THE WESTERN SOCIETY OF MALACOLOGISTS

Annual Report
For 2019

Volume 52
December 2022

Abstracts and papers from the 52nd annual meeting of the
Western Society of Malacologists meeting conducted as part of the
World Congress of Malacology

Asilomar Conference Center, Monterey, CA, USA
August 11-16, 2019

CONTENTS

The Annual Report of the Western Society of Malacologists is based on its yearly meeting. Distribution of the Annual Report is free to regular and student members who are, at the time of issue, in good standing. Membership dues are $20.00 for regular and institutional members and $8.00 for student members. Forms and payment information can be found at www.westernsocietymalacology.org.

Correspondence regarding membership and orders for additional or back issues of the **Annual Report** should be addressed to the current WSM Treasurer, Kelvin Barwick, 16391 Del Oro Circle, Huntington Beach, CA 92649 USA; Kbarwick@ocsd.com.

Western Society of Malacologists

Executive Board 2018-2019

President	Pat Krug
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Meeting Program

World Congress of Malacology

2019

Pacific Grove, California, USA

SUNDAY 11 AUGUST, 2019

(Asilomar Conference Center, Pacific Grove, CA)

2:00-6:00 pm Registration - *Merrill Hall*

10:30 am-12:00 pm Unitas Malacologica Council Meeting- *Merrill Hall*

1:30-3:30 pm Western Society of Malacologists Council Meeting - *Merrill Hall*

3:30-5:30 pm American Malacological Society Council Meeting - *Merrill Hall*

MONDAY 12 AUGUST, 2019

(Asilomar Conference Center, Pacific Grove, CA)

7:30-8:30 am Breakfast - *Crocker Dining Hall*

8:30-11:30 am Registration - *Merrill Hall*

8:30 am Welcome and Opening Session -Terry Gosliner - *Merrill Hall*

Plenary Session: The Future of Molluscan Research - *Merrill Hall*

9:00 am - Genomics and the Future of Tropical Marine Ecosystems - Mónica Medina, Pennsylvania State University

9:45 am - Our New Understanding of Dead-shell Assemblages: A Powerful Tool for Deciphering Human Impacts - Sue Kidwell, University of Chicago

10:30-10:45 am Coffee Break - *Merrill Hall*

10:45 am - Evolution of Molluscan Shells and the Predatory Arms Race - Geerat Vermeij, University of California, Davis

11:30 am - Investigating Molluscan Venom From Evolution to Molecular Function: Discovery, Characterization, Optimization, and Delivery of Venom Peptides from Predatory Conoidean Marine Snails - Mande Holford, Hunter College

12:00-1:30 pm Lunch - *Crocker Dining Hall*

1:30 pm - Comprehensive Review of Mollusca - David Lindberg, University of California, Berkeley

2:15 pm - Casting a Wide Net: Capturing Gene Regulatory States that Drive Morphogenesis in Slipper Shell Snails, and What They can tell us About Molluscan Evolution - Deirdre Lyons, SCRIPPS Institution of Oceanography, University of California, San Diego

3:00 pm - Shedding Light: Evolution of Photosymbiosis in Bivalves - Jingchun Li, University of Colorado

3:45-6:00 pm Poster Presentations and Reception - *Merrill Hall*

6:00-7:00 pm Dinner - Crocker *Dining Hall*

TUESDAY 13 AUGUST, 2019

(Asilomar Conference Center, Pacific Grove, CA)

7:30-8:30 am Breakfast - *Crocker Dining Hall*

8:30-11:00 am Registration - *Chapel Hall*

Molluscs as Key Ecological Players Symposium - *Chapel Hall*

8:30-8:40 am - Introduction to the Symposium: Ecological Insights from Molluscs, from Mountaintops to the Deep Sea - **Patrick Krug***

8:40-9:00 am - The Role of Ecological Interactions in the Diversification of Galapagos' Land Snails - **Christine E. Parent**

9:00-9:20 am - Crypsis and the Jack-of-all-Trades Hypothesis: Are Island or Mainland Snails Better at Camouflage? - **Andrew C. Kraemer** and Christine E. Parent

9:20-9:40 am - Surviving a Mass Extinction: the Ecology of Persistence in Society Islands Partulids - **Cindy Bick**, In Hee Lee, David Blaauw, Trevor Coote, and Diarmaid Ó Foighil

9:40-10:00 am -Assessing Aquatic Communities Using Stagnicola Elodes and its Assemblage of Trematode Parasites - **Timothy Rawlings**, Hanna J. Maclean , and Brooke A. McPhail

10:00-10:20 am - Empirical Test of Crab-Clam Predator-Prey Model Predictions: Storm-driven Phase Shift to a Low-density Steady State - **Cassandra N. Glaspie**, Rochelle D. Seitz, and Romuald N. Lipcius

Commercial and Restoration Aquaculture of Molluscs Session- *Curlew Hall*

9:00-9:20am - Catches, Yield, Bycatch and Discards in the Small-scale Cuttlefish Trap Fishery - **Paulo Vasconcelos**, Fabio Pereira, Ana Moreno, Miguel B. Gaspar

9:20-9:40 am - First Restocking Attempt of the Striped Venus (*Chamelea gallina*) Off Portimão (Southern Portugal) - **Miguel B. Gaspar**, Sandra Joaquim, Ana M. Matias, Cláudia Roque, Paulo Vasconcelos, Fábio Pereira, Paula Moura, Marta Rufino, and Domitília Matias

9:40-10:00 am - EMPTY

10:00-10:20 am - The Effects of Land Subsidence and Uplift on Intertidal Mollusks Including Commercially Important Bivalves Following the 2011 Great East a pan Earthquake - **Kenji Okoshi**, Masahiro Suzuki, and Waka Sato-Okoshi

Systematics Session - *Marlin Hall*

8:20-8:40 am - Conservation Genomics of the Partulidae - **Amanda E. Haponski**, Cindy Bick, Taehwan Lee, and Diarmaid Ó Foighil

8:40-9:00 am ~~-Molecular and Morphological Studies of *Burnupia* Walker,1912 (Gastropoda Hygrophila) - **Ximena Ovando**, Dayse A. Silva, L. E. M. Lacerda, and Sonia B. Santos~~ [WITHDRAWN]

9:00-9:20 am - The Complete Mitochondrial Genome of the Endemic Philippine Land Snail *Ryssota otaheitana* Ferrusac, 1821 (Pulmonata: Chronidae) -**Amor M. Damatac II** and Ian Kendrich C. Fontanilla

9:20-9:40 am - First Global Phylogeny of the Deep-sea Gastropod Genus **Scaphander** Reveals Higher Diversity, A Possible Need for Generic Revision and Polyphyly Across Oceans - **Justine Siegwald**, Trond R. Oskars, and Manuel Antonio E. Malaquias

9:40-10:00 am - Systematic Revision of the Predatory Snail Genus *Paciocinebrina* Houart, Vermeij & Wiedrick, 2019 (Muricidae: Ocenebrinae) Based on Molecular and Morphological Analyses - **Shawn Wiedrick*** and D. J. Eernisse

10:00-10:20 am - Neogastropod Phylogeny: New Insights After a Study on Buccinoideans - **Luiz Ricardo L Simone**

AMS Presidential Symposium on Molluscan Collections - *Scripps Hall*

9:00-9:20am - Mollusk Collections -A 50-year Perspective: Where Have We Been and Where are We Going? - **Ellen E Strong**

9:20-9:40 am -A Brief History Of Computerization Of Mollusk Collections - **Gary Rosenberg**

9:40-10:00 am - Mobilizing the World's Mollusk Collections - **Rüdiger Bieler**

10:00-10:20 am - Utility Of Molluscan Collections in Answering Ecological Questions and Climate Change - **Terry Gosliner**

10:20-10:40 am Coffee Break - *Chapel Hall*

Molluscs as Key Ecological Players Symposium - *Chapel Hall*

10:40-11:00 am - Dipping Our Toes Into a Sea of Possibilities: Defining the Unknown Functions and Requirements of Olympia Oysters via Science-based Restoration - **Danielle Zacherl***

11:00-11:20 am - Snails on the Menu? Using Long-term Ecological Data to Contextualize Performance of a California Kelp Forest Predator and Emerging Fishery Species, *K. kelletii* - **Xochitl S. Clare*** and Gretchen E. Hofmann

11:20-11:40 am - Loss Of Shell Coiling In Trochid Snail: Adaptation to Wave-swept Rock Surfaces and Symbiotic Life in Sea Urchin Pits - **Luna Yamamori** and Makoto Kato

11:40-12:00 pm - Pushing Boundaries: Investigating the Disturbance of the Pugnacious Nudibranch *Phidiana hiltoni* in Northern California - **Emily Otstott** and Terry Gosliner

Physiology Session - *Curlew Hall*

10:40-11:00 am - Influence of Vitamin E on Shell Repair, Haemolymph Biochemical Parameters, Haemagglutination Potential and Ovo-tesist Activity of Giant African Land Snail (*Archachatina marginata*) After Shell Damage - **John Adesanya Abiona**, Abiola Blessing Okunlola, Nneka Sandra Obanya, and Muhammed Okanlawon Onagbesan

11:20-11:40 am - Subcritical Forces Fatigue and Fracture California Mussel Shells - **R.L. Crane** and M.W. Denny

11:40-12:00 pm -Are Bacteria Important in Chalk Formation In Oysters? - **Roxanne Marie Wolfe Banker**

Systematics Session - *Marlin Hall*

10:40-11:00 am - So What is *Mitrella* Anyway? - Marta J. deMaintenon

11:00-11:20 am - Biodiversity, Evolution, and Extinction in the Imperiled Galapagos-Endemic Land Snail Genus - **Nathaniel Shoobs**, Andy C. Kraemer, John G. Phillips, and Christine E. Parent

11:20-11:40 am -Australia's First Monoplacophoran: Diving Deep Off Western Australia - **Nerida G. Wilson**

11:40-12:00 pm - Revolutionizing Biodiversity and Systematics Research on Aplacophora (Mollusca) and Training the Next Generation of Malacologists - **Kevin M. Kocot**

AMS Presidential Symposium on Molluscan Collections - *Scripps Hall*

10:40-11:00 am - Biv3D: Capturing Multiple Dimensions of Biodiversity By CT-Scanning the Shallow-Marine Bivalves of the World - **Katie S. Collins**, Stewart M. Edie, David Jablonski

11:00-11:20 am - Mollusca Types in Great Britain: A Union Database for the UK - **Andreia Salvador**, Anna Holmes, and Harriet Wood

11:20-11:40 am - Molluscan collections in South Africa - **Dr. Mary Louise Cole**

11:40-12:00 pm - The Tyranny of Remoteness: Contemporary Chances and Challenges for Collection-Based Malacological Research Down Under - **Frank Köhler**

12:00-1:00 pm Lunch - *Crocker Dining Hall*

Molluscs as Key Ecological Players Symposium - *Chapel Hall*

1:00-1:20 pm - Reproductive Phenology in the Tropics: What Can Molluscs Tell Us?- **Rachel Collin**

1:20-1:40 pm - Ecological Insight Into the Origins of Photomutualism: How Sea Slugs Benefit From Kleptoplasty - **Patrick Krug***, Andre LaBuda, Holly V. Moeller

1:40-2:00 pm - Cryptic Coral Connoisseurs: Exploring the Hidden Diversity of Corallivorous

Nudibranchs - **Allison L. Fritts-Penniman**, Paul H. Barber, and Terrence M. Gosliner

2:00-2:20 pm - Clues for the Evolution of Bivalved Gastropods Through Observations of *Berthelinia singaporensis* (Mollusca: Gastropoda: Sacoglossa: Juliidae) - **Nur Leena Wong W.S.** and Julia D. Sigwart

2:20-2:40 pm - Recognizing and Predicting Global Patterns of Marine Mollusk Ornamentation Expression Through Machine Learning- **T. Mason Linscott*** and Christine E. Parent

Biogeography Session - *Curlew Hall*

1:00-1:20 pm - Neogene Diversification of the Crown Helicostyline Land Snails (Gastropoda: Stylommatophora: Camaenidae) in the Philippines - **Gizelle A. Batomalaque**, Adnan Moussalli, and Gary Rosenberg

1:20-1:40 pm - Land Malacofaunal Surveys in Northern Luzon, Philippines: Status and Challenges - **Zenaida G. Baoanan** and Roscinto Lumbres

1:40-2:00 pm - Unravelling a Hidden Biodiversity: The Caudofoveata (Aplacophora) from the Southwestern Atlantic Ocean - **Marcel Sabino Miranda**, Carmen Regina Parissotto Guimarães, and Flávio Dias Passos

2:00-2:20 pm - Limited Growth and Hindered Reproduction Cause the Demise of Native Mollusks on the Israeli Mediterranean Shallow Shelf- **Paolo G. Albano**, Jan Steger, Zara Guifarro, Bella S. Galil, and Martin Zuschin

2:20-2:40 pm - Biodiversity, Biogeography and Vulnerability of Hydrothermal Vents: A Case Study Using Bathymodioline Mussels - **Kerry Walton**, Bruce Marshall, and Ashley Rowden

Systematics Session - *Marlin Hall*

1:00-1:20 pm - Factors Influencing Microevolutionary Processes in Taxonomically Challenging Land Snail Species of *Trochulus* (Gastropoda: Hygromiidae) - **Małgorzata Proćków**, Joanna R. Pieńkowska, Tomasz Strzała, Elżbieta Kuźnik-Kowalska, Jarosław Proćków, Paweł Blażej, and Paweł Mackiewicz

1:20-1:40 pm - A Phylogenetic Analysis of the Superfamily Acteonoidea (Gastropoda: Heterobranchia) - **Kendall Feliciano** and Ángel Valdés*

1:40-2:00 pm - Redefining *Pila scutata*: A Pathway For Improving the Conservation of a Disappearing Species - **Kelli Deleon**, E. E. Strong, and K. A. Hayes

2:00-2:20 pm - Missing Gaps in The Family Goniodorididae, H. Adams & A. Adams, 1854 (Mollusca: Nudibranchia). Past, Present and Future. - **Sofia Paz-sedano**, Terrence M. Gosliner, and Marta Pola

2:20-2:40 pm - How The Famous Nudibranch *Hexabranchus sanguineus* (Rüppell & Leuckart, 1830) Has Fooled Everyone - Preliminary Results - **Yara Tibiriçá**, Manuel António E. Malaquias, Marta Pola, Terrence M. Gosliner, and Juan Lucas Cervera

AMS Presidential Symposium on Molluscan Collections - *Scripps Hall*

1:00-1:20 pm - Red Listing Can Protect Deep Sea Biodiversity - **Julia D. Sigwart**, Chong Chen, Elin Thomas, Monika Bohm, and Mary Seddon

1:20-1:40 pm - Gut Microbiome Analysis of Museum *Oreohelix strigosa* Collections - **Bridget Chalifour** and Jingchun Li

1:40-2:00 pm - Threatened, Endangered, and Extinct Oh My! Growing and Using Natural History Collections in the Midst of a Biodiversity Crisis - **Norine Yeung**

2:00-2:20 pm - Sequencing Historical Collections to Unlock Systematic and Nomenclatural Issues - **Nicolas Puillandre**, Paul Zaharias, Jawad Abdelkrim, Yuri Kantor, and Alexander Fedosov

2:20-2:40 pm - Biodiversity Research on Marine Heterobranchia In Indonesia - In the Light of National and International Regulations, Collaborations and Networking- **Heike Wägele**, Nani Undap, Adelfia Papu, Dario Karmeinski, and Alexander Donath

2:40-3:00 pm Coffee Break - Chapel Hall

Molluscs as Key Ecological Players Symposium - *Chapel Hall*

3:00-3:20 pm - Predicting Arm Loss Patterns From Life History Traits in Eight Northeastern Pacific Octopus Species - **Kelley M. Voss** and Rita S. Mehta

3:20-3:40 pm - Presence of *Argonauta hians* in Mexican Waters?- **Miguel Angel del Río Portilla***, Carmen E. Vargas-Peralta, and Carmen Alejo Plata

3:40-4:00 pm - In the Footsteps of Edmondson: Shipworm (Bivalvia, Teredinidae) Diversity, Biology, and Ecology in the Hawaiian Archipelago - **Nancy C. Treneman***, James T. Carlton, Regina Kawamoto, and J. Reuben Shipway

4:00-4:20 pm - Mollusks in Deep-sea Chemosynthetic Habitats: Hydrothermal Vents, Hydrocarbon, Seeps, Whale- and Wood-falls - **Robert C. Vrijenhoek**

4:20-4:40 pm - Diving in the Cold South: The Challenging Biology and Ecology of Antarctic Heterobranchs - **Conxita Avila**

4:40-5:00 pm – ~~Pteropod Ecology – **Nina Bednarsek** ~~[WITHDRAWN]

Biogeography Session - *Curlew Hall*

3:00-3:20 pm - *Falcidens salvini-plawen*, 1968 (Chaetodermatidae), a Genus of Aplacophora with a Great Taxonomical and Morphological Diversity in Brazilian Marine Deep Waters - **Flávio Dias Passos**, Marcel Sabino Miranda, Paulo Vinicius Ferraz Corrêa, and Paola Visnardi Fassina

3:20-3:40 pm - Updates on Giant Clam Status and Restocking Efforts in the Philippines - **Sherry Lyn G. Sayco**, Patrick C. Cabaitan, Cecilia Conaco, Lala Grace Calle, Jeremiah Noelle C. Requilme, Eymard John P. Sy, Roger G. Dolorosa, Elmer G. Villanueva, Nino Jess Mar F. Mecha, Krizia Meryl A. Ecube, Girley S. Gumanao, Christine Mae A. Edullantes, Tracy D. Tabalanza, and Rezelle B. Sobradil

3:40-4:00 pm - Trans-Atlantic Rafting-American Bivalves on British Shores - **Anna M. Holmes**

4:00-4:20 pm - Clash of the Chitons: How Morphology, DNA, and Distribution Differ in Three *Nuttallina* Species **Newton Z. Hood** and Douglas J. Eernisse* [Given as POSTER]

4:20-4:40 pm - *Pomacea sordida*, Species Complex or Single Species from Rio De Janeiro State, Brasil? - **Kevin Barbosa**, KennethA Hayes, Robert H Cowie*, Aline Carvalho Mattos, Monica Ammon Fernandez, and Silvana Carvalho Thiengo

Systematics Session - *Marlin Hall*

3:00-3:20 pm - Phylogenetic Systematics of the Genus, *Cyerce* Bergh 1871 (Sacoglossa, Caliphyllidae) Using Molecular and Morphological Data - **Karina Moreno**, Ángel Valdés, Terrence Gosliner, and Patrick Krug*

3:20-3:40 pm - One or Two Black Species Of *Cyerce*? Bergh's Footnotes and What Pease Did Not Mention - **Kathe R. Jensen**

3:40-4:00 pm -A Squadron of Species: An Analysis of the *Goniobranchus roboi* Species Complex -**Lynn J. Bonomo** and Terry Gosliner

4:00-4:20 pm - Dirty Dorid Disaster: An Analysis of the Biodiversity of Discodorididae Nudibranchs - **Samantha A. Donohoo** and Terry Gosliner

4:20-4:40 pm -Arminid Ambiguity: Establishing Significant Genetic and Morphological Markers to Assess Diversity in the Nudibranch Family Arminidae - **Kelly Larkin** and Terry Gosliner

4:40-5:00 pm - Slugs, Slugs, and More Slugs: New Aeolid Nudibranch Species From Western North America - **Brenna Green** and Terry Gosliner

AMS Presidential Symposium on Molluscan Collections - *Scripps Hall*

3:00-3:20 pm - Evolution, Revolution or Neither? Uses of Digitized Molluscan Specimen Records - **Robert Guralnick**

3:40-4:00 pm - Envisioning the 21st Century Museum - **Christopher Meyer**

4:00-4:20 pm - Museums at the Frontline in Archiving the Undocumented Species Diversity of the World - **Philippe Bouchet**

6:00-7:00 pm Dinner - *Crocker Dining Hall*

WEDNESDAY 14 AUGUST, 2019

(Asilomar Conference Center, Pacific Grove, CA)

7:30-8:30 am Breakfast - Crocker Dining Hall

7:00 am - Marine fossils of Capitola Beach with Peter Roopnarine - outside Social Hall

7:30 am - Whale watching on Monterey Bay {Please note: Check in at Discovery Whale

Watch at Fisherman's Wharf in Monterey at 8:30 am. Participants must provide their own transportation to Fisherman's Wharf. Departs 9 am sharp!)

9:00 am - all other field trips depart - outside *Social Hall*

Following in the footsteps of Steinbeck & Ricketts with Alan Kabat Big Sur Coastline

Wine tasting in Carmel Valley & Santa Lucia Mountains

Marine mammal viewing at Point Lobos & Elkhorn Slough with David Lindberg Land snails and slugs of Monterey County with Tim Pearce & John Slapcinsky

6:00-7:00 pm Dinner - *Crocker Dining Hall*

7:00 pm-9:00 pm Student panel discussion by Jessica Goodheart - *Seascapes*

THURSDAY 15 AUGUST, 2019

(Asilomar Conference Center, Pacific Grove, CA)

7:30-8:30 am Breakfast - Crocker Dining Hall

8:30-10:30 am Registration - Chapel Hall

Evolution of Molluscan Weirdness Symposium - *Chapel Hall*

8:40-9:00 am -Weird is the New Normal- How Understanding Adaptations Informs Deep Molluscan Phylogeny - **Julia D, Sigwart**

9:00-9:20 am- Evolution ofYoyo Clams: Within-host Ecological Shifts Lead to Dramatic Morphological Changes - **Ryutaro Goto**, Teal A. Harrison, and Diarmaid Ó Foighil

9:20-9:40 am- Phylogeny of the Lower Heterobranchia Through an Expanded Taxon Sampling and Sanger Sequencing - **Bastian Brenzinger**, Tsuyoshi Takano, Michael Schrödl, and Yasunori Kano

9:40-10:00 am - Transcriptome Based Phylogeny of Gastropoda - Juan E. Uribe, **Vanessa Gonzalez**, Yasunori Kano, David Herbert, Ellen E. Strong, and M. G. Harasewych

10:00-10:20 am - Gain and Loss of the Operculum. Gerhard Haszprunar

Systematics and Biogeography of Continental Molluscs Symposium - *Curlew Hall*

8:20-8:40 am - A Fresh Look at Melanopsidae (Caenogastropoda: Cerithioidea): Evolutionary Systematics, Biogeography, and Conservation Genetics - *Marco T. Neiber*, Simone Cianfanelli, Fabrizio Bartolini, Thomas von Rintelen, and Matthias Glaubrecht

8:40-9:00 am - Phylogeny and Evolution of Genus *Cremnoconchus* (Gastropoda: Littorinidae) from the Western Ghats, India - **Aravind Neelavar Ananthram**, Anushree Jadhav, and Nipu Kumar Das

9:00-9:20 am - Considering the Process of Speciation while Investigating Species Limits Suggests Reinforcement as a Driver of Speciation in Taildropper Slugs - **Megan L. Smith** and Bryan C. Carstens

9:20-9:40 am - Molecular Phylogeny of African Vitrinidae: Unravelling Tertiary Distribution Patterns - **Beat Pfarrer**, Bastian Brenzinger, Yasunori Kano, Michael Schrodt, Nerida Wilson, and Gonzalo Giribet

9:40-10:00 am - Molecular Insights into Species Recognition within SouthernAfrica's Endemic *Tricolia* Radiation - **Tshifhiwa C. Nangammbi**, David G. Herbert, and Peter R. Teske

10:00-10:20 am - Diversification in a Rainforest Land Snail: The Genus *Corilla* Adams Adams, 1858 - **Dinarzarde C. Raheem** and Thierry Backeljau

Systematics Session - *Marlin Hall*

8:20-8:40 am - Looks can be Deceiving: Galapagos Endemic Species of Chiton are Sisters, not Different Clades - **Douglas J. Eernisse*** and Margarita Brandt

8:40-9:00 am - From Three to Ten Species: High Cryptic DiversityAmong Hawaiian Tornatellininae - **Norine W. Yeung**, John Slapcinsky, Ellen E. Strong, and Kenneth A. Hayes

9:00-9:20 am - Update ofAeolidiidae systematics with particular reference to the genus *Aeolidiella* Bergh, 1867 (Gastropoda, Nudibranchia) - **Leila Carmona**, Marta Pola, Terrence M. Gosliner, and Juan Lucas Cervera

9:20-9:40 am - The Mitogenomic Phylogeny of West African Cone Snails (Gastropoda: Conidae) has Taxonomic and Conservation Implications - **Manuel J. Tenorio**, Samuel Abalde, Jose R. Pardos-Blas, Rafael Zardoya, and Carlos M. L. Afonso

9:40-10:00 am - How Many Micro-mollusks are There? A Case Study on Species Richness from Hawai'i - **Bianca Campagnari** and Daniel L. Geiger

10:00-10:20 am - Investigating Species Diversity and Endemism in Hawaiian Microsnails (Stylommatophora: Achatinellidae: Pacificellinae) - **Tricia C. Goulding**, Norine W. Yeung, and Kenneth A. Hayes

Molluscs in Citizen Science Symposium - *Scripps Hall*

8:40-9:00 am - LiMPETS, a Citizen Science Program, Demonstrates the Effectiveness of California's Marine Protected Areas inAllowing Owl Limpets (*Lottia gigantea*) to Grow Larger and more Abundant- **Hannah Sarver**, Rosemary Romero, and John Pearse

9:00-9:20 am - Molluscan Mycophagy- **Casey H. Richart**, BJ Stacey, Kathryn Turner, and Liam E. O'Brien

9:20-9:40 am - "Slugs count" Mapping Slug Diversity in UK Gardens - **Imogen C.N. Cavadino**, Gerard R.G. Clover, Hayley B.C. Jones, Gordon Port, and Helen E. Roy

10:00-10:20 am - Sea Slugs of Southern Norway:An Example of Citizens Contributing to Science - **Cessa Rauch** and Manuel Antonio E. Malaquias

10:20-10:40 am Coffee Break - *Chapel Hall*

Evolution of Molluscan Weirdness Symposium - *Chapel Hall*

10:40-11:00 am - Replacing Mechanical Protection with Colorful Faces - Twice: Parallel Evolution of Non-operculate Marine Worm-snail Genera (Caenogastropoda: Vermetidae) - **Rüdiger Bieler**, Camila Granados-Cifuentes, Timothy M. Collins, Rosemary Golding, John M. Healy, and Timothy Rawlings

11:00-11:20 am - The Scaly-foot Snail Genome and the Ancient Origins of Biomineralized Armor - **Jin Sun**, Chong Chen, Norio Miyamoto, Julia D. Sigwart, and Pei-Yuan Qian

11:20-11:40 am - Sexual Differentiation in Somatic Growth within Two Species of Freshwater Mussels, Lampsilis cardium and Lampsi!is siliquoidea, as a Function of Environmental Impacts - **Mariah Scott** and Rudiger Bieler

11:40 am-12:00 pm - Genomic Factors Involved in Sex Determination and Differentiation in a Protandrous Hermaphrodite Bivalve, the Pearl Oyster *Pinctada margaritifera* - **Vaihiti Teaniniuraitemoana**, Celine Reisser, Jeremie Vidal-Dupiol, and Gilles Le Moullac

Systematics and Biogeography of Continental Molluscs Thematic Session - *Curlew Hall*

10:40-11:00 am - Ampullariidae of the Midwest Region of Brasil: Hydrographic Basin Tocantins-Araguaia and Paraguay River Basin - **Silvana A. R. Thiengo**, R. H. Cowie*, M.A. Fernandez, K. H. P. Barbosa, and K.A. Hayes

11:00-11:20 am - New Species of *Uncancylus* Pilsbry, 1913 (Gastropoda: Hygrophila: Planorboidea: Ancylinae) from SouthAmerica - **Sonia Barbosa dos Santos**, Ximena Maria Constanza Ovando, Luiz Eduardo Macedo de Lacerda, and Dayse Aparecida da Silva

11:20-11:40 am - Land Snail Diversity Across Habitat Gradients in Mount Banahaw Protected Landscape, Luzon Island, Philippines - **Kinsely Meg G. Perez**, Virginia C. Cuevas, Carmelita M. Rebancos, Emmanuel Ryan C. de Chavez, and Juan Carlos T. Gonzalez

11:40 am-12:00 pm - Placing Peculiar Planorbids of the Pacific Northwest - **David C. Campbell** and Charles Lydeard

Systematics Session - *Marlin Hall*

10:40-11:00 am - Integrating Population Genetics and Genomics with Shell Shape Analyses on the Brooding Chiton *Onithochiton neglectus* (Polyplacophora:Chitonidae) - **Priscila M. Salloum**, Anna W. Santure, Pierre de Villemereuil, and Shane D. Lavery

11:00-11:20 am -Targeted Sequencing and Phylogenomics of the Critically Imperiled Pleuroceridae - **Ellen E. Strong**, Nathan V. Whelan, Nicole Garrison, Paul D Johnson, and Jeffrey T. Garner

11:20-11:40 am - Is the Flamed Tigersnail,*Anguispira alternata*, a Species Complex or Complex Species? - **John Slapcinsky**, Reham Fathey, Ryan Corlett, Timothy A. Pearce, and Kenneth H. Hayes

11:40 am-12:00 pm - Population Genetics of European Populations of the Shining Ramshorn Snail, *Segmentina nitida*- or are They? - **C.S. Hobbs**, R. Vega, D.A. Dawson, G.J. Horsburgh, and C.D. Harvey

Molluscs in Citizen Science Symposium - *Scripps Hall*

10:40-11:00 am - Scaling Volunteer Biodiversity Documentation of Molluscs through Citizen Science Programs and Technology - **Alison N. Young** and Rebecca F. Johnson*

11:00-11:20 am - The Gulick Effect: How Malacological Collecting, Observation, and a Prepared Mind Changed Evolutionary Theory - **Carole S. Hickman***

11:20-11:40 am - John Thomas Gulick in Japan - **Paul Callomon**

11:40 am-12:00 pm - SLIME: Citizen Science Focused on the Terrestrial Malacolofauna of Southern California - **Jann E. Vendetti***

12:00-1:00 pm Lunch - *Crocker Dining Hall*

Utility of Molluscan Genomics Symposium - *Chapel Hall*

1:00-1:20 pm -Are we there yet? The Impact of NGS in Molluscan Phylogenetics - **Gonzalo Giribet**, Tauana Cunha, Vanessa L. Gonzalez, Vanessa L. Knutson, Sarah Lerner, and Juan Moles

1:20-1:40 pm - Gene Family Expansions in the Evolution of Cephalopod Innovations - **C. B. Albertin**, T. Mitres, H. Schmidbaur, E. Garcia, Z. Y. Wang, 0. Simakov, C. W. Ragsdale, and D.S. Rokhsar

1:40-2:00 pm - Genomic Analysis of Contagious Cancers of Clams - **Michael J. Metzger**

2:00-2:20 pm - The More, the Merrier: Expanding Taxon Sampling to Address Heterobranch Phylogeny in a Phylogenomic Context- **Vanessa L. Knutson**, Bastian Brenzinger, Yasunori Kano, Michael SchrodI, Nerida Wilson, and Gonzalo Giribet

2:20-2:40 pm - TBD - **D.S. Rokhsar**

Systematics and Biogeography of Continental Molluscs Thematic Session - *Curlew Hall*

1:00-1:20 pm - The Status of *Tryonia porrecta* (Mighels, 1845) in the Hawaiian Islands (Gastropoda: Cochliopidae) - **Carl C. Christensen**

1:20-1:40 pm - Modification of the Penial Twin Papillae System within the Tribe Otalini (Stylommatophora, Helicidae) - **Jeannette Kneubiihler** and Eike Neubert

1:40-2:00 pm - Distribution Patterns and Genetic Differentiation of the Endangered Thick-shelled River Mussel *Unio crassus* Philipsson, 1788 in Southwest Germany - **Ira Richling** and Cornelia Krause

2:00-2:20 pm -A Mitochondrial Genome Phylogeny of Mytilidae (Bivalvia: Mytilida) - Yucheol **Lee,** Taeho Kim, and Joong-Ki Park

2:20-2:40 pm - Margaritiferidae Revisited - **Arthur E. Bogan**, Ivan N. Bolotov,Van Tu Do, David C. Aldridge, Miguel M. Fonseca, Han Ming Gan, Mikhail Y. Gofarov, AlexanderV. Kondakov, Vincent Prie, Ronalda Sousa, Simone Varandas, Ilya V. Vikhrev, Amflcar Teixeira, Rui-Wen Wu, Xiaoping Wu, Alexandra Zieritz, Elsa Froufe, and Manuel Lopes-Lima

Novel Approaches to Managing Invasive and Pest Molluscs Symposium - *Marlin Hall*

1:00-1:20 pm - *Phasmarhabditis* spp and Invasive Gastropods in the US: Where are we in the Battle? - **Irma Tandingan De Ley**, Rory Mc Donnell, and Timothy Paine

1:20-1:40 pm - Development and Integration of Lures into Southern Florida's Giant African Snail (*Lissachatina fulica*) Eradication Program - **Amy L. Roda**, Jocelyn G. Millar, Mary Yong Cong, Chris Jacobsen, and Rory J. McDonnell

1:40-2:00 pm - 3D Printed Traps, Detector Dogs, and Bees as Tools for Invasive Snail Detection in Florida - **Katrina L. Dickens** and Ariane McCorquodale

2:00-2:20 pm - Habitat Selection and Invasion Success of an Exotic Slug - **Érik L'Heureux** and Bernard Angers

2:20-3:00 pm - Essential Oils as Novel Tools for Managing the Invasive Slug *Deroceras reticulatum* (Agriolimacidae: Gastropoda) - **Rory J. McDonnell**, Matthew L. Klein, Thomas G. Chastain, and Carol J. Garbacik

Evolution of Molluscan Weirdness Symposium - *Scripps Hall*

1:00-1:20 pm - Snail of Many Parts - Anatomical Diversity and Ecological Disparity Among Deep-sea Abyssochrysoid Gastropods - **Chong Chen**, Katsuyuki Uematsu, Hiromi K. Watanabe, and Shannon B. Johnson

1:20-1:40 pm - Sexual Selection and Reciprocity in Euthyneuran Gastropod Mating Systems - **Janet L Leonard*** and Chantal Stock

1:40-2:00 pm - Mating Behavior in Aeolids did not Complete so Quickly - **Yasuhiro Nakashima** and Keita Yokoi

2:00-2:20 pm - Signatures of Divergence, Invasiveness, and Terrestralization Revealed by Four Apple Snail Genomes - **Jack C.H. Ip** and Jian-Wen Qiu

~~2;20-2:40 pm - A Rock-boringand Rock-ingesting Freshwater Bivalve (Shipworm) from the Philippines - **J. Reuben Shipway**, Daniel L. Distel, Gary Rosenberg, Gisela P. Concepcion, and Margo G. Haygood~~ [WITHDRAWN]

2:40-3:00 pm Coffee Break - *Chapel Hall*

Utility of Molluscan Genomics Symposium - *Chapel Hall*

3:00-3:20 pm - The Genome of the Chiton *Acanthopleura granulata*: An Aculiferan Perspective of Molluscan Biomineralization - **Rebecca M. Varney** and Kevin Kocot

3:20-3:40 pm - Discovery of New Light-sensing Proteins in the Scallop: Strategies to Best Utilize Large Datasets - **Jeanne M.Serb**, G. Dalton Smedley, and Davide Faggionato

3:40-4:00 pm - Setting the Foundations and Developing Tools for Studying the Regeneration of Complex Eyes in the Emerging Research Organism, *Pomacea canaliculata* (Gastropoda, Ampullariidae) -**Alice Accorsi**, Eric Ross, Melainia McClain, Timothy Corbin, and Alejandro Sanchez Alvarado

4:00-4:20 pm - Exon Capture Resolves a Recent Radiation and Uncovers Mitonuclear Discordance in Nudibranchs - **Kara Layton**, Jose I. Carvajal, and Nerida G. Wilson

4:20-4:40 pm - Transcriptome Based Phylogeny of Gastropoda - **Juan E. Uribe**, Vanessa L. Gonzalez, Yasunori Kano, David G. Herbert, Ellen E. Strong, and M. G. Harasewych

4:40-5:00 pm - Using Comparative Genomics to Reveal the Underpinnings of Bioluminescence Symbioses in Bobtail Squid - **Michele K Nishiguchi**, Elizabeth Heath-Heckman, and Daravuth Cheam

Systematics and Biogeography of Continental Molluscs Symposium - *Curlew Hall*

3:00-3:20 pm - Land Snails (1) : Dinosaurs (0) - Phylogenomics Resolves Late Mesozoic Diversification of Helicoid Land Snails - **Frank Köhler**, Makiri Sei, Gary Rosenberg, and Adnan Moussalli

3:20-3:40 pm - Go with the Flow? - Diversity and Speciation in Endemic Freshwater Gastropods in the Kaek River, Thailand - **Nora Lentge-Maaß** and Matthias Glaubrecht

3:40-4:00 pm - Non-invasive Audio-video Sampling of Gastropod Activity - **Christopher L. Kitting**

Evolution of Toxins in Molluscs mini-Symposium - *Curlew Hall*

4:00-4:20 pm - Fish-hunting Cone Snails: How Correlating Behavior with Venom Peptides Facilitates Biomedical Applications - **Baldomero M. Olivera**, Shrinivasan Raghuraman, and Helena Safavi

4:20-4:40 pm - Poisonous Eggs From *Pomacea* Snails have Evolved a Defensive Protein that Damage Cell Membranes with a Pore-forming Toxin Delivered by a Lectin - **Heras Horacio**, Matías Giglio, Santiago Ituarte, Verónica Milesi, and Eduardo Prieto

4:40-5:00 pm - Venom Evolution of West African Cone Snails (Gastropoda: Conidae) - **Samuel Abalde**, Manuel J. Tenorio, Carlos M. L. Afonso, and Rafael Zardoya

Novel Approaches to Managing Invasive and Pest Molluscs Thematic Session - *Marlin Hall*

3:00-3:20 pm - *Mytella strigata* Emerging as an Invasive Marine Threat in SoutheastAsia - **Kitithorn Sanpanich** and Fred E. Wells

3:20-3:40 pm - Infestations of Exotic Pest Snails and Slugs in Australian Grain Crops - **Michael Nash**

3:40-4:00 pm - Hungry Slugs: the Feeding Habits of an Invasive Species - **Érik L'Heureux**, Hinatea Ariey, and Bernard Angers

4:00-4:20 pm -Apple Snails as a Weed Biocontrol Using Anti-feedance - Fatima Haider, Myron Smith, and **James Coupland**

4:20-4:40 pm - Molluscan Receptors and Neuropeptides to Control the Gray Garden Slug,

Deroceras reticulatum - **Man-Yeon Choi** and Seung-Joon Ahn

4:40-5:00 pm - Biocontrol of Land Snails: Unlearned Lessons and Non-target Impacts - **Kenneth A. Hayes**, Carl C. Christensen, and Norine W. Yeung

Evolution of Molluscan Weirdness Symposium - *Scripps Hall*

3:00-3:20 pm - Phylogenetic Patterns of Dorid Nudibranch Spicule Networks - **Brian K. Penney** and J. Mitchell Young

3:20-3:40 pm - Slug Thieves: Nematocyst Acquisition Process in Aeolid Nudibranchs - **Lisa Paggeot** and Terrence M. Gosliner

3:40-4:00 pm - Phylogenetic Variability of Neural Circuitry in Nudipleura - **Paul S. Katz**, Akira Sakurai, Arianna N. Tamvacakis, and Joshua L. Lillvis

4:00-4:20 pm - Evolution of Mantle Sensory Organs in Bivalves: What Pteriomorphians tell us about Convergence and Adaptive Innovations - **Jorge A. Audino**, Jeanne M. Serb, and José Eduardo A. R. Marian

4:20-4:40 pm - Hemocyanin and Habitat Shifts of Heterobranchia - **Bernhard Lieb** and Gabriela Schäfer

4:40-5:00 pm - A New Intriguing Species of *Psilodens* (Caudofoveata, Limifossoridae) - **Marcel Sabino Miranda**, Carmen Regina Parissotto Guimarães, and Flávio Dias Passos

6:00-7:00 pm Dinner - *Crocker Dining Hall*

7:30-9:30 pm Molluscan Auction (snacks and no host bar) - *Seascapes*

FRIDAY 16 AUGUST, 2019

(Asilomar Conference Center, Pacific Grove, CA)

7:30-8:30 am Breakfast - Crocker Dining Hall

8:30-10:30 am Registration - Chapel Hall

Malacological Society of London Symposium on Color and Vision in Molluscs Symposium - *Chapel Hall*

9:00-9:20 am - The Sound of a Wild Snail Eating - **Elisabeth Tova Bailey**

9:20-9:40 am - Eye morphology and the depth distribution of large heteropods (Pterotracheidae and Carinariidae) in the northern Gulf of Mexico - **Michael Vecchione**, Kristine A. Clark, Heather L. Judkins, Brad A. Seibel

9:40-10:00 am - The evolution and diversification of eyes in strombid gastropods - **Alison Irwin**, Ellen Strong, Nicholas Roberts, Elizabeth Harper, Suzanne Williams

10:00-10:20 am - Repeated loss of vision and sensory compensation in deep-sea gastropods - **Lauren Sumner-Rooney**, Julia Sigwart, Suzanne Williams

Biogeography Session - *Curlew Hall*

9:00-9:20 am - Origin of Diversity by Repeated Hybridization in the Doorsnail *Charpentieria itala* in the Southern Alps - **Bernard Haudorf**

9:20-9:40 am - Comparison of Biogeography Patterns of Two Freshwater Snails - Physa acuta and Helisoma anceps - **Kelly Martin**, Jingchun Li

9:40-10:00 am - *Micrarionta* land snails living on San Clemente Island, California: One species or two? - **Timothy A. Pearce**, Marvin C. Fields, Nathan Brouwer

10:00-10:20 am - Archipelago-wide patterns of diversity and divergence among an endemic radiation of Galapagos land snails - **John G. Phillips**, T. Mason Linscott, Andrew M. Rankin, Andrew C. Kraemer, Christine E. Parent

Utility of Molluscan Genomics Symposium - *Marlin Hall*

8:20-8:40 am - Empirical testing of minimum sample size and marker number required for estimating population genomic parameters using ddRAD seq data from *Webbhelix multilineata* (Mollusca, Gastropoda, Stylommatophora) - **Jermaine Mahguib**, Kyung Seok Kim, and Kevin Roe

8:40-9:00 am - Phylogenomic analyses confirm a novel invasive North American *Corbicula* (Bivalvia: Cyrenidae) lineage -**Amanda E. Haponski**, Diarmaid O' Foighil

9:00-9:20am - Generating molecular tools to study gastropod development - **Maryna Lesoway**, Jonathan Henry

9:20-9:40 am - Tangled tentacles: how useful are currently available genome-scale data for resolving relationships among the decapodiform cephalopods? - **Frank E. Anderson**, Annie R. Lindgren

9:40-10:00 am - Toward a fully resolved phylogeny of the Neogastropoda: a phylogenomic approach helps dissecting backbone relationships - **Alexander E. Fedosov**, Paul Zaharias, Mark Phuong, Delphine Gey, Maria Vittoria Modica, Mandë Holford, Yuri I. Kantor, Marco Oliverio, Philippe Bouchet, and Nicolas Puillandre

10:00-10:20 am - Understanding Phylogenetic Relationships in Cladobranchia (Nudibranchia,Heterobranchia, Gastropoda) using NGS Data - **Dario Karmeinski**, Jessica Goodheart, Tatiana Korshunova,Alexander Martynov, Michael Schroedl

Molluscs as Model Paleontological Systems Symposium - *Scripps Hall*

9:00-9:20am -Are all happy families alike? Trajectories of phylogenetic, functional, and morphological diversity in marine bivalve lineages following the end-Cretaceous extinction. - **Stewart M. Edie**, Katie S. Collins, David Jablonski

9:20-9:40 am - EMPTY

9:40-10:00 am - What's (Dug) up (at Old) Dock II -**Timothy Campbell**, Lyle Campbell, David Campbell

10:00-10:20 am - The evolution of mollusks at deep-sea hydrothermal vents and methane seeps - **Steffen Kiel**

10:20-10:40 am Coffee Break - *Chapel Hall*

Malacological Society of London Symposium on Color and Vision in Molluscs Symposium - *Chapel Hall*

10:40-11:00 am - Holding mirrors up to nature: The structure and function of the eyes of scallops - **Daniel I. Speiser**

11:00-11:20 am - Astonishing photochemical diversity in the scallop *Argopecten irradians* (Pectinidae) indicates sophisticated visual system - **Jeanne M. Serb**

11:20-12:00 pm - Dynamic colorful skin and colorblind camouflage by cephalopods - **Roger T. Hanlon**

Biogeography Session- *Curlew Hall*

10:40-11:00 am - Contrasting Phylogeography of Two Limpet Genera in the Southern Ocean - **Hamish G. Spencer**, Claudio González-Wevar

11:00-11:20 am - Deep Down Under: Australia's abyssal mollusc fauna - **Hugh MacIntosh**, Francesco Criscione, Anders Hallan, Frank Koehler

11:20-11:40 am - Macro (and micro!) molluscs of the Kimberley marine region of Western Australia - **Lisa Ann Kirkendale**, Zoe T. Richards, Andrew Hosie, Peter Middelfart

11:40-12:00 pm - Growth rates of potamidid snails in mangroves in northern Australia - **Fred E. Wells**

Utility of Molluscan Genomics Symposium - *Marlin Hall*

10:40-11:00 am -A congruent topology for deep gastropod relationships -**Tauana Junqueira Cunha**, Gonzalo Giribet

11:00-11:20 am - Resolving the relationships of clams and cockles using dense transcriptome sampling - **Sarah Lerner**, David Combosch, Peter Ward, Neil Landman, Gonzalo Giribet

11:20-11:40 am - Phylogeny and diversity of the Indo-West Pacific gastropods *Haloa sensu lato* (Cephalaspidea: Haminoeidae): Tethyan vicariance, generic diversity, and ecological specialization - **Manuel António E. Malaquias**, Trond R. Oskars

11:40-12:00 pm - Molluscan Biomineralisation in the Antarctic - An Integrative Approach - **Victoria A. Sleight**

Molluscs as Model Paleontological Systems Symposium - *Scripps Hall*

10:40-11:00 am - Advances in Quaternary non-marine molluscan research: the view from Britain and NW Europe - **Tom S. White**

11:00-11:20 am - Miocene California and Caribbean mollusks refine age of the Salada Formation, southwestern Baja California Sur, Mexico - **Judith Terry Smith***

11:20-11:40 am -Why are there so few molluscs in the polar oceans? - **James Alistair Crame**

11:40-12:00 pm -An Integrated Approach to Unraveling the Fossil Record: Estimating the Paleontological Past, One Phylogeny at a Time - **S. G Wiedrick***, A. J. W. Hendy, and D. J. Eernisse

12:00-1:00 pm Lunch - *Crocker Dining Hall*

Malacological Society of London Symposium on Color and Vision in Molluscs Symposium - *Chapel Hall*

1:00-1:20 pm - Unravelling the rainbow - attempts to understand the evolution of shell colour in molluscs - **Suzanne T. Williams**, Heather E. Grant, Jessica Wade

1:20-1:40 pm - Elucidating the molecular basis of pigmentation in the tropical abalone, *Haliotis asinina* - **Carmel McDougall**, Daniel J. Jackson, Bernard M. Degnan

1:40-2:00 pm - Shell Pigmentation In The Eastern Oyster, *Crassostrea virginica* - **Michael Whiteside**, Suzanne Williams, Kazumas Wakamatsu Sho Ito, Jessica Wade, Ximing Guo

2:00-2:20 pm - Deciphering shell color pigmentation pathways in the pearl oyster *Pinctada margaritifera* (Linnaeus 1758) through whole transcriptome sequencing and fine gene expression tuning - **Pierre-Louis Stenger**, Chin-Long Ky, Celine Reisser, Serge Planes, Jeremie Vidal-Dupiol

2:20-2:40 pm - The colour polymorphism of the snail *Cepaea nemoralis* is indiscrete - **Angus Davison**, Hannah J. Jackson, Ellis W. Murphy, and Tom Reader

Molluscs as Key Ecological Players Symposium - *Curlew Hall*

1:00-1:20 pm - The biology of Japanese epizoic limpet *Lottia tenuisculpta*- **Ryo Nakayama**, Tomoyuki Nakano

1:20-1:40 pm - Monitoring freshwater mussels in complex rivers: comparison of case studies - **Joaquim Reis**, Daniel Garrido, Daniel Pires

1:40-2:00 pm - Community Structure of Intertidal Muricids (Mollusca; Muricidae) Present in Verde Island, Batangas City, Batangas Philippines - **Ruthela P. Payawal**, Brian B. Valencia, Adelyn Escobar, Karl Arbie Borrero

2:00-2:20 pm - Developing resilience to ocean acidification in abalone aquaculture - **Daniel S. Swezey**, Sara E. Boles, Kristin M. Aquilino, Doug Bush, Tessa M. Hill, Brian Gaylord, Cynthia A. Catton, Laura Rogers-Bennett, Andrew Whitehead, Jim Moore, and Eric Sanford

2:20-2:40 pm - Decline and Stabilization of Black Abalone in Monterey Bay, California - **J.C. Selgrath**, J. Carlton, R. Elahi, J. Pearse, T. Thomas, J. Watanabe, and F. Micheli

Utility of Molluscan Genomics Symposium - *Marlin Hall*

1:00-1:20 pm - Phylogenomics and macroevolution of the venomous gastropods Turridae (Gastropoda, Conoidea) - **Paul Zaharias**, Yuri I. Kantor, Alexander E. Fedosov, Mark Phuong, Nicolas Puillandre

1:20-1:40 pm - Exploring species delimitation methods in the *Albinaria cretensis* complex on Crete based on RADseq data - **Sonja Bamberger**, Bernhard Hausdorf

(1:40-2:00 pm - The complete mitochondrial genome of the pygmy octopus "Octopus" fitchi (Cephalopoda: Octopodidae) from the Gulf of California, Mexico reveals its phylogenetic position within Octopoda - **Miguel Angel del Río Portilla***, Erika Magallón-Gayón, Irene A. Barriga-Sosa

2:00-2:20 pm - Presence of *Argonauta hians* in Mexican waters? - **Miguel Angel del Río Portilla***, Carmen E. Vargas-Peralta, Carmen Alejo Plata

2:20-2:40 pm - Do emergent technologies (10X Genomics, PacBio and Hi-C) help molluscan genome reconstruction?: Assembling a reference-quality genome for *Solemya velum* (Bivalvia: Protobranchia) - **Vanessa L. Gonzalez**, Shelbi L. Russell, Rebecca B. Dikow, Gonzalo Giribet Ellen Strong

Molluscs as Model Paleontological Systems Symposium - *Scripps Hall*

1:00-1:20 pm -What Ammonoid Cephalopods Tell Us About Biodiversity Dynamics on a Changing Earth - **Dr. Margaret M. Yacobucci**

1:20-1:40 pm - Biodiverity hotspots and the dynamics of diversity gradients: Marine bivalves in time and space- **David Jablonski**, Stewart M. Edie, Katie S. Collins, Kaustuv Roy, James W. Valentine

1:40-2:00 pm - Morphometric species-level discrimination of fossil taxa in a Neogene venerid species complex - **Peter Roopnarine**

2:40-3:00 pm Coffee Break - *Chapel Hall*

Molluscs as Key Ecological Players Symposium - *Curlew Hall*

3:00-3:20 pm - Integrative Systematics of the genus *Thuridilla* Bergh, 1872 (Mollusca, Gastropoda, Heterobranchia) Reveals a Cryptic Radiation of Polymorphic Sea Slug Species - **M. Rosario Martín-Hervás**, Leila Carmona, Manuel António E. Malaquias, Patrick J. Krug*, Terrence Gosliner, and J. Lucas Cervera

3:20-3:40 pm- Integrative approach to the systematics of the genus *Dondice* Marcus, 1958 (Heterobranchia: Nudibranchia) from the Western Atlantic - Kelly García-Méndez, Angel Valdés*

Utility of Molluscan Genomics Symposium - *Marlin Hall*

3:00-3:20 pm - High-throughput identification of homologous neurons in the nudibranch *Berghia stephanieae* - **M. Desmond Ramirez**, A. Tamvacakis, J. Dwyer, J. Bergan, P. Katz

3:20-3:40 pm - Genome assembly of the pearl oyster *Pinctada margaritifera*: a tool for environmental and evolutionary research - **Celine M.O. Reisser**, Jeremie Vidal-Dupiol, Jeremy Le Luyer, Chin Long Ky, Serge Planes

3:40-4:00 pm - Genomic signatures of evolution in *Nautilus* - **Sarah Lerner**, David Combosch, Peter Ward, Neil Landman, Gonzalo Giribet

4:00-4:20 pm - Utility of mitogenomes in resolving the phylogeny of gastropods at different taxonomic levels - **Rafael Zardoya**, Samuel Abalde, Juan E. Uribe, José Templado, and Manuel J. Tenorio

Additional Activities and Meetings

3:00 Monterey Bay Aquarium behind-the scenes tour-The tour starts at 3:45 pm, and takes up to 1 hour; you can stay longer at the Aquarium until closing (6 pm), which will give you time to return to Asilomar for the end-of-meeting banquet! You need to find your own transportation to the Aquarium.

3:00-4:30 pm	Unitas Malacologica General Assembly- *Chapel Hall*
3:00-4:30 pm	Western Society of Malacologists business meeting - *Scripps Hall*
4:30-6:00 pm	American Society of Malacologists business meeting - *Chapel Hall*
7:00-10:00 pm	Mexican Fiesta Banquet and student awards ceremony - *Outdoor Barbeque Area*

Oral Presentations

Alphabetical by First Author

NOTE Only those presentations from WSM members are included here. Please see the World Congress site for the complete listing

Pomacea sordida, Species Complex or Single Species from Rio de Janeiro State, Brasil?

Kevin Portilho Barbosa*[1], Kenneth A Hayes[3], Robert H Cowie[2], Aline Carvalho Mattos[1], Monica Ammon Fernandez[1], and Silvana Carvalho Thiengo[1]

[1]Laboratório de Malacologia, Instituto Oswaldo Cruz, Fundação Oswaldo Cruz, Av. Brasil 4365, Manguinhos, CEP21040-900, Rio de Janeiro, RJ, Brasil.

[2]Pacific Biosciences Research Center, University of Hawaii, 3050 Maile Way, Honolulu, Hawaii 97822, USA.

[3]Bishop Museum, Honolulu, Hawaii 97822, USA

Despite the ecological and economic significance of Ampullariidae, the taxonomy of many members of this family is still in need of revision. This work, part of a broader Neotropical ampullariid taxonomic revision, aims to examine the species limits and biogeography of *Pomacea sordida*, a potentially threatened apple snail endemic to Rio de Janeiro state. The Mollusc Collection of the Oswaldo Cruz Institute (CMIOC) contains 89 lots of *P. sordida* that were examined morphologically (conchology and soft anatomy), and DNA sequence data were obtained from the 11 lots containing ethanol preserved material. The main diagnostic anatomical features were found in the male reproductive system and specimens from different municipalities exhibited differences in penis sheath shape and the location of its glands in comparison with the previous descriptions. Mitochondrial COI sequences from eight individuals produced five new haplotypes, when compared to two previously published sequences for this species. Analysis of all haplotypes indicated K2P distances of 0.7- 4.3%, values consistent with population structure recorded in other species of Pomacea. Such structure is consistent with populations that have disjunct distributions across a heterogenous landscape, resulting in reduced gene flow among populations. Information from newly collected samples in 12 municipalities will help to clarify the taxonomy of *P. sordida*. Additional surveys in Rio de Janeiro will help clarify the biogeography, evolution, and systematics of *P. sordida*, as will additional morphological and molecular analyses. These data will allow us to address the question of species limits in *P. sordida* and the closely related *P. intermedia* which has been confused historically with *P. sordida*.

A Squadron of Species: An Analysis of the *Goniobranchus roboi* Species Complex

Lynn J. Bonomo*[1,2] and Terrence M. Gosliner[1]

[1]California Academy of Sciences, Department of Invertebrate Zoology and Geology

[2]San Francisco State University, Department of Biology

In the last several years, the family tree of Chromodorididae has been undergoing refinement due to molecular work, indicating new relationships between taxa. The genus *Goniobranchus* is one clade of the Chromodorididae and used to be included within *Chromodoris*. This genus was determined to be non-monophyletic and *Goniobranchus* was separated out. Molecular work to resolve the internal relationships in Goniobranchus has not been undertaken previously. Only 41 of the 89 potential species have been described formally. Through genetic sequencing, I have added 185 (183 new) *Goniobranchus* specimens and added an additional 43 species from GenBank. I used two mitochondrial (COI and 16s) genes and one nuclear gene (H3) to begin to resolve the genetic relationships between *Goniobranchus* species. Through my phylogenetic analyses, I have discovered a species complex of *G. roboi* that consists of at least four species. Details of this newly documented diversity are presented here and morphological differences that reflect the genetic differences will be discussed.

Update of Aeolidiidae Systematics with Particular Reference to the Genus *Aeolidiella* Bergh, 1867 (Gastropoda, Nudibranchia)

Leila Carmona*[1], Marta Pola[2], Terrence M. Gosliner[3], and Juan Lucas Cervera[1,4]

[1]Campus Rio San Pedro s/n, Marine Research Institute (INMAR), 11510 Puerto Real, Cadiz, Spain.

[2]Departamento de Biología, Facultad de Ciencias del Mar y Ambientales, Campus de Excelencia Internacional del Mar (CEI-MAR), Universidad de Cádiz, Polígono Río San Pedro, s/n, Ap.40, 11510 Puerto Real, Cádiz, Spain

[3]Department of Invertebrate Zoology, California Academy of Sciences, 55 Music Concourse Drive, Golden Gate Park, San Francisco, CA 94118, USA

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Traditionally, *Aeolidiella* Bergh, 1867 is the aeolidiid genus to which most nominal species have been ascribed. *Aeolidiella alderi* (Cocks, 1852), *Aeolidiella occidentalis* Bergh 1874, *Aeolidiella sanguinea* (Norman, 1877), *Aeolidiella drusilla* Bergh, 1900, *Aeolidiella alba* Risebec, 1928, *Aeolidiella lurana* Marcus and Marcus, 1967 and *Aeolidiella stephanieae* Valdés, 2005 are some examples of species ascribed or transferred to *Aeolidiella* at least once. However, recent studies redefined *Aeolidiella*, in order to recover its monophyly, as a small genus constituted by *A. alderi* (the type species), *A. glauca* (Alder and Hancock, 1845) and *A. sanguinea.* This contribution aims to improve the systematics of this genus by incorporating into the molecular and morphological study specimens of *A. drusilla*. Our molecular phylogeny based on H3, COI and 16S, as well as the species-delimitation analyses reveal the existence of an undescribed genus and a new species of *Aeolidiella*.

Dirty Dorid Disaster: An Analysis of the Biodiversity of Discodorididae Nudibranchs

Samantha A. Donohoo*[1,2] and Terrence M. Gosliner[1]

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Due to increases in ocean temperature, the overall biodiversity of coral reefs will continue to change, and key predators such as nudibranch sea slugs may be decimated by the lack of prey. One sponge-eating nudibranch family nicknamed the “Dirty Dorids”, also known as the Discodorididae, are generally small cryptic nudibranchs with retractable gills, and are found in almost every marine ecosystem around the world. The diversity and systematics of the Discodorididae is not well understood due to the high number of diverse species and genera, few curated specimens maintained in ethanol, and major confusion on the evolution of several basal genera. My goal is to determine the diversity and evolutionary history of Discodorididae by utilizing specimens representing around 50+ genera of previously known and unknown species. Using sanger sequencing, I will generate a molecular phylogeny of the cytochrome oxidase I (COI) and 16s mitochondrial genes and 18S, 28S, and histone 3 (H3) nuclear genes, which will then be supported with morphological features used for identification. Within Discodorididae, we expect to find two major subgroups: one composed of genera with extra sensory outgrowths known as caryophyllidia and a second group of genera without caryophyllidia. We anticipate that caryophyllidia evolved later in the evolutionary history of the family because they are only found within the Discodorididae.

Looks can be Deceiving: Galápagos Endemic Species of *Chiton* are Sisters, not Different Clades

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The authors of separate recent monographs of Chitoninae (Polyplacophora) each used valve characters to assign two impressively large-bodied species of *Chiton* Linnaeus, 1758, both endemic to Galápagos shores, to different New World species groupings. Their classifications had little else in common. In his 1988 monograph, Bullock assigned the first Galápagos species, the heavily-sculpted *Chiton sulcatus* Wood, 1815, to *Chiton* s.s. along with its Caribbean type species, *C. tuberculatus* Linnaeus, 1758, plus two Eastern Pacific species. He placed the smooth- valved Galápagos species, *Chiton goodallii* Broderip, 1832, in subgenus *Diochiton* Thiele, 1893, with its Eastern Pacific type species, *C*. (*D*.) *albolineatus* Broderip & Sowerby, 1829, and also including the Caribbean *C*. (*D*.) *squamosus* Linnaeus, 1764 and *C*. (*D*.) *marquesanus* Pilsbry, 1893, endemic to the French Polynesian Marquesas Islands. In 2006, Kaas, Van Belle, and Strack mostly followed Van Belle's 1983 classification in grouping both *C. sulcatus* and *C. goodallii* into subgenus *Radsia* Gray, 1847, with its Chilean type species, *C*. (*R*.) *barnesii.* Bullock had also recognized *Radsia* but elevated to full genus and including only a South African species besides the type species. Our own DNA-based analysis, based on new material from the Galápagos (MB) and ongoing analysis of the family (DE), supports neither conflicting view. Instead, the Galápagos species are resolved as sister species, nested within a group of three tropical Eastern Pacific species, and even closer to the Polynesian, *C. marquesanus*. The phylogenetic position of *C. marquesanus* implies a long-distance rafting event from the Galápagos to the Marquesas Islands, representing an exception to the New World distribution of *Chiton*.

A Phylogenetic Analysis of the Superfamily Acteonoidea (Gastropoda: Heterobranchia)

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Acteonoidea is a superfamily of shelled sea slugs that includes the families Acteonidae and Aplustridae. Bullinidae is another potential family in this group with unclear status, currently being included within Aplustridae. Within each family, the relationships between genera are largely unknown. Members of Acteonoidea are distributed worldwide. This clade has been historically classified as a member of Cephalaspidea due to the presence of a headshield.

However, recent molecular analyses have reclassified Acteonoidea into an unofficial group termed Lower Heterobranchia. Although members of Acteonoidea have been traditionally classified based on morphological features, recent studies have indicated that these characters may be homoplastic. The goal of this analysis is to reconcile molecular and morphological data and determine the relationships among members of Acteonoidea. This study will create a molecular phylogeny based on a number of specimens from localities around the globe using two mitochondrial genes (16S and CO1) and one nuclear gene (H3).

Cryptic Coral Connoisseurs: Exploring the Hidden Diversity of Corallivorous Nudibranchs

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While geographic speciation processes have historically dominated the literature, there is growing interest in ecological speciation, where reproductive isolation evolves as a result of divergent natural selection. Ecological speciation may be an important source of biodiversity on coral reefs, where sister taxa often share ranges with little evidence for divergence via vicariance. A common driver of ecological speciation is host shifting, where species that are adapted to live and feed on a specific host evolve a preference for a novel host, resulting in isolation and diversification. Host shifting has been suggested as a key mechanism for speciation in corallivorous nudibranchs. In this study we integrate ecological, morphological, geographic, and genomic data to evaluate the evolutionary history of corallivorous nudibranchs with respect to their coral hosts. We custom-designed a new targeted bait set to capture 2,018 ultraconserved elements and exons, which can be broadly applied across all heterobranchs. We successfully sequenced 1,951 of the targeted loci and constructed new phylogenetic trees for the coral-feeding *Tenellia* and *Phyllodesmium*. We will present these new, robust trees, along with comparative analyses of the relative roles of hard and soft coral in generating Aeolid biodiversity. We find that the number of coral-feeding nudibranch species, and the number of ecological niches potentially available to nudibranchs, is much higher than previously thought.

Utility of Molluscan Collections in Answering Ecological Questions and Climate Change

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Scientific collections have been utilized primarily for systematic studies, but have also a wide range of utility in answering fundamental questions in comparative biology, medical sciences, and a wide array of other applications. In studying tropic specialization, museum collections provide additional opportunities to examine predator/prey interactions. Traditionally, stomach contents of specimens in museum collections have been utilized to identify potential prey of species of interest and examples of this methodology are illustrated with the heterobranchs with the Polyceridae and Arminidae. With the advent of molecular techniques and barcoding genes we have also been able to expand our knowledge of trophic relationships by sequencing stomach contents. This has even resulted in the discovery of novel taxa. Museum specimens also provide a window into historical distributions of species and permit us to ascertain when range expansions have begun to expand as a response to climate phenomena such as El Niño events and longer-term distributional shifts in response to climate change. Museum collections also provide clues to examining sympatry and allopatry of cryptic and pseudocryptic species.

Historical collections provide critical baseline data for detecting natural and anthropogenic change and are critical to understanding of historical distributional changes.

Slugs, Slugs, and More Slugs: New Aeolid Nudibranch Species from Western North America

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Molecular analysis of nudibranchs from the temperate northeastern Pacific historically assigned to the family Flabellinidae has revealed a more complex taxonomic picture than previously recognized. Our molecular studies using the COI, 16s, and H3 markers, combined with morphological study, have uncovered multiple new species from the west coast of North America within Flabellinidae sensu lato. Many of these new species form north-south sister pairs with overlapping ranges, following a pattern found in several other recent studies of cryptic diversity among northeastern Pacific mollusks.

The Gulick effect: How Malacological Collecting, Observation, and a Prepared Mind Changed Evolutionary Theory

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John Thomas Gulick's research on land snails in Hawaii was both innovative and influential in the late nineteenth and early twentieth century development of modern evolutionary theory. Although there is a recent revival of interest in and appreciation of Gulick as a theorist, there is little commensurate effort to understand his considerable academic preparation in science and the recognition he received during his lifetime. It is easy to dismiss the Rev. Gulick as a missionary whose paid vocation was not science. Likewise, it is difficult to devote the requisite attention to his scholarly precise writing, wordsmithing, and attention to detail in a modern age that is quick to dismiss such writing as verbose. Perhaps the strongest objections to Gulick have arisen from the shifting baseline in museum collection philosophy in the Anthropocene age of human-caused extinction. This baseline effect is most acutely felt on oceanic islands and in the small, geographically isolated populations and environments in which he collected. The breakthroughs of avocational science are overdue for celebration. They are of increasing public interest as historians popularize lives of the "hidden figures" of women, the contributions of outstandingly well-educated clergy and missionaries, and the achievements of high school dropouts. Where does Gulick fit in this picture? His formally prepared mind (academic training in biology and graduate degree from Williams College) exceeded that of Charles Darwin. So did his publication record in what are today prestigious journals with high impact factors. And his achievements in evolutionary biology were recognized late in his life by receipt of two honorary doctoral degrees.

Clash of the Chitons: How Morphology, DNA, and Distribution Differ in Three *Nuttallina* Species

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The chiton genus *Nuttallina* (Mollusca: Polyplacophora: Lepidochitonidae) is extremely common along the California coast, but while WoRMS and some earlier authorities have recognized only *Nuttallina californica* (Reeve, 1847) as valid in California, newer evidence has confirmed that three species are present with only subtle morphological distinctions and substantial genetic divergence. Differences in their geographic and microhabitat distributions have been poorly understood, but *N. californica* was

known to dominate north of Point Conception, whereas *N. fluxa* (Carpenter, 1864) is dominant in southern California, extending south to the Pacific coast of Baja California Sur, Mexico. However, we have found that *N. californica* can occasionally be common at cool exposed sites south of Point Conception, and a third species, *N.* sp. A, is known from few localities in both southern and central California. We tested for differences in the morphology, microhabitat, or latitudinal distribution of each of the three species of *Nuttallina*. We sampled *Nuttallina* from central and southern California, and subsampled both high and low microhabitats at selected localities**.** Randomly selected individuals were identified with a PCR-based DNA assay, taking advantage of known sequence differences and using species-specific 16S and COI primers. Morphology was compared with a morphometric analysis of the fifth of eight disarticulated valves and comparisons of the girdle and gills. Our general conclusion is that the species can be surprisingly patchy, reflecting environmental differences in habitat. These *Nuttallina* species provide a useful system for investigating competitive interactions and range shifts between these ecologically important intertidal grazers.

Non-invasive Audio-video Sampling of Gastropod Activity

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Non-invasive environmental monitoring can quantify animal activities while minimizing risks to environments, often among protected species and habitats. Faint sounds often are overlooked, but can monitor animal activity as individuals or whole assemblages. Video recording offers good (not best) audio capabilities, but audio tracks usually get abandoned (later simulated) for nature videos. In educating broad audiences, multiple senses reinforce human memory and understanding. However, labs usually have audible and electrical interference. Outdoors, wind, waves, other animals, and man-made sounds interfere with audio monitoring. An animal's motion, such as a shell's friction against another surface, also is very audible. But upon rather rare feeding, instructive feeding sounds (if above water) are barely audible with the unaided ear, stethoscope, or simple tubing. Proper remote microphones (above or below water) can monitor and record activity clearly. A video track can help identify sources of sounds. Kitting's historic audio recordings from tape are no worse than modern digital recordings. However, many analog to digital conversions lose much signal. New examples with common *Cornu* (*Helix*) garden snails are convenient practice, by starving a group of individuals, and offering them raw vegetables. Even starved individuals failed to feed frequently on their locally common habitat plant, *Agapanthus* ("Lily of the Nile"). Despite subtle motion of their head, feeding was audible and rhythmic for extended periods when undisturbed, even in light. Such natural micro soundscapes can uncover hidden behaviors, even in darkness or murky water, prevent disturbance to specimens and environments, and provide memorable, instructive evidence for broad audiences.

Ecological Insight into the Origins of Photomutualism: How Sea Slugs Benefit from Kleptoplasty

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Kleptoplasty, the retention of functional chloroplasts within heterotrophic cells, is a form of acquired metabolism that can provide insight into the origins of photosynthetic mutualisms and endosymbiosis. Among animals, only sacoglossan sea slugs maintain photosynthetically active chloroplasts. About half of sacoglossans digest plastids within hours; most remaining species are short-term retainers (STR) with ingested plastids functioning up to two weeks. In five independent origins of long-term retention (LTR), species maintain plastids for over a month.

These transitions are a model for studying the evolution of mixotrophic metabolism but recent studies proposed that slugs only benefit from kleptoplasty during starvation, or that photosynthesis kills starving STR species. To explore the ecological context of kleptoplasty, we compared fitness, feeding rate and photosynthetic function over time for five STR and two LTR species with a fed/starved x light/dark design. Photosynthesis and feeding had additive or synergistic benefits for most species; effects varied by chloroplast source more than slug retention type. Growth was consistently highest in light x fed treatments and lowest in light x starved treatments. All species fed at lower rates in the light, yet grew more. These results counter prevailing hypotheses that kleptoplasty evolved as a buffer against starvation. Instead, our findings suggest shifts to partial autotrophy were favored because kleptoplasty maximizes growth while reducing the rate of feeding on chemically defended macroalgae, and reveal a crucial role of photosynthesis by sacoglossans under ecologically relevant conditions.

Arminid Ambiguity: Establishing Significant Genetic and Morphological Markers to Assess Diversity in the Nudibranch Family Arminidae

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Arminidae is an underrepresented and understudied family of nudibranchs within Cladobranch research. Originally grouped together by a single shared characteristic of an oral veil, confusion over Arminid relationships has persisted over time. This evolutionarily interesting group of nudibranchs consists of one genus with lateral gills found globally, and a more derived gill-less genus restricted to the Indo-Pacific. Additionally, Arminids represent one of the few groups of specialist predators on octocorals, with the two main *Arminid* genera, *Dermatobranchus* and *Armina*, split between the two lower classifications of Octocorallia, Alcyonacea and Pennatulacea, respectively. My project illuminates issues with previous species descriptions and has doubled the known diversity of *Dermatobranchus*. I will present the current state of Arminid diversity using genetic phylogenies and atypical morphological features, with an assessment of their feeding ecologies and the future direction of mapping *Arminid* species divergence through time.

Sexual Selection and Reciprocity in Euthyneuran Gastropod Mating Systems

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The euthyneuran gastropods (opisthobranchs and pulmonates), are a clade composed almost exclusively of simultaneously hermaphroditic species with some form of internal fertilization. The mating behavior of many taxa is characterized by reciprocity, in which the both members of a pair act as male and as female in a single mating interaction. Reciprocity may take the form of simultaneous reciprocal copulation or alternation of sexual role in a series of copulations.

Reciprocal mating has classically been understood as a solution to the problem of sexual conflict created by a preferred sexual role in hermaphrodites. However not all species have reciprocal mating. Moreover, the type of reciprocity may vary even within a genus, as in *Ariolimax*. Some species of pulmonates and opisthobranchs copulate apparently unilaterally or in chains where an individual may act as both male and female but not normally with the same partner. Some of this variation may be related to body shape. Species of pulmonate with a more globose shell usually have unilateral

copulation while those that have a more laterally compressed shell typically have reciprocal copulation. The relationship between reciprocal copulation and reciprocal paternity is not clear, given the prevalence of sperm storage in these taxa. In opisthobranchs, species with a greater separation between male and female genital openings tend to have unilateral copulation, chain copulation or alternation of sexual roles between a pair of individuals. Here we will explore the evolutionary implications of explicitly reciprocal copulation vs. other patterns with a view to understanding the effect, if any, on the cost of sex problem.

Recognizing and Predicting Global Patterns of Marine Mollusk Ornamentation Expression through Machine Learning

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Compared to their freshwater and terrestrial counterparts, marine mollusks possess the greatest degree of shell biomineralization. The robustness of the exoskeleton of marine species has been attributed, in part, to the high degree of availability of calcium carbonate in marine environments. Individual studies have documented a higher proportion of heavily- biomineralized, ornamented (e.g. possessing ribs, spines, or keel, etc.) species in highly supersaturated aragonite ($\Omega_{aragonite}$) regions than in less supersaturated regions. As biomineralization and ornamentation expression are highly labile within some marine species, and ornamentation expression is one of the key morphological characters used to delimit extant and fossil taxa, understanding the role of $\Omega_{aragonite}$ in marine mollusk ornamentation expression at the intra- and interspecific levels is vital to interpreting species diversity in the fossil record and among extant taxa. Further, $\Omega_{aragonite}$ is predicted to decrease globally due to anthropogenic climate change so there is need to understand the effects of saturation state to predict the future distribution and expression of ornamentation. We developed an object detector that classifies images into ornamented- and smooth-shell taxa and applied it to geo- tagged images of all marine mollusks. This process generated a global dataset to test the association of water chemistry and other environmental variables with ornamentation expression. The dataset was then used for training and validation for a Random-Forest classifier that predicts ornamented species occurrence given local environmental variables. We found that ornamented species occurrence is significantly associated with key environmental variables and that ornamentation expression is predicted to change globally under future scenarios of climate change.

Casting a Wide Net: Capturing Gene Regulatory States That Drive Morphogenesis in Slipper Shell Snails, and What They Can Tell Us About Molluscan Evolution

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One of the most fascinating enduring questions in biology is how the great diversity of extant organisms came to be. In each generation, an animal first acquires its basic body-plan through the process of development; thus studying development in a comparative context can help explain how animals have different shapes, physiologies, behaviors, and adaptations. In many cases, developmental cell fate specification in animals is well-understood, thanks to the study of gene regulatory networks (GRNs). GRNs describe the steps of cellular differentiation over time, with a focus

on regulatory connections between transcription factors and signaling molecules. While GRNs have been constructed for animals that fall into the deuterostome and ecdysozoan clade of metazoans, there are no comprehensive GRNs among the Spiralia. One reason for the paucity of GRN-level analysis in the Spiralia, especially among molluscs, is that the construction of GRNs requires direct gene perturbation. Relatively few molluscan species have been used for this approach. Among those species that have, calyptraeid gastropod slipper shells in the genus *Crepidula* are well-suited for experimentally dissecting the developmental process from a molecular perspective. *Crepidula* species have been used to understand embryonic cell lineages in marine animals since the late 19th century and modern fate-mapping, along with advancements in gene editing capabilities, have made them excellent experimental systems for exploring gene function among marine gastropod molluscs. I will describe our work establishing a framework for GRN analysis of cell fate decisions and morphogenesis in these species, and discuss how such data can be used to understand molluscan embryogenesis in comparison to other metazoan developmental programs.

Comparison of Biogeography Patterns of Two Freshwater Snails - *Physa acuta* and *Helisoma anceps*

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Native to North America, Physidae and Planorbidae are long-established, globally-invasive snails and are the most abundant and widespread freshwater gastropod families. Their adaptability to diverse ecosystems makes these snails ideal intermediate hosts for many parasitic trematodes. To date, studies examining each family's genetic diversity focus predominately on their invasive range, with considerably less sampling within their native range. Recent phylogenetic studies of North American *Physa acuta* identify significant east-west genetic structuring, however, the factors leading to the observed patterns remain unclear. The objective of this study is to address the biogeography of two Western United States freshwater snails, *Helisoma anceps* (Gastropoda: Planorbidae) and *P. acuta* (Gastropoda: Physidae), to compare the population genetic patterns between the species and determine if watersheds, geographic distance, or other biotic factors contribute to the observed genetic structuring. While *H. anceps* and *P. acuta* often occur sympatrically, their life history characteristics vary. Specifically, *P. acuta* is known to have higher fecundity, reproductive plasticity and effective passive dispersal abilities. Preliminary results corroborate the east-west genetic structuring of *P. acuta* and improve the resolution of a previously identified distinct clade from west of the Rocky Mountains to the southwest United States. Across the sampling range, *H. anceps* has more pronounced genetic structuring than *P. acuta*. Comparison between the species offers insight into how biogeographical factors in the Western United States impact genetic variation of freshwater gastropods and provides implications for their species-specific role in parasite-host relationships.

Integrative Systematics of the Genus *Thuridilla* Bergh, 1872 (Mollusca, Gastropoda, Heterobranchia) Reveals a Cryptic Radiation of Polymorphic Sea Slug Species

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A major problem for biodiversity conservation of marine gastropods is that significant species diversity remains 'hidden' as cryptic or pseudocryptic species. Body color pattern is important for identifying species of *Thuridilla* Bergh, but has also led to controversy about the conspecificity of color morphs in the *T. gracilis* (Risbec, 1928) complex of Indo-Pacific species. The most recent hypothesis considers two species within the complex as valid: *Thuridilla gracilis* and *T. splendens* (Baba, 1949), whereas *T. bayeri* (Er. Marcus, 1965) and *T. ratna* (Er. Marcus, 1965) are considered junior synonyms of *T. gracilis*. We inferred a worldwide phylogeny of *Thuridilla* using a multi-locus approach, combining one nuclear (H3) and two mitochondrial (COI and 16S) genes, using both Bayesian and Maximum likelihood criteria. Furthermore, species delimitation analyses (ABGD, GMYC, bPTP) and the comparison of radular teeth were performed to assess the systematics of the genus. Remarkably, the *T. gracilis* complex contained 14 delimited species, all distinguishable by radular characters and external morphology as well as by molecular analyses. The four traditional species plus the 10 new species we identified together comprise a relatively recent yet polymorphic radiation, with each having a diagnostic color pattern. This radiation represents the bulk of the cryptic diversity in the genus: our analyses revealed that *Thuridilla* comprises 33 species, including 11 undescribed taxa, of which 10 are in the *T. gracilis* complex. Our phylogenetic insights provide a novel comparative framework for studying how color patterns drive radiations among diverse heterobranch groups, including these colorful and rapidly diversifying sacoglossans.

Phylogenetic Systematics of the Genus, *Cyerce* Bergh 1871 (Sacoglossa, Caliphyllidae) Using Molecular and Morphological Data

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The genus *Cyerce* Bergh 1871 is a group of sea slugs in the family Caliphyllidae, characterized by having bifid rhinophores, enrolled oral tentacles, multiple flattened, leaf-like cerata, and a transverse groove splitting the foot sole of the animal transversally. *Cyerce* currently includes eleven accepted species distributed throughout tropical and subtropical areas of the Indo-West Pacific, Eastern Pacific, Northern Atlantic, Caribbean, and Mediterranean. Species of *Cyerce* are stenotropic herbivores that possess remarkable adaptations such as aposematic coloration, synthesis of polypropionates, and acquisition of plastids from their algal hosts. The evolution of these traits in *Cyerce* has not been studied, although observed in other lineages within Sacoglossa. Cladistic analyses have been performed on Sacoglossa, but a species level phylogenetic analysis for the genus *Cyerce* are lacking. The objective of this study is to produce a monographic review of the genus Cyerce using both molecular and morphological data. In order to resolve the evolutionary relationships among *Cyerce* species, two mitochondrial genes (CO1, 16S) and nuclear gene (H3) were sequenced from 109 specimens borrowed from museums or collected in the field. Bayesian analyses were used to generate phylogenetic trees. The internal anatomy of the *Cyerce* specimens was studied to supplement molecular data. This included dissections of the radula and male reproductive anatomy. A species delimitation analysis with ABGD was performed using CO1 aligned sequences to support phylogenetic analyses. Fifteen genetically distinct species of *Cyerce* were recovered from the analyses with observed differences in size of the buccal mass and radula across species.

Pushing Boundaries: Investigating the Disturbance of the Pugnacious Nudibranch *Phidiana hiltoni* in Northern California

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The northward progression of the pugnacious nudibranch *Phidiana hiltoni* was documented in 2011, with its northern range limit jumping from the Monterey Peninsula to Marin County, CA. The rise of *P. hiltoni* at Duxbury Reef (DR) in Marin County coincided with a decline in several resident nudibranch species, potentially from *P. hiltoni* consuming these species and increasing competition for prey. To determine if vulnerable nudibranchs of DR are still in decline or whether the reef is recovering from the disturbance of *P. hiltoni*, I have conducted monthly to bimonthly timed counts in 2018 and 2019. *Phidiana hiltoni* is still the most abundant nudibranch at DR, more than doubling its abundance since 2011. While some vulnerable species have not been observed at DR since the arrival of *P. hiltoni*, others have made a comeback. Behavioral responses of the southern *Hermissenda opalescens* and northern *H. crassicornis* to the historically southern *P. hiltoni* were observed to investigate whether the northern species would be more vulnerable than the southern. *Phidiana hiltoni* was not more likely to attack one species over the other, but behavioral responses of the *Hermissenda* spp. did differ. Future efforts will aim to investigate the overlap of prey between *P. hiltoni* and other hydroid-eating nudibranchs at DR.

Slug Thieves: Nematocyst Acquisition Process in Aeolid Nudibranchs

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Nudibranchs encompass over three thousand species around the world, and still counting. One subgroup of nudibranchs is called aeolids: a specialized group of nudibranchs that are capable of stealing nematocysts from their cnidarian prey and using them as part of their own defensive mechanism. Nematocysts are also known as “explosive cells”, a variety of special organelles that are present in cnidarians. The relationship between the nematocysts in nudibranchs and their cnidarian prey remains unclear due to the variation and diversity within nematocysts.

Earlier studies also show a discrepancy in the results, warranting a project looking at different species of aeolid nudibranchs and their cnidarian prey. My project focuses on comparing nematocyst content in multiple aeolids and cnidarians along the Californian coast to examine specificity of nematocyst selection and retention within Nudibranchia. Preliminary results show that different aeolid nudibranchs vary in the diversity of nematocysts they retain, and these only represent a subset of nematocysts found in their prey.

Missing Gaps in the Family Goniodorididae H. Adams & A. Adams, 1854 (Mollusca: Nudibranchia). Past, Present and Future.

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The family Goniodorididae H. Adams & A. Adams, 1854 is a group of Nudibranchs whose species richness, systematic, biogeography and phylogeny is far from known. This family includes eight different genera (*Okenia* Menke, 1830, *Goniodoris* Forbes & Goodsir, 1839, *Ancula*, Lovén, 1846, *Lophodoris* G. O. Sars, 1878, *Spahria* Risbec, 1928, *Trapania* Pruvot-Fol, 1931, *Goniodoridella* Pruvot-Fol, 1933, and *Murphydoris* Sigurdson, 1991) within which around 130 species are currently considered valid. However, the richness of the family is highly underestimated since approximately 100 more species are found in different field guides reported as unidentified. In addition, some of the valid species lack complete anatomical descriptions, several species have been synonymized without consensus among experts and, in the last years, cryptic and pseudocryptic species have been reported, masking not only the exact number of species but also their real distribution range. Molecular data are missing for most of the species and phylogenetics studies have only been carried out for one of the eight genera belonging to this family. Moreover, the latest studies show that the phylogenetic relationship between the species of the different genera are not resolved, and that Goniodorididae is deeply needing a worldwide revision. In summary, the few studies available in the family Goniodorididae keep this group of nudibranchs still very unknown to science, with a wide variety of pending studies involving different fields of research, such as taxonomy, systematics, biogeography and ecology.

Archipelago-Wide Patterns of Diversity and Divergence Among an Endemic Radiation of Galápagos Land Snails

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Species diversity on islands is typically initiated by colonization. Newly arrived species on remote islands are likely to encounter less predation and competition, which might facilitate their divergence and speciation within island as they fill previously unoccupied niche space. Thus, establishing patterns and timing of colonization can enhance our understanding of adaptive radiation. Herein, we use Naesiotus snails in the Galápagos islands to estimate timing of colonization from mainland South America. We explore inter-island patterns of colonization and within-island radiations to understand their contribution to community assembly.

Contradicting previously published topologies, phylogenetic reconstructions using genome- scale data suggest that most Naesiotus form island-specific clades, with sympatric speciation dominating cladogenesis. Time-calibrated phylogenetic and ancestral area reconstructions generally align with geologic age of the islands, although colonization from the mainland and a few colonization and speciation events among and within islands predate previously estimated dates of island emergence. Galápagos Naesiotus also adhere to the island progression rule, with colonization proceeding from old to young islands and within-island diversification occurring earlier on older islands. Our work provides a framework for evaluating the contribution of colonization and in situ speciation to the diversity of other Galápagos lineages.

Sexual Differentiation in Somatic Growth Within Two Species of Freshwater Mussels, *Lampsilis cardium* and *Lampsilis siliquoidea*, as a Function of Environmental Impacts

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Females have to balance their survival and somatic growth with the fitness of their offspring. Somatic growth rate differences between females and males of a given species may provide insight into how costly reproduction is for females, in comparison to their male counterparts. Sexual dimorphism in shell shape is evident in these two species. Are there significant growth rate differences between females and males of *Lampsilis cardium* or *Lampsilis siliquoidea*? If so, does the amount of sexual differentiation in somatic growth differ between habitats? This study compares between female and male *Lampsilis cardium*, as well as female and male *Lampsilis siliquoidea*, from two watersheds for each species to answer these questions. The comparisons of males and females of a single species will be limited to shells taken from a single collection event. Samples from each location will include the right shell valves of up to 30 females and 30 males of the species, utilizing existing museum collections. Optical 3-D scans of the specimens will be combined with cross-sections to determine the amount of external area and shell thickness added annually for a specimen. These measurements will allow specimens to be analyzed morphologically, with simulations of their growth rates over time. The growth of a specimen will be a model of the change in shell volume and shell cavity volume of females, compared to males, over successive years of growth.

Miocene California and Caribbean Mollusks Refine Age of the Salada Formation, Southwestern Baja California Sur, México

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Miocene California and Caribbean Mollusks refine age of the Salada Formation, southwestern Baja California Sur, México For decades yellow marine sandstones were regarded as Pliocene and mapped as the Salada Formation on both sides of the Baja California peninsula. Described by Heim (1922), the type section in Arroyo La Salada was lost to science until the early 1990s when Schwennicke (1998) recovered and measured the 12-m thick section (GPS N24° 30.153', W111° 31.573'). The unit crops out only in the Magdalena embayment as far south as Arroyo La Muela, north of Todos Santos. Some 700 m downstream from the type section Smith (1991) collected a hard gray concretionary layer equivalent to the lower Salada beds and identified the Middle Miocene (15 – 13 Ma) California index species *Amusium lompocensis* (Arnold) and *Amussiopecten vanvlecki* (Arnold), also *Interchlamys aidei* (Harris) described from Falcón, Venezuela, *Clementia dariena* (Conrad), *Cyathodonta gatunensis* (Toula), *Psammotreta* (*Leporimetis*) *trinitaria* (Dall), and *Raeta hasletti* (Anderson). A slightly older Caribbean assemblage is found in Arroyo La Muela (GPS N23° 32'49", W110° 14'33"): *Turritella abrupta* (Conrad), *Cymia henekeni* (Maury), *Cymatophos turbacoensis* (Anderson), and *Pyruclia diadela* (Woodring). The formation has broader importance as one of the northern outliers of the Perrilliat (1981, 1987) Pacífico – Atlántico Province, named for Caribbean mollusks in the La Mira basin, Michoacan, that expanded the Tertiary-Caribbean Province of Woodring (1966). In tectono-stratigraphic terms, the Salada Formation was deposited when the Baja California Peninsula lay against mainland México (Lyle and Ness, 1991), before the ancient Gulf of California began to open at ca 12 Ma (Sutherland et al, 2012, Geosphere).

Ampullariidae of the Midwest Region of Brasil: Hydrographic Basin Tocantins-Araguaia and Paraguay River Basin

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Ampullariidae are freshwater gastropods that occur in tropical and subtropical regions of Africa, Asia and the Americas, often in dense populations. In addition to their undeniable ecological importance, they are also agricultural pests and disease vectors. Ampullariids exhibit their highest diversity in Brasil, with about 50 species of *Pomacea* found in all parts of the country.

Three additional genera, *Asolene*, *Felipponea*, and *Marisa* are also found in Brasil. Here we report on the ampullariid species present in two important hydrographic basins in the central western region of Brasil, the Tocantins-Araguaia and the Paraguay basins. Both basins have been negatively impacted by increasing development of dams in the region, as well as the damaging effects of intense agriculture, deforestation and mining. The results from several regional surveys undertaken by our team, in addition to data from the Mollusc Collection of the Instituto Oswaldo Cruz, recorded four ampullariid species: *Pomacea maculata*, *Pomacea scalaris*, *Pomacea lineata* and *Marisa planogyra*. *Pomacea maculata* has the widest distribution, occurring from north-central Brasil south into Paraguay, Uruguay, and Argentina. *Pomacea scalaris* and *M. planogyra* are endemic to the Paraná-Paraguay and Prata basins, while *P. lineata* occurs along the coast of Brasil in the northeast region with some reports further south. Records of *P. lineata* in the Midwest region are probably due to anthropogenic dispersal. Detailed distribution of these species, including first records in this region are presented, with notes and illustrations of the morphology (shell and anatomy) of all four species.

How the Famous Nudibranch *Hexabranchus sanguineus* (Rüppell & Leuckart, 1830) has Fooled Everyone – Preliminary Results

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The “most famous” nudibranch of the world – the “Spanish dancer” *Hexabranchus sanguineus* (Rüppell & Leuckart, 1830) – has a confusing taxonomic history with around 27 synonym names. The most dramatic rearrangement considered that all morphs of *Hexabranchus spp.* from the Indo-West Pacific Ocean (IWP) belonged to the same species, synonymizing 20 nominal names under *H. sanguineus*. Up to now most authors have accepted *H. sanguineus* as the only species present in the IWP realm, but on the other hand the variability found in this species is intriguing and several authors questioned the conspecificity of all IWP morphs. The most recent review of the genus was based on morphology and resurrected the Atlantic Ocean species *H. morsomus* Ev. Marcus & Er. Marcus, 1952, but has still considered all morphs of *H. sanguineus* occurring in the IWP to be the same species. In this study, molecular and morphological tools are used to test whether the various colour morphs of *H. sanguineus* are conspecific or may represent different taxonomic entities. Preliminary molecular phylogenetic and species delimitation analyses of 17 specimens from across the IWP indicate the occurrence of four

species in this region. Additionally, photographic evidence suggests the possible occurrence of an additional three lineages, but this warrants confirmation. Ontogenetic colour shifts and morphological similarities between species are likely the main historical causes of taxonomic confusion. Understanding the *H. sanguineus* species-complex is essential to clarify past studies on their ecology, defensive mechanisms and pharmaceutical properties.

In the Footsteps of Edmondson: Shipworm (Bivalvia, Teredinidae) Diversity, Biology, and Ecology in the Hawaiian Archipelago

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Shipworms, recognized for centuries as the destroyers of wooden vessels, remain a serious pest of wood pilings, piers, and docks. In nature, shipworms degrade vast amounts of wood, converting the terrestrial energy stored in lignocellulose into body mass, larvae, and feces, all of which provide food for a variety of organisms. Their postmortem burrows become habitat for other species. Historical shipworm surveys in the Hawaiian Archipelago were carried out by Charles Howard Edmondson up to the 1960s, recording teredinid diversity on Oahu, with scattered reports from the rest of the Archipelago and other South Pacific islands. Our ongoing study, commenced in 2015, revisits past survey sites as well other islands and the northern atolls, with an emphasis on shipworm diversity and biogeography. In addition, we examine the role of shipworms as ecosystem engineers, teredinid ecology, life history and reproductive strategies. Short term brooders, which release planktonic larvae, dominate ports and bays with longer water retention and reduced salinity; long term brooders that release competent pediveligers are more abundant in outer coastal habitats. Three pelagic specialists are found in long-range driftwood. We detected several cryptic species and a possible change in species diversity in comparison to historical surveys. Ongoing genetic analyses will help resolve relationships among Hawaiian taxa and provide insights into their population structure. Polynesians in wooden vessels began visiting the Archipelago more than a 1000 years ago, and European ships first arrived in the 1770s. We examine how the combined roles of maritime history and rafting by ocean-currents have shaped modern shipworm diversity in the Hawaiian Archipelago.

SLIME: Citizen Science Focused on the Terrestrial Malacofauna of Southern California

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SLIME (Snails and slugs Living in Metropolitan Environments) is a community/citizen science initiative sponsored by the Natural History Museum of Los Angeles County (NHMLA) and hosted online by iNaturalist, since 2015. Its focus is the terrestrial malacofauna of southern California and has amassed nearly 12,000 terrestrial snail and slug records from approximately 1500 participants. Efforts to promote SLIME by NHMLA have included malocofauna bioblitzes, events (e.g. SnailFest and SnailBlitz), public lectures, and outreach through social media. The project's results include first occurrence records for

snails and slugs in the state of California and in southern California counties (e.g. Los Angeles and Riversid), including the limacid slug *Ambigolimax nyctelius* (Bourguignat, 1861). These outcomes demonstrate the efficacy of citizen science to document molluscan biodiversity in a major metropolitan area and could serve as a model for similar initiatives at other museums or institutions.

Species Name Formation for Malacologists: A Quick and Helpful Tutorial

Jann Elizabeth Vendetti*[1] and Robert Garland[2]

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Creating scientific names for species, and/or reviewing those created by other authors, is a necessary part of the job for malacologists working in taxonomy and systematics. Guidelines for the construction of species names for animals are outlined in the International Code of Zoological Nomenclature but many modern systematists are stymied by the Code because they are unfamiliar with Latin and/or have little experience navigating the idiosyncrasies of Linnaean binomial nomenclature. Therefore, in this talk the author will present 10 pragmatic and simplified strategies for creating zoological species names. They are intended to demystify the derivation and construction of species names and facilitate the process of naming species for a broad audience of malacologists working in systematics.

Systematic Revision of the Predatory Snail Genus *Paciocinebrina* Houart, Vermeij & Wiedrick, 2019 (Muricidae: Ocenebrinae) Based on Molecular And Morphological Analyses

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Paciocinebrina Houart et al. (2019) is a species-rich genus restricted to western North America, with species found in the mid-intertidal to depths of 284 m. They were formerly assigned to *Ocinebrina* Jousseaume, 1880, which is now considered to be a distinct European clade. Species of *Paciocinebrina* are notorious for their phenotypic plasticity and unsettled taxonomy. The paucispiral protoconchs found in members of this group are indicative of direct development, a reason to suspect regional differences that confound species delimitation. The abundant literature contains a daunting number of misidentifications and other errors, with an overdue need for systematic revision. Because species descriptions have been based chiefly on shell features, we used these in our selection of museum or private vouchers for study, and collected new corresponding material targeted for molecular analysis from 15 California field sites ranging from Humboldt (40°N) to Orange County (37°N), and additional material (in prep.) from Washington (48°N). Spiral morphology of each taxon was recorded to compare morphological characteristics with molecular results. We estimated species limits and phylogenetic relationships across *Paciocinebrina* with a combined analysis of mitochondrial (COI + 16S) and nuclear (28S + ITS-2) sequences. Molecular results have affirmed the validity of some recognized *Paciocinebrina* species, while challenging any separation between others that are instead attributed to the influence of habitat. They have also revealed evidence for new cryptic or overlooked

species. The new phylogenetic estimate is providing insight into clarifying the biogeography and evolutionary history of this endemic radiation of the northeastern Pacific, and allows for refining ecological and reproductive differences between its members.

An Integrated Approach to Unraveling the Fossil Record: Estimating the Paleontological Past, One Phylogeny at a Time

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The diverse muricid genus, *Paciocinebrina* Houart, Vermeij & Wiedrick, 2019, of the northeastern Pacific, is phenotypically plastic with a great deal of confusion associated with previously proposed taxa and historical records. Species of the genus are currently recorded from Alaska to Baja California, with most species known and described from California. The ecological role of these snails is most notable for their drilling capabilities by which they primarily prey on sessile barnacles and other marine mollusks, and partly for their richness in local intertidal zones along the northeastern coastline. A review of relevant literature, museum vouchers and the careful collection and analysis of molecular data has provided an insight to patterns of occurrence, distributions of taxa, ecological importance, and the overall clarification of taxonomic instability. Our approach utilizes the traditional use of morphological analysis, combined with, and based on, modern molecular techniques and analysis of both mitochondrial (COI &16S) and nuclear (28S & ITS-2) loci. The mode of development of this group is thought to be direct, as indicated by the paucispiral protoconch, a trait known to support higher levels of diversification compared to planktonic dispersal and development. The extensive assemblage of Pilocene-Pleistocene fossils is remarkable and in need of major revision, with species dating back to the Oligocene of California. As a member of the Ocenebrinae, *Paciocinebrina* Houart et al. 2019 is one of a variety of clades thought to have originated from an ancestral group from the Paleogene of Europe. The absence of *Ocinebrina*-like species from the Western Atlantic suggests the migration of ancestral species was likely through the Thethys seaway during the late Paleogene, further supported by morphologically similar records from Japan. The Late Oligocene fauna of California is reported to include 5 to 6 species, with a modern record of about 20 distinct members. Additional undescribed species are expected to increase our knowledge about this expansive and diverse group. Modern molecular techniques are here leveraged to establish and estimate the relationships between members of this genus, a tool used to interpret paleontological relations and to reconstruct the biogeography and biodiversity of this large group of organisms.

Scaling Volunteer Biodiversity Documentation of Molluscs through Citizen Science Programs and Technology

Alison N. Young*[1], Rebecca F. Johnson[1]

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Collaboration between amateur naturalists and professional scientists in the pursuit of natural history and biodiversity discovery is not new, but in recent years has taken on a different look, mostly due to increased connectivity through technology. We can now communicate and share in ways we could not have imagined only a decade ago. The California Academy of Sciences engages volunteers in searching for and documenting species - including molluscs, primarily in the rocky intertidal - using the iNaturalist platform, creating occurrence records with photographic evidence from around the globe. We do this in many ways, from encouraging and supporting individuals in making biodiversity observations, to long-term monitoring, to coordinated and concentrated bioblitzes along the California coastline. This

work addresses the need for open and available biodiversity data at scale, as the pairing of our programs with iNaturalist not only allows us to create data that are open to anyone, but also democratizes natural history, making it accessible for anyone to participate without the barrier of needing to be trained to identify species. Through our programs and iNaturalist, volunteers have uploaded more than 100,000 observations of molluscs along the California coast, tracking fluctuations in species ranges, creating species atlases for rocky intertidal sites, discovering new county records to fill in range gaps, and even documenting new records for North America. By providing tools and resources, designing programs that scale, and networking local projects together, we are generating biodiversity data on the scale we need to make informed conservation decisions, fueling meaningful science, and building strong local and global communities of naturalists.

Poster Presentations

Alphabetical by First Author

NOTE Only those presentations from WSM members are included here. Please see the World Congress site for the complete listing

The Risk Potential of the Eastern Heath Snail, *Xerolenta obvia*, in Montana

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The eastern heath snail, *Xerolenta obvia* (Fam.: Hygromiidae), is a dryland massing snail centered in southeastern Europe but which occurs across Europe. In 2012, the snail was reported in Cascade Co., Montana, USA and a large population was subsequently located over an estimated 30,000 ha area. This infestation represents one of only three in North America; the others being located in Detroit and a residential/forested area in Ontario, Canada. The presence of *X. obvia* in Montana poses a potential regulatory risk for grain and hay production and for export markets. This snail is of particular concern since it is known to feed on fodder crops. Currently little is known about the biology or invasive behavior of *X. obvia*. This information is essential in assessing the potential risk of the snail to grain growing regions of North America and for developing long-term management strategies. This poster presents preliminary findings of the snail's development at three temperatures, egg laying behavior, feeding preferences, and associated mortality factors. *X. obvia* exhibits high variability but develops fastest at 20˚C as determined by width, weight, and number of whorls. Individuals at both 12˚C and 28˚C were noticeably smaller with snails reared at 28˚C experiencing high mortality. Eggs are laid both in the autumn and spring. Nematodes belonging to three genera, *Panagrolaimus*, *Plectus*, and *Rhabditia* are associated with *X. obvia* mortality in Montana.

Phylogenomic evidence that chiton 'shell eyes' may have recently evolved from shell eyespots

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Chitons possess clusters of sensory cells called aesthetes within their eight overlapping shell plates. In some polyplacophoran species, aesthetes are modified to include an eyespot, and in others, aesthetes are present in addition to eyes with a lens and retina. To address the evolution of complexity in chiton eyes, it is necessary to phylogenetically test whether Chitoninae, with eyespots, is sister to Acanthopleurinae + Toniciinae, with lenses. To address this question, we sequenced transcriptomes from sixteen chiton species and one aplacophoran with Illumina Hi-Seq. In addition to novel aculiferan data sequenced for this study, we included data from thirteen publically available transcriptomes and genomes. Our final data matrix contains 30 mollusk species and >500 genes. Overall, our phylogenomic results are consistent with previously published chiton phylogenies, with major lineages supported as monophyletic. Chitoninae is sister to Acanthopleurinae + Toniciinae, suggesting that eyespots may be the morphological precursors of 'shell eyes'. However, expanded taxon sampling is needed. To generate a more taxon-rich phylogeny for Chitonina, we are taking a target capture approach. We designed a set of 19,980 probes covering exon regions from 355 genes, using exon boundary information from three mollusk genomes (*Lottia*, *Octopus*, and *Crassostrea*). In preliminary analyses of 12 chiton species sequenced with MiSeq, the probe set recovered data from a median of 343 and mean of 294 genes using the HybPiper software package. This target- capture study will enable us to more directly address the questions of lens origins in chitons.

McLean Memorial Volume and the Northeast Pacific Gastropods

Daniel L. Geiger*[1], Lindsey T. Groves[2], and Jann E. Vendetti[2]

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James H. McLean (1936–2016) had been working on a revision of the northeast Pacific gastropods his entire career. Unfortunately, he could not complete his vision. Select families have now been treated by a number of global experts (Geiger: scissurellids, seguenziids; Geiger & Owen: Haliotidae; Tuskes: Calliostoma; Alf: Tegulidae & Turbinidae; Raines: Caecidae; Vafiadis & Stephens: Pelycidion; Collin: Calyptraeidae; Groves: Cypraeidae; Moreno: Atlantidae; Seapy: Pterotrachoidea, Janthininae; Brown: new species of *Epitonium*; deMaintenon: Columbellidae; Clark: new species of *Bucciunum*; Houart, Vermej & Widerick: Muricidae; Valdes: benthic shelled Opisthobranchia; Janssen, Bush & Bernarsek: Pteropoda). The contributions have been published as a memorial volume in Zoosymposia 13, which is available via open access (or "which is openly accessible") in its entirety thanks to a generous donation by Jim’s brothers Arthur and Hugh. Many more gastropod groups remain to be treated. Manuscript files that Dr. McLean compiled as a basis for thorough revision are available to researchers with expertise and interest. Please inquire with Daniel Geiger (geiger@vetigastropoda.com), Lindsey Groves (lgroves@nhm.org), or Jann Vendetti (jvendett@nhm.org).

A Mitogenomic Phylogeny of Chitons (Mollusca: Polyplacophora)

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With a rather conserved morphology and only about 1000 extant species, chitons form a discrete and comparatively understudied class of mollusks (Polyplacophora). Understanding of chitons’ evolutionary history is confounded by conflicting classification systems and variable interpretations of their patchy fossil record. Furthermore, few molecular studies have addressed the phylogenetic relationships among major chiton lineages. Here, we reconstructed a phylogeny of chitons using 13 newly sequenced and six available mitogenomes, as well as mitochondrial gene sequences assembled from four RNAseq datasets. The inferred phylogenies largely agreed with the latest taxonomic system, supporting a deep split between the two extant orders, Lepidopleurida and Chitonida, and mostly supporting a split in the latter into suborders Chitonina and Acanthochitonina. However, the current classification of Callochitonidae within Chitonina has remained problematic and, as here represented by Callochiton, was instead resolved as sister to all other Chitonida in agreement with gamete characters. At lower taxonomic levels, we found evidence for major reorganizations in some families as currently defined, calling for taxonomic revisions and re-evaluation of the evolutionary history of previously studied morphological characters. Despite the generally conserved gene order in chiton mitogenomes, we found three new rearrangements that have phylogenetic utility, and reconstructed a plausible model explaining mitochondrial gene order evolution in chitons. Using a relaxed molecular clock approach with available but limited fossil calibrations, we inferred divergence times of major lineages that largely agree with the few previous molecular clock estimates and the fossil record.

Tiny Orange Eulimid Snails on Brittlestar Arms: A New Species of *Stilapex* Iredale, 1925 in Southern California on a Common Intertidal Ophiuroid Host

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Eulimid gastropods are parasitic snails on particular echinoderm hosts, but they are relatively rare and mostly in subtidal depths in California, and none are known to be associated with ophiuroids. We were thus surprised in 2018 to find small (ca. 2mm) bright orange snails attached to the ventral arm surfaces of the most common brittlestar, *Ophionereis annulata* (Le Conte, 1851), at three southern California intertidal localities. The snail profile was much more stout, with fewer whorls, than most worldwide eulimids, and we tentatively identified it as a little-known Panamic species, *Stilapex cookeana* (Bartsch, 1914), whose type locality is in Baja California Sur, Mexico. However, further comparisons to Bartsch's illustrations and specimens that have been identified as this species from further south in Mexico have led us to conclude the California snails are a previously undescribed species of *Stilapex*. Elsewhere, we are describing it as new. By searching for it in the LACM (Los Angeles) collections, we found none in extensive (especially 1940-1980) microgastropod collections, but did find a 1996 specimen among forty Californian specimens of LACM *O. annulata* checked. We also found a single pair of snails on the same host from a 2017 image on iNaturalist.org, and added another intertidal specimen from 2019. Altogether, we have records for eight specimens from San Diego to Los Angeles counties, 1996 to 2019. The absence of any other records from the Eastern Pacific or elsewhere, despite considerable collective expertise of California malacologists, could imply that this is a previously undescribed and unknown species that was recently introduced to California.

An Integrated Approach to Unraveling the Fossil Record: Estimating the Paleontological Past, One Phylogeny at a Time

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The diverse muricid genus, *Paciocinebrina* Houart, Vermeij & Wiedrick, 2019, of the northeastern Pacific, is phenotypically plastic with a great deal of confusion associated with previously proposed taxa and historical records. Species of the genus are currently recorded from Alaska to Baja California, with most species known and described from California. The ecological role of these snails is most notable for their drilling capabilities by which they primarily prey on sessile barnacles and other marine mollusks, and partly for their richness in local intertidal zones along the northeastern coastline. A review of relevant literature, museum vouchers and the careful collection and analysis of molecular data has provided an insight to patterns of occurrence, distributions of taxa, ecological importance, and the overall clarification of taxonomic instability. Our approach utilizes the traditional use of morphological analysis, combined with, and based on, modern molecular techniques and analysis of both mitochondrial (COI &16S) and nuclear (28S & ITS-2) loci. The mode of development of this group is thought to be direct, as indicated by the paucispiral protoconch, a trait known to support higher levels of diversification compared to planktonic dispersal and development. The extensive assemblage of Pilocene-Pleistocene fossils is remarkable and in need of major revision, with species dating back to the Oligocene of California. As a member of the Ocenebrinae, *Paciocinebrina* Houart et al. 2019 is one of a variety of clades thought to have originated from an ancestral group from the Paleogene of Europe. The absence of *Ocinebrina*-like species from the Western Atlantic suggests the migration of ancestral species was likely through the Thethys seaway during the late Paleogene, further supported by morphologically similar records from Japan. The Late Oligocene fauna of California is reported to

include 5 to 6 species, with a modern record of about 20 distinct members. Additional undescribed species are expected to increase our knowledge about this expansive and diverse group. Modern molecular techniques are here leveraged to establish and estimate the relationships between members of this genus, a tool used to interpret paleontological relations and to reconstruct the biogeography and biodiversity of this large group of organisms.

Meeting Minutes

Minutes, Executive Meeting, Western Society of Malacologists
Fifty-second Annual Meeting, 11 August 2019, Pacific Grove, CA

Executive team present: President Pat Krug, 1st Vice President Miguel Angel del Rio Portilla, Secretary Wendy Enright, Treasurer Kelvin Barwick, Member-at-Large Shawn Wiedrick

Meeting called to order at 6:30 pm by WSM President Pat Krug

Old business

- Student grants have been awarded; the recipient has been notified but has not yet responded with confirmation of his mailing address
- Nominating committee has yet to achieve commitment from someone for second VP.
- Various names were discussed
- The society's financial picture remains steady as does its membership
- Annual reports are still behind but better than they were a year ago

New business

- Miguel discussed concerns regarding meeting planning. Kelvin reiterated that WSM is there to support both financially and with advice and personnel
- Doug Eernisse has been nominated to be part of the audit and editorial committees

The meeting was concluded by a motion from Kelvin with a second by Wendy

Respectfully submitted,

Wendy Enright

Wendy Enright
WSM Secretary

Minutes, General Meeting, Western Society of Malacologists
Fifty-second Annual Meeting, 16August 2019, Pacific Grove, CA

Executive Members Present: President Pat Krug, 1st Vice President Miguel Angel del Rio Portilla, Treasurer Kelvin Barwick, Secretary Wendy Enright, Member-at-Large Shawn Wiedrick

Meeting called to order at 3:40pm by President Pat Krug

- Secretary's Report
  - Annual Report production current through 2016, Wendy is hoping to get 2017 and 2018 completed by the end of the year.
  - Issue was put forth regarding how to deal with publication of the annual report for 2019 especially considering the large number of abstracts. Wendy proposed that the annual report be limited to society business, the meeting program, and those abstracts that were either part of the WSM-sponsored symposium or that were presented by current WSM members. Discussion ensued.
    - Shawn Wiedrick made a motion to support Wendy's proposal of a limited abstract publication with a second by Pat. Motion carried
- Treasurer's Report
  - See Kelvin's financial statement – statement shown at the meeting did not include recent Student Grant award, symposium honorarium, or other more recent expenses
  - Several donations have been made at the meeting to the Student Awards fund
  - Jann Vendetti proposed erecting a student travel grant award, especially for large meetings such as WCM which are more expensive than a typical WSM
    - Discussion ensued regarding how this travel grant might be structured; who would judge the applicants, should all applicants and their major professors/sponsors be members, should it be a fixed number or a fixed dollar amount
    - Danielle Zacherl volunteered to spearhead the information gathering aspect of this endeavor
    - Wendy made a motion to initiate a travel grant committee composed of Danielle, Jann and herself with the understanding that the process would be refined over time; Shawn seconded. Motion carried
- Student Grants Report
  - Danielle reported on the awarding of the general Student Research Grant
    - There were 13 applicants and the committee decided to award one grant
      - Alex Neu, UC San Diego. Shell surface microbiomes of intertidal gastropods, $904
  - Jann reported on the McLean museum collection grants
    - Only two applicants and both received funding
      - Meghan Yap-Chiongco, Ph.D. Student, Biological Sciences, University of Alabama. Classifying the biodiversity of aplacophoran molluscs, Cal Academy of Sciences, $750
      - Omar Ojeda Gómez, Undergraduate Biology student in the Faculty of Natural Sciences of the National Autonomous University of Mexico. The Eulimidae family in Mexico, USNM, $1,000
    - Discussion regarding whether this grant is being advertised/shared among enough people with the hope that there are more applicants next year

Pat moved to accept these reports with a second from Wendy. Motion carried.

Officer Nominations for 2020

President: Miguel Angel del Rio Portilla

1st Vice President: Shawn Wiedrick

2nd Vice President: Sam Donohoo

Treasurer: Kelvin Barwick

Secretary: Wendy Enright

Members-at-Large: Jann Vendetti and Lisa Paggeot

The slate of officers was accepted and elected

Kelvin made a motion to thank Pat for a great meeting and bringing WSM to WCM

Side note: WCM 2022 will be in Munich and we are all welcome to join them

++++++++++++++++++ Passing of the gavel to Miguel ++++++++++++++++++

Miguel gave a brief presentation on possibilities for the 2020 meeting in Ensenada. Many details remain to be worked out, especially since larger government funding for CICESE is troublingly questionable at this time.

All assured Miguel that WSM is ready to help in any way possible, be it with funding, personnel, or other advice

One priority for sure is to have longer poster sessions/posters displayed throughout the conference in order to facilitate a more thorough discussion with the presenters

Shawn will most likely have the meeting in 2021 on the campus of Cal State Fullerton

Kelvin made a motion to accept the president's presentation which Chris Kitting seconded with gratitude. Motion carried

Miguel then concluded the meeting.

Respectfully Submitted,

Wendy Enright

WSM Secretary

Treasurer's Report

WSM Treasurer's Reports
August 11,2019

WSM cash flow for June 16, 2018 thru July 22, 2019:

In-flows		
Membership		$1,111.64
Interest earned		$4.27
Student grant donations (available balance $5,365.85)		$630.00
	Total in-flow	$1,745.91
Out-flows		
Student paper/poster awards		-$175.00
Annual Report Production		-$1,168.80
Office supplies		-$27.47
	Total out-flow	-$1,371.27
	Net	**$374.64**

Cash on hand as of July 22, 2018:

Checking		$13,558.49
Savings		$13,152.83
Credit card		$0.00
	Total	**$26,711.32**

PayPal cost not realized above (2.9% plus $0.30 per transaction)

Donations & membership		$424.00
Fees		-$19.48
	Net	**$404.52**

Membership report:

55 Regular members (increase of 4 from 2018)
6 Institutional members (decrease of 1 from 2018)

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