

In both years, nine different mollusk species were collected on the leaves, of which seven were shared: *Bithynia leachii*, *Bithynia tentaculata*, *Acroloxus lacustris*, *Physa fontinalis*, *Physella acuta*, *Ferrissia clessiniana*, and *Dreissena polymorpha*. Three of them have to be considered exotic, invasive species: *Physella acuta*, *Ferrissia clessiniana* and *Dreissena polymorpha*.

In autumn 1998, two species were found which were not seen in autumn 2015: *Gyraulus albus* and *Gyraulus crista*. Likewise, in autumn 2015, two species were found which were absent in autumn 1998: *Lymnaea stagnalis* and *Anisus vortex* (Table 3). In 1998, a total of 66 specimens were found on the 10 leaves which means a mean number of 6.6 specimens per leaf, while in 2015, only 31 specimens were counted, i.e. a mean number of 3.1 specimens per leaf. This difference may have been caused by the presence of a large number of filamentous algae on the underside of the leaves in 2015, while the leaves were almost free of adhering algae in 1998.



Figure 1. The broad ditch along the Vesting in Monnickendam, North-Holland, the Netherlands, with dense stands of *Nuphar lutea* and some *Nymphaea alba*. Photograph by the author on 10 Sept. 2015.

### Reference:

Mienis, H.K. 2013. Molluscs on Water Lilies, 1: Snails and Mussels on *Nymphaea alba* and *Nuphar lutea* in Edam, the Netherlands. *Ellipsaria*, 15 (2):29-31.

Table 1: Monnickendam, broad ditch along the Vesting, north-side, aquatic molluscs on 10 leaves (1-10) of *Nuphar lutea*, 22 September 1998

| Species                      | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Percent Occupation of Leaves | Mean Specimens per Leaf |
|------------------------------|---|---|---|---|---|---|---|---|---|----|------------------------------|-------------------------|
| <i>Bithynia leachii</i>      | - | - | - | - | - | - | - | 1 | - | -  | 10%                          | 0.1                     |
| <i>Bithynia tentaculata</i>  | - | - | - | - | - | - | - | 1 | - | -  | 10%                          | 0.1                     |
| <i>Acroloxus lacustris</i>   | - | 4 | 1 | - | 5 | 5 | - | 5 | 2 | 2  | 70%                          | 2.4                     |
| <i>Physa fontinalis</i>      | - | - | - | - | 3 | - | 1 | - | - | -  | 20%                          | 0.4                     |
| <i>Physella acuta</i>        | 1 | - | - | - | - | - | - | - | - | -  | 10%                          | 0.1                     |
| <i>Ferrissia clessiniana</i> | 1 | 4 | 2 | 2 | 2 | - | 2 | 1 | 2 | 1  | 90%                          | 1.7                     |
| <i>Gyraulus albus</i>        | 1 | - | - | 1 | - | - | - | - | - | -  | 20%                          | 0.2                     |
| <i>Gyraulus crista</i>       | - | - | - | - | - | 2 | - | - | - | -  | 10%                          | 0.2                     |
| <i>Dreissena polymorpha</i>  | - | 3 | - | 1 | - | 4 | 1 | - | 3 | 2  | 60%                          | 1.4                     |

Table 2: Monnickendam, broad ditch along the Vesting, north-side, aquatic molluscs on 10 leaves (1-10) of *Nuphar lutea*, 10 September 2015

| Species                      | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | Percent Occupation of Leaves | Mean Specimens per Leaf |
|------------------------------|---|---|---|---|---|---|---|---|---|----|------------------------------|-------------------------|
| <i>Bithynia leachii</i>      | 2 | 2 | 1 | - | - | - | - | - | - | 1  | 40%                          | 0.6                     |
| <i>Bithynia tentaculata</i>  | - | - | - | - | 1 | 1 | 1 | - | 1 | -  | 40%                          | 0.4                     |
| <i>Acroloxus lacustris</i>   | - | 1 | - | - | - | - | 2 | - | - | -  | 20%                          | 0.3                     |
| <i>Physa fontinalis</i>      | - | - | - | - | - | 1 | - | - | - | -  | 10%                          | 0.1                     |
| <i>Physella acuta</i>        | 1 | - | - | - | - | - | - | - | - | -  | 10%                          | 0.1                     |
| <i>Lymnaea stagnalis</i>     | - | - | - | 1 | - | - | - | - | - | -  | 10%                          | 0.1                     |
| <i>Anisus vortex</i>         | 1 | 2 | 2 | - | - | - | - | - | - | -  | 30%                          | 0.5                     |
| <i>Ferrissia clessiniana</i> | 1 | 2 | - | - | - | - | - | - | - | -  | 20%                          | 0.3                     |
| <i>Dreissena polymorpha</i>  | - | 1 | 1 | - | 2 | - | 2 | 1 | - | -  | 50%                          | 0.7                     |

Table 3: Monnickendam, broad ditch along the Vesting, north-side, comparison of the mean presence of aquatic molluscs on ten leaves on *Nuphar lutea* in the autumns of 1998 and 2015

| Species                      | Percent Occupation of Leaves in 1998 | Percent Occupation of Leaves in 2015 | Mean Specimens per Leaf in 1998 | Mean Specimens Per leaf in 2015 |
|------------------------------|--------------------------------------|--------------------------------------|---------------------------------|---------------------------------|
| <i>Bithynia leachii</i>      | 10%                                  | 40%                                  | 0.1                             | 0.6                             |
| <i>Bithynia tentaculata</i>  | 10%                                  | 40%                                  | 0.1                             | 0.4                             |
| <i>Acroloxus lacustris</i>   | 70%                                  | 20%                                  | 2.4                             | 0.3                             |
| <i>Physa fontinalis</i>      | 20%                                  | 10%                                  | 0.4                             | 0.1                             |
| <i>Physella acuta</i>        | 10%                                  | 10%                                  | 0.1                             | 0.1                             |
| <i>Lymnaea stagnalis</i>     | -                                    | 10%                                  | -                               | 0.1                             |
| <i>Anisus vortex</i>         | -                                    | 30%                                  | -                               | 0.5                             |
| <i>Ferrissia clessiniana</i> | 90%                                  | 20%                                  | 1.7                             | 0.3                             |
| <i>Gyraulus albus</i>        | 20%                                  | -                                    | 0.2                             | -                               |
| <i>Gyraulus crista</i>       | 10%                                  | -                                    | 0.2                             | -                               |
| <i>Dreissena polymorpha</i>  | 60%                                  | 50%                                  | 1.4                             | 0.7                             |



## First Confirmed Record of the Native Limnic Apple Snail *Pomacea lineata* (Spix, 1827) in the Metropolitan Region of the “Great Porto Alegre,” Rio Grande do Sul State/ RS, Southernmost Brazil

**A. Ignacio Agudo-Padrón** Project “Avulsos Malacológicos – AM,” Caixa Postal (P. O. Box) 010, 88010-970 Centro, Florianópolis, Santa Catarina / SC, Brasil [ignacioagudo@gmail.com](mailto:ignacioagudo@gmail.com) & [goodcatt30@gmail.com](mailto:goodcatt30@gmail.com) ; <http://noticias-malacologicas-am.webnode.pt>

Giving continuity to the regional malacological survey, and based on the examination of samples obtained in the course of work done in the field, the present short report/ contribution incorporates the geographical record of one more continental mollusk form for the little Municipal District of “Cachoeirinha,” north section of the “Great Porto Alegre” metropolitan region of the “Pampa” Biome, Rio Grande do Sul State/ RS, southernmost Brazil (for a map of the locality see Agudo-Padrón and Lenhard 2011:164). The native gastropod species AMPULLARIIDAE *Pomacea lineata* (Spix, 1827) was not included in the previous available records in the literature for this locality or the State in general (Agudo-Padrón 2009, 2012; Agudo-Padrón and Lenhard 2011).

Some live specimens of this species were obtained during the last southern rainy season in wetland areas located in the city of “Cachoeirinha” (Figure 1). These snails were found on the shores of Gravataí River, living in sympatry with the traditional local species *Pomacea canaliculata* (Lamarck, 1804), as well as in local garden paludariums. They had laid your typical "color pink eggs" (Figure 2). The confirmation of this species increases the regional mollusk inventory to 70 species, including 46 gastropod forms – 26 limnic/ freshwater (Agudo-Padrón and Lenhard 2011, Agudo-Padrón 2012).



Figure 1. Native limnic snails *Pomacea lineata* (Spix, 1827) from Cachoeirinha, Great Porto Alegre/ RS.





Figure 2. Egg masses found associated with native limnic snails *Pomacea lineata* (Spix, 1827) from Cachoeirinha, Great Porto Alegre/ RS.

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### Additional Geographical Records of Operculated Amphibian Snails Assimineidae for Santa Catarina State/ SC, Central Southern Brazil

**A. Ignacio Agudo-Padrón and Jefferson Souza da Luz**, Project “Avulsos Malacológicos – AM,” Caixa Postal (P. O. Box) 010, 88010-970 Centro, Florianópolis, Santa Catarina / SC, Brasil  
[ignacioagudo@gmail.com](mailto:ignacioagudo@gmail.com) & [goodcatt30@gmail.com](mailto:goodcatt30@gmail.com); <http://noticias-malacologicas-am.webnode.pt>

The present brief contribution/ report incorporates two new geographical records of amphibian gastropod mollusks of the family Assimineidae H. and A. Adams, 1856, genus *Assiminea* Fleming, 1828, for Santa Catarina's State/ SC territory. These are minute snails with an operculum that live in brackish water, freshwater, or on the land (Agudo-Padrón *et al.* 2013, 2014; Agudo-Padrón & Luz 2015) (Figure 1). Three dried shells found by the second author in September 2015 in sand for construction deposited in a public square of Municipal District of “Joinville”, northern region of the State (Figure 2).

This snail also was “unexpectedly” found recently by us in September/ October 2015 during a period of high ambient humidity, with constant and heavy rains in an area of internal little “spring” and some flooded points of this small basin in “Bosque Vereador Pedro Medeiros,” an urban preserved area, in Municipal District of “Florianópolis” (Continental sector), central region of the State (Figure 3). These abundant specimens (a population boom – Figure 4) form a new mollusk record for that site (Agudo-Padrón and Luz 2014).



Figure 1. Little amphibian operculated snails *Assimineia* sp of the “Great Florianópolis”, Santa Catarina’s State/ SC territory. (Photo: Jefferson Souza da Luz, Project AM)

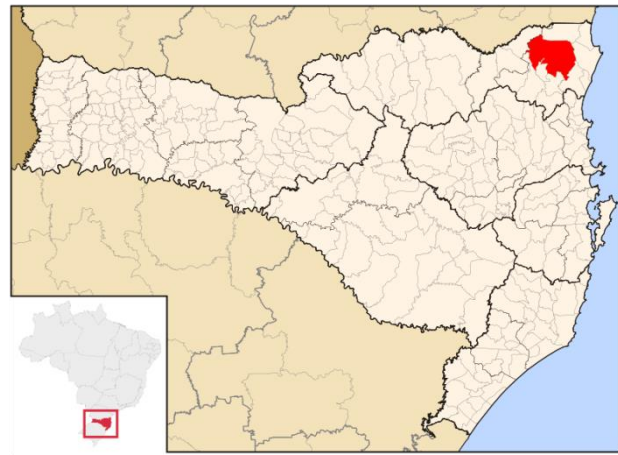


Figure 2. Joinville Municipal District in Santa Catarina State/ SC, Central Southern Brazil (Map - Red color)

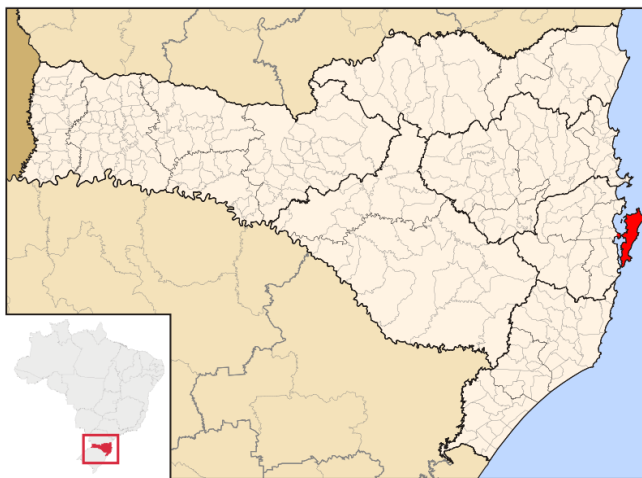


Figure 3. Florianópolis Municipal District (Map – red color) and the Continental section (red square) where these snails were found.

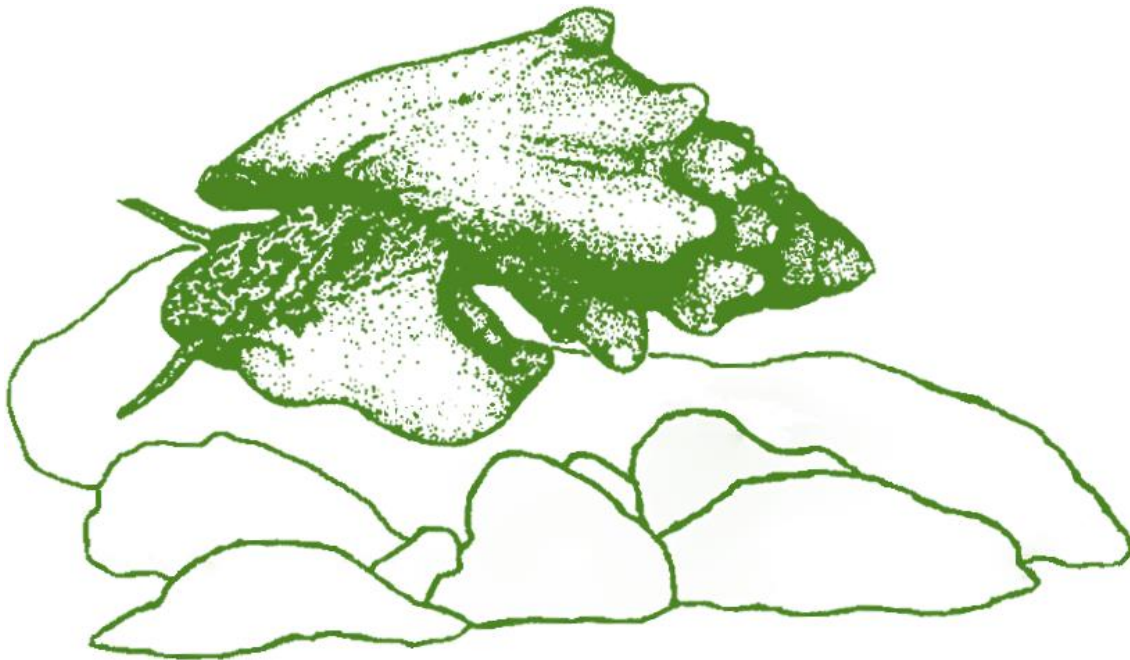


Figure 4. Indication of the “population boom” of *Assimineia* sp detected in the “Bosque Vereador Pedro Medeiros”, Continental Florianópolis, SC. (Photo: Jefferson Souza da Luz, Project AM)



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## Obituary

### Arthur Haddleton Clarke, Jr.

July 12, 1926 (Danvers, Massachusetts) – December 25, 2014 (Portland, Texas)

Arthur Clarke did his undergraduate studies at Boston University, and obtained his Master's degree at Cornell University. While at Cornell, he published on the Wesley Newcomb collection of Pacific island land snails housed at Cornell. His doctoral thesis on deep-sea molluscs of the Atlantic was completed in 1960 at the Museum of Comparative Zoology, Harvard University, with William J. Clench as his thesis advisor.

Clarke worked at the Lamont-Doherty Geological Observatory of Columbia University (1957-1959), the National Museum of Canada (1959-1977), and the Smithsonian Institution (1977-1979). He then founded Ecoscience, Inc., which conducted natural history surveys for government agencies.

Clarke's best-known publication was "*The Freshwater Molluscs of the Canadian Interior Basin*" (1973), which comprised an entire volume of *Malacologia*, and was updated in 1981 as *The Freshwater Molluscs of Canada*, published as a book by the National Museum of Canada. He also published about 90 articles and abstracts on deep-sea molluscs and on the Unionidae of North America. He described nearly 50 new species and genera of molluscs, mostly from the deep-sea fauna. With his first wife, Louise R. Clarke, he published two papers on the ethnographic use of shells by the Nootka and zooarchaeological analysis of marine shell from a site in British Columbia. He edited the *Malacology Data Net* (1986-1994), a journal that included the descriptions of several new molluscan taxa, including *Bathynnerita*. The unionid *Lampsilis haddletoni* Athearn, 1964, now classified in *Obovaria*, was named after him.

Clarke served as President of the American Malacological Union in 1968. In that role, he hosted the annual meeting in Ottawa, Ontario, in 1967, and presided over the annual meeting in Corpus Christi, Texas, in 1968.

**Alan Kabat**, Research Associate, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts 02138.



Arthur H. Clarke, Jr. at Woods Hole, Massachusetts, taken in 1966. Photograph by Robert Robertson and used with his permission.

### A Preliminary Bibliography of Non-marine Molluscan Publications of Arthur Haddleton Clarke, Jr.

**Arthur E. Bogan**. North Carolina Museum of Natural Sciences, Raleigh, North Carolina 27601

This compilation of 88 citations was developed from a number of sources including my reprint collection, the Herbert D. Athearn reprint collection, Cummings et al. online freshwater Mollusk Bibliography, and a search of Zoological Record. For completeness, all titles are included regardless of whether they are peer-reviewed papers, meeting abstracts, book chapters, books, or gray literature contract reports. No assumption is made that this is a complete inventory of Arthur's publications, especially regarding his gray literature reports. This is a beginning.



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## FMCS Officers

**President**

Teresa Newton  
U.S. Geological Survey  
Upper Midwest Environ. Science Center  
2630 Fanta Reed Road  
LaCrosse, WI 54603  
608-781-6217  
[tnewton@usgs.gov](mailto:tnewton@usgs.gov)

**Secretary**

Janet Clayton  
West Virginia Division of Natural Resources  
PO Box 67  
Elkins, WV 26241  
304-637-0245  
[Janet.l.clayton@wv.gov](mailto:Janet.l.clayton@wv.gov)

**Past President**

Patricia Morrison  
U.S. Fish and Wildlife Service  
Ohio River Islands NWR  
3982 Waverly Road  
Williamstown, WV 26187  
304-375-2923 x 124  
[patricia\\_morrison@fws.gov](mailto:patricia_morrison@fws.gov)

**President Elect**

Heidi L. Dunn  
Ecological Specialists Inc.  
1417 Hoff Industrial Park  
O'Fallon, MO 63366  
636-281-1982; Fax: -0973  
[Hdunn@ecologicalspecialists.com](mailto:Hdunn@ecologicalspecialists.com)

**Treasurer**

Emily Grossman  
Ecological Specialists Inc.  
1417 Hoff Industrial Park  
O'Fallon, MO 63366  
636-281-1982  
[egrossman@ecologicalspecialists.com](mailto:egrossman@ecologicalspecialists.com)

*Ellipsaria* is posted on the FMCS web site quarterly: around the first of March, June, September, and December. This newsletter routinely includes Society news, abstracts, meeting notices, publication announcements, informal articles about ongoing research, and comments on current issues affecting freshwater mollusks. Anyone may submit material for inclusion in *Ellipsaria*; however, only current dues-paying members of FMCS can access the two most recent issues. Older issues are accessible to anyone. Information for possible inclusion in *Ellipsaria* should be submitted via e-mail to the editor, John Jenkinson, at [jjjenkinson@hotmail.com](mailto:jjjenkinson@hotmail.com).

Contributions may be submitted at any time but are due by the 15<sup>th</sup> of the month before each issue is posted. MSWord is optimal for text documents but the editor may be able to convert other formats. Graphics should be in a form that can be manipulated using PhotoShop. Please limit the length of informal articles to about one page of text. Note that submissions are not peer reviewed but are checked for clarity and appropriateness for this freshwater mollusk newsletter. Feel free to contact the editor with questions about possible submissions or transmission concerns.

## FMCS Standing Committees and Their Chairs/Co-chairs

If you are interested in participating in committee activities, please contact one of the appropriate chairs.

### Awards

W. Gregory Cope  
North Carolina State University  
[greg\\_cope@ncsu.edu](mailto:greg_cope@ncsu.edu)

Teresa Newton  
Upper Midwest Environ. Science Center  
[tnewton@usgs.gov](mailto:tnewton@usgs.gov)

Emy Monroe  
University of South Dakota  
[emy.monroe@usd.edu](mailto:emy.monroe@usd.edu)

### Environmental Quality & Affairs

Steve McMurray  
Missouri Dept. of Conservation  
[stephen.mcmurray@mdc.mo.gov](mailto:stephen.mcmurray@mdc.mo.gov)

Braven Beaty  
The Nature Conservancy  
[bbeaty@tnc.org](mailto:bbeaty@tnc.org)

### Gastropod Status and Distribution

Nathan Whelan  
University of Alabama  
[nwhelan@crimson.ua.edu](mailto:nwhelan@crimson.ua.edu)

Jeremy Tiemann  
Illinois Natural History Survey  
[jtiemann@illinois.edu](mailto:jtiemann@illinois.edu)

### Genetics

David J. Berg  
Miami University  
[bergdj@miamioh.edu](mailto:bergdj@miamioh.edu)

Curt Elderkin  
The College of New Jersey  
[elderkin@tcnj.edu](mailto:elderkin@tcnj.edu)

### Guidelines and Techniques

Mary McCann  
HDR, Inc.  
[mary.mccann@hdrinc.com](mailto:mary.mccann@hdrinc.com)

Ryan Schwegman  
EnviroScience, Inc.  
[RSchwegman@EnviroScienceInc.com](mailto:RSchwegman@EnviroScienceInc.com)

### Information Exchange

Journal -- G. Thomas Watters  
OSU Museum of Biological Diversity  
[Watters.1@osu.edu](mailto:Watters.1@osu.edu)

W. Gregory Cope  
North Carolina State University  
[greg\\_cope@ncsu.edu](mailto:greg_cope@ncsu.edu)

Newsletter -- John Jenkinson  
Clinton, Tennessee  
[jjjenkinson@hotmail.com](mailto:jjjenkinson@hotmail.com)

### Mussel Status and Distribution

Arthur E. Bogan  
N.C. State Museum of Natural Sciences  
[arthur.bogan@ncdenr.gov](mailto:arthur.bogan@ncdenr.gov)

John L. Harris  
Arkansas State University  
[omibob1@gmail.com](mailto:omibob1@gmail.com)

### Nominations

Leroy Koch  
U.S. Fish and Wildlife Service  
[leroy\\_koch@fws.gov](mailto:leroy_koch@fws.gov)

### Outreach

Megan Bradley  
Virginia Game & Inland Fisheries  
[Megan.Bradley@dgif.virginia.gov](mailto:Megan.Bradley@dgif.virginia.gov)

Jennifer Archambault  
North Carolina State University  
[jmarcham@ncsu.edu](mailto:jmarcham@ncsu.edu)

### Propagation, Restoration, & Introduction

Dan Hua  
Tennessee Wildlife Resources Agency  
[Dan.Hua@tn.gov](mailto:Dan.Hua@tn.gov)

Rachael Hoch  
North Carolina Wildlife Resources  
Commission  
[rachael.hoch@ncwildlife.org](mailto:rachael.hoch@ncwildlife.org)

### Symposium

Heidi L. Dunn  
Ecological Specialists Inc.  
[Hdunn@ecologicalspecialists.com](mailto:Hdunn@ecologicalspecialists.com)

## Parting Shot



This picture was taken this past summer in French Creek, in northwestern Pennsylvania. Hopefully you can find the single, undisturbed freshwater mollusk in it. If so, can you identify the species from what you can see? [The answer is the first species discussed in the contributed article starting on Page 16 of this issue. For confirmation, those specimens also were found in French Creek.] Photograph by Lindsey Moss, TRC.



If you would like to contribute a freshwater mollusk-related image for use as a **Parting Shot** in *Ellipsaria*, e-mail the picture, informative caption, and photo credit to [jjjenkinson@hotmail.com](mailto:jjjenkinson@hotmail.com).