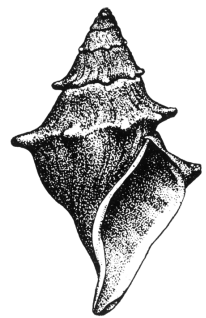


# NEWSLETTER OF THE AMERICAN MALACOLOGICAL SOCIETY

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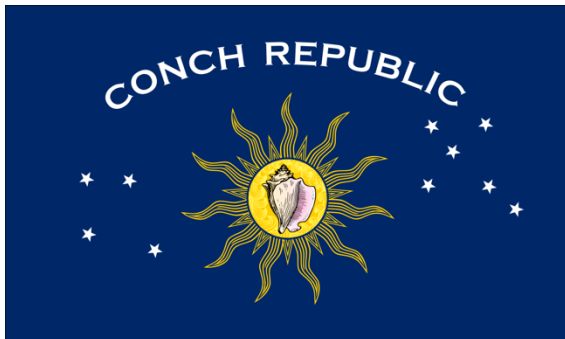
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## NEXT MEETING

**AMS 2020 IN THE CONCH REPUBLIC  
86TH ANNUAL MEETING**



**FARO BLANCO RESORT  
FLORIDA KEYS, FL  
JULY 13-17, 2020**

*Submitted by Tim Collins, president AMS*

The 86<sup>th</sup> meeting of the American Malacological Society (AMS) will take place Monday July 13<sup>th</sup> – Friday July 17<sup>th</sup> at the Faro Blanco Resort in the middle Florida Keys. The program will include symposia, contributed talks and posters, pre or post meeting workshops (if proposed), an auction in support of student research, social event, and local field trips. Full information about registration, events, schedules, accommodations, and submission of titles will be presented on the AMS website (<https://ams.wildapricot.org/>) in January of 2020. Please contact Tim Collins ([collinst@fiu.edu](mailto:collinst@fiu.edu)) for further information or if you are interested in organizing a workshop or symposium for the meeting.

The middle Florida Keys are an ideal place for a meeting of the AMS, with access to incredible molluscan diversity in marine, freshwater, and

terrestrial habitats, and within a short drive to the Everglades to the north and Key West to the south. Those interested in the night life can explore Key West or Miami Beach, and there are numerous state and national parks, museums, art galleries and exciting destinations within easy reach. Enjoy the laid-back vibe of the Conch Republic. For those coming by air, flights into Miami International Airport (MIA) will be most convenient, with regular shuttle service from MIA to the Keys. Those driving will come down to I 95 and then south on US 1 to Mile Marker 48. I look forward to seeing you in the Keys next summer! ☞



## OTHER UPCOMING MEETING

**AMS 2021  
CAPE BRETON, CANADA  
JUNE 14-18, 2021**

*Submitted by Timothy Rawlings, president-elect AMS*

The 2021 AMS meeting will be held in Sydney, Cape Breton Island, Nova Scotia, Canada, from Monday June 14<sup>th</sup> – Friday June 18<sup>th</sup>. A meeting venue within Canada is well overdue. The AMS has been held in the Great White North only three times during its history: in 1939 at the Royal Ontario Museum of Zoology, Toronto; in 1960 at the Redpath Museum, McGill University, Montreal; and in 1967 at Carleton University and the National Museum of Canada, Ottawa. The 2021 meeting will be hosted by Cape Breton University, a small undergraduate-based university located between Sydney and Glace Bay, with local research programs focusing on the conservation ecology of freshwater mussels, oyster diseases (MSX), the development of a sustainable

whelk (*Buccinum undatum*) fishery, and the ecology of freshwater and marine snails. Sydney is a great starting point for exploring local sites of interest, including Fortress Louisbourg, a reconstruction of an 18th-century French fortress; Parks Canada's Alexander Graham Bell National Historic Site in beautiful Baddeck and on the edge of Canada's "inland sea" - the Bras d'Or Lake; and the picturesque Cabot Trail that winds through Cape Breton Highlands National Park (see photos below). Cape Breton Island is also only a stone's throw away from Newfoundland (accessible via ferry), the Bay of Fundy (including Joggins Fossil Cliffs, a UNESCO World Heritage Site) and other maritime hotspots such as Halifax, NS, and Charlottetown, Prince Edward Island. A variety of field trip options will be available on the last day of the conference. Symposium ideas are still in development; if you have any suggestions please contact the local host: Tim Rawlings (timothy\_rawlings@cbu.ca). Sydney is accessible via road from Halifax's Stanfield International Airport (4.5-hour drive) or via air from Halifax, Toronto or Montreal (seasonal). ☞



The Skyline Trail – a must do hike within Cape Breton Highlands National Park with amazing views of the Gulf of St. Lawrence.



View looking down over Pleasant Bay - a good site for local whale watching.



Lush forest views along the drive between Cape North and Pleasant Bay, Cabot Trail.



## MEETING REPORTS

### Report on the World Congress of Malacology 2019, joined with the 85<sup>th</sup> AMS Annual Meeting

#### Pacific Grove, California

*Submitted by Ellen Strong, past president AMS*

The World Congress of Malacology (WCM) 2019 was held at the Asilomar Conference Grounds in Pacific Grove California, from 11-16 of August. Jointly sponsored by UNITAS Malacologica, the American Malacological Society, and the Western Society of Malacologists (WSM), the program hewed to the traditional WCM format, consisting of four days of presentations, plus one day for field trips. 270 registrants from 30 countries were in attendance, including 70 students.

The scientific program featured 220 oral presentations and kicked off on Monday August 12 with the plenary symposium. Reflecting the theme "*The Future of Molluscan Research*," the symposium highlighted the work of seven researchers who addressed topics in genomics (Mónica Medina, Pennsylvania State University), deciphering human impacts using dead-shell assemblages (Susan Kidwell, University of Chicago), the evolution of molluscan shells in response to the predatory arms race (Geerat Vermeij, UC Davis), the evolution and utility of molluscan venoms (Mandë Holford, Hunter College), gene regulatory networks (Deirdre Lyons, Scripps Institution of Oceanography), and evolution of photosymbiosis in bivalves (Jingchun Li, University of Colorado at Boulder). David Lindberg (UC Berkeley) also presented an update on the eagerly anticipated two-volume book *Biology and Evolution of the Mollusca* (CRC Press) by WF Ponder, DR Lindberg, and JM Ponder. The keynote symposium

was followed that afternoon by the poster session featuring 69 poster presenters.

The succeeding three days of presentations on Tuesday, Thursday, and Friday, included eight symposia, three thematic sessions, as well as open sessions for contributed talks on systematics, physiology, and biogeography. The symposia were organized around a wide array of topics, including: Ecological Insights from Molluscs: From Mountaintops to the Deep Sea (Patrick Krug, California State University, Los Angeles); Evolution of Molluscan Weirdness – Mechanisms and Tempos of Phenotypic Diversity (Julia Sigwart, Queen's University Belfast); Molluscs in Citizen Science (Jann Vendetti, NHMLA; Rebecca Johnson, CAS); Utility of Molluscan Genomics (Jessica Goodheart, UCSB, Deirdre Lyons, Scripps); Evolution of Toxins in Molluscs (Baldomero Olivera, University of Utah); Color and Vision in Molluscs (Suzanne Williams, NHMUK; Jeanne Serb, Iowa State); Molluscs as Model Paleontological Systems (David Jablonski, University of Chicago; Peter Roopnarine, CAS).

The scientific program also included three thematic sessions: Novel Approaches to Managing Invasive and Pest Molluscs (Amy Roda, US Department of Agriculture; Rory McDonnell, Oregon State University); Progress in Evolutionary Systematics and Biogeography of Continental Gastropods (Marco Neiber, University of Hamburg; Aravind Ananthram, Ashoka Trust for Research in Ecology and the Environment); and Commercial and Restoration Aquaculture of Molluscs (Kristin Aquilino & Daniel Swezey, Bodega Marine Laboratory). The AMS Presidential Symposium on Molluscan Collections (Ellen Strong, NMNH) featured 16 speakers who addressed the challenges of managing and building collections and mobilizing collections data. They also explored what insights new technologies are revealing using historical collections, and what is the next frontier for collections and the institutions that are charged with their care. The audience was treated to a special, unannounced (even to the symposium organizer...) lecture by Philippe Bouchet (MNHN) who wrapped up the days' proceedings with his inimitable wit and style. Many thanks to all of our symposium and session organizers and presenters!

When not listening to presentations or chatting with colleagues, participants could enjoy the stunning scenery of California's beautiful Monterey Peninsula, stroll among the 107 acres of forests,

dunes, and beaches, relax or play billiards by the fire in the main hall, go for a run along the beach, or take a dip in the heated pool. The adventurous among us could avail themselves of bicycles for rent or go paddle boarding or kayaking.

Field trips on Wednesday provided more opportunities to enjoy everything California's central coast has to offer. Participants could follow in the footsteps of Steinbeck & Ricketts, enjoy local California wines in Carmel Valley, watch marine mammals at Point Lobos & Elkhorn Slough or in Monterey Bay, collect marine Pliocene fossils at Capitola Beach, search for native California land snails and slugs, or explore the beautiful Big Sur coastline. The whale-watching group in Monterey Bay was rewarded with sightings of humpbacks, Risso's dolphins, and blue whales. Some participants elected to explore the nearby Monterey Bay Aquarium, Old Fisherman's Wharf, and Historic Cannery Row on their own. Others just slept in and relaxed, and the procrastinators among us could put the finishing touches on presentations. On the last day of the conference, a special behind-the-scenes tour of the Monterey Bay Aquarium was organized for a lucky group of participants.

After the field trips, Jessica Goodheart (UCSB) led panelists Heike Wägele (Zoologische Forschungsmuseum Alexander Koenig), Sarah Lemer (University of Guam), Zenaida Baoanan (University of the Philippines), Andrew Kraemer (Creighton University) and Frank Köhler (AMS) on a discussion for up-and-coming student malacologists. The goal was to provide students the chance to ask questions related to the PI's/Senior Researcher's perspective on students working internationally, building and maintaining international collaborations, and similarities and differences in mentor/mentee relationships across the globe.

In addition to many other opportunities to socialize, the ever-popular AMS auction to raise funds in support of student research took place on Thursday evening, with the charismatic Paul Callomon (ANSP) presiding. Bidding was fierce for the mollusk-themed treasures going under the hammer, with bidding wars erupting over several highly sought-after volumes of historical molluscan literature. In all, we raised almost \$5,000 for this worthy cause! Many thanks to all of you who provided donations to make the auction an enormous success.



I hope that all who could join us at Asilomar enjoyed the conference, made new friends, had a chance to reconnect with old ones, and built valuable connections with colleagues from around the world. I look forward to seeing you at the annual AMS meeting in the Florida Keys in July 2020! ☺



**Land Snail Field Trip, Big Sur, CA, 14 Aug 2019, World Congress of Malacology**

Submitted by Timothy A. Pearce



Field trip participants. Back row: Nozomu Sato, John Slapcinsky, Jochen Gerber, Erik L’Heureux, Michael Nash, Imogen Cavadino, Stephanie Clark, and Amy Blair. Front row: Mary Cole, Tim Pearce, Katrina Dickens, and Brenda Peters.

The land snail field trip for the 2019 World Congress of Malacology was co-led by John Slapcinsky and Tim Pearce, with 10 other participants.



*Helminthoglypta dupetithouarsi*, photo by Imogen Cavadino.

At 9:00 am, we boarded a 13-passenger van driven by Dave the van driver and made four stops through the day, all in Monterey County, returning to Asilomar Conference grounds just after 5:00 pm, in time to clean up before dinner.

It was rewarding to see the darker colored local species of *Helminthoglypta* that live in those parts of California. Of particular interest was the finding of an apparently undescribed species of *Pristiloma*.

**Stop 1.** SFB Morse Botanical Reserve (36.59119 -121.92413). In a pine forest, we encountered:

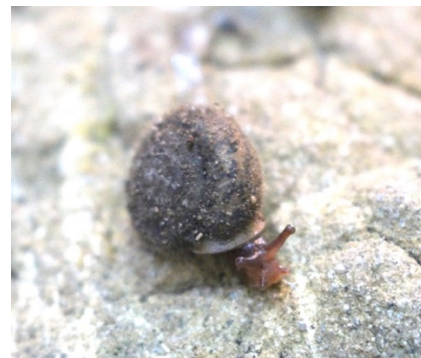
*Deroceras reticulatum*, *Helminthoglypta dupetithouarsi*, *Prophysaon* cf *andersoni*, *Vespericola pinicola*.



*Haplotrema minimum*, photo by Imogen Cavadino

**Stop 2.** Pfeiffer Big Sur State Park, Big Sur River near Parking Lot 4 (36.24398 -121.77779) [micro snails are from 50 m W of there at base of slope]. In a redwood forest, we encountered:

*Haplotrema* cf *minimum*, *Helminthoglypta umbilicata*, cf *Oxychilus*, *Punctum* cf *californicum*, *Striatura* sp.



*Vespericola pinicola*, photo by Imogen Cavadino.

**Stop 3.** East side of highway 1, 250 m SSE of Loma Vista (36.2337 -121.7669). In a redwood forest and among sword fern, we encountered:

*Haplotrema minimum*, *Helminthoglypta umbilicata*, *Pristiloma* cf n.sp., *Striatura pugetensis*, *Vertigo rowelli*, *Vespericola pinicola*.

**Stop 4.** Andrew Molera State Park. Among redwood and bay trees, participants mostly looked along the Big Sur River southeast of the parking lot (36.28284 -121.83549) and encountered:

*Haplotrema minimum*, *Helminthoglypta umbilicata*, *Vespericola pinicola*. In addition, some participants looked at two other localities between there and the parking lot; at stop 4B (36.28342 -121.84131) we found *Oxychilus alliarius*; at stop 4C (36.28307 -121.83823) we found *Haplotrema* cf *minimum*, *Punctum* cf *californicum*. ☞



### Thirteenth Annual Meeting of Ohio (River) Valley Unified Malacologists (OVUM) 2019

Submitted by Timothy A. Pearce



Participants at the OVUM 2019 meeting, from left to right, back row: Jeff Schroeder, Lori Schroeder, Wesley Parker, Catherine Nield, William Sanchez; front row: Tim Pearce, Yurena Yanes, Ezequiel King Phillips.

On Saturday, 12 Oct. 2019 the thirteenth annual meeting of the Ohio (River) Valley Unified Malacologists (OVUM) was hosted by Yurena Yanes at University of Cincinnati, Cincinnati, Ohio. Eight participants (see photo) enjoyed seven presentations and lively discussions on topics from using isotopes for environmental and diet reconstruction to species delimitations. Abstracts of the presentations are given in the order presented. In every talk, the presenter is the first listed author.

Wesley G. Parker<sup>1</sup>, Yurena Yanes<sup>1</sup>, Eduardo Mesa Hernandez<sup>2</sup>, Donna Surge<sup>3</sup> – <sup>1</sup>University of Cincinnati; <sup>2</sup>Universidad de La Laguna, San Cristobal de La Laguna, Canary Islands, Spain; <sup>3</sup>University of North Carolina, Chapel Hill.

### A high-resolution assessment of the Medieval Climate Anomaly in the subtropical northeastern Atlantic Ocean inferred from shells of *Phorcus atratus* (Gastropoda).

Sea surface temperatures from the Medieval Climate Anomaly were reconstructed from oxygen isotope analysis of shells of the marine gastropod *Phorcus atratus* retrieved from archaeological sites in the Canary Islands. The oxygen isotope values of the aragonitic shell layer suggested a marked cooling during the Medieval Climate Anomaly, ~2.5°C cooler than modern temperatures, possibly due to enhanced coastal upwelling in Northwest Africa and the establishment of localized island upwelling off the western coastlines of the Canary Islands.

Timothy A. Pearce<sup>1</sup>, Heather L. Hulton VanTassel<sup>1</sup>, Marvin C. Fields<sup>1</sup>, Nathan L. Brouwer<sup>2</sup>, Jann E. Vendetti<sup>3</sup> – <sup>1</sup>Carnegie Museum of Natural History, Pittsburgh; <sup>2</sup>University of Pittsburgh; <sup>3</sup>Natural History Museum of Los Angeles County.

### One species or two? *Micrarionta* land snails on San Clemente Island, California.

The land snails *Micrarionta gabbi* (smaller) and *M. maxima* (larger), on San Clemente Island, California have variously been considered subspecies, species, or synonyms. Multivariate analysis successfully separates the forms; the larger form occurred mostly in three areas of the NE side of the island. However, DNA (COI+ITS2) analysis indicates they are a single species. Future work could explore the apparent size bimodality and why the larger form occurs in particular areas.

Ezequiel King Phillips, Yurena Yanes – University of Cincinnati.

### Avoiding meat to beat the heat: shifting snail diets in a warming world.

As average global temperatures are predicted to increase in coming decades, the effect of rising temperatures on food webs and feeding habits of organisms is becoming an increasing concern. We plan to quantify trophic level shifts and dietary preferences of selected marine and terrestrial snail species with broad geographical distribution in North America by analyzing stable isotopes of carbon and nitrogen from snail body tissues to compare with those from surrounding food resources.

Catherine Nield<sup>1</sup>, Yurena Yanes<sup>1</sup>, Jeffrey Nekola<sup>2</sup>, Jason Rech<sup>3</sup>, Jeffrey Pigati<sup>4</sup> – <sup>1</sup>University of Cincinnati; <sup>2</sup>University of New Mexico; <sup>3</sup>Miami University; <sup>4</sup>US Geological Survey.

### Calibration of land snail shell stable isotope ratios at high arctic tundra.

Our study investigates the species composition and geochemistry of small land snails along a north to south transect in Alaska. We aim to calibrate snail shell oxygen and carbon stable isotope values from high arctic tundra ecosystems for future paleoclimate reconstruction in extreme environments using fossil shells.

Lori Schroeder<sup>1</sup>, Hsiu-Ping Liu<sup>2</sup>, Robert T. Dillon, Jr.<sup>3</sup> – <sup>1</sup>Bernheim Arboretum and Research Forest, Bardstown, KY; <sup>2</sup>Metropolitan State University of Denver; <sup>3</sup>Freshwater Gastropods of North America Project, Charleston, SC.

### Confirmation of the specific status of *Fontigens cryptica* Hubricht, 1963.

The genus *Fontigens* includes nine poorly studied stygophilic hydrobioid freshwater snail species with a tenth, *Fontigens cryptica*, of questionable status. Up to 2019, GenBank contained only one *Fontigens* DNA sequence. We report COI barcoding data for 83 individual *Fontigens*, from 13 populations of 6 recognized species, plus a single individual of *F. cryptica* sampled from Bernheim Arboretum and Research Forest south of Louisville, KY. Intrapopulation sequence variation was unremarkable, ranging up to 2.1%, while variation among conspecific populations was exceptionally high, ranging from 2.3% to the 14.4% divergence recorded between a pair of *F. orolibas* populations from Virginia. Sequence divergence was also high among recognized species, ranging from 8.7% between *F. bottimeri* and *F. antroecetes* up to 21.6% between *F. nickliniana* and *F. morrisoni*. Our single *F. cryptica* individual, at 14.4% divergence from its nearest neighbor, seems to represent a distinct and valid species.

William Sanchez<sup>1</sup>, Yurena Yanes<sup>1</sup>, Eduardo Mesa-Hernandez<sup>2</sup> – <sup>1</sup>University of Cincinnati; <sup>2</sup>Universidad de La Laguna, San Cristobal de La Laguna, Canary Islands, Spain.

### Paleoclimate reconstruction during the Little Ice Age in the Canary Islands.

This research aims to generate oxygen stable isotope time-series of the marine intertidal rocky gastropod *Phorcus atratus* (Gastropoda: Trochoidea) to reconstruct sea surface temperatures at submonthly resolution. The analyzed shells were retrieved from archeological middens from the Canary Islands that were radiocarbon dated to the Little Ice Age, with the goal to assess the paleoclimate of this region during that time interval.

Yurena Yanes<sup>1</sup>, Javier Fernandez Lopez de Pablo<sup>2</sup> – <sup>1</sup>University of Cincinnati; <sup>2</sup>Universidad de Valencia.

### Early Holocene climate change and cultural transitions during the Mesolithic in SE Spain.

Archeological shells of the arid-dwelling edible-size land snail *Sphincterochila candidissima* were analyzed for oxygen isotope values to infer the humidity and precipitation over the Epipaleolithic – Mesolithic transition in SE Spain. These results suggest conditions became wetter during the Mesolithic, coinciding with increased intensity of subsistence strategies by humans in this area. ☞



#### RESEARCH NOTES

### A Snail's Eye View of Habitat Variation in a Pacific Archipelago

Submitted by Teresa Rose Osborne, recipient of the Carriker Research Award 2017

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SUNY College of Environmental Science and Forestry, Syracuse, NY 13210

In Summer 2018, I conducted a field season in the Belau Archipelago (Republic of Palau, Oceania) to collect land snail specimens and habitat data as part of my dissertation research on Pacific land snail body size evolution. My goals for this research were (1) to explore abiotic differences in land snail habitats throughout the Belau Archipelago and (2) to connect habitat variation with differences in land snail body size. Body size analyses are ongoing, but I am happy to share results on land snail habitat variability.

Land snails are found in three microhabitat types in the Belau Archipelago, organic litter, live vegetation,



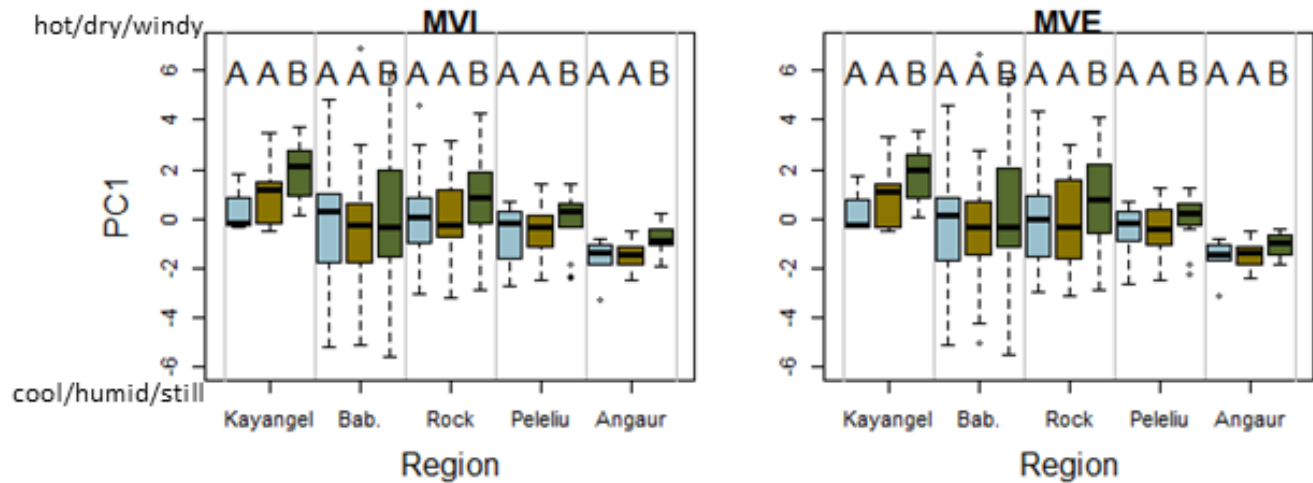


Figure 1. Differences in PC1 scores between microhabitat types in different regions of the Belau Archipelago. Microhabitat types are indicated by color (for each triplet, rock on the left in blue, litter in the middle in brown, and vegetation on the right is rock in green). Letters above bars represent significantly different microhabitat types, as indicated using Tukey’s HSD test. PCA was performed twice with similar results, once with missing values filled in with variable means (missing values included; MVI) and again with observations with missing values deleted (missing values excluded; MVE).

and rock (limestone and/or volcanic). At 87 sites, I collected live land snails, shells, substrate and air temperature data, wind speed data, and humidity data from all microhabitats present. I also measured soil moisture, soil pH, above-ground wind speed, and above-ground temperature at each site. Using PCA, I found that a hot/dry/windy to cool/humid/still axis (PC1) explained about 33% of variance between sites and microhabitats. ANOVA and Tukey’s HSD test revealed significant difference between microhabitat types, with higher PC1 scores for live vegetation than for organic litter or rock (Fig. 1). These results suggest that snails living in live vegetation experience increased exposure and physiological stress compared to other Belau land snails.

MANOVA and univariate ANOVA and Tukey HSD tests on each habitat variable confirmed that live vegetation was windier and drier than other microhabitat types. The surfaces of vegetation were also hotter than rock surfaces, and air temperature near vegetation was more variable than near litter. In addition, these analyses uncovered subtle differences between organic litter and rock microhabitats (hotter litter substrates, more substrate temperature variability in litter but more air temperature variability near rock, and possibly greater humidity maximum in litter) and difference among regions of the Belau Archipelago.

The archipelago can be divided into five regions, Kayangel Atoll in the north, the large volcanic island of Babeldaob, hundreds of limestone karst Rock

Islands, and low limestone islands of Peleliu and Angaur in the south. Substrate temperatures were lower in the southernmost island of Angaur than in other regions, and above-ground winds were stronger on Kayangel and Babeldaob. Soil moisture was also greater on Babeldaob. Soil pH was lowest on Babeldaob, moderate on Angaur and Rock Islands, and highest on Peleliu and Kayangel. These results show that clay soils found on volcanic Babeldaob retain more water than porous limestone-based or sandy islands. Soil moisture retention is likely physiologically favorable to land snails. However, clay soils were also found to be more acidic, which can interfere with calcium deposition and shell growth.

Differences detected between microhabitat types and regions suggest that land snails across the Belau Archipelago face a variety of physiological stressors that may impact growth and/or place selective pressures on body size evolution. As I continue to analyze Belau land snail morphology, I am grateful to the American Malacological Society, Conchologists of America, the Lewis and Clark Fund, and SUNY College of Environmental Science’s Alumni Association and Graduate Student Association for enabling my research on abiotic correlates of land snail body size. I look forward to sharing the results of those analyses with the malacological community.

More information on my research is available at [snailevolution.org](http://snailevolution.org) and on Twitter @tr\_osborne. ☞



### The Role of Shell Construction and Remodeling in Gastropod Inducible Defense

Submitted by David Charifson, recipient of the Carriker Research Award 2017

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Department of Ecology & Evolution, Stony Brook University, NY 11794

I am interested in gastropod inducible defenses (i.e., phenotypic plasticity in response to predators), especially for fine-scale morphological traits of the shell. Many gastropod species respond plastically to shell-crushing predators by producing a thicker shell that is more resistant to predator attacks. However, less attention has been paid to how the thickness of microstructural shell layers may be altered with inducible shell thickening. Additionally, few studies have considered if inducible shell thickening is limited only to shell deposited after predator exposure or if previously deposited shell can be remodeled to produce a more effective defense against predators.

I investigated the role of phenotypic plasticity in shell construction and remodeling in the marine gastropod *Nucella lamellosa*, which produces a thicker shell in response to *Cancer productus*, a shell-crushing predatory crab. I sectioned and examined the thickness of microstructural shell layers of specimens preserved from a previous experiment conducted by Paul Bourdeau (Funct. Ecol. 25:177-185, 2011) where *N. lamellosa* were grown in the presence of chemical cues from *C. productus*. Multiple regions of the sectioned shell were examined using microscopy, including the aperture, body whorl, and apical whorls.

*Nucella lamellosa* exposed to *C. productus* had 17-23% thicker shells compared to the controls in the three parts of the shell laid down longest ago that I examined (Nested ANOVA,  $P < 0.05$  for each). As these regions of the shell were present before the experimental period this indicates differential shell remodeling between treatments. This shell remodeling allows for a more fully integrated shell morphology with no abrupt transition between thick and thin regions of the shell that could represent a mechanical weakness. Additionally, shell remodeling might allow for reversible phenotypic

plasticity, which could be advantageous in avoiding a phenotype-environment mismatch if predation risk changes during the lifetime of the snail.

The overall thickening of newly accreted shell at the aperture in crab-exposed snails (Nested ANOVA,  $F_{1,6} = 212.1$ ,  $P = 0.001$ ) was due to a combination of increased thickness of both the inner crossed lamellar layer (Kruskal-Wallis test,  $P = 0.02$ ) and the outer homogeneous layer (Nested ANOVA,  $F_{1,6} = 153.9$ ,  $P = 0.001$ ). The crossed lamellar layer was 0.079 mm thicker with increased predation risk, which was 18.1 times thicker than the control. The homogeneous layer was 0.77 mm thicker with increased predation risk, which was 2.1 times thicker than the control. The increase in crossed lamellar thickness at the aperture is particularly interesting, as it is a stronger material compared to the homogenous layer and halts the propagation of cracks through the shell. This suggests that apertural lip thickening in *N. lamellosa* is not just an effective defense merely due to increased overall shell thickness, but also because of changes in the proportion of microstructural layers, which in turn may change biomechanical properties.

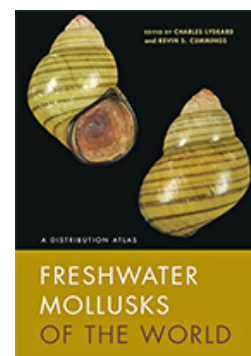
I am deeply grateful for the financial support I received to conduct this research. This includes a Melbourne R. Carriker Award for Student Research from the AMS and a Lawrence B. Slobodkin Award from the Department of Ecology and Evolution, Stony Brook University. ☞



#### NEWS AND ANNOUNCEMENTS

### Freshwater Mollusks of the World

Submitted by Charles Lydeard



Charles Lydeard and Kevin Cummings recently published a co-edited volume entitled “Freshwater Mollusks of the World – A Distribution Atlas.” It



includes contributing authors from around the world. For more information about the book and the list of contributing authors please go to: <https://jhupbooks.press.jhu.edu/title/freshwater-mollusks-world> ☞



IN MEMORIAM

**Obituary – G. Thomas Watters (1953-2019)**

*Submitted by Timothy A. Pearce*



George Thomas (Tom) Watters, VIII

George Thomas "Tom" Watters, 66, passed away 10 Oct. 2019. Since 1995, Tom was Adjunct Assistant Professor in the Department of Evolution, Ecology, and Organismal Biology at Ohio State University (OSU), since 2001, he was Curator of Molluscs at the Museum of Biological Diversity, and since 2002 he was the founding Science Director of the Columbus Zoo and Aquarium Freshwater Mussel Conservation and Research Center. He taught Invertebrate Zoology classes at OSU and mentored graduate students. He strove to help freshwater mussel recovery with his work on propagation and fish host studies.

He authored more than 68 peer-reviewed publications, two books, and four book chapters on Mollusca. Tom was a proud founding member and past president of the Freshwater Mollusc Conservation Society (FMCS).

Tom's interests included Zoogeography and phylogeny of Caribbean landsnails, reproductive biology of freshwater mussels, functional

morphology of bivalve molluscs, and conservation of endangered invertebrates. He dedicated his life and passion to the research, public education, and conservation of mollusks with a focus on the freshwater mussels of Ohio.

He was a research associate in the Section of Mollusks at Carnegie Museum of Natural History since 2002 and a research associate at The Wilds, Cumberland, OH since 2010.

His fieldwork included trips to Great Smoky Mountains, Puerto Rico, Belize, Panama, Honduras, Bahamas, Grenada, Antigua, Jamaica, and Dominican Republic.

Tom's dry wit was evident by the quotes included in the signature of his email messages, quotes such as:

"The world is my oyster, except for months with an R in them" - Firesign Theatre

"People who think they know everything are a great annoyance to those of us who do" - Isaac Asimov

"I have the world's largest collection of seashells. I keep it on all the beaches of the world. Perhaps you've seen it." - Steven Wright

And when constantly asked if you can eat freshwater mussels, he would reply, "You can eat anything once."

He was born 28 Feb 1953 in Dayton, Ohio to George (the 7th) and Mae "Chris"(Chisholm) Watters, making him George Thomas the 8th. He is survived by his wife of 34 years Renee (Skorepa), his three children Caitlin Marie, George Thomas (the 9th), and Ian Michael.

He graduated from high school in Beavercreek, Ohio. He received his B.S. in Biology in 1974, from the University of Miami in Florida. For his Master of Science Degree, 1980, from the University of Rhode Island, he wrote a thesis entitled "A Review of the New World Acanthochitonidae (Polyplacophora: Mollusca)," under the guidance of Dr. Robert Bullock. He received his Ph.D. degree in 1990 from Ohio State University, Columbus, with a dissertation entitled, "Functional Morphology of the Shell of Infaunal Bivalves," under the guidance of Dr. David H. Stansbery.

In honor of Tom, consider donating to The Freshwater Mollusc Conservation Society, FMCS. Please make checks payable to FMCS c/o Alan Christian at 20 Pleasant St., Potsdam NY 13676. <https://molluskconservation.org/index.html>

He was an inspiration and wealth of knowledge to all who knew him. ☞



### Obituary – Kenneth P. Hotopp (1960–2019)

Submitted by Timothy A. Pearce and Alice May Hotopp



Kenneth P. Hotopp in 1990

Kenneth P. Hotopp passed away at age 58 on 7 June 2019. He died from pancreatic cancer, having survived two years since his diagnosis with the disease. Despite the difficulty of contending with an aggressive cancer, he stayed upbeat and continued to make those around him laugh and feel loved.

Ken's work focused on land snails of the Appalachian area. He was a superb naturalist, with extensive knowledge about a wide variety of plants and animals. He was a research associate in the Section of Mollusks at Carnegie Museum of Natural History, Pittsburgh, since 2002. He published 8 articles on snails, including naming a new subspecies of land snail (*Triodopsis juxtidentis robiniae*) after his wife. Two of his works in progress that have been very helpful to mollusk workers are a web resource on land snails of the northeastern USA and a field guide to land snails of New York. He had created two versions of land snail web resources, one about Pennsylvania, later modified to include Virginia, and he was nearing completion on an expanded version of the web resource that would include the entire northeastern USA. The preliminary draft of a field guide to land snails of New York has been useful to workers. He also wrote 12 reports to funding agencies about results of his studies on snails. His mollusk-related publications and resources are listed at the end of this article.

Ken worked as a biologist for the Maryland Natural Heritage Program from 1990-1997. Later in his career, Ken started Appalachian Conservation Biology, a consulting business specializing in

ecology, conservation, and rare species inventory primarily of land snails but also including butterflies, salamanders, plants, and natural communities in the Appalachian Mountains. As a field course instructor at Eagle Hill in Maine, he led one-week field courses on snails in 2012 and 2013.

Ken was born in Birmingham, Alabama, on 30 Nov 1960. His family moved to Cobleskill, New York when he was young. He spent his childhood roaming through forests and farm fields, the beginning of his lifelong love of the outdoors. His skill as an artist was also apparent from a young age, and he enjoyed sketching and painting his surroundings.

Ken graduated from Cobleskill High School in 1978. Carrying his interest in the natural world into his studies, Ken received a BS in forest biology in 1982 from SUNY ESF (Environmental Science and Forestry) in Syracuse, NY. He earned his MS degree in Ecology and Animal Behavior from SUNY, Albany in 1987 with a thesis on the foraging behavior of deer mice.

In the summer of 1987 in Kennebunk, Maine, Ken met his love and adventure partner, Robin Gorrell, a small animal veterinarian. Two years later they married and settled in the Appalachian Mountains of Frostburg, Maryland. Ken, Robin, and daughters Marian and Alice canoed, hiked, and cross-country skied wild places from West Virginia to Ontario, Canada. The family moved to Bethel, Maine in 2005.

Ken was a fierce defender of wilderness and the climate, working locally to protect natural places and participating in actions against climate change. As a part of their effort to reduce impact on the environment, Ken and Robin built and lived in a passive-solar home in Newry, Maine, at the time, the most energy efficient passive-solar home that far north in the USA.

Ken is survived by his parents Marian M. and Kenneth R. Hotopp; his siblings Grace, Margaret, and Matthew Hotopp; his adored wife Robin Gorrell; and his daughters Marian and Alice Hotopp.

Next time you are outside, remember Ken by noticing fox tracks in the mud, insects pollinating wildflowers in bloom, and snails living under the bark of a downed tree.

In lieu of flowers, consider making a donation in Ken's honor to the Mahoosuc Land Trust at 162 North Road, P.O. Box 981, Bethel ME 04217 ([www.mahoosuc.org/](http://www.mahoosuc.org/)) or to UNICEF ([www.unicefusa.org/](http://www.unicefusa.org/)).



*Triodopsis juxtidentis robiniae* Hotopp, 2015, holotype

#### Publications:

Hotopp, K.P. & Smith, D.A. 1995. Notes on land snails near Big Reed Pond in Piscataquis County, Maine. *Maine Naturalist* 3(2):103-106.

Hotopp, K.P. 2002. Land snails and soil calcium in Central Appalachian Mountain forest. *Southeastern Naturalist* 1(1):27-44

Hotopp, K.P. 2006. *Patera panselenus* (Hubricht, 1976) on the lower Cheat River, West Virginia (Gastropoda: Pulmonata: Polygyridae). *Banisteria* 27:40-43.

Hotopp, K.P., Pearce, T.A. & Dourson, D.C. 2008. Land Snails of the Cheat River Canyon, West Virginia (Gastropoda: Pulmonata). *Banisteria* 31:40-46.

Hotopp, K.P., Pearce, T.A., Nekola, J.C., & Schmidt, K. 2010. New land snail (Gastropoda: Pulmonata) distribution records for New York State. *Proceedings of the Academy of Natural Sciences of Philadelphia* 159:25-30.

Pearce, T.A. & Hotopp, K.P. 2011. Federally endangered land snail *Polygyriscus virginianus* (Burch, 1947) still alive in Pulaski County, Virginia, USA (Gastropoda: Helicodiscidae). *Tentacle, Mollusk Conservation Newsletter* (19):27-28.

Beier, C.M., Woods, A.M., Hotopp, K.P., Gibbs, J.P., Mitchell, M.J., Dovčiak, M., Leopold, D.J., Lawrence, G.B. & Page, D.B. 2012. Variability in gastropod and amphibian communities along a soil calcium gradient in Adirondack northern hardwood forests. *Canadian Journal of Forest Research* 42:1141-1152.

Hotopp, K.P. 2015. A new *Triodopsis juxtidentis* subspecies (Gastropoda: Pulmonata) from West Virginia, U.S.A. *Zootaxa* 3914(4):490-494.

#### Web Resources:

Hotopp, K.P. & Pearce, T.A. 2006. Land Snails of Pennsylvania. Carnegie Museum of Natural History, Pittsburgh, PA, USA.

Hotopp, K.P., Pearce, T.A., Nekola, J.C., Slapcinsky, J., Dourson, D.C., Winslow, M., Kimber, G. & Watson, B. 2013. Land Snails and Slugs of the Mid-Atlantic and Northeastern United States. Carnegie Museum of Natural History, Pittsburgh, PA, USA. Online at <http://www.carnegiemn.org/science/mollusks/>

#### Unpublished Snail-Related Reports:

Hotopp, K.P. 2000. Cheat Threetooth (*Triodopsis platysayoides* Brooks) Inventory 2000. Report to the US Fish & Wildlife Service, West Virginia Field Office, and West Virginia Division of Natural Resources, Elkins, WV. 38pp.

Hotopp, K.P. 2000. Land snails at four Nature Conservancy preserves in West Virginia. Report to the West Virginia Chapter of The Nature Conservancy, Charleston, WV. 34pp. +attachments.

Hotopp, K.P., Pearce, T.A. & Grimm, F.W. 2003. Land snails of selected Pennsylvania Natural Areas. Report to Pennsylvania Dept. of Conservation & Natural Resources, Harrisburg, PA. 44pp.

Hotopp, K.P. 2003. Uncommon Pennsylvania land snails: supporting citations for state ranking. Unpublished report to the Pennsylvania Dept. of Conservation & Natural Resources, Harrisburg, PA. 40pp.

Hotopp, K.P. 2005. Land and freshwater snails of Great Falls and Turkey Run National Parks. Report to the National Park Service, McLean, VA. 26pp. +attachments.

Hotopp, K.P. 2006. Expert report: Opinion for conservation of the Cheat Threetooth (*Triodopsis platysayoides* Brooks). Report for legal proceedings to DiTrapano, Barrett & DiPiero, PPLC, Charleston, WV. 16pp.

Hotopp, K.P. 2006. Inventory for two butterflies and two land snails in West Virginia. Report to the West Virginia Division of Natural Resources, Elkins, WV. 24pp.

Hotopp, K.P. and Pearce, T.A. 2007. Land snails in New York: statewide distributions and talus site faunas. Report to the New York State Biodiversity Research Institute, Albany, NY. 91pp.

Hotopp, K.P. and Pearce, T.A. 2008. Land snail distributions in West Virginia. Report to the Wildlife Resources Section, West Virginia Division of Natural Resources. 126pp.

Hotopp, K.P. 2012. Freshwater snail inventory of the Fish River lakes. Unpublished report to the Maine Outdoor Heritage Fund, Pittston, ME. 47pp. +attachments.

Hotopp, K.P. and Roe, J.L. 2014. Discovering Maine's Own Freshwater Snail. Crowdfunded project through experiment. Online at: <https://experiment.com/projects/discovering-maine-s-own-freshwater-snail-part-1>.

Hotopp, K.P., Watson, B.T., Pearce, T.A., Nekola, J.C. & Perez, K.E. 2014. Shaggy Coil Conservation Plan, September 2014. Report to Bureau of Wildlife Resources, Virginia Department of Game and Inland Fisheries, Richmond, VA. 23 pp.

Hotopp, K.P., Watson, B.T., Pearce, T.A., Nekola, J.C. & Perez, K.E. 2015. Rubble Coil Conservation Plan, March 2015. Report to Bureau of Wildlife Resources, Virginia Department of Game and Inland Fisheries, Richmond, VA. 30 pp. ☞





**MINUTES OF THE ANNUAL BUSINESS MEETING**

Presented by Amanda S. Lawless, Secretary

**August 16, 2019**

**Asilomar Conference Grounds, Pacific Grove, CA**

The meeting was called to order by President Ellen Strong at 4:30pm.

**A motion was made and passed to approve the minutes of the 2018 business meeting.**

Executive and Committee Reports were presented:

President’s Report: Presented by Ellen Strong. The joint meeting had 250-260 registrants from more than 30 nations, over 70 student presentations with 65 students in attendance. Presidential Symposium topic was Collections. There were 16 symposium speakers, eight of whom are getting support from AMS symposium funds.

President-Elect: Presented by Tim Collins. The tentative meeting dates are July 14-17, 2020 in Marathon, Middle Key, FL at the Faro Blanco Resort. Capacity of the conference space is 130, so would have to cap meeting attendance at this number, which may pose an issue. Marathon is halfway between Miami and Key West, so there will be a lot of options for field trips.

**A motion was made and passed to accept the 2020 meeting venue.**

Vice-President: Presented by Tim Rawlings. The meeting in 2021 will take place on Cape Breton Island, Nova Scotia, Canada. The venue will be on Cape Breton University campus in the town of Sydney. Proposed dates for the meeting are June 14-18, with three days of scheduled talks and symposia, and field trip excursions on the last day. There are hotels in the area of varying price ranges. Symposia topics have not been decided, but there is some interest in a symposium focused on “new approaches in freshwater bivalve conservation.” Other symposium ideas are breaking down boundaries between US and Canadian science and molluscan symbiosis.

Treasurer’s Report: Presented by Elizabeth Shea. Dr. Charlie Sturm died in October 2018 and Liz assumed the Treasurer’s responsibilities with Council approval. PNC Bank is our new bank. Our banking

and investments are now all on-line. We have officially moved to Wild Apricot as our membership platform and now renewals can be processed on-line and credit cards are accepted. The convenience of an on-line membership platform outweighs the cost of Wild Apricot credit card processing fees.

	<b>Budget</b>
<b>REVENUE</b>	
<b>Membership Related</b>	
- Life Membership Transfer from Investment Accounts	\$1,320
- Dues	\$4,500
<b>Meeting Related</b>	
- Symposium Transfer from Investment Accounts	\$6,000
- AMS Meeting Auction	\$1,500
<b>Publication Related</b>	
- Institutional Subscriptions to AMB	\$2,800
- BioOne – revenue + surplus share	\$19,000
- Page Charges from Authors	\$5,500
<b>Other</b>	
- Royalties: American Fisheries Society - “Common & Scientific Names of Aquatic Invertebrates from the US and Canada: Mollusks” Turgeon et al.	\$50
- Royalties: Universal Publishers – “The Mollusks” Sturm Pearce & Valdes	\$200
<b>TOTAL REVENUE</b>	<b>\$40,870</b>
<b>EXPENSES</b>	
<b>Membership Related</b>	
- Dues for the Life/Honorary Life Members	\$1,320
- Wild Apricot	1,300
<b>Awards</b>	
- Mel Carriker - Student Research	\$3,500
- Connie Boone Award – Best Student Paper/Poster	\$3,000
- Charlie Sturm Award – Best Student Bivalve Paper/Poster	\$500
- Dick Petit Award – Best Student Systematics Paper	\$500
- Dee Saunders Memorial Research Funds	\$1,000
<b>Meeting Travel Support</b>	
- Symposium Travel Support	\$6,000
- Council Travel Expenses	\$5,000
- Student Travel Grants	-
- Student Webmaster Meeting Travel Funds	\$500
<b>Publication Related</b>	
- Publication of AMB (Sheridan)	\$18,000
<b>Other</b>	
- Membership to AIBS	\$250
<b>TOTAL EXPENSES</b>	<b>\$40,870</b>
<b>TOTAL SURPLUS/(DEFICIT)</b>	<b>\$0</b>

**Motion to pass budget. Motion passed.**

**Secretary's Report:** Presented by Amanda Lawless. Highlights of the report were the launch of the new AMS website and online membership database through Wild Apricot. It was launched the beginning of 2019 with the help of Chris Hobbs (webmaster) and Liz Shea (treasurer). Members can now sign up and pay dues online and finally have access to BioOne. Assisted Ellen with preparations for the 2019 meeting. Tim Pearce has agreed to be co-editor of the newsletter with Christine Parent and the newsletter is back up and running. It is still a struggle to get members to submit content for the newsletter. Helped with the transition of the new treasurer.

**Editor and Publications Committee Report:** Presented by Wallace "Marty" Meyer. The last two issues Vol 36(2) and Vol 37(1) were published in December 2018 and July 2019, respectively. The low stream of manuscripts delayed publication of Vol 37(1). Our intent is to print an issue in June and December. AMB impact factor for 2017-18 is 0.519. For this report year (2018-19, issues 36(2) to 37(1)), we have received relatively few independent submissions (13). Five symposium papers in 36(2) have supplemented for the low submission rate. Of the 13 papers submitted, four were rejected, and two are still awaiting author revisions.

**Endowment Committee Report:** Presented by Rüdiger Bieler. (Endowment Committee: Rüdiger Bieler, José Leal, and Alan Kohn) Each invested AMS endowment fund (currently: symposium, life membership) has a targeted 50/50 stock/bond ratio subject to regular rebalancing. **2018 performance:** The funds did not perform well (overall loss of \$6,126.45). However, our strategy of 50% bond investment sheltered us from the greater risks of stock-heavy portfolios. **2019 performance:** Fund performance has been strong, with an end-of-2<sup>nd</sup> quarter total of \$31,637.99 in six months. [Note no check withdrawals had yet been made for 2019 expenditures.]

**Membership Committee Report:** Presented by Beth Davis-Berg. 2019 Membership: 147 members (22 life members, 13 family memberships, 79 regular members, and 33 students). Facebook networking is strong with 6485 likes as of July 2019 up from 4566 likes in 2018. We are losing a small but relatively consistent portion of students every year. We need to concentrate on keeping full members and keeping members renewed rather than lapsed. Proposed actions: 1) Get a standing membership committee; 2) Solicit more memberships from PIs and their students; 3) Consider revising membership

categories; 4) Online only journal option; 5) Recruit members from shell clubs and other non-traditional sources.

**Nominating Committee Report:** Presented by Jose Leal. (Nominating Committee: Jose Leal, Angel Valdes, and Jessica Goodheart) The following nominations were presented: President - Tim Collins, Florida International University; President-Elect - Tim Rawlings, Cape Breton University; Vice-President - Ken Hayes, Bishop Museum; Past President (4-10 years) - Tom Duda, University of Michigan; Past President (>10 years) - Paula Mikkelsen, Field Museum of Natural History; Councilor at Large - Jingchun Li, University of Colorado, Boulder; Councilor at Large (student) - Vanessa Knutson, Harvard University; Treasurer - Elizabeth Shea, Delaware Museum of Natural History.

**No nominations were received from the floor, and the slate was approved by motion.**

**Conservation Committee Report:** Chair Jay Cordeiro. Activity within the U.S. Fish and Wildlife Service regarding Endangered Mollusk species: Two species were listed as threatened while proposals to list three others were found to be unwarranted. Included were the first cephalopod to be listed by the Endangered Species Act, the chambered nautilus, *Nautilus pompilius*, now listed as Threatened. The listing of this species resulted in the formal creation of a new taxonomic level within the framework of the Act, CEPHALOPODS, approved on April 8, 2019. Candidate listings for 10 species were proposed for review and one Recovery Plan created. Five-year status reviews were up for 38 species. Conservation Committee news will be reported on the AMS Imperiled Species Newsletter (<http://www.malacological.org/conservation.html>) and contributions are welcomed from all AMS members.

**Student Awards Committee Report:** Presented by Jeanne Serb. 2019 Melbourne R. Carriker Student Research Awards in Malacology: *Ad hoc* committee - Jeanne Serb (chair), Jessica Goodheart, Tricia Golding, Chris Hobbs. This year we had 17 applicants; 2 funded for a net total of \$1850. Recipients of awards were: **Michelle Gannon**, Drexel University, "Mudsnails (*Tritia obsoleta*) record nutrient pollution in Barnegat Bay, New Jersey." The \$900 award matched the total amount requested. **Andrew Villeneuve**, University of Massachusetts, "Investigating local adaptation across latitudinal thermal gradients in the Atlantic

Oyster Drill (*Urosalpinx cinerea*).” The \$950 award matched the total amount requested.

**Systematics Committee Report:** Submitted by Charles Lydeard (Chair) and Ken Hayes. Two announcements were posted in 2019. One about the 2019 World Congress of Malacology meetings and a second about the publication of Freshwater Mollusks of the World – A Distribution Atlas, which was co-edited by Lydeard and Kevin Cummings. The blog received 3,457 page views since the June 2018 report for a total of 28,908 page views.

**Resolutions Committee:** Presented by Paula Mikkelsen. No activities to report by the committee in 2018-2019.

**Constitution & Bylaws Committee:** Submitted by Paula Mikkelsen. No activities to report by the committee in 2018-2019.

**New Business:** Paul Callomon (AMS Archivist) gave an update on the AMS archives that are held at the Academy of Natural Sciences in Philadelphia and provided some advice on how to preserve this material moving forward.

Gary Rosenberg reached out the members to see if there was interest in updating the common names in Turgeon et al. (1998).

**A motion to adjourn was made and passed.**

Amanda S. Lawless, Secretary  
Chicago, November 2019



NEWSLETTER EDITORS

Contributions to the biannual AMS newsletter are always welcomed. Send articles, short notes, or news items to either **Timothy Pearce** or **Christine Parent**, the newsletter co-editors. Items can be sent to the following addresses:

*Timothy A. Pearce*  
Carnegie Museum of Natural History  
4400 Forbes Avenue  
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E-mail: [pearcet@carnegiemnh.org](mailto:pearcet@carnegiemnh.org)

*Christine Parent*  
Department of Biological Sciences  
University of Idaho  
Moscow, ID 83844  
E-mail: [ceparent@uidaho.edu](mailto:ceparent@uidaho.edu)



AMS WORD SEARCH

*Submitted by Tim Pearce*

Locate the given words in the grid, running in one of eight directions: horizontal, vertical, or diagonal. Unused letters contain a secret message.

Words from Jul. 2019 issue of American Malacological Bulletin (vol. 37(1)). If words intrigue you, see the bulletin – member access through the AMS website (<https://ams.wildapricot.org/>).

N D O P O L A H P E C N H  
C O N S E R V A T I O N A  
C O I E S T U A R I N E P  
H C L T G E N E T I C S A  
E Y S O A F A U N A P Y T  
C T L N N V B A E R O K U  
K H I E W I I R A N G I A  
L O A Y R E Z T R A E H N  
I E N T I N V A S I V E O  
S I S E N E G O T E M A G  
T I A B I O T I C I A A R  
D R E S P I R A T I O N A  
R E P R O D U C T I O N R

- |              |               |              |
|--------------|---------------|--------------|
| ABIOTIC      | AESTIVATION   | ARGONAUTA    |
| CEPHALOPOD   | CHECKLIST     | COLONIZATION |
| CONSERVATION | DISTRIBUTION  | ESTUARINE    |
| FAUNA        | GAMETOGENESIS | GENETICS     |
| HEART        | INVASIVE      | KOREA        |
| OCYTHOE      | RANGIA        | REPRODUCTION |
| RESPIRATION  | SNAILS        |              |