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## Molluscan Forum 2023

Last November an international group of young malacologists took part in the 24th Malacological Forum at the Natural History Museum. The abstracts of the presentations start inside on page 10.



This image accompanies an abstract entitled "More than meets the eye: integrative taxonomy uncovers hidden diversity in the *Limacina* species complex" by Giada Spagliardi, Le Qin Cho, Erica Goetze, & Katja Peijnenburg. The abstract is on page 25.

### EDITORIAL

Once again, the annual Molluscan Forum of the Malacological Society of London (MSL) included contributions from a wide range of countries. Held on the 16 November 2023, the Forum was a hybrid meeting, contributions being both 'in-person' and on-line. In lieu of posters, there were 5 minute (3 slide maximum) Quickfire PowerPoint presentations and the hybrid format allowed for thirty three oral and poster presentations. The Society is grateful for the work done by Jonathan Ablett, Phil Hollyman, Andreia Salvador and Thomas Goulding in organising what has now become an annual flagship event for the MSL. All the abstracts from this meeting are presented on pages 7-28. The hybrid format meant that there was an enhanced number of participants and contributors, which means that at 40 pages, this issue of *The Malacologist* is a little bulkier than usual.

In 2020, plans to hold a symposium focussing on the *biology of limpets* had to be put on hold due to the covid-19 pandemic. Thankfully, the plans have been resurrected and the limpet meeting will now be held on 5-6th March 2024 at the Natural History Museum, London. The MSL has held successful meetings on limpets in the past, including one at Millport. The present meeting accompanies the AGM of the Society which takes place at lunchtime on the 6 March 2024. The limpet symposium is open to all, but members are particularly welcomed to the AGM. More details can be seen on page 6.

Recipients of financial awards from the MSL are required, as a *quid pro quo*, to supply a report on what they have achieved with their grant. They are evidence of malacological progress having been made and it is always a pleasure to see such reports appear in *The Malacologist*. This issue features a report on page 33 from Kumudu Wijesooriya of the University of Peradeniya, Sri Lanka who reports on his attendance at a meeting on *Molluscs of South Asia: Research, Conservation, and Livelihoods* - *Commemorating the life and work of H.H. Godwin-Austen,* held in Bangalore in 2023. His presentation was entitled *Taxonomic review of the enigmatic Sri Lankan land snail genus <u>Acavus (Eupulmonata: Acavidae)</u>. On page 34, Samuel Tan from the University of Maine reports on his attendance in 2023 at a conference at Cambridge University UK entitled <i>Bivalves – Where Are We Going?*; there he presented a paper on *Unravelling the <u>Brachidontes variabilis species complex</u> (Bivalvia: Mytilidae).* 

The MSL occasionally proves financial support for the organisation of symposia etc. Such an award was made for a residential *workshop at Kanneliya Forest*, southwestern Sri Lankan, 1-3 September 2023 organized by Dinarzarde Raheem, Oshan Wedage & Kumudu Wijesooriya of Rajarata University of Sri Lanka and the University of Sri Jayewardenepura, Sri Lanka'. Their report is presented on page 29.

On page 36, there is a review of *Animals under logs and stones* by Wheater, Read & Wheater. The molluscs are a major component of this biocoenose (the animals are collectively called the cryptozoa) but the book will be of interest to a wide range of biologists.

Finally and importantly, on page 37, there is a notice regarding the forthcoming symposium at the Natural History Museum, London entitled *Biology of limpets: evolution, adaptation, ecology and environment. During this symposium the* 131st AGM of the MSL will take place at 1300h on Wednesday 6th March 2024. At the latter, the Council for 2024-25 will be elected and the nominations are listed here.

#### TAXONOMIC/NOMENCLATURAL DISCLAIMER

This publication is not deemed to be valid for taxonomic/nomenclatural purposes [see Article 8b in the International Code of Zoological Nomenclature  $3^{rd}$  Edition (1985), edited by W.D. Ride *et al.*].

### News and notes

## 131st Malacological Society of London (MSL) AGM and Symposium

The 131st Malacological Society of London AGM and Symposium will take place in the afternoon, 13.00-14.00 (UK time) on Wednesday the 6<sup>th</sup> March 2024 in conjunction with the Limpets 2024 symposium, 5th-6th March 2024 https://malacsoc.org.uk/wp/wp-content/uploads/2023/11/Limpets-2020-4-2nd-Announcement.pdf



### Mollusc jokes to irritate your children

How does a mollusc hide from predators?

#### Clamouflage

Walking down the street when out of nowhere a shellfish falls out of the sky and hits me in the head. Dazed, I
pick up the mollusc and say "Where did you come from?" The shell creaks open slightly and I hear it say "A
tornado picked me and threw me. You better get somewhere safe, it's headed this way!" I look around and
see mostly blue skies, except for a few clouds. That's when I realized:

It was the clam before the storm.



LEWS AND NOTES

## Lectures on-line at the Bailey Matthews National Shell Museum, USA

The lectures listed below are available to view on the website of the Bailey-Matthews National Shell Museum at https://www.shellmuseum.org/online-lectures

#### The Charisma of Cowries

By Dr. José H. Leal, Ph.D., Science Director and Curator, Bailey-Matthews National Shell Museum

#### Sep 14, 2023 **Renewal: The Bailey-Matthews National Shell Museum One Year After Hurricane Ian** By Sam Ankerson, Executive Director, Bailey-Matthews National Shell Museum

Aug 17, 2023 **The Secret and Endangered Lives of Freshwater Mussels** By Dr. John Pfeiffer, Curator of Bivalvia, Smithsonian National Museum of Natural History

Jul 13, 2023 Hawaiian Land Snails: Lessons in Conservation, Curation, and Research By Dr. Norine Yeung, Malacology Curator, Bernice Pauahi Bishop Museum

May 17, 2023

#### Micromollusks: The Allure of Small Size

By José H. Leal, Ph.D., Science Director and Curator, Bailey-Matthews National Shell Museum

Apr 20, 2023

#### The Journey to One Billion Oysters with One Million New Yorkers

By Pete Malinowski, Executive Director of Billion Oyster Project

Mar 23, 2023

### Exploring the Oceans for Public Television

By Alexa Elliott, Creator and Producer of PBS Program Changing Seas

Feb 15, 2023

Renovating the George W. Strake Hall of Malacology, From Bottom to Top

By Tina Petway, Associate Curator of Malacology, Houston Museum of Natural Science

Jan 19, 2023 Land Snails in Los Angeles: An Experiment in Urban Citizen Science By Dr. Jann Elizabeth Vendetti, Associate Curator and Twila Bratcher Chair in Malacology Natural History Museum of Los Angeles County

Nov 10, 2022 Hurricanes and Mollusks By Dr. José H. Leal, Science Director and Curator Bailey-Matthews National Shell Museum

Sep 14, 2022 Saving the Queen of the Sea: Queen Conch Conservation Aquaculture By Megan Davis, Ph.D., Research Professor, Aquaculture and Stock Enhancement Program Florida Atlantic University Harbor Branch Oceanographic Institute

Aug 11, 2022

**Mobilizing Millions of Mollusks of the Eastern Seaboard** By Rüdiger Bieler, PhD, Curator of Invertebrates Field Museum of Natural History; and José H. Leal, PhD, Science Director and Curator Bailey-Matthews National Shell Museum

Jul 13, 2022 Let's Get Kraken: Cephalopods Coast to Coast By Bret Grasse, Manager of Cephalopod Operations Marine Biological Laboratories (Woods Hole, MA)

Jun 16, 2022 **Spot the Mollusk!** By Rebecca Mensch, Senior Marine Biologist



Bailey-Matthews National Shell Museum & Aquarium

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Oct 20, 2021 **Spooky Mollusks and Other Evils of the Deep: A Halloween Special** By José H. Leal, Ph.D., Science Director and Curator, Bailey-Matthews National Shell Museum

#### Sep 28, 2021

Shell Dressed: Seashells in Fashion and Jewelry By Jean M. Burks, Curator Emerita, Shelburne Museum, and Kory Rogers, Francie and John Downing Senior Curator of American Art, Shelburne Museum

Sep 16, 2021 Why Am I Growing Giant Clams in the Middle of the Arizona Desert? By Dan Killam, Ph.D., Biosphere 2, University of Arizona

Aug 24, 2021 8,000 Years of Shells in the American Southeast: Archaeological Insights on the Ecology, Diet, Architecture, and Ritual of Ancient Native Americans By Kenneth E. Sassaman, Hyatt and Cici Brown Professor of Florida Archaeology, University of Florida

## The Malacological Society of London Broadening Access Membership Scheme (BAMS)

The Malacological Society of London invites applicants to the second year of the MSL **Broadening Access Membership Scheme (BAMS)** to help support more postgraduate students from developing economies in their malacological studies.

The Society offers **10 postgraduate students** <u>each year</u> free membership to *The Malacological Society of London* for a period of 3 years. Last year, seven students joined the Society through this scheme.

Students who are studying a postgraduate malacology-related course in countries designated 'developing economies' are invited to apply for this award with the support of their supervisor. Applications are open immediately and will close when all 10 memberships have been allocated. Membership for this round starts on 1st January 2024 and ends on 31st December 2026.

More details on conditions and how to apply can be found on the MSL website: <u>Broadening Access Membership Scheme -</u> <u>The Malacological Society of London (malacsoc.org.uk)</u>

Membership Secretary

## Two-ton Tony Galento fought Oily the Octopus

BBC Radio 5 Live - Bunce's Tales of the Extraordinary, The Boxer and the Bear, Two Ton Tony Galento vs Oily the Octopus https://www.bbc.co.uk/programmes/p05l6gb7

The story of Two-Ton Tony, a bloody fight in the Nut Club bar and a giant octopus | The Independent | The Independent https://www.independent.co.uk/sport/boxing/the-story-of-twoton-tony-abloody-fight-in-the-nut-club-bar-and-a-giant-octopus-a6937741.html



26 January – 1 February 2024 | The New Statesman





### Saving Brittany's rare Quimper snails from a tramway

#### Kim Willsher

In Brest, this protected species, found only in Brittany and the Basque Country, is being painstakingly moved to a new home before their habitat is destroyed. The Quimper snail, is a terrestrial gastropod protected at French and EU level. Unlike most common snails, its brown, transparent shell lies flat. Its predators include hedgehogs, birds, toads, salamanders, beetles and some worms, though the greatest threat is the deforestation of its natural habitat and the prevalence of non-native trees. Although the species is not considered directly endangered in France or Spain, Quimper snail populations are said to be "fragile" and their limited geographic situation makes them vulnerable.

On a drizzly November evening, ecologists in Brest, Brittany are rooting through the damp undergrowth flanking an unmarked and unlit track going no-



Quimper snails *Elona quimperiana* (A. Férussac 1821) Source: Wikipedia: Escargot de Quimper

where. They are searching for Quimper snails (*Elona quimperiana*). It's a slow and meticulous job: the snails are small, come out only at night and prefer the dank, dark cover of soggy leaves and twigs. Soon, their natural habitat here will be destroyed by a  $\in$ 200m (£170m) public transport project, which includes a new tramway. As environmental damage cannot be avoided, it has to be reduced and compensated for. So the Quimper snails, only known to exist in northern Brittany and the Basque Country, are being saved, one gastropod at a time, and compensated with a new home.

"Here's one," says Timothée Scherer, a conservationist at Biotope, an ecological consultancy. It is a race against time to find as many of the snails as possible before the temperature drops and they hibernate. Scherer admits there appears to be an abundance of the snails in the undergrowth, but as a protected species they have to be found and saved. "Because they only exist in two places in the world there is obviously a risk of extinction," he says. "Elsewhere there are very few."

The greatest threat to the Quimper snail is the deforestation of its natural habitat and the prevalence of non-native trees. That Brest's multimillion-euro public transport scheme should be forced to consider the fate of flora and fauna is a welcome surprise. But it is not the first time the Quimper snails have fought the odds and won, much to the chagrin of local developers. In 2012, the city's football club, Stade Brestois, was forced to halt its plans for a new training centre after it was discovered that the proposed site was home to the snails. The centre was eventually built on a snail-free site.

Mindful that it could face similar objections, Brest Métropole authority commissioned an environmental impact study into the proposed transport plan that includes a second tram line, new bus route, 7 miles (12km) of new cycle lanes and nine hubs where the various forms of transport converge, as well as an inventory of the vegetation and animals that would be affected. The study found 200 species in the construction area, 75 of which are officially protected. Among them were birds, bats and reptiles, most of which were deemed able to relocate. The slow-moving snails, however, presented a problem. Once saved, the Quimper snails will be moved to a new home about 200 metres away. "Our aim is to clear the area of individuals before the work starts," Scherer says, placing another Quimper snail in a plastic bucket lined with fresh mulch. "We will also scrape off the topsoil so we are also moving the snails' environment.

### On-line and in-person Council meeting at the Natural History Museum 17 January 2024





## Biology of Limpets: evolution, adaptation, ecology and environmental impacts

(Meeting of the Malacological Society of London)

First Announcement Date of Meeting – 5<sup>th</sup> & 6<sup>th</sup> March 2024

## Venue: Natural History Museum, London

**Meeting Organisers** 

Dr Phillip Fenberg (University of Southampton), Prof Steve Hawkins (Plymouth MBA), Dr Louise Firth (University of Plymouth/University College, Cork), Prof Alan Hodgson (Rhodes University), Mr Jon Ablett (NHM, London)

In 2020 plans to hold a 3-day meeting providing a forum to discuss recent findings on all aspects of limpet biology was cancelled due to the covid-19 pandemic. Now that in person meetings are happening, we would like to announce a 1.5 day conference in early 2024 on all things limpet. It is hoped that a scaled-down meeting will still stimulate more research on these ecologically important molluses. A number of key-note speakers are being approached (names to be announced later this year) and sessions will be available for contributed papers and posters. Presentations of research in which limpets (marine and freshwater, living and extinct) have been used as model animals in evolutionary, adaptational (morphology, physiology, reproductive biology, behaviour), ecological, environmental and elimate studies are especially encouraged.

Meeting duration – 1.5 days with no parallel sessions (Note: meeting will commence with talks and an informal social gathering on the afternoon/evening of the 5<sup>th</sup> March) Registration Fee – FREE

During the meeting the Malacological Society will also hold its AGM

To help plan the meeting, **e-mail your expression of interest** to Alan Hodgson (<u>A.Hodgson@ru.ac.za</u>) indicating type of presentation you would prefer (platform paper or poster) and possible topic.

Details about registration, deadlines, and outline programme will be announced later in 2023 as plans for the meeting take shape.





## Molluscan Forum 2023

## Natural History Museum, London took place on 16<sup>th</sup> November 2023

### JONATHAN ABLETT, Organiser

President of the Malacological Society of London Senior Curator in Charge, Mollusca, Natural History Museum (email: j.ableÉ@nhm.ac.uk)

### PHIL HOLLYMAN , Organiser

Vice President of the Malacological Society of London Fisheries Ecologist, British Antarctic Survey (email: phyman@bas.ac.uk)

### ANDREIA SALVADOR, Organiser



Photo by Kateřina Kubíková: *Faustina cinguella* is a rock-dweling species endemic to limestone areas of Slovakia with its centre of distribution in the Malá and Veľká Fatra Mts

Council member of the Malacological Society of London Senior Curator of Marine Gastropoda and Historical Mollusca Collections, Natural History Museum (email: a.salvador@nhm.ac.uk)

### THOMAS GOULDING, Organiser

Early Career Representative of the Malacological Society of London

PhD Candidate, Marine and Environmental Science Centre, Lisbon University (email: tgoulding@fo.ul.nt)

ing@fc.ul.pt)

This year the Forum was a hybrid meeting, being both 'in-person' and on-line. In lieu of posters, there were 5 minute (3 slide maximum) **Quickfire PowerPoint** presentations,

## Schedule

09.00 - 09.50 Registration, coffee & set up of posters

09.50 - 10.00 JONATHAN ABLETT: Welcome and introduction to the day

#### 10.00- 11.00 Session I (Virtual Talks)

- 10.00 **Putri Pertiw:** Ethnozoological Land Snail Case Study in Hamlet Gunungkelir Community, Yogyakarta, Indonesia
- 10.15 **Das:** Molluscan fauna of Meghalaya's limestone caves: Understanding diversity and threats for conservation
- 10.30 **Monreal:** Phenotypic evolution of the marine gastropod *Littorina obtusata* across an environmental gradient at high latitudes
- 10.45 Idczak-Figiel: Overwintering in Helix pomatia L. snails: a new view on cold adaptation

#### 11.00-11.20 Session II (Hybrid Quick Fire Talks)

**Eckhofen** :Exploring shell shape variation under different environmental conditions in *L. littorea* and *L. saxatilis*: Comparing traditional geometric morphometrics and growth parameters (Shell Shaper)

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#### CONTINUED>

**Caril:** Establishing baseline data for conservation via a comparative species survey of marine macro-molluscs (Bivalves and Gastropods) from a disturbed-commercialized and a protected reserve coastal area in the Philippines - A tale of two coastal barangays.

**Ellorin:** Species composition of Family Strombidae (Mollusca: Gastropoda) in the coastal areas of Lucena City, Quezon and Caramoan, Camarines Sur, Philippines.

Jaramillo: Behavioural changes of piscivorous cone snail species based on factors of climate change.

#### 11.20 - 1200 Poster Session/Coffee

#### 12.00 - 1300 Session III (Hybrid Quickfire talks/In-person talks)

Kowaleska: Pohysa challenges our views – parasitic burden in non-native host?

Ampuero: What is essential is no longer invisible to the eyes: 3D reconstruction of aesthetesore networks in Polyplacophora

Zapitis: 'Phototaxis' in the absence of light? Locomotory patterns in unionid mussels.

- 12.15 **Spagliardi:** More than meets the eye: integrative taxonomy uncovers hidden diversity in the *Limacina* species complex.
- 12.30 Foka-Kavalieraki: Problem solving and exploratory behavior in Octopus vulgaris in captivity.
- 12.45 **King**: Environmentally-driven variations in the shell characteristics of *Cerastoderma* on the East coast of England.

#### 13.00-14.00 Lunch break

#### 14.00 - 15.00 Session IV (In-person Talks)

- 14.00 **Eggleton:** Trail Watch: visualising gastropod mucus trails using optical profilometry and light microscopy
- 14.15 **Ocampo:** First record of non-indigenous *Irus* sp. (Bivalvia: Veneridae) from South Harbour Manila Bay, Philippines
- 14.30 Vončina: Checklist of recent Polyplacophora a centralized source of reliable data on chiton systematics
- 14.45 Abeyrantha: The effect of niclosamide monohydrate on two invasive snails in North America

#### 15.00-15.15 Session V (In-person Quickfire Talks)

Yeo: Grazing effect of a common gastropod on macroalgae distribution and community on intertidal seawalls

Brown: Stable isotope signatures in beaks and eye lenses of common octopus (Octopus vulgaris) juveniles.

**Martins**: Using shell shape analysis based on landmarks to trace the geographical origin of the common cockle (*Cerastoderma edule*).

#### **Poster Session/ Coffee**

#### >CONTINUED

#### 15.45-16.30 Session VI (In-person Talks)

- 15.45 Qin : Evolution at a chromosomal inversion in the flat periwinkle *Littorina fabalis* across wave exposure gradients
- 16.00 **Svobodova**: Gastropod diversity of Central European forests in modern and historical perspective: introduction to my PhD project
- 16.15 Jenkinson: Molluscs of Mochras: benthic molluscan turnover though the Pliensbachian and Toarcian (Lower Jurassic), particularly across the Toarcian Oceanic Anoxic Event, in the Llanbedr (Mochras Farm) core.

#### 16.30 - 17.20 Session VII (Virtual Talks + Quickfire)

- 16.30 Solis: The micro-gastropod collection from Bocas del Toro, Panama
- 16.35 da Silva : How can we study the diet of an opportunist predator?
- 16.50 **Corzas Cruz:** Unraveling synonymy among bycatch molluscs from the Gulf of California: an enduring challenge in malacological research.
- 17.05 **Belamyra:** Understanding the function of *Mytilus galloprovincialis* shells from the Middle Stone Age of Bizmoune cave: experimental end use-wear approach

#### 17.20 JONATHAN ABLETT: Closing Remarks

#### 1720-1830 Wine Reception

Poster Presentations

BORDEAN: Patterns of predation on Pea Urchins: past and present

- **EDMUNDS :** Variation and diversity of calcite layers within the Muricidae (Gastropoda): evolutionary and ecological im plications
- INGRAM: The evolution of blue and green shell colour in the Bivalvia

OMURA: Embryonic development of Paintpot Cuttlefish, Ascarosepion tullbergi (Appellöf, 1886)

WHITE: Predation pressure on Neogene freshwater gastropods

## Abstracts

### Alphabetical by presenter

#### The effect of niclosamide monohydrate on two invasive snails in North America

W.A.N.U Abeyrathna<sup>1</sup>, Davinack, A.A.<sup>2</sup>

<sup>1</sup>Department of Biology, Clarkson University, Potsdam New York, USA <sup>2</sup>Department of Biology, Wheaton College, Norton, Massachusetts, USA Email: <u>abeyranu@clarkson.edu</u>

*Callinina georgiana* (the banded mystery snail) and *Heterogen japonica* (the Japanese mystery snail) are two exotic viviparid snail species that were introduced to North America in 1867 and 1911 respectively. These snail species harbour parasites, predate on the eggs of native species and have extensive growth rates to replace native species by overpopulating the aquatic ecosystems. While several recent studies have explored the population structure and range expansion of both species in the United States, none have formally addressed control or eradication. To find out whether using niclosamide is an effective chemical control method for these snails, we



exposed both snail species to acute and chronic concentrations of niclosamide monohydrate, (Pestenal ®, 2',5dichloro-4'-nitrosalicylanilide) in laboratory conditions. Mortality of both species were recorded after 24 hours, exposing both snails to a concentration series. Lethal doses for 50 % mortality ( $LD_{50}$ ) of niclosamide, for *C. georgiana* and *H. japonica* were 1.509 mg/L and 1.296 mg/L respectively. In acute exposure experiments we observed that at higher concentrations, all *C. georgiana* in the experimental treatment tanks were dead. However, *H. japonica* snails never reached 100% mortality even at the highest concentration. In chronic exposure experiments, *C. georgiana* did not survive more than seven days and *H. japonica* did not survive more than 11 days in the experimental tanks. We conclude that niclosamide cold be an effective chemical control agent for eradication of invasive mystery snails in North America. However, further studies exploring the effect of the molluscicide on non-target species, especially local native fauna, should be investigated prior to any scaled-up field applications.



#### What is essential is no longer invisible to the eyes: 3D reconstruction of aesthetes pore networks in Polyplacophora

Ampuero, A., Vončina, K. & Sigwart, J.

Department of Marine Zoology, Senckenberg Research Institute, Frankfurt am Main, Germany,

#### Email: andre.ampuero-leon@senckenberg.de

The application of micro-computed tomography ( $\mu$ CT) has significantly advanced our understanding of anatomical structures and their evolutionary processes. This technique has successfully been applied to a diverse range of organisms, from tiny arthropods to massive mammals. Its non-invasive nature enables us to explore internal morphological features without damage to the specimens. One intriguing group that benefits from  $\mu$ CT visualization is the class Polyplacophora. Chitons lack a true head or cephalic sense organs, and instead rely on specialized sensory structures known as aesthetes situated within pores on the dorsal shell plates. The aes-



thete channels penetrate both the dorsal (tegmentum) and ventral (articulamentum) layers of the plates through a network that connects to the sub-adjacent mantle. Most previous studies have relied on the observation of external pores to infer channel distribution. Endocasts can reveal the inner structure but require destruction of specimens, and therefore the technique is not suitable for museum specimens, rare species, or fossil material. We have generated 3D reconstructions of aesthete networks using µCTclades, to identify patterns that distinguish different taxonomic orders, superfamilies and families. Aesthete structures in Lepidopleurida and Chitonida are dramatically different, with strong secondary structuring in Chitonida. This approach to visualization also clarifies and develops earlier hypotheses concerning the interaction of the sensory network with taxonomically diagnostic external features such as articulamentum thickness and tegmentum reduction. Visualizing these 3D internal structures is important to understanding the evolution of this complex sense organ and diversity within the Polyplacophora.

## Understanding the function of *Mytilus galloprovincialis* shells from the Middle Stone Age of Bizmoune cave: an experimental end use-wear approach.

Belamrya, H. & Bozouggar, A.

Department of Prehistoric Archaeology, National Institute of Archaeology and Heritage Sciences, Rabat, Morocco Email: Belamrya.fivehouda@gmail.com

The Middle Stone Age witnessed a set of cultural, social and behavioral changes that helped human adapt to environmental conditions. Among these behavioural aspects in North Africa, there is marine resources exploitation for multiple purposes including alimentary, symbolic and functional use. Research conducted at Bizmoune cave in centralwestern Morocco unveiled evidence of diverse marine shell usage. Additionally, geomorphological studies indicated that around 150,000 years ago, during the Middle Stone Age, the shoreline was located about 50 kilometers away from the cave. Shell tools have been discovered at various ancient sites worldwide. They served different functions, sometimes due to limited access to other materials like stone; in other cases they were merely a part of a human's diverse tool kit. Given the shape and characteristics of *M. galloprovincialis* shells, including their conformity to hand, and edge sharpness, we suppose that they were used as tools to perform certain tasks. Our research objectives are twofold: first, to understand the specific roles that *M. galloprovincialis* shells played in this ancient society, and second, to gain insight into how Homo sapiens interacted with their environment. This involves studying how these shells were procured, the social and economic groups organization, mobility patterns, and their potential influence on the development of modern human behaviour. To better understand early human skills and how they adapted to changing environments and resources, we conducted experiments. We used modern M. galloprovincialis shells, collected from the Atlantic coastline near the mouth of Oued Ikem, to work on a bovidian bone. Subsequently, we analyzed the use-wear on the shells resulting from this process. By applying the principle of actualism, analogy and ethnographic observations, we aim to develop a broader understanding of the use of *M. galloprovincialis* shells during the Middle Stone Age



#### Patterns of Predation on Pea Urchins: Past and Present

Bordean C & Harper E.M. Department of Earth Sciences, University of Cambridge, Downing Street, Cambridge, CB2 3EQ Email: <u>cb2023@cantab.ac.uk</u>

The potential of minute clypeasteroid *Echinocyamus* pusillus (OF.Müller 1776) to preserve evidence of drilling predation throughout the Paleocene has not been fully appreciated until recently. A total of 1216 individuals of one species were analysed for signs of drilling, making this the largest study of its kind. Both fossil and modern specimens from 3 different time periods were measured from 12 locations across Europe. The overall predation rate was 19%. Predation frequency could have changed with time across the whole study area but is far more likely to be affected by local conditions and population structures. Multiple behaviours were captured in this study including size and non-size selective predation and parasitism. This was only possible because we did not assume what the predator species was or that only one species was producing the drill holes. What has remained consistent over time and space is the tactic used by the molluscan predators. Piercing the test is



achieved by secretion of acid and muscular rasping with the radula to produce a roughly circular hole. 'Pore theory' encapsulates how a predator detects advantageous sites; first by olfaction sensing chemical signals probably released via the large gonad pores on the aboral surface, then utilising the pore structures already perforating the test to get directly to the most nutritious tissues. The site chosen by predators is such that the acid volume secreted and drilling time are minimised so net energy gain is maximised and risk of losing their prey is minimal. The tactics used for urchin predation are remarkably different from those used to hunt bivalves due to the heterogeneous nature of the urchin test.

#### Stable isotope signatures in beaks and eye lenses of common octopus (Octopus vulgaris) juveniles.

Markris Brown, S.<sup>1,2</sup>, Fernández-Álvarez, F.A.<sup>1</sup>, Escolar, O<sup>1</sup> & Villanueva, R.<sup>1</sup>

<sup>1</sup>Institut de Ciènces del Mar, Consejo Superior de Investigaciones Científicas, (CSIC), Barcelona, Spain <sup>2</sup>Institut de Ciència I Tecnologia Ambientals, Univeristat Autònoma de Barcelona (UAB), Bellaterra, Spain Email: skyemarkrisbrown@gmail.com

*Octopus vulgaris* hatch as free-swimming planktonic paralarvae in coastal waters and develop in the water column until their settlement as benthic juveniles, a transitional phase to posterior benthic subadults and adults. The main habitat of *O. vulgaris* during their planktonic paralarval life is unknown, as is whether they remain in inshore environments inhabited by adults or disperse to offshore oceanic environments to come back to coastal waters for settlement. Aiming to determine the planktonic habitat of the species as coastal or oceanic, carbon and nitrogen stable isotopic signatures of whole beaks and eye lenses of 62 juveniles and 16 adults were analyzed. As these metabolically inert structures integrate the isotopic signature of the octopus life, we hypothesized that comparing signatures between adults and juveniles would indicate a possible ontogenetic shift of diet and foraging habits. We assumed that recently settled, juvenile individuals, will mainly reflect in their beaks and lenses the signature of the previous planktonic life. We found significant increments in  $\delta^{13}$ C and  $\delta^{15}$ N signatures from juveniles to adults in both structures, suggesting they occupy distinct isotopic niches. Increases in  $\delta^{15}$ N were 4.21 and 5.16 ‰ for beaks and lenses respectively, reflecting a ~ 1.2 and 1.5 trophic level differences.  $\delta^{13}$ C values showed a similar trend with 1.56 and 1.35 ‰ increases, reflecting ~ 1.4 and 1.3 trophic level differences, respectively. We explore the possibilities of these differences being attributed to ontogenetic shifts in diet towards higher trophic level prey or whether they reflect differences in foraging.

## Establishing baseline data for conservation via a comparative species survey of marinemacro-molluscs (bivalves and gastropods) from a disturbed-commercialized and a protected reserve coastal area in the Philippines - a tale of two coastal barangays

<u>Caril, A</u><sup>1,2,3</sup>, Bernabe, J.<sup>1,3</sup>, Aggabao, M.J.<sup>1,3</sup>, Bantigue, P.C.<sup>1,3</sup>, Guinto, A<sup>1,2,3</sup>, Gabriel, E.M.<sup>1,3</sup>, Roderos, A.R.<sup>1,3</sup>, Ellorin, R.J.<sup>1,3</sup>, Naca, A.<sup>3</sup> & Saguil, N.<sup>2,3,4</sup>

<sup>1</sup>Graduate School, Polytechnic University of the Philippines, Sta. Mesa, Manila 1016, Philippines

<sup>2</sup>Department of Biology, College of Science, Polytechnic University of the Philippines, Sta. Mesa, Manila 1016, Philippines
 <sup>3</sup>Center for Engineering and Technology Research, Research Institute for Science and Technology, Polytechnic University of the Philippines, Sta. Mesa, Manila 1016, Philippines
 <sup>4</sup>Olivera Laboratory, School of Biological Sciences, University of Utah, Salt Lake City, Utah, USA
 Email: carilus.alvinii@gmail.com

Marine biodiversity, particularly in coastal areas, is constantly threatened by human activities. This study aimed to establish baseline data for conservation efforts by conducting a comprehensive comparative survey of marine macro molluscs, bivalves and gastropods, in two contrasting



coastal barangays of the Philippines - one disturbed and commercialized, and the other designated as a protected reserve, Barangay Talao-talao in Lucena, Quezon Province and Barangay Paniman in Caramoan, Camarines Sur, respectively. Our research unexpectedly reveals a paradoxical situation in which the disturbed commercialized area showed a significantly higher molluscan species richness, with 203 species compared with the protected reserve, which has 90 species. Purposive sampling and species identification along the coastlines of both sampling sites were part of the comparative survey conducted over a year. Our results demonstrated that the disturbed-commercialized area harbored a significantly greater number of species. This discovery challenges conventional assumptions about the negative impact of anthropogenic activities on marine biodiversity. The presence of 203 molluscan species in the disturbed-commercialized area can be attributed to several factors. First, the area's proximity to a significant trading hub may facilitate unintentional species introductions through ballast water discharge from shipping activities. Second, despite habitat degradation, the site may provide microhabitats that support a wide range of molluscan species. Furthermore, diverse habitats, such as artificial structures and mangrove stands, may contribute to increased biodiversity. In contrast, although relatively undisturbed, the protected reserve exhibited a surprisingly lower number of molluscan species. This could be attributed to the limited range of reserve habitats, predominantly consisting of coral reefs and seagrass beds. It is essential to recognize that while protection measures may maintain the overall health of ecosystems, they may not necessarily promote high species diversity. The study emphasizes the importance of considering both disturbed and protected coastal areas in conservation planning. It highlights the complexity of factors affecting marine molluscan biodiversity, challenging prevailing assumptions and emphasizing the need for comprehensive, data-driven strategies. Our findings provide a valuable baseline for ongoing conservation efforts and call for reevaluating the conventional wisdom regarding marine biodiversity in disturbed coastal areas.

#### Unraveling synonymy among bycatch molluscs from the Gulf of California: an enduring challenge in malacological research.

The phylum Mollusca has 93,000-200,000 species; they can be found in a wide range of terrestrial and aquatic habitats, from various types of soil to the deepest oceans. It has been

Corzas Cruz, J.C. Biological Research Center of the Northwest (CIBNOR), La Paz, Mexico Email: jcorzas@yahoo.com



Megapiteria aurantica

IOLLUSCAN FORUM

estimated that 52,000 species belong to the seashore, making them part of the incidental catch in shrimp fishing, especially at industrial-scale through trawling. Although molluscs have been reported as a minor percentage of shrimp bycatch, three recurrent groups have been reported: Cephalopoda, Bivalvia and Gastropoda. In our study we used data obtained by INAPESCA during the

closed season of shrimp fishery between 2002 and 2018 on the Sonoran coast of the Gulf of California. The first step was to check and correct the names of the species in the database; the records included common names, outdated scientific



Street art-Nosotros\_Collejues - Photo-Sandra Muñoz

names, and accepted scientific names. We found 75 species of molluscs as bycatch along with 400 synonyms, resulting in a total of 475 scientific names (both unaccepted and accepted names). We retained the accepted name according to the WoRMS website. Phylum Mollusca exhibits a variety of forms, colours and characteristics that make them unique and attractive not just for predators, but for scientists and enthusiasts (e.g. conchologists) as well; these characteristics have led both scientists and enthusiasts to name molluscs according to their knowledge and perceptions. In this brief talk, our aim was to promote a more uniform usage of scientific names, because this would facilitate communication rather than having names which are 'getting lost in translation'.

#### Molluscan fauna of Meghalaya's limestone caves: understanding diversity and threats for conservation

Kumar Das, N. 1,3,4 & Ananthram Aravind, N.1,2,

<sup>1</sup>SM Sehgal Foundation Center for Biodiversity and Conservation, Ashoka Trust for Research in Ecology and the Environment (ATREE), Bangalore 560064, India <sup>2</sup>Yenepoya Research Centre, Yenepoya (deemed to be University), University Road, Derlakatte, Mangalore 575018, India

<sup>3</sup> Manipal Academy of Higher Education (MAHE), Madhav Nagar, Manipal, Udupi 576104. India

<sup>4</sup> Department of Zoology, Kamrup College, Chamata, Nalbari, 781306, Assam, India Email: nipu.das@atree.org

Cave biodiversity studies are of paramount importance as they provide crucial

insights into unique faunal diversity, regressive evolution, and the conservation of endemic species. Despite their significance, India's caves, particularly those in Meghalaya in Northeast India, have remained largely unexplored, leading to limited knowledge about the diverse molluscan fauna that inhabits these unique habitats. To address this knowledge gap, a detailed study was undertaken to investigate the molluscan fauna and potential threats to selected caves in Meghalava. The survey was carried out in eight limestone caves, and a total of 49 land mollusc species belonging to 27 genera and 15 families were collected. A considerable proportion of these species are previously unknown to science, highlighting the immense potential for new species discoveries in these caves. The diversity of molluscs observed varied significantly among the different caves and also between their inside and outside the cave. In addition to documenting the molluscan fauna, our study also documented habitat variables such as temperature and humidity. The temperature inside the caves ranged from 17 to 21.5°C, while the outside was between 16.8 and 23.3°C. The humidity levels inside the caves ranged from 64% to 70%, while outside, it was between 61% and 71%. The study documented several potential threats to the cave ecosystems, such as pollution originating from a nearby cement factory, which can have adverse effects on the delicate cavedwelling organisms. Additionally, the presence of plastic waste and artificial lighting installed for tourism were identified as potential threats to the cave fauna. Furthermore, the impact of tourism-related footfall on faunal composition within the caves raised concerns about the long-term sustainability of these ecosystems. In light of the results, the study highlights the urgent need for further research and conservation efforts in Meghalaya's caves. Given their rich biodiversity and the various threats they face, implementing appropriate conservation strategies is imperative to safeguard these remarkable cave ecosystems and the unique species that rely on them. To ensure the protection of these delicate cave fauna, proactive measures must be taken to address pollution sources and mitigate the impact of tourism on these sensitive environments.



#### How can we study a diet of an opportunist predator?

da Silva, E.J.<sup>1</sup>, Martins, I.X.<sup>2</sup> & Beserra, L.E.A.<sup>3</sup>

- <sup>1</sup> Institute Education, Science and Technology of Roraima IFRR Novo Paraíso Campus, Caracaraí, Brazil
- <sup>2</sup> Institute of Sea Sciences (LABOMAR), Federal University of Ceará, Fortaleza, Brazil <sup>3</sup>Laboratory of Molluscs (LABMOL), Federal Rural University of the Semiarid, Mossoró Brazil

#### Email: ellanosilva7@gmail.com

Octopuses, renowned for their voracious predatory nature, exhibit remarkable cognitive abilities that influence their foraging behavior. This study presents a novel exploration into the dietary habits of *Octopus insularis*, a dominant species inhabiting the shallow waters of the Western Atlantic. Three distinct methodologies were employed to investigate its dietary preferences: i) Midden Counts (MC): This approach involved the examination of recent prey remains, devoid of biofouling, in and around octopus dens; ii) Daytime Observations (DO): Octopuses



Shells of molluscs and appendages of swimming crabs identified using the midden count (MC) method

observed outside their dens underwent analysis of their ventral regions for the presence of prey; iii) Stomach Content (SC): Crop and stomach contents of the octopuses were meticulously analyzed. Data collection spanned from 2012 to 2016, encompassing 159 octopuses from the intertidal zone of a northeastern Brazilian beach, characterized by semidiurnal tides with an average amplitude of 284.5 cm. Surveys were exclusively conducted during syzygy low tides. The findings unveiled noteworthy variations in diet composition among the three methodologies. According to the MC method, *O. insularis* has exhibited a pronounced preference for molluscs (frequency of occurrence = FO > 70%), with crustaceans serving as a secondary food source. By contrast, the DO method identified this species as predominantly consuming crustaceans (FO > 70%), a conclusion reinforced by the SC analysis (FO > 90%). Crucially, the study's results highlighted significant differences (P< 0.05) in the FO between the methods. These disparities were largely attributed to the substantial



Female *O.insularis* captured with prey adhering to its suckers, as observed during daytime (DT) operations presence of molluscan remains in the MC dataset. It's essential to recognize that the MC method represents an indirect assessment of dietary habits, while the DO and SC methods directly observe what octopuses are actively consuming or have consumed. Furthermore, the analysis of items found in or near octopuses' dens can be significantly influenced by abiotic factors, particularly in high hydrodynamic environments such as our study area. For instance, during rising tides, crustacean carapaces may be easily transported away, leaving only mollusc shells behind. This phenomenon can lead to potentially misleading conclusions when relying solely on the MC method to assess diet composition.

## Species composition of Family Strombidae in coastal areas of Lucena City, Quezon and Caramoan, Camarines Sur, Philippines

<u>Ellorin, R.J.</u><sup>1</sup>, Aggabao, M.J. <sup>1,3</sup>, Bantigue, P.C.<sup>1,3</sup>, Bernabe, J.<sup>1,3</sup>, Guinto, A.<sup>1,2,3</sup>, Caril, A. <sup>1,2,3</sup> & Saguil, N. <sup>2,3,4</sup>

- <sup>1</sup> Graduate School, Polytechnic University of the Philippines, Sta. Mesa, Manila 1016, Philippines
- <sup>2</sup> Department of Biology, College of Science, Polytechnic University of the Philippines, Sta. Mesa, Manila 1016, Philippines
- <sup>3</sup> Center for Engineering and Technology Research, Research Institute for Science and Technology, Polytechnic University of the Philippines, Sta. Mesa, Manila 1016, Philippines
- <sup>4</sup> Olivera Laboratory, School of Biological Sciences, University of Utah, Salt Lake City, Utah, USA

#### Email: rachelj.ellorin@gmail.com

The Philippines is located in an ocean region that is a hub of marine biodiversity. As an archipelagic nation, it has abundant aquatic resources, with molluscs being a prominent example. Molluscs have a crucial role to play in the marine ecosystem, and their significance has been extensively researched. The Family Strombidae, which belongs to

Class Gastropoda, typically inhabit tropical and subtropical seas in shallow or shallow water. However, climate change and human activities pose a threat. In tropical shallow waters, larger species of 'Strombs' are harvested as a popular and exploited food source. Strombidae are used by humans in a wide range of ways, primarily as food or decoration. Although the Philippines has a biogeographic advantage for mollusc collection, more studies are needed to determine the composition, diversity, and distribution of molluscs in unexplored areas. This study aims to evaluate the diversity of marine macro- molluscs, specifically Strombidae species, in the intertidal areas of Barangay Talao-Talao, Lucena, Quezon, and Barangay Paniman, Caramoan, Camarines Sur, Philippines. From December 2022 to May 2023, sampling was carried out by hand-picking. The collected specimens were cleaned, measured and photographed to facilitate identification. The survey in the area revealed 112 Strombidae species, with 65 from Barangay Paniman and 47 from Barangay Talaotalao, and *Canarium urceus* having the highest species count.

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The survey results suggest that the intertidal region of Barangay, Talao-talao and Barangay Paniman has a diverse and rich composition of strombid species. The presence of these species indicates that the environment fosters and nurtures strombid species. Additionally, the environment has a well-functioning nutrient cycle, sustainably supporting these creatures. Despite the diverse anthropogenic elements impacting on marine biodiversity in Philippine waters, this research has furnished crucial fundamental data regarding strombid species and can therefore aid marine ecosystem conservation.



## Exploring shell shape variation under different environmental conditions in Littorina littorea and Littorina saxatilis: Comparing traditional geometric morphometrics and growth parameters (ShellShaper)

Klingler, N.P., <u>Dehne L-M.</u>, Billy, M., Ecker-Eckhofen, G. & Mangwani, S. International Master of Science in Marine Biological Resources (IMBRSea), Marine Biology Research Group, Ghent University, Ghent, Belgium Email: laura.marie.dehne@imbrsea.eu

The dynamic relationship between organisms and their environment drives an ongoing process of adaptation and evolution. A particularly pressing challenge for adaptation, especially for benthic organisms, is evolving an optimal body shape for success in a challenging environment. This study examines dynamics of shell shape variation in Littorina snails across distinct coastal habitats. Our study investigates shape variation of two *Littoring* snails (*L. littorea, L. saxatilis*) on exposed and sheltered rocky shores. Our research addresses two primary questions. (i) Whether shell shape differs between contrasting environmental conditions within the two species, and (ii) whether shell shape differences are similar in the two species. We applied two distinct techniques to analyze and compare shell shapes across two different species within a wave-exposed, and sheltered rocky coastal site. By utilizing traditional geometric morphometrics with fixed and sliding landmarks, and the ShellShaper method, as an alternative methodology based on growth parameters, we aimed to gather more information to address our research questions. Our results suggest there are differences in shell shape within both Littorina species across various sites. These differences not only show the variability between sites and species but also provide insights into how they adapt uniquely to shared environmental pressures. Furthermore, we observed indications of a wider range of shell shape variations in L. littorea, which raises the possibility that a greater dispersal range could be associated with increased potential for phenotypic variation. Additionally, our research offers an exploration of how shell morphologies in both species may vary in response to site exposure. These findings raise questions for future research, encouraging further exploration into the origins of this variability and the potential ecological implications, while acknowledging the need for further investigation. The methods independently describe distinct features that differentiate shapes between the two species. This highlights the utility of using both sources of information as a starting point for research that examines the drivers of this variation.

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Principal component analysis showing potential clusters between site and species across the 2 main axes of variation. The plot on the top (A) is based on traditional GM landmarks, while that on the bottom (B) is based on the Shellshaper dataset. Ellipses are drawn around clusters of the same species, while symbols refer to species within each site type.



Sample images, on the left (A) showing the 29 fixed and sliding landmarks used for the traditional GM analysis. Fixed landmarks are the large red points, while sliding landmarks are the small red points that define the blue curve. The image on the right (B) displays the Shellshaper method, which uses different, specific, landmarks to define growth parameters.

## Variation and diversity of calcite layers within Muricidae (Gastropoda): evolutionary and ecological implications

Edmunds, R.

Department of Earth Sciences, University of Cambridge, Cambridge, UK Email: re382@cam.ac.uk

B

Within the Muricidae, the diverse and predatory murex shells, 11 out of 12 subfamilies (41 out of 317 genera) were examined to determine their shell ultrastructure. Calcite layers were observed in 14 genera with 5 seemingly independent origins as a lower estimate of all those that are within the Muricidae. Within different calcite-secreting clades, there is variation in calcite microstructure. Most species had a prismatic or acicular calcite layer microstructure, with multiple independent origins converging, or reconverging, on the same microstructure. There were some exceptions, for example, *Trophonella rugosolamellata*, the Antarctic haustrum shell, displayed a foliotic microstructure whilst *Dermomurex neglectus* displayed a granular microstructure. Calcite is found in the outer layer, and is more common in species inhabiting waters further away from the equator and therefore, hypotheses for the gain in calcite layers are discussed.

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Calcite



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## Trail Watch: visualising gastropod mucus trails using optical profilometry and light microscopy

Eggleton, L & Holland, C Department of Materials Science and Engineering, University of Sheffield, Sheffield, UK Email: leggleton1@sheffield.ac.uk

Gastropod mucus can transition between two apparently contradictory states, acting

as both an adhesive and lubricant based on the needs of the animal. However, the mechanisms behind this are yet to be elucidated as this material is often studied in biological isolation and from a purely engineering perspective. Current methods of analysis and sample collection can disrupt the gastropod mucus' native trail structure, preventing the subtler structure-function properties and dynamics from being explored. In order to investigate this system effectively, a method for visualising the native deposition of gastropod mucus trails *in situ* was developed. This used a combination of optical profilometry and light microscopy to uncover how the secondary structures present in gastropod mucus affected its drying dynamics and functional properties. Rapid profilometry scans allowed for variations in the post-deposition mucus trail to be observed. Analysis of the dried trail topography provided insight into the alignment and depth of gastropod mucus trails. Our results revealed that gastropod mucus trails have a non-uniform deposition profile with alignment along the trail edge and the centre of the trail. Whilst in a hydrated state, the trail has a convex profile, with evaporation occurring from the trail edge, which is inverted once fully dried with distinct ridges visible along

both edges. This indicates a potential difference in mucin deposition or alignment that is independent of the hydration state of the mucus. This distinct trail topography was present across a range of specimen sizes in the three slug species used for this study: *Arion vulgaris, Arion flagellus* and *Limax maximus*. However, the trail profile was modified by specimen speed, with lower velocities reducing the prominence of the trail edge ridges. Our results suggest that mucus deposition rate and muscle movement have a more significant impact on mucus trail alignment than species or specimen mass. We propose that this method, when used in conjunction with techniques such as FTIR and rheology, can provide invaluable insight into how gastropods manipulate the properties of their mucus across their trails.

## Problem solving and exploratory behavior in Octopus vulgaris in captivity

Foka-Kavalieraki, Y. &, Raitsos, D.E.

Department of Biology, National and Kapodistrian University of Athens, Greece Email: juliefoka@phs.uoa.gr

Octopuses in captivity, as exceptionally sentient animals with individual variations of personality, need carefully designed cognitive and sensory stimulation in order to advance their healthy development and well-being. The provision of various puzzles, toys and opportunities for basic hunting activities, are considered to be appropriate stimuli. These stimuli enhance their problem solving, memory and learning abilities. To investigate such processes, we ran two experiments: (a) Three rubber toys were alternatively presented to two adult female octopuses, each for 6 and 12 times respectively. The toys were similar in size, colour and texture, but differed in complexity as per the number of features or moveable parts they had. Handling time for each toy was measured. The responses of the two animals differed: one octopus handled the object that had more features for a mean time of 178 minutes, compared to the spherical one (28 minutes) or the one that had moveable rings (48 minutes), whereas the mean handling time for the other octopus was 30, 32 and 19 minutes respectively. Feeding status was not related to the handling time of the toys. (b) After a brief time of familiarization with the next task, food was exclusively offered to one of the octopuses for 13 trials, in a plastic jar, closed with a screw lid. The lid had 3 levels of opening difficulty. The octopus managed to open the jar with its body and get its food every time under the easy







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(mean time 55 minutes) and moderate difficulty level (mean time 127), but only one time under the most difficult level, at the last trial, in 98 minutes. Surprisingly, in 30% of the trials, the animal invented an innovative way to open the jar, by using the rocks in its tank as opening tools for the lid. All activities were video recorded. We anticipate that our results will contribute to the understanding of octopuses' behaviour, as well as to offer suggestions for the cognitive enrichment of captive animals.



## Overwintering in Helix pomatia L. snails: a new view on cold adaptation

Idczak-Figiel, P.A. & Nowakowska, A.

Department of Animal Physiology and Neurology, Nicolaus Copernicus University in Toruń, Toruń, Poland

Email: pidczak@doktorant.umk.pl

Helix pomatia L. is a large, air-breathing, stylommatophoran land snail native to Europe. It is

distinguished by a globular brown shell and is frequently found synanthropically throughout its range. It is also known as the Roman snail, Burgundy snail, or escargot. My doctoral research project's main aim was to determine the putative role of Heat Shock Proteins (HSPs) in response to environmental stress as well as identifying Cold Shock Proteins (CSPs) in *H. pomatia* snails, and then determining the expression of the proteins during exposure to freezing in snails. After considering the available literature, I assumed that upregulation of either HSPs or CSPs may enhance survival under thermal stress conditions by acting as cryoprotectants and reducing the energetic cost associated with protein damage. It needs to be stressed that both the knowledge about the role of HSPs in molluscs and the direct relation of CSPs level with the functionality of these proteins during freeze/thaw cycles have not been investigated so far. During the last three years of working on these hypotheses, I have successfully achieved our basic goals: thus I have identified the presence of HSPs and CSPs in *H pomatia*, and determined the expression of CSPs in the annual cycle of groups of snails acclimated to low and high temperature as well as long and short photoperiod using the RTqPCR method. Additionally, to broaden my knowledge on this topic, I was able to identify proteins coexisting with HSPs using western blot and coimmunoprecipitation methods, and finish a project related to the analysis of seasonal changes in the snail gut microbiome and its potential role as ice-nucleating Agents (INAs) using both standard microbiology culture methods as well as 16rDNA sequencing and whole genome sequencing methods. We also worked on a hypothesis about freeze-tolerant microbiota inoculation of summer snails, tested by measurement of the supercooling point of their body fluids.





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## The evolution of blue and green shell colour in the Bivalvia

Ingram, A.L., Brodie, J. & Williams, S. Department of Life Sciences, Natural History Museum, London, United Kingdom. Email: a.ingram@nhm.ac.uk

Bivalves exhibit an enormous range of shell colours, of which blue and green are the rarest, reflecting a wider trend amongst animals generally. It is not known why these colours have rarely evolved, but bivalves provide an excellent model group with which to investigate this question since they include examples of blue and green shells amongst a diverse range of related species. The work will be addressed with a new project as part of a Daphne Jackson Fellowship, which aims to identify and overlay morphological and ecological factors onto an updated phylogeny to establish which may be driving the evolution of these rare colours. An initial survey will identify all blue and green shelled bivalves using literature and online photographic sources and these taxa will be targeted for inclusion in an updated phylogeny. Traits scored will include shell colour, tissue location of colour (shell/periostracum), habitat, depth and biogeographic ecozone. The mechanism of colour production will be identified using Raman spectroscopy to determine firstly whether colour is due to pigments, and whether different pigments are associated with different colours and tissues, and secondly, to determine whether Raman-inactive colours are due to structural colour. Although there are few examples of structural colour in Mollusca, some interesting possibilities can be found in bivalves. Scanning electron micrographs have shown possible photonic nanospheres in the green tissues in some mytilid species, which may create structural colour. Initial studies using spectrophotometry, scanning electron microscopy and modelling will therefore focus on these species. To understand how colour evolved, a new gene-rich bivalve phylogeny will be produced by sequencing new mitochondrial genomes and nuclear genes from species not represented in previous phylogenies which, when added to published sequences, will create the most taxon-rich phylogeny to date. Colour and its mode of production, together with other recorded traits, will be mapped onto the new phylogenetic framework to test for correlation with morphological and ecological traits and phylogenetic signal.

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## Behavioural changes of piscivorous cone snail species based on factors of climate change

Jaramillo, A.D.B., Omandam, R.K.A. & Saguil, N.A.<sup>1,2,3</sup> <sup>1</sup>Department of Biology, College of Science, Polytechnic University of the Philippines, Manila, Philippines

 <sup>2</sup>Center for Engineering and Technology Research, Research Institute for Science and Technology, Polytechnic University of the Philippines, Manila, Philippines
 <sup>3</sup>Olivera Laboratory, School of Biological Sciences, University of Utah, Salt Lake City, USA Email: jaramilloarnolddaniel2@gmail.com,

Behaviour is the attribute of an organism's action that involves interacting with or act-

ing on its external environment. This response is crucial to the survival of all organisms because it ensures that metabolic processes run at maximum efficiency. Climate change influences the structure of marine ecosystems, and organisms with dynamic behavior usually respond quickly to changing environmental conditions. Such behaviour is crucial to a species' ability to adapt to environmental changes. Phylum Mollusca, to which cone snails belong, is one of the most diverse taxa. However, evolutionary studies only consider the species' adaptability over long periods of time, ignoring any unexpected modifications in behaviour, for example due to climate change. Thus, in the present study, we used an *in-situ* approach and used indoor aquaria to simulate climate change and observed the behaviour of piscivorous cone snail species using a video recording camera set-up while abiotic parameters such as temperature, salinity, and pH level were altered.



Conus magus laying eggs

These factors were then tested to determine how they affected other aspects of the species, including diet, mobility, reproduction, and mortality. By observing quick changes in essential features, this study provides knowledge that improves our knowledge of species adaptability. We noted that temperature changes drive activity and start reproduction, pH changes cause partial inactivity, and salinity causes total inactivity as well as an increase in mortality. Additionally, the findings emphasize the implications of these behavioral changes, such as higher rates of reproduction leading to an increase in population, which may lead to increased competition for survival. The findings also apply to other molluscan species' adaptation as climate change affects their overall biodiversity.



Conus magus with proboscis pointing down



# Molluscs of Mochras: benthic molluscan turnover though the Pliensbachian and Toarcian (Lower Jurassic), particularly across the Toarcian Oceanic Anoxic Event, in the Llanbedr (Mochras Farm) core.

Jenkinson, M. & Little C.T.S.

School of Earth and Environment, The University of Leeds, Leeds, United Kingdom. Email eemj@leeds.ac.uk

During the early Toarcian (Lower Jurassic~183 million years ago) much of northwest Europe experienced widespread marine dysoxia linked to hyperthermal conditions triggered by the eruption of the Karoo-Ferrar Large Igneous Province. Termed the Toarcian Oceanic Anoxic Event (TOAE), this event is associated with a strong global negative carbon isotope excursion (CIE), deposition of organic-rich laminated black shales, and widespread extinction of benthic macrofauna. Benthic extinction and recovery patterns across the Pliensbachian and Toarcian are well constrained in the Cleveland Basin of Yorkshire, where the major benthic turnover correlates with the negative CIE and onset of black shale deposition in the early Toarcian. However, less is known about the timings and causes of turnover elsewhere in the UK, particularly where coeval black shales are absent. The Llanbedr (Mochras Farm) core (Cardigan Bay Basin, North Wales) provides an almost continuous, expanded section throughout the entire Pliensbachian and Toarcian, and notably does not contain any laminated black shales anywhere within the section. The benthic molluscan fauna of Mochras differs significantly from contemporaneous assemblages in Yorkshire, and up to three turnovers in the benthic molluscs are recorded during this time. Two occur during the Pliensbachian which largely mark the disappearance of taxa, and one within the middle Toarcian where several species appear or reappear in the basin. The benthic molluscs comprise many taxa which are rare or absent in time-equivalent strata in Yorkshire. Bivalves are the most abundant benthic representatives at Mochras, whilst gastropods are extremely rare throughout, except in the upper Toarcian. Bivalves are largely dominated by epifaunal taxa across the entire Pliensbachian and Toarcian, but many taxa which act as environmental indictors and characterise the extinction-recovery interval in Yorkshire are absent in Mochras. Faunal composition and lack of black shales therefore suggests different redox conditions in the sediment between the two localities.

## Environmentally driven variations in shell characteristics of *Cerastoderma* on the East Coast of England

<u>King, B.F<sup>1</sup></u>., Harper, E.M. <sup>1</sup> & Peck, L.S<sup>-2</sup> <sup>1</sup>Department of Earth Sciences, University of Cambridge, Cambridge, UK <sup>2</sup>British Antarctic Survey, Cambridge, UK Email: bfk24@cam.ac.uk

Anthropogenic greenhouse gas emissions and human disturbance are serious threats to ecosystem functioning. Alterations of the physical and chemical properties of the ocean include increasing surface temperatures, acidification and oxygen loss. Calcifying organisms are considered especially vulnerable to ocean acidification, facing increased difficulty and cost of shell formation, and accelerated loss and corrosion of the shell. Historic collections are important archives of species response to past abiotic and biotic conditions. They present a



Demonstration of a strange pathology observed in several specimens of the historic and modern collections which, as of yet, has not been determined.

long-term dataset across large spatial and geographical scales that can reveal natural changes over considerable time periods. In the late 1960s, collectors Boyden and Russell extensive sampled two ecologically important species of cockle across the UK and Europe with contemporaneous habitat data. Resampling from selected sites allows natural variations in shell characteristics to be investigated under the heterogeneous conditions of the coastal environment across an important period of the Anthropocene. The commercially harvested *Cerastoderma edule* inhabits dynamic intertidal mudflats and tidal estuaries, while its congeneric, *Cerastoderma glaucum*, inhabits sheltered and low-energy lagoons and estuaries. This project also provides comparative data on the shell growth and maintenance of the two species. Coastal lagoons are of conservational importance and are relatively rare in the UK. East Anglia has a proportionately large num-



Coastal lagoon adjacent to the River Crouch near South Woodham Ferrers, Essex.

ber of lagoon systems and has become the initial focus for resampling modern fauna. Preliminary results show significant changes in the shell thickness of specimens over the last 60 years. In addition, variations in shell size and shape are observed, and regression analysis evinces seasonal growth patterns. The complex nature of marine ecosystems means the stressors driving these variations could involve many factors, including salinity, temperature change, nutrient runoff and predation. The aim is to use statistical methods to determine which abiotic and biotic factors are driving shell plasticity. These esults will help us to better understand the impact of ongoing climate change on marine calcifiers and improve predictions on their response to forecasted future environmental change. An undetermined pathology has also been uncovered in *C. glaucum* and requires examination.

## *Physa* challenges our views – parasitic burden in a non-native host?

#### Kowaleska, Z.

Department of Invertebrate Zoology and Parasitology, Nicolaus Copernicus University in Toruń, Toruń, Poland Email: 312437@stud.umk.pl

One of the reasons why non-native species achieve such high success is thought to be the lack of compatible parasites in their new environment, which allows them to thrive without the disease pressures they would experience in their native range. *Physa acuta* (Draparnaud, 1805) is a prime example of a non-native species that has successfully established itself in multiple regions in Europe. *Physa acuta* is a freshwater gastropode native to North America and has been shown to live in both still and running waters in a variety of different microhabitats with a wide extent of occurrence including every continent except Antarctica. The species is also considered insensitive to environmental changes, including water pollution. However, little is known about the extent and prevalence of parasite species in *P. acuta* populations and their potential role in parasite transmission. In order to examine this, dissections were performed on a sample of *P. acuta* specimens collected from Licheńskie Lake, Poland. Over 98% of the samples contained parasites. The most common were xiphidiometacercaria, which were found in all of the infected snails. Other parasites were also found, including echinostomatid metacercaria and tetracotyle metacercariae. These findings challenge the current belief that non-native species are free from significant parasite burdens. The results of this study imply that alien *P. acuta* specimens are probably not acting as first, but certainly as second intermediate hosts to the mentioned taxa of trematode digeneans.

## Using shell shape analysis based on landmarks to trace the geographical origin of the common cockle (*Cerastoderma edule*)

<u>Martins I.</u><sup>1</sup>, Chainho P.<sup>1,2,3</sup>, Goulding T.<sup>1</sup>, Saramão J.<sup>4,5</sup> & Rufino M.M.<sup>4,6</sup> <sup>1</sup> MARE - Centro de Ciências do Mar e do Ambiente, Faculdade de Ciências, Universidade de Lisboa, Portugal

<sup>2</sup> Departamento de Biologia Animal, Faculdade Ciências da Universidade de Lisboa, Portugal

<sup>3</sup> CINEA-ESTS-IPS – Energy and Environment Research Center of the Polytechnic Institute of Setúbal, Setúbal, Portugal

<sup>4</sup> IPMA - Instituto Português do Mar e da Atmosfera, Algés, Portugal

<sup>5</sup> Nova School of Science and Technology, Almada, Portugal

<sup>6</sup> CEAUL - Centro de Estatística e Aplicações, Universidade de Lisboa, Portugal

email: fc57034@alunos.ciencias.ulisboa.pt

Determining the geographical origin of seafood is crucial for regulators and fishing industries who seek to prevent commercial fraud, enforce food safety regulations, and ensure high standards in sustainable fisheries management. The cockle, *Cerastoderma edule* (Linnaeus 1768), is a key species in estuarine ecosystems and is harvested all over Europe. Therefore, traceability tools using quick and inexpensive techniques to identify the origin are of paramount importance to support law enforcement. In this work, we explore the potential of using Geometric



Right valve of a *Cerastoderma edule* shell, with all landmark placements (in blue: Type I; in green: Type II; in yellow: Type III; and in black: pseudo or semi-landmark) and a representation of the imaginary line used to determine landmark #16 in orange.

Morphometric (GM) methods to identify the geographical origin of cockle specimens. This method is based on landmarks identified in the shell to trace the origin of specimens obtained in nearby aquatic systems (from <35 km to <250 km distance). Specimens were collected in five systems (Ria de Aveiro, the Tagus and Sado estuaries, and the Albufeira and Óbidos coastal lagoons) in Portugal. Shells were digitalized and 16 landmarks were identified in each right valve and analyzed using Generalized Procrustes Superimposition. The discriminating power for traceability of 12 statistical and machine learning methods was assessed based on the corresponding shape variables, using R and Python (Linear Discriminant Analysis (LDA), Canonical Variable Analysis (CVA), Between-Group (BG), Principal Component Analysis (PCA), Partial Least Squares Discriminant (PLSD), Classification Regression Tree (CRT), Logistic Regression (LR), Random Forest (RF), Gradient Boosting (GB), K Nearest Neighbors (KNN), Support Vector Machines (SVM), Extending Gradient Boosting (EGB) and Neural Networks (NNET). LDA, CVA, SVM, and NNET demonstrated overall accuracies and a F1-score >80%, even with a small sample size (train dataset 362 specimens, unbalanced). The highest percentage of correctly assigned individuals was obtained in the Tagus estuary (mean 90%) and in the Albufeira lagoon (mean 93%), which were also the systems with more specimens measured (174 and 59 respectively), whereas the worst results were obtained in the Sado estuary (48%, 56 ind). In the Tagus estuary, the best classification methods reached 100% correct classifications. Our results support the use of GM based on landmarks as a reliable tool for bivalve traceability, since it is a quick, simple and unexpensive approach. Further research should extend these findings to other species and other shape analysis tech-

## Phenotypic evolution of the marine gastropod *Littorina obtusata* across an environmental gradient at high latitudes

Pires, A.<sup>1,2</sup>, Monreal, M.<sup>1</sup>, Gaio, R<sup>2</sup>, Pálsson, S.<sup>3</sup>, Raeymaekers, J.<sup>4</sup>, Westram, A.<sup>4</sup> & Faria, R.<sup>1</sup>

<sup>1</sup> Centro de Investigacao em Biodiversidade e Recursos Genéticos (CIBIO), Universidade do Porto, Porto, Portugal

<sup>2</sup>Faculty of Science of the University of Porto, Porto, Portugal

<sup>3</sup>Department of Life and Environmental Sciences, University of Iceland, Reykjavik, Iceland

<sup>4</sup>Faculty of Biosciences and Aquaculture, Nord University, Bodø, Norway

Species of the genus Littorina are among the most extensively studied marine gastropods. The potential as a model for studies in evolutionary ecology lies in their distribution across the intertidal zone (where organisms experience strong selective pressures), the occurrence of multiple intraspecific polymorphisms in shell morphology associated with different habitats (often called ecotypes) that probably evolved in parallel across its range, and interspecific variation in life history traits. In Littorina obtusata, the focal taxon of this study, two varieties have been described palliata and retusa (with higher and lower spire, respectively). In Europe, the former is confined to the shores northern of the Lofoten Islands (Norway) and in the north and east of Iceland, while the latter variety is common elsewhere. The European green crab (Carcinus maenas) together with temperature have been suggested to drive this polymorphism in the Western Atlantic. A detailed characterization of the phenotypes as well as the evolutionary mechanisms involved remains to be done in European shores. In order to fill this gap, a thorough characterization of shell phenotypes from five Norwegian L. obtusata populations was implemented to quantify the main phenotypic differences across the latitudinal gradient encompassing the geographic transition between the two varieties to provide insights about the main forces and environmental/biotic factors driving their evolution. The analysis of total weight, shell thickness, total height, spire/total height, spire angle, and shell strength) revealed a trend of increasing average values from northern to southern populations, except for spire/total height, in agreement with previously reported results for palliata and retusa varieties. Air and sea water temperature, salinity, and the presence of crabs all vary in the same direction, making it difficult to pinpoint the main driving factor of this polymorphism. The populations located in intermediate latitudes of our transect, showed intermediate values or are clustered either with the northern vs or southern populations, depending on the trait. This suggests that the transition between the two varieties could be more in the north than previously described, highlighting the potential of this region-system to study how global warming affects the eco-evolutionary dynamics of biodiversity in marine coastal areas.

## First record of non-indigenous *Irus* sp. (Bivalvia: Veneridae) from South Harbor, Manila Bay, Philippines

Ocampo, M.A.B.<sup>1,2</sup>, Anover, A.P.<sup>1</sup>, Arenas, A.<sup>1</sup> & Vallejo, B. Jr.<sup>2</sup>

<sup>1</sup>Department of Biology, University of the Philippines Manila

<sup>2</sup>Institute of Environment Science and Meteorology, University of the Philippines Diliman Email: <u>mbocampo@up.edu.ph</u>

Port environments are novel ecosystems which can support non-indigenous species carried by marine vessels and allow their individuals or populations to establish. When conditions are optimum, these organisms can become invasive. As such, they can displace indigenous species, affect ecosystem services and impact food security. The Port of Manila in Manila Bay is the biggest international port in the Philippines and is susceptible to bioinvasions. This study reports the first record of the non-indigenous white bivalve Irus sp. (Bivalvia: Veneridae) in Manila Bay, Philippines. From 2014 until 2019, mussels of white color were reported in the area but not identified. PICES collectors were deployed in a man-made marina in the South Harbor of Manila Bay from 2021 to 2022. The collectors were retrieved periodically during the two-year study. The bivalve was present in all eight collections. Samples were morphologically described and molecular identification was done using DNA barcoding. DNA barcoding showed >99% match between the study specimens and two species of Irus sp., namely Irus irus and Irus macrophylla. Shell characteristics fit the description of Irus sp. But there were no morphological differences between the two species. I. irus is native to the Aegean Sea, Mediterranean Sea, Red Sea and other waters of European countries, while I. macrophylla is native to Tanzania and Madagascar. The trends in abundance of Irus sp. during the sampling seasons are described, as well as the potential of the species to become invasive and competitive with native Perna viridis (Linnaeus, 1758) and another invasive bivalve Mytella strigata (Hanley, 1843). Monitoring of the species in the bay is recommended, along with monitoring at other major ports in the country.







Irus macrophylla

## Embryonic Development of Paintpot Cuttlefish, Ascarosepion tullbergi (Appellöf, 1886)

<u>Omura, A.</u><sup>1,2</sup>, Takano, H.<sup>3</sup>, Tomita, T.<sup>3</sup> & Oka, S.<sup>3</sup>

<sup>1</sup>Faculty of Bioresources, Mie University, Mie, JP <sup>2</sup>Department of Design, Nihon University College of Art, Tokyo, JP

<sup>3</sup>Okinawa Churashima Foundation, Okinawa, JP

Email: cuttlefish.ayano.o@gmail.com

Paintpot cuttlefish (Ascarosepion tullbergi) are renowned for a distinctive walking behaviour, employing the fourth arms as front legs and its ambulatory flaps as hind legs to traverse the seafloor. However, our understanding of the fundamental biology of this species is lacking, especially concerning its developmental stages in relation to ecology and evolution. In this research, we conducted thorough observations and documented the embryonic development of paintpot cuttlefish, establishing criteria for the developmental stages. We observed from the beginning of gastrulation (stage 12) to hatching (stage 30). The developmental pattern of the paintpot cuttlefish was similar to that of other cuttlefish species, including Sepia officinalis, Sepia pharaonic, and Sepia bandenis in the timing of mantle primordium, arm primordium, elevated mantle, eye pigmatation and cuttlebone formation. Up to stage 25, the paintpot cuttlefish displayed a morphology akin to that of other cuttlefish. However, at stage 26, the onset of pigmentation marked the emergence of unique and specific characteristics. Particularly noteworthy was the enlargement of the fourth arm compared with other cuttlefish. At stage 26, the ambulatory flap made its appearance. Although the ambulatory flap serves as a locomotor organ similar to hind legs, its development did not occur simultaneously with the arms. Instead, it coincided with the emergence of other skin protrusions, suggesting that the structure of the ambulatory flap incorporates elements of skin protrusion structures. At stage 29, although a small external yolk sac remained, it had reached a state where hatching was possible. Apart from the reproductive organs, the embryo exhibited a morphology similar to that of an adult. Hatching occurred at stage 30. The implication of these results is discussed.



## Ethnozoological land snail case study in the hamlet Gunungkelir Community, Yogyakarta, Indonesia

<u>Pertiwi, M.P.</u><sup>1</sup>, Iskandar, I.<sup>2</sup>, Berry Juliandi<sup>1</sup>, Nurinsiyah, A.S.<sup>3</sup> & Priawandiputra, W.<sup>1</sup>

<sup>1</sup>Department of Animal Bioscience, PB University, Bogor, Indonesia

<sup>2</sup>Department of Biology, Padjadjaran University, Jatinangor, Indonesia

<sup>3</sup>National Research and Innovation Agency, Cibinong, Indonesia Email: <u>akunipbmeilisha@apps.ipb.ac.id</u>

Vertebrate and invertebrate animals have long been used for traditional medicine in rural Indonesia. The practice (*praxis*) is strongly based on local knowledge (*corpus*) and the cosmos/



Amphidromus palaceus

Lissachatina fulica

belief. However, nowadays, its use is pushed out by modern medicine in urban areas, so that the local knowledge is eroded. The aim of this research is to examine local rural knowledge regarding types and folk classification, use for traditional medicine, as well as ethnozoological knowledge about the use of land snails for traditional medicine based on gender, age, education, and occupation in Hamlet Gunungkelir, Yogyakarta Province, Indonesia. Mixed methods, qualitative and quantitative, with an ethnozoological approach, were used. Field data collection techniques included field observations,

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OLLUSCAN FORUM

#### >CONTINUED

land snails inventory, semi-structured/deep interviews with informants by purposive sampling, and structured interviews with 246 respondents from Hamlet Gunungkelir residents. Qualitative data analysis was done by cross- checking, summarizing, and synthesizing from various data sources, and doing descriptive analysis. Meanwhile, quantitative data were analyzed using statistics, such as the frequency of respondents' answers to a question prepared in the questionnaire and used value (UV) index, which is calculated from the use value of certain species to informant i, the number of uses of species in each event by informant i, and the number of events in which informant i cited - species s. The results of the research show that the folk classification recorded 42 types of land snails. However, only 33 species can be scientifically identified. The rest can only be identified at the family level. Based on gender, male respondents have a higher knowledge of using land snails as medicine (75.60%) than female (19.10%). Based on age, adult respondents have higher knowledge (63.00%) than elderly (31.30%) and teenagers (0.40%). Based on the educa-



Analysis of hamlet Gunungkelir Resident's local knowledge about land snail as material for traditional medicine based on gender, age, education, and occupation

tion level of respondents, respondents in the elementary had higher knowledge (53.25%) compared junior high, high school (15.04%), bachelor (3.25%) and postgraduate (0.81%). Meanwhile, based on occupation, farmer group have a higher knowledge (63.82%), compared with enterpreneur (15.85%) and civil servants (0.81). The UV index shows Amphidromus palaceus and Lissachatina fulica have a high UV for traditional medicine among residents of hamlet Gunungkelir, Yogyakarta.

### Evolution at a chromosomal inversion in the flat periwinkle Littorina fabalis across wave exposure gradients

Choo, L.Q.<sup>1</sup>, Le Moan, A.<sup>2</sup>, Faria, R.<sup>1,3,4</sup>, Kučka, M.<sup>5</sup>, Johannesson, K.<sup>2</sup>, Chan, F.<sup>5</sup> & Butlin, R.<sup>1,2</sup> School of Biosciences, University of Sheffield, UK

<sup>2</sup> Department of Marine Science at Tjärnö, University of Gothenburg, Sweden

<sup>3</sup>CIBIO - Research Center in Biodiversity and Genetic Resources, Porto, Portugal

<sup>4</sup>CIIMAR - Interdisciplinary Center in Marine and Environmental Research, University of Porto, Portugal

<sup>5</sup>Friedrich Miescher Laboratory of the Max Planck Society, Tübingen, Germany Email: I.choo@sheffield.ac.uk

Littorina fabalis is an intertidal snail that occurs on coasts across western Europe in habitats ranging from sheltered mudflats to rocky shores. Within this species, there are two documented ecotypes: the 'dwarf' and 'large' ecotypes with lesser and greater exposure to wave action respectively. These ecotypes can be distinguished not just by their shell length and



Sample site in Wales

habitat, but also in the relative frequency of arrangements for a putative chromosomal inversion on linkage group 3 (LG3) of their genome. Inversions result in reduced recombination and lead to alleles along the region being subsequently inherited together. The arginine kinase gene has been identified in this region in LG3, which suggests that the inversion plays a role in the adaptive divergence of the species into ecotypes. To better understand the role of the inversion in their adaptation to different environments, we sampled Littorina periwinkles (L. fabalis and their sympatric sister species L. obtusata) from Sweden, Wales, and Spain across a wave exposure gradient from sheltered, moderate to exposed. These snails were sequenced using Illumina short reads with haplotagging barcodes, which provide long range linked read information to help in reconstructing the breakpoints of the inversion. We investigated if the segregation of inversion arrangements among the ecotypes was consistent across the sampling locations, and whether populations in sympatry were more likely to maintain polymorphisms in inversion arrangements, i.e. between the ecotypes and between the two sister species. By understanding the role of chromosomal inversions in the formation and maintenance of ecotypes in these species, we can gain further insight on how genomic rearrangements can contribute to selection and divergence across heterogeneous landscapes.





## Micro-gastropod collection from Bocas del Toro, Panama

Ramiro Solis<sup>1, 2</sup>, Blanca Figuerola<sup>3</sup>, and Aaron O'Dea<sup>1</sup> <sup>1</sup>Smithsonan Tropical Research <sup>2</sup>Universidad Maritima Internacional de Panama <sup>3</sup>Biodiversity Research Institute (IrBIO) University of Barcelona Email: ramiros704@gmail.com

Micro-gastropods include many taxa not yet systematised within Phylum Mollusca and most studies on malacology have focused on large properties to date. In part, this is due to the specific techniques of the collection, the difficulty of ordering its small size and, of course, the taxonomic complexity. The objective of the project is to establish a baseline for future studies in the field of malacology and thus encourage the research of a group that, despite presenting so

many difficulties, promises to be one of the most diverse and abundant marine and coastal communities. Samples were collected in previous research by Fredston-Hermann, et al. and Cramer et al. through coral cores and sediment bundles in different parts between 3 and 5 m deep. The photographs of the collection were made with a Sony Alpha 6300 camera, mounted on a Leica brand stereoscope. With the help of Adobe Photoshop, the photos were processed through the technique of "stacking photos" to create the illustrations. A total of 300 samples are part of the collection, identifying 39 species, 77 genera and 47 families. The high number of species presented in the collection and the variety of ecosystems where they live demonstrate that the Bocas del Toro Archipelago is an essential habitat for these organisms. Apart from these characteristics, their good preservation and the high abundance found in this region, both in recent samples and in the fossil record, suggest that some taxa may be good indicators of environmental changes and therefore more research should be developed in this field.

### More than meets the eye: integrative taxonomy uncovers hidden diversity in the Limacina species complex

Spagliardi, G.<sup>1</sup>, Choo, L.Q.<sup>1,3</sup>, Goetze, E.<sup>2</sup> & Peijnenburg, K.<sup>1,3</sup> <sup>1</sup>Marine Ecology & Evolution Department, Naturalis Biodiversity Center, Leiden, The Netherlands

<sup>2</sup>Department of Oceanography, University of Hawaii at Manoa, Honolulu, USA

<sup>3</sup>Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, Amsterdam, The Netherlands

Email: giada.spagliardi@naturalis.nl

Holoplanktonic pteropods are widely regarded as bioindica-



tors of ocean acidification due to their thin aragonitic shells vulnerable to dissolution. The Limacina genus is most frequently used for this purpose owing to its high abundance and widespread distribution across all oceans. However, different species exhibit different sensitivities to environmental stressors and at present, the taxonomy of the Limacina genus is unclear. Here, we used an integrative taxonomic approach combining morphology with DNA barcoding (cytochrome c oxidase subunit I, 28S rDNA) to assess diversity across the five nominal species in the Limacina genus. In addition, we developed a methodology to facilitate the imaging of ethanol-preserved shelled pteropods and we demonstrate for the first

time the application of micro-CT scanning to visualize the pteropod radula. Shell shape of 302 individuals was studied, based on linear and geometric morphometric analyses on stacking microscopy images and micro-CT scans. We found that shell thickness and volume varied significantly across species. Cold-water species were larger. All five extant species could be identified based on shell shape variation, except for L. lesueurii and L. helicina, which show overlapping shell shape distri-



butions. We showed that unrecognized diversity and distinct thickness patterns hide under the similar shell shapes of the two nominal cold-water species occurring in both hemispheres (L. helicina and L. retroversa). Our analyses also suggest that there may be hidden diversity within the warm-water species, considering they occur in distinct ocean basins. The levels of divergence may imply substantial differences in physiology and potential to adapt to climate change.





Pvrmidellidae

## Gastropod diversity of Central European forests in modern and historical perspective: Introduction to my PhD project

Svobodová, K

Department of Botany and Zoology, Masaryk university, Brno, CZE Email: <u>kristina.svoby@seznam.cz</u>

Forest management in the Czech Republic in its current form poses a threat to a whole range of forest organisms. This is mainly due to the planting of spruce monocultures, which create an inhospitable, acidic environment unsuitable for most forest species, especially molluscs. Moreover, an already hostile environment lacks sufficient quantities of coarse woody debris (CWD) in various stages of decay that would enrich the forest with nutrients and pro-

vide habitat for organisms. Gastropods are also threatened by clear-cutting, as they are unable to respond quickly enough to such a rapid change in the environment. However, their slow response makes them good indicators of long-term ecosystem change. The current Central European malacofauna mainly includes species of land snails that pre-fer forest habitats. Their diversity changed considerably during the Holocene. The first half of the Holocene was mainly related to the spread of dendrophilic forest species from glacial refugia and the development of a forest environment that is suitable for snails. In the second half of the Holocene, a gradual impoverishment occurred due to anthropo-



genic influence, happening mainly in the 18th century because spruce monocultures were planted on large areas. Mitigation of such species loss can be achieved by leaving deadwood and interspersed deciduous trees, which is especially important for spruce monocultures and their future development. In my master's thesis, I demonstrated the positive effect of CWD on snail abundance and species richness. Based on the analyses, I concluded that 8 m<sup>3</sup>/ha of CWD is the minimum required to support diverse gastropod assemblages. However, the advanced stage of decomposition of the CWD and the presence of beech trees in the plot proved to be more significant. To make the results more robust, I would like to add more plots. I also want to clarify which part of the malacofauna can be supported by appropriate management.

## Checklist of Recent Polyplacophora – a centralized source of reliable data on chiton systematics

Vončina, K.<sup>1</sup>, Schwabe, E.,<sup>2</sup> Sirenko, B.<sup>3</sup> & Sigwart, J.D.<sup>1</sup>

<sup>1</sup>Department of Marine Zoology, Senckenberg Research Institute and Natural History Museum Frankfurt, Frankfurt am Main, Germany

<sup>2</sup>Zoologische Staatssammlung München (Bavarian State Collection of Zoology), München, Germany

<sup>3</sup>Zoological Institute, Russian Academy of Sciences, St. Petersburg, Russia email: <u>katarzyna.voncina@senckenebrg.de</u>

Chitons are a class of exclusively marine molluscs, with around 1000 living species described so far. Their systematics have developed using both morphological and molecular data, resulting in relatively well-resolved phylogeny of three distinct orders (Callochitonida, Chitonida and Lepidopleuirda), and the order Chitonida comprising four superfamilies (Cryptoplacoidea, Mopalioidea, Chitonoidea, and Schizochitonoidea). However, progress in resolving relationships at the genus and family level has been more limited. Our current work is to develop tools to fill the gaps at species- and genus-level, both in terms of documenting classification and improved taxon sampling for molecular phylogenetics. Molecular methods have clarified the position of some problematic genera, e.g., *Choriplax* or *Cryptochiton*, and their updated classification has already been adopted in primary systematics literature, but yet to be been adopted in publicly available databases. This has caused some confusion in other publications by non-specialists. In order to clearly document the areas that remain problematic and subject to future revision, we have compiled the *"Checklist of Recent Polyplacophora"*. This list can be updated annually with a clear version history, containing a list of valid extant polyplacophoran species and their classification, maintained by specialists. The online form of the list allows for occasional updates in systematics and easy

tracking of changes in relation to previous versions, yet at the same time pointing to areas which still need revision, or marking species whose position/validation is still questioned by experts. The checklist should help prevent further confusion and accelerate revisionary work by identifying areas for further analysis. As the position and relationships of several genera still remain unclear, these urgently require increased taxon sampling for molecular phylogenetics. Many of the relevant species are rare and endemic, or were described based only on a few specimens. Implementation of ancient DNA methodology in extraction of DNA from historic museum specimens is the next step to allow us to fill in the gaps in chiton phylogeny.





### The Malacologist







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## Predation pressure on Neogene freshwater gastropods

White, J.C.R.,<sup>1</sup> Harper, E.M.<sup>1</sup> & Schneider, S.<sup>2</sup> <sup>1</sup>Department of Earth Sciences, University of Cambridge, Cambridge, UK <sup>2</sup>CASP, Cambridge, UK Email: jw2189@cam.ac.uk





### Seven bulk samples of viviparids—a family of

freshwater gastropods—were examined for signs of attempted predation. Predation is an important evolutionary selection pressure; many predation studies have been conducted on marine molluscs, but little is known from freshwater settings. This study's samples were collected from Thailand, Greece, Uganda, India, and the UK, with a time range spanning the Middle Miocene to the present. Repair scars fall into two broad categories, representing different attack styles: cleft (nipping the mantle) and embayment (peeling back the shell). Crustaceans and fish are the most likely predators based on scar morphology and available information on the accompanying fauna. The scars are almost universally centrally

positioned and are always on the penultimate or final whorl. No repairs were observed on juveniles (or the first three whorls), perhaps because they are not worth attacking or because they are too frail to survive predation attempts. Repaired individuals typically have only one scar, though a small number have up to three. Repair frequency in all populations is between 2% and 8%. An estimate of predation pressure from repair frequency will always be an underestimate, as attacks involving total shell destruction are not preserved. Modern viviparid shells from rat middens in Roswell Pits (Ely, UK) have distinctively jagged breakage patterns, but for all other populations, successful predation attempts could not be studied. Features not related to predation were also noted, including sediment incursion, pathological thickening, post-mortem holes and fractures, and minor dents and scrapes. Further studies into predation on freshwater gastropods will help to confirm the identity of predators and establish the effect of features such as ornamentation in localities where more than one gastropod species is present.



## Grazing effect of a common gastropod on macroalgae distribution and community on intertidal seawalls

<u>Yeo, H.J.H.</u><sup>1</sup>, Quek, V.Z.Q.<sup>1</sup>, Hartanto, R.S<sup>1</sup>, Loke, L.H.L.<sup>1,2</sup> & Todd, P.A.<sup>1</sup> <sup>1</sup> Department of Biological Sciences, National University of Singapore, Singapore <sup>2</sup> School of Natural Sciences, Macquarie University, North Ryde, NSW, Australia Email: <u>hannah.yeohj@gmail.com</u>



On rocky shores, the role of intertidal grazers as top-down regulators of algal community

structure is well recognised. However, no study to date has examined the consumptive effects of the gastropod grazer *Neri-ta undata* on the algal community within the tropics, even though they are relatively large-sized and common on natural and artificial shores around Singapore. To determine these effects, we conducted an exclusion-inclusion experiment at three seawall sites in Singapore from October 2019 to March 2020 using stainless-steel wire mesh cages. A total of 108 experimental plots were scraped clean at two shore heights ('High' and 'Low') and assigned to three caging treatments ('Exclusion'



with a cage, 'Inclusion' with a cage and one *N. undata* enclosed within, and 'Control' with no cage). Percentage cover of algae was monitored every two weeks for six months, and we analysed the community composition and biomass after six months for each treatment. Our results revealed that total algal cover was consistently highest in the Exclusion treatments, and that algae such as encrusting, turf and green algae could grow above the natural algal line when all grazers were excluded. This suggests that, besides abiotic conditions, grazing activity had a strong influence on the upper limits of algal distribution. There was no significance difference in algal cover between Inclusion and Exclusion cages, possibly indicating that the grazing activity of this species or a single individual alone may not be enough to impact the overall composition and succession of algae at the scales we studied. Our study suggests high primary productivity on seawalls in Singapore and underscores the importance of understanding basic ecological processes occurring on artificial coastal structures in the tropics.

## Phototaxis' in the absence of light? Locomotory patterns in unionid mussels

Zapitis, C.<sup>1,2</sup>, Ramsey, A.,<sup>1</sup>, Huck, M.,<sup>1</sup> Landler, L.<sup>3</sup> & Burian, A.<sup>4,5</sup> <sup>1</sup>College of Science and Engineering, University of Derby, Derby, UK <sup>2</sup>Schief Scientist Directorate, Natural England, York, UK <sup>3</sup>Institute of Zoology, University of Natural Resources and Life Sciences (BOKU), Vienna, Austria <sup>4</sup>Department of Computational Landscape Ecology, UFZ–Helmholtz

Centre for Environmental Research, Leipzig, Germany

<sup>5</sup>Marine Ecology Department, Lúrio University, Pemba, Mozambique Email: charitoszapitis@outlook.com

Locomotion in benthic invertebrates can strongly affect habitat selection and ecosystem nutrient cycling. In the case of freshwater mussels, the drivers of locomotion are largely unresolved. Our aim was to assess the influence of light presence and intensity on the locomotory behaviour of freshwater mussels in controlled laboratory experiments. The species investigated in our study were the widely distributed Anodonta anatina and Unio pictorum, two widely distributed mussels in European lentic and lotic inland waters. At low algal concentrations, known to be associated with more frequent locomotory activities, we found that both species moved primarily in the absence of light (72.7% of all movements across experiments). However, the movements of both species were directed towards the light source, resembling a net-positive 'phototactic' response but in the absence of light. The distance to the light source, which was negatively related to light intensity, had a positive effect on the distance covered in locomotory activities by A. anatina but not by U. pictorum. Intraspecific variation in shell size had no impact on movement distance, indicating that the energetic costs of movement were not a limiting factor. We suggest that the observed movement towards brighter locations helps to enhance food quantity and quality, whilst movement in darkness mitigates predation risks.





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### WORKSHOP GRANT REPORT

## A residential workshop at Kanneliya Forest, southwestern Sri Lankan, 1-3 September 2023, funded by the Malacological Society of London

#### Dinarzarde Raheem<sup>1</sup>, Oshan Wedage<sup>2</sup> & Kumudu Wijesooriya<sup>3</sup>

<sup>1</sup> Department of Biological Sciences, Faculty of Applied Sciences, Rajarata University of Sri Lanka

- <sup>2</sup> Department of History and Archaeology, University of Sri Jayewardenepura, Sri Lanka
- <sup>3</sup> Department of Zoology, Faculty of Science, University of Peradeniya, Sri Lanka

A three-day residential workshop on the identification of Sri Lankan land snails was held from 1 to 3 September 2023 at the



Kanneliya Conservation Centre at Koralegama, near Udugama, Galle District, Sri Lanka. The objective was to introduce participants to both the Sri Lankan land-snail fauna and the field identification of characteristic forest-living genera and species. The Sri Lankan land-snail fauna is rich in endemic species (80% of the *c*. 200 species described are endemic to the island) and is globally important, forming part of the Western Ghats–Sri Lanka Biological Hotspot. Our understanding of the taxonomic diversity of this fauna is still limited and many species are threatened by the loss of their natural forest habitat. The workshop was targeted at students naturalists researchers and enthusiasts with no prior experience of identifying

The workshop was targeted at students, naturalists, researchers and enthusiasts with no prior experience of identifying



Figure 2: Excursion to Kottawa Arboretum. Images: Sanjaya Banda-

Sri Lankan land snails and was attended by 26 fulltime and 5 part-time participants (Fig. 1). The fulltime participants included students and staff from universities from across the island (Universities of Colombo, Jaffna, Kelaniya, Peradeniya, Sri Jayawardenepura and Vavuniya; Eastern University; Rajarata University of Sri Lanka; and Southeastern University of Sri Lanka); amateur naturalists; and two archaeologists from the University of Sydney, Australia. These participants were: Thaveesha de Alwis, Gnanasekar Ajithargavin, Sanjaya Kanishka Bandara, Yumeth Bandara, Patrick Faulkner, H.P. Saranga Hansamali, Ravisara Jayamanna, Imesh Indeevara Javalath, T. Keerthanaram, K.A. Isuru Anuradha Kodithuwakku, A.G. Dhanushka Lakmal, M. Dilanga Madhushan, K.V.N.P. Madhuwanthi, Pirunthini Ma-

heswaran, P.L.T. Nirath, M. Shafran Packeer, M.W. Dileepa Bandara Rajaguru, Rajamanokari Rasalingam, R.M.I.I. Senevirathna, K.M. Dhanani Sepalika, W. Sudesh Udayakantha, Oshan Wedage, W.A.P.D. Menaka Wickramasingha, Sanoj Wijayasekara, Kumudu Wijesooriya and Martin Wright. The five part-time participants, who joined us for the lectures, were local guides

from the Information Point at the Koralegama entrance of Kanneliya Forest, namely H.W. Indika, G.G. Manel Saman Kumari, D.L. Latha, M. Upul Nalaka and H.W. Mallika Vasanthi.

The workshop started at lunchtime on day 1, with a series of lectures on the diversity and ecology of the Sri Lankan land-snail fauna in the afternoon and early evening. The morning of day 2 was taken up by an excursion to Kottawa Arbore-tum (Fig. 2), a small, easily accessible rainforest fragment, where because of the overcast and rainy weather. a number of land-snail species were seen out and about. These included the large tree snail *Acavus haemastoma* (Acavidae) (Figs 3–5) and its ground-living relative *Oligospira polei* (Acavidae) (Fig. 5), the caenogastropd *Tortulosa pyramidata* (Pupinidae) (Fig. 6) and the ariophantids *Ariophanta chenui, Euplecta* cf. *emiliana* (Fig. 7) and *Ratnadvipia karui*.



Figure 3: Adults of *Acavus haemstoma* feeding on fungus at Kottawa. Image: Sanoj Wijayasekara.

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#### >CONTINUED



Figure 4: An immature Acavus haemstoma at Kottawa; note the thin apertural margin. Image: Sanoj Wijayasekara.

#### The Malacologist

Figure 5: Three live examples of *Oligospira polei* (left) with different levels of shell wear and two individuals of *Acavus haemastoma* (right), Kottawa. Image: Sanoj Wijayasekara.



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We were also fortunate to come across a clutch of ariophantid eggs

(possibly those of *Ariophanta chenui*) in leaf litter at the base of a tree; some of these eggs were close to hatching whereas others were at a much earlier stage of development. The afternoon of day 2 was taken up by a session on the microscopebased study of shell characters (Fig. 8) and participants were able to study examples of the shells of most of the native and endemic land-snail genera recognized from the island. The field excursion to a site inside Kanneliya Forest on the morning of day 3 had to be cancelled because of heavy rain, but we were fortunate to do evening walks along the main trail into Kanneliya Forest on the previous two evenings. On these evening walks we saw live examples of a number of land snail species including *Leptopoma semiclausum* (Cyclophoridae), *Corilla adamsi* (Corillidae), *Beddomea albizonata* (Camaenidae) (Fig. 9), *Ratnadvipia irradians* (Ariophantidae) and a *Satiella* sp. (Helicarionidae) (Fig. 10). We also saw some other characteristic rainforest invertebrate and vertebrate taxa.



Figure 6: An adult *Tortulosa pyramidata* at Kottawa; note the damaged shell apex.



Figure 7: An adult *Euplecta* sp. (possibly *E. emiliana*) found on a decaying log at Kottawa. Image: Ravisara Jayamanna.



Figure 8: Shell study session in the lecture hall at the Kanneliya Conservation Centre. Images: Ravisara Jayamanna.

#### Feedback

The feedback provided by the workshop participants was extremely positive. Some excerpts follow.

**Thaveesha de Alwis, final year medical student, University of Colombo:** "Land-snail fauna in Sri Lanka is a taxon that has a lesser interest and lesser knowledge than other taxa. So, it is very important to organize such a workshop to increase the interest and give the basic knowledge to enthusiasts at the beginner level. And the lectures and field sessions were superb. Specially, I had no idea about identification before, except for a few landsnail genera. I think this has given me the skills to identify common genera in the field. Also, the shell study session was a great experience. It was well organized and the techniques of measuring shells and the shell characters that we have to look for in malacology were simply explained....I suggest to organize several other workshops in the future, as well as to continue to raise enthusiasm among youngsters about snails. Thank you so much for organizing such an amazing workshop and continue it in in the future also."

#### >CONTINUED



Figure 9: An immature *Beddomea albizonata* at Kanneliya. In this species it is actually the body that is green; the shell is white and transparent. Image: Ravisara Javamanna.

**M. Shafran Packeer, nature enthusiast, Piliyandala:** "This workshop was a successful one mainly because it was organized well and had good time management...We gained a good understanding of land snail identification and snail behaviour. The field experience was new and enjoyable. Overall, the workshop adds more memories and knowledge."

Yumeth Banadara, zoology undergraduate, University of Peradeniya: "As a first year university student, I had a much less idea about land snails before this workshop. Only know to identify some common species. But after this workshop, I got a good idea and enthusiasm about this field. When talking about the workshop, the schedule and time management is great. All the work was on time and no unnecessary workload. When talking about the field sessions and taxonomy sessions, all the supplied facilities were really helpful. Finally, I like to thank the MSL and all the resource persons for the great opportunity."

M. Dilanga Madushan, research assistant, Leopard Valley Re-

**search Station (Wildlife Conservation Society - Galle), Morningside, Eastern Sinharaja:** "I had a much less idea about land snails before this workshop. I only know to identify some common species. But after this workshop, I got a good idea and enthusiasm about this field."

**R.M. Ishara Indrajith Senevirathna, masters student in archaeology, University of Sri Jayawardenepura:** We gained a lot of knowledge and training, especially through the three days of explorations, lectures and night field trips around the rainforest in Kanneliya."

**T. Keerthanaram, temporary lecturer in zoology, University of Vavuniya, Vavuniya:** "I was always a person who looks above in sight of biodiversity, like birds and others. But this workshop made me aware that there are a lot more on the ground too. And also, the way it was organized, from giving the history of land snails in Sri Lanka to practical sessions on identification, successfully made me aware of each component. The classroom session with microscope was so fabulous, to understand how unique each species is....I would love to extend this knowledge to our colleagues and students."

**A.G. Dhanushka Lakmal, biology undergraduate, South Eastern University of Sri Lanka:** " ...this workshop made a great influence in malacological research area/field and obviously the seeds have been planted in the field now for the coming next generations. The most important thing should be expressed specially is the bond we could make with the gigantic characters in malacology would be truly amazing influence for all the young researchers who joined here. All the lectures, organization, accommodation and the guidance were truly amazing. Thank you everyone for gifting this unforgettable workshop."

**Imesh Indeevara Jayalath, nature enthusiast, Homagama:** "My favourite was the shell study session. Could have stayed many more days with those microscopes there....The lectures and study sessions were so great and I learnt so many things about Sri Lankan land snails."

**P.L.T. Nirath, research assistant, Rajarata University of Sri Lanka:** "It was really interesting to participate in this workshop, which covered all the fundamentals of land snail identification, taxonomy and ecology....I really enjoyed the field sessions and observing the natural habitat of snails and their interactions. Also, the shell study session gave us different insights about the identification challenges."

**M.W.D.B. Rajaguru, masters student in zoology, University of Kelaniya:** "My first experience to engage with malacological studies/workshop and I was able to learn enormously/many things about this subject. The organizing of the workshop was at the top level and organizers gave a great effort to teach us everything they know. Thanks to them, land snail subject/ field is now one of my favourites....Thanks to this workshop, I will give my attention to land snails when I am doing my field-work."

**Pirunthini Maheswaran, zoology undergraduate, University of Jaffna:** "It was a great experience participating in this knowledgeable workshop. From this onwards, we grasp a very good idea about the diversity of land snails in Sri Lanka.... Through the fieldtrips and shell identification, we had a wide experience in landsnails. We would like to work more and do research on landsnails of Northern Sri Lanka."

**H.W. Mallika Vasanthi, local guide, Kanneliya Forest:** "I was able to learn some very important facts about snails by participating in this workshop on landsnail identification. More such workshops are needed. My grateful thanks to all those who made this workshop possible."

**Sanoj Wijayasekara, masters student in zoology, University of Colombo:** "Landsnails of Sri Lanka seems to be a neglected field among the naturalist community....I hope the young enthusiasts who came to the workshop will actively engage in the study of landsnails and expand the knowledge, and some may even try to fill the gaps in the field. It was a great opportunity to observe the shells under microscopes and also see the live snails in the rainforest. I would give my sincere gratitude to Dr Dinarzarde Raheem, the organizing team and the Malacological Society of London, who made this possible." W. Sudesh Udayakantha, biology lecturer, South Eastern University of Sri Lanka: "I participated in this workshop as a beginner in this field...But now I feel that I can do something in this field. The workshop comprised lectures, lab sessions and also fieldwork and these are all very important to improve our knowledge in this field...Thank you very much for organizing this kind of free workshop for us. Everything has been well planned. We enjoyed a lot and I think that the goal of the workshop has been reached. Thank you!"

**Pat Faulkner, archaeologist, University of Sydney:** "The workshop was excellent. It provided an ideal opportunity to bring a number of young researchers with different research interests together. The focus on Sri Lankan land snails allowed these different interests to converge. As an international researcher and archaeologist, having an introduction to Sri Lankan terrestrial molluscs and the opportunity to interact with malacologists/zoologists was very beneficial, and will hopefully provide capacity for col-



Figure 10: An adult semislug of the genus *Satiella* at Kottawa. Image: Ravisara Jayamanna.

laborative work into the future. The combination of lectures, practicals and fieldwork was excellent, allowing for deep engagement with issues around land snails in this region."

#### Acknowledgements

The workshop would not have been possible without generous funding from the Malacological Society of London and the support of key personnel at the Galle Divisional Office of the Forest Department Sri Lanka, Ministry of Wildlife and Forest Resources Conservation, Government of Sri Lanka. Our thanks to K. Yogarathnam, Divisional Forest Officer for Galle, who made sure that renovations to the Kanneliya Conservation Centre were completed in time for the workshop and facilitated the workshop in every possible way. Our thanks also to D.M.A.K. Bandara (Range Forest Officer for Kanneliya) for all his efforts to have the Kanneliya Dormitory ready in time and to R. Liyanage (Beat Forest Officer for Kanneliya) and G.C.B. Vitharana (Beat Forest Officer for Kottawa) for their support and encouragement. Thasajini Sajeevan was very helpful in connecting us with the heads of department at the University of Jaffna, Eastern University and South Eastern University of Sri Lanka. Kanishka Ukuwela and Malaka Wijayasinghe introduced us to several of the participants. Our thanks to M. Vinobaba (Head, Department of Zoology, Faculty of Science, Eastern University), Riyas Ahamed (Head, Department of Biological Sciences, Faculty of Applied Sciences, Eastern University), Mrs Piratheepa Sivakumar (Senior Lecturer, Department of Zoology, Faculty of Science, University of Jaffna) and S. Wijeyamohan (Head, Department of Bio-science, Faculty of Applied Science, University of Vavuniya) for sending us students and/or early-career staff from their institutions. Professor Inoka Karunaratne, Head, Department of Zoology, University of Peradeniya kindly granted permission for the use of a multimedia projector, four microscopes and several light sources and tabletop magnifying lenses; these pieces of equipment were carefully packed for transport to Kanneliya by Bandula Ekanayake, Varuni Imbuldeniya, Anoja Kapilarathne and W.M. Seelawathi of the Zoology Lab, University of Peradeniya. We were also loaned two microscopes from the Department of History and Archaeology, University of Sri Jayewardenepura. Madura de Silva of the Wildlife Conservation Society - Galle generously loaned us a multimedia projector; the arrangements for this were handled by G.G. Sisira Darshana Jayasinghe, the animal rescue officer at the society's Hiyare research centre. Pasindu Dilshan and Rohan Pethiyagoda loaned us a microscope and external lightsource. G.C. Athulathmudali organized the making of several wooden stools for the microscopy session. Jon Ablett (Natural History Museum, London) provided the plastic petri dishes that were used in the shell study session. Our thanks to U. Nilanthi Rupika and P.P. Nilantha at Koralegama for handling all the catering, in collaboration with H.D. Somasiri and Siril. Rupika and Nilantha also generously allowed us the use of their living room for the lectures on day 1 of the workshop (because of an issue with the electricity supply in the Kanneliya Conservation Centre's lecture hall) and loaned us several large tables for the microscopy session. Finally, we would like to thank our team: L. Wasana Perera, H.W. Vishan Pushpamal, Sameera Wickramanayake and N.H. Chithrasekera. Wasana coordinated all the catering, did the food shopping and accounts, and provided transport in his van. Vishan and Sameera assisted with organizing the workshop, managed various administrative tasks and, together with Dinarzarde, handled all the training. Chithrasekera led the walks into Kanneliya and he, Vishan and Sameera shared their extensive knowledge of the forest and land snails with the workshop participants.

TRAVEL GRANT REPORTS

## Molluscs of South Asia: Research, Conservation, and Livelihoods -Commemorating the life and work of H.H. Godwin-Austen,

### Bangalore 2023

## Taxonomic review of the enigmatic Sri Lankan land snail genus *Acavus* (Eupulmonata: Acavidae)

#### Kumudu Wijesooriya

Department of Zoology, Faculty of Science, University of Peradeniya, Peradeniya, Sri Lanka kumuduw@sci.pdn.ac.lk

The first Molluscs of South Asia Conference was held from the December 11<sup>th</sup> to 13<sup>th</sup>, 2023, in Bangalore, India. It was organized by the Asoka Trust for Research in Ecology and the Environment (ATREE). The conference accommodated a diverse audience, including scientists, post-doctoral researchers, Ph.D. and M.Sc. students, early career researchers and independent researchers working in the field of Malacology around the world. The conference program included plenary talks, lead talks, short talks, speed talks and poster sessions providing a comprehensive platform for the exchange of knowledge and ideas among malacologists. During the conference, I had the privilege of presenting the preliminary findings of my undergraduate research project through a short talk.



A snapshot of my short talk on the 'Taxonomy and Distribution of *Acavus*'

My study focused on the taxonomy and distribution of the enigmatic, endemic land snail genus *Acavus* in Sri Lanka. I presented the distribution of three species of *Acavus* in Sri Lanka with new distributional records, morphological and anatomical variations within species, varieties and populations of *Acavus* in Sri Lanka. The opportunity to share my work at this conference opened up novel avenues to get suggestions, diverse perspectives, and feedback from other researchers. Interacting with researchers from different parts of the world exposed me to the exchange of thoughts and experiences. These conversations proved to be enriching knowledge. Also, this helped to establish new potential collaborations. I was particularly en-



A highlight of the field visit was the observation of the orange morph of *Indrella ampulla*, captured in Honey Vally, Coorg, India.

gaged by the panel discussion "*Challenges to collaboration in malacological research*" discussed important issues and how to overcome these issues when making collaborations.

Following the conference, I had the opportunity to visit ATREE laboratories and establish connections for potential future collaborations between Sri Lanka and India. Afterwards, I participated in the post-onference, three-day, field visit visit to Honey Vally, Coorg (Kodagu region), Western Ghats to explore both terrestrial and aquatic molluscs in their natural habitats with field experts from different parts of the world. I was fortunate to observe most of the targeted species and the majority were my lifers.

The knowledge I gained and the experiences I shared would not have been possible without a Malacological Society of London Travel Grant. Hence, I am grateful to the Malacological Society of London for granting me the opportunity to embark on my journey into the world of molluscs.



Post-conference field visit to Taidyendamol, Western Ghats, India.

A conference group photo taken at the conference venue, Royal Orchid Resort and Conservation Center, Bangalore, India.



## Bivalves - Where Are We Going? 5-8 September 2023; Cambridge, UK.

## Unravelling the Brachidontes variabilis species complex (Bivalvia: Mytilidae)

#### Samuel Tan

School of Marine Sciences, University of Maine Email: <a href="mailto:samuel.tan@maine.edu">samuel.tan@maine.edu</a>

The "Bivalves – Where Are We Going?" conference was a long-overdue successor to a series of meetings on just about anything to do with the taxon, spanning a plethora of fields such as palaeobiology, biogeochemistry, phylogenetics and physiology. While my current PhD studies in the US have little to do with molluscs per se, I have been involved in some taxonomic work on a range of marine taxa over the years, with the most recent and extensive work being on resolving cryptic mytilid taxa in the Indo-Pacific region, led by Dr. Koh Siang Tan of the National University of Singapore. As such, I was grateful for the support afforded by the Malacological Society of London to travel to Cambridge and mingle with a different sort of research community from what I'm normally used to.



Samuel Tan with Rhys Edmunds and Sarah Humbert of the Dept of Earth Sciences, University of Cambridge

The work Koh Siang and I presented at the conference was centred around two topics; using DNA barcoding to resolve phylogenetic relationships between mytilid genera, and to identify cryptic species within the genus *Brachidontes*. *Brachidontes* is a common and abundant mytilid genus on hard substrata that is ecologically significant globally both as a filter feeder and food to predators, but is taxonomically confusing and poorly defined in the Indo-West Pacific region. Using DNA barcoding of a set of five nuclear and mitochondrial genes, we identified eight closely related species in this region, forming two distinct lineages. The majority of these species are difficult to distinguish morphologically, more so in South-East Asia where three species are known to co-occur. We are still working to barcode more specimens to better constrain geographic ranges and resolve relationships between some of the closer sister species. Followup work may involve examining how Indo-West Pacific *Brachidontes* fit in with Atlantic and Eastern Pacific species. Given how popular the conference was, I was only able to present a poster on the latter topic, but what struck me about the conference atmosphere was how relaxed and welcoming it was. I was able to meet many of Koh Siang's long running collaborators; and was heartened to have the opportunity to share in their expertise and listen to the stories they had to tell, as well as their enthusiasm for their pet taxa. In addition, we were able to solicit invaluable feedback on our work: all the more welcome when faced with the conundrum of whether to lump or split taxa that are basically physically indistinguishable!

I was also able to meet many researchers at a similar career stage to mine. While we started our careers in an era



L-R Dr. Koh Siang Tan (Samuel Tan's supervisor when he was a research assistant at the National University of Singapore), Samuel Tan and Prof. Simon Cragg (University of Portsmouth) and his wife. (Professor Cragg was a member of the Council of the Malacological Society of London for several years)

where modern scientific and analytical tools are a lot more accessible than in the era of the old guard, the perspectives of the latter are nevertheless invaluable in informing how to best make use of such tools to begin with. For one, even though I'd like to think of myself as detail-oriented; I've learned over the years that I'm better at molecular ecology than traditional taxonomy. Without the expertise of career taxonomists, I would never have been able to pick out subtle differences between many of the taxa we've examined.

Overall, I was glad to be given the opportunity to keep abreast of modern bivalve research, and to present my work to the community. While the future is still up in the air as to what I'll do post-PhD, this conference has given me a better idea of what molecular ecology in this space looks like, and I'd be more than happy continue with bivalve research throughout my career, be it side projects, or perhaps, a deeper dive altogether.

Bivalves - Where Are We Going? 5-8 September 2023; Cambridge, UK.

## The functional role of freshwater mussels in changing tropical environments

## <u>T Blackwell</u><sup>1</sup>, A Zieritz<sup>1</sup>, H Hartikainen<sup>2</sup>, KAA Rahim<sup>3</sup>, C Gibbins<sup>4</sup>, B Egeter<sup>5</sup>, SC Creer<sup>6</sup>.

<sup>1</sup> School of Geography, University of Nottingham, Nottingham, UK

<sup>2</sup> School of Life Sciences, University of Nottingham, Nottingham, UK

<sup>3</sup> Faculty of Resource Science & Technology, Universiti Malaysia Sarawak, Kota Samarahan, Sarawak, Malaysia

<sup>4</sup> School of Environmental and Geographical Sciences, University of Nottingham Malaysia Campus, Kuala Lumpur, Malaysia.

<sup>5</sup> NatureMetrics, Guildford, UK

<sup>6</sup> School of Natural Sciences, University of Bangor, Bangor UK

<sup>1</sup> University of Nottingham, <sup>2</sup> Universiti Malaysia Sarawak, <sup>3</sup> University of Nottingham Malaysia Campus, <sup>4</sup> NatureMetrics, <sup>5</sup> University of Bangor. Email: <u>Tabitha.blackwell2@nottingham.ac.uk</u>

The conference '*Bivalves* – *Where are we going*?' was held from the 5<sup>th</sup> to the 8<sup>th</sup> of September 2023 in Cambridge, UK. Over 90 delegates registered for the event, with over 65 different talks and around 30 poster presentations. There have only been four previous meetings of its kind, the last being in 2006 in Barcelona. I was delighted to receive financial support via a Travel Grant award from the Malacological Society of London (MSL) to be able to attend and be a part of this auspicious event.



Talks were focussed not only on the question of 'where are we going?' but also 'where have we been?' and 'where are we now?' and included an incredible breadth of research fields, including modern-day- and paleo- phylogeny, bivalves as archives of environmental change, symbioses, DNA barcoding advancements, shell geometries, and body size evolution.

While the specific interests of each delegate varied, there was a feeling of common interest, not just in terms of the study taxa, but shared interest in collaborative, innovative, research. This shared interest created an atmosphere of camaraderie and a kind of symbiosis that I have rarely experienced at conferences to date. Small moments throughout the event such as the round of applause given to a presenters' first publication acceptance, the jovial 'booing' of an incidental gastropod, and the looks of awe at the many 'beautiful' bivalves, will make a large and lasting impact on my, and I'm sure many others', perspective of what a career in research can be when collaboration and interdisciplinarity are encouraged.

The conference also gave me my first opportunity to present my PhD research on the functional role of freshwater mussels as filter feeders in changing tropical environments. The main aim of my poster was to share the broad approaches of this work; combining an understanding of the functional role of mussels as filter feeders with a molecular approach to uncovering the vast knowledge gaps that exist in the tropics. There are many challenges for research in this area, both from the lack of existing knowledge and expertise to the physical challenges of conducting field work in such extreme environments. Sharing this work with such a broad group of bivalve experts was an important first step to help design an effective second field campaign in the coming academic year. I came away with renewed inspiration to tackle these complex questions, with suggestions from a broad range of academics across the globe and across a variety of career stages. This included suggestions on methodological approaches, as well as theoretical ones, for example, a reminder never to ignore the geological background of a new environment. I particularly enjoyed meeting the other ~20 students present, an unexpectedly high proportion of the overall turnout, and I know I will keep in touch with many of them over the course of our careers.

Some key take-homes for me were to 'know your bivalve', the importance of sampling regime design, and the lessons we can learn from other fields of study that we may not normally consider. I am very grateful for the support I received from MSL which allowed me to attend, share my research, and be a part of this wonderful community I hope to continue collaborating with as my career progresses.

## **Book review**

### Animals under logs and stones

Wheater, C.P., Read, H.J. & Wheater, C.E. Naturalists' Handbook 22 Ecology and identification Pelagic publishing, London 1-344, 2nd edition

You are a biologist with a detailed knowledge of a particular group of organisms (say freshwater snails) but only a general knowledge of all the rest. Out on a countryside walk in woodland, you decide to take a break and sit down on a fallen tree. As you sit down, your foot disturbs a piece of bark, which you idly kick over. Revealed beneath is a whole world of invertebrate animals whose general taxonomy you know (mites, harvestman, slugs, snails, insects, centipedes etc). Of their detailed identities and lifestyles, however, you know nothing. You move the bark back into place and move on .... or, if you are a curious person with your interest peaked, you would like to know more of these creatures and their habits. In the latter case, how do you proceed? This book Animals under logs and stones by Wheater, Read & Wheater could be an starting point (Fig. 1). It is an aesthetically pleasing book of 344 pages, replete with excellent drawings and photographs, dichotomous keys and additional information. It covers all the animal groups which might occur under logs and stone in the UK, ranging from invertebrates such as flatworms, spiders, molluscs and insects (amongst others) to vertebrates such as amphibians, reptiles and even small mammals.

The book opens with a general definition of **cryptozoa** – animals which live in the vegetation litter zone beneath logs and stones. A series of photographs explains what these places might look like. This introduction then leads into a general description of animal classification and introduces the reader to a straightforward taxonomy of the cryptozoan animals. Using clear and economical prose, Chapter 2 takes the reader into the environmental conditions of the cryptozoan biotope, describing the microclimate, the substrate and the processes of decomposition. Wheater *et al.* introduce island biogeography in relation to the cryptozoa, as well as the role of the cryptozoan biotope in ecosystem services. I have taught island biogeography in relation to water bodies and woodlands for many years but until I read this book, it never occurred to me that decaying logs could be used for practical studies of island biogeography. Chapter 3 concerns the biology of the cryptozoa, including clearly written sections on activity patterns, life cycle, nutrition and





Figure 1



Fig. 2

general biology of major taxonomic groups. These sections are supported by informative diagrams and photographs (Fig. 2) and act as biological introductions to the dichotomous taxonomic keys which occupy later sections of the book. (It would have been helpful if the photographs had included scale bars). The eighty seven pages which precede Chaper 4 on identification could be useful reading for 'A' level (17-18y) and new undergraduates who study biology.

Chapter 4 contains dichotomous keys to all the relevant taxonomic groups. Initially, there is a useful hierarchical picture key (called a 'guessing guide' by the authors) which helps the reader to determine what kind of animal they are looking at. This guessing guide could also be useful for primary age (7-11) children. The keys are clearly written, unambiguous and easy



to follow, and are supported by excellent diagrams of the pertinent taxonomic features (Fig. 3). Cross referencing to images, to confusion taxa and to sources of information (including both paper and digital records) is assiduously done throughout the keys and the book as a whole. Twenty two pages are devoted to the molluscs. In the 37 taxa which are presented in the book, almost all the slugs featured in Rowson *et al.* (2014) are here. The keys refer to 71 species of snail. By contrast, Kerney & Cameron (1996) map the distributions of 120 species of land snails in Britain.

In conclusion, this excellent, aesthetically pleasing book fulfils its aims in allowing the interested amateur or professional naturalist to navigate their way into what might be, to them, a new and fascinating biotope represented by the cryptozoa. It is an excellent little textbook and is well worth its paperback price of £30. An ebook version is available.

Rowson, B., Turner, J. Anderson, R. & Symondson, B. (2014) *Slugs of Britain and Ireland*, Field Studies Council, Telford Kerney, M.P. & Cameron, R.A.D. (1996) *Land snails of Britain and North West Europe. Collins field guide*. Harper Collins, London

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## **Membership** Notices

# THE MALACOLOGICAL SOCIETY OF LONDON

**Registered Charity No. 275980** 

Hon. Secretary - Debbie Wall Palmer

The 131st Annual General Meeting of the Malacological Society of London (MSL) will take place at 1300h on Wednesday 6th March 2024 at the Natural History Museum, London. There will be an accompanying symposium entitled *Biology of limpets: evolution, adaptation, ecology and environment* 

#### Agenda for the AGM

Apologies for absence Minutes of the last (129th) AGM Matters arising Financial report Annual report of Council (delivered by the President) Awards Election of Council Any other business Year of existence

Year of existence	2023–2024	2024-25 proposed
	130	131
President	Jon Ablett (3)	Fiona Allen (1)
Vice Presidents	Fiona Allan (3)	Phillip Hollyman (3)
	Phillip Hollyman (2)	Aidan Emery (1)
Ex officio		Jon Ablett
Councillors	Aidan Emery (3)	Rowan Whittle (3)
	Robert Cameron (3)	John Grahame (3)
	Victoria Sleight (3)	Phil Fenburg (1)
	Katie Collins (3)	Crispin Little (1)
	Rowan Whittle (2)	Katie Collins (1)
	John Grahame (2)	James Witts (1)
EC-Rep	Thomas Goulding (2)	Giada Spagliardi
Co-opted	Phil Fenburg (2)	Victoria Sleight (1)
	Crispin Little (2)	Katrin Linse (1)
	Alan Hodgson (1)	Lauren Sumner Rooney (1)
Journal Editor	Dinazarde Raheem	Dinazarde Raheem
Bulletin Editor	Georges Dussart	Georges Dussart
Treasurer	Vacancy	Tom White (1)
Membership Secretary	Harriet Wood	Harriet Wood
Hon. Secretary	Debbie Wall-Palmer (3)	ТВС
Web manager	John Grahame (web)/Victoria Sleight (Facebook)	John Grahame (web)/ Victoria Sleight (Facebook)
Awards Officer	Lauren Sumner Rooney (3)	Alan Hodgson (1)
Archivist	Andreia Salvador (3)	Andreia Salvador

Numbers indicate years in post; posts are usually for 3

## **Grants and Awards**

The Research Awards Scheme was established to commemorate the Society's Centenary in 1993. Under this scheme, the Society gives awards to support research on molluscs that is probably to lead to publication. The closing date for applications each year is 15th December. Grants are preferentially conferred on students and researchers without regard to nationality or membership of the Society. Preference is also given to discrete research projects that fall within the subject areas covered by the Society's *Journal of Molluscan Studies*. Applications will be assessed by scientific merit, value of the project and for student applicants, the extent to which the research will benefit the applicant's scientific aspirations. The successful applicants will be notified by 31st March and announced at the Annual General Meeting. Awardees are encouraged to publish their work in the *Journal of Molluscan Studies* (full papers) or *The Malacologist* (travel award reports, research award reports, news of ongoing research etc) as appropriate,

#### Early Career Research grants

Eligibility is restricted to those investigators at the outset of their independent scientific career. Applications must therefore be 1) postgraduate students, 2) within five years of being awarded their PhD (adjustable for career breaks), or 3) independent researchers not having a PhD. Early Career Research Grants will only be awarded to individuals twice, but not within 3 years of receiving a first award. From December 2021, the Society also offers additional awards to a) applicants from developing and transition countries (as according to the UN), and b) UK/EU applicants from Black, Asian, or any other underrepresented ethnic background.

#### Sir Charles Maurice Yonge Award

There is no application process for Sir Charles Maurice Yonge Awards. These awards are given for the best Travel Award application on bivalves. The award is to support attendance at an international meeting (not including the Molluscan Forum). Authors of exceptional studies on bivalves in *the Journal of Molluscan Studies* may on occasion also be given this award. The Editor will nominate such papers as he/she sees fit. The award covers the costs requested in a Travel Award, or for open access publication of the paper. Members of the Society will also receive a personal cash prize of £300. Non-members will receive a personal cash prize of £250 plus one year's membership to the Society. If a paper is multi-authored, the award will be made to the corresponding author.

#### Senior Research Awards

These are aimed at established researchers in professional positions, but without regard to nationality. Applicants for Senior Research Awards must be members of the Malacological Society of London. The Society currently awards up to five Senior Research Grants per year, each with a value of up to £1,500, to support research on molluscs that is probably to lead to publication. The maximum amount available should not be considered as a 'target'; rather requests should reflect the research that is proposed. The grants are reviewed by a Reviewers Panel including both Council and non-Council members invited for that purpose.

#### **Travel Grants**

Travel Awards are available as bursaries to support attendance at a conference or workshop relevant to malacology. Grants are preferentially conferred on students but researchers without professional positions may also apply. The maximum amount for one of these awards is £500 for Society members and £300 for non-members. Preference will be given to members of the Society. There are two closing dates each year, The deadlines are 1<sup>st</sup> March, for travel scheduled between 1st June and 30th November, and 1st September for travel scheduled between 1st December and 31st May.

For further information, guidance notes and to access the application form see here - http://malacsoc.org.uk/awards-and-grants/travel-grants

#### Annual Award

This Award is made each year for an exceptionally promising initial contribution to the study of molluscs. This is often a thesis or collection of publications. The value of the Award is £500. Candidates need not be a member of the Society but must be nominated by a member. There is no application form: the nominating member should send the material for evaluation with a covering letter or letter of support to the Honorary Awards Secretary. The closing date each year is 15<sup>th</sup> December. The winner(s) will be notified by 31st March, and announced at the Annual General Meeting.

#### Applications

Applications for Research Awards and Travel Grants should be sent to the **Honorary Awards Secretary, Lauren Sumner-Rooney,** Museum für Naturkunde, Invalidenstrasse 43, Berlin 10115, Germany. For further information, guidance notes and to access the grant application form see http://malacsoc.org.uk/awards-andgrants/research-grants

## Malacological Society of London – Subscription and Membership

### Objects

The objects of the Society are to advance education and research for the public benefit by the study of molluscs from both pure and applied aspects. We welcome as members all who are interested in the scientific study of molluscs. There are Ordinary Members, Student Members and Honorary Members. Members are entitled to receive a digital copy of the *Journal of Molluscan Studies* and such circulars as may be issued during their membership. The Society's website is at: http://www.malacsoc.org.uk

#### **Publications**

The Society has a continuous record of publishing important scientific papers on molluscs in the *Proceedings*, which evolved with Volume 42 into the *Journal of Molluscan Studies*. The *Journal* is published in annual volumes consisting of four parts which are available on -line by members and student members. The Society no longer produces paper copies of the Journal. Members also receive access to *The Malacologist*, which is the bulletin of the Society, issued twice a year, in February and August. *The Malacologist* is published on-line on the website of the Society.

#### **Meetings and articles**

In addition to traditional research on molluscan biology, physiological, chemical, molecular techniques are amongst the topics considered for discussion meetings and papers for publication in future volumes of the *Journal*.

### Subscriptions

Membership subscriptions are valid from **1st January** for a single calendar year.

### Membership fee structure

Ordinary Members: Journal on-line only £45 Student Members: Journal on-line only £25

Due to increased charges by Oxford University Press, from and including 2025, subscriptions will increase to Ordinary members £50

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Student members £29

#### **Methods of Payment**

#### New Members:

To join the Society for the first time please fill in the Membership Form on the MSL website and make your payment using a Credit or Debit Card (Mastercard, Visa, American Express):

https://malacsoc.org.uk/membership-form/

#### **Existing Members:**

If you already have an account on the MSL website please **login** to renew your membership and make your payment using a Credit or Debit Card (Mastercard, Visa, American Express).

#### OR

If you have already set up a standing order you may continue to pay in this way. We do not encourage members who have a MSL account on the website, or any new members, to set up a standing order.

### For any membership queries please contact the Membership Secretary: membership@malacsoc.org.uk

### **Broadening Access Membership Scheme**

This initiative helps support postgraduate students from countries listed as developing economies in their malacological studies.

Each year, we offer to **10 postgraduate students free membership** to *The Malacological Society of London* for a period of 3 years under the new Broadening Access Membership Scheme (BAMS). Students who are studying a postgraduate malacology-related course in countries designated 'developing economies' are invited to apply for this award with the support of their supervisor. Applications open each autumn and will close when all 10 memberships have been allocated.

Successful candidates benefit from:

- online access to entire archive of *Journal of Molluscan Studies* (back to 1893)
- electronic delivery of Society's bulletin, The Malacologist
- access to a higher rate of travel grant
- regular communication from MSL about the Society's themed meetings and the annual Molluscan Forum

#### **Application procedure:**

To find out more about the scheme, who is eligible and how to apply, please go to the following page on our website: <a href="https://malacsoc.org.uk/developing-economies-membership-scheme/">https://malacsoc.org.uk/developing-economies-membership-scheme/</a>