ISSN 1759-1406

The Malacologist

The Bulletin of The Malacological Society of London

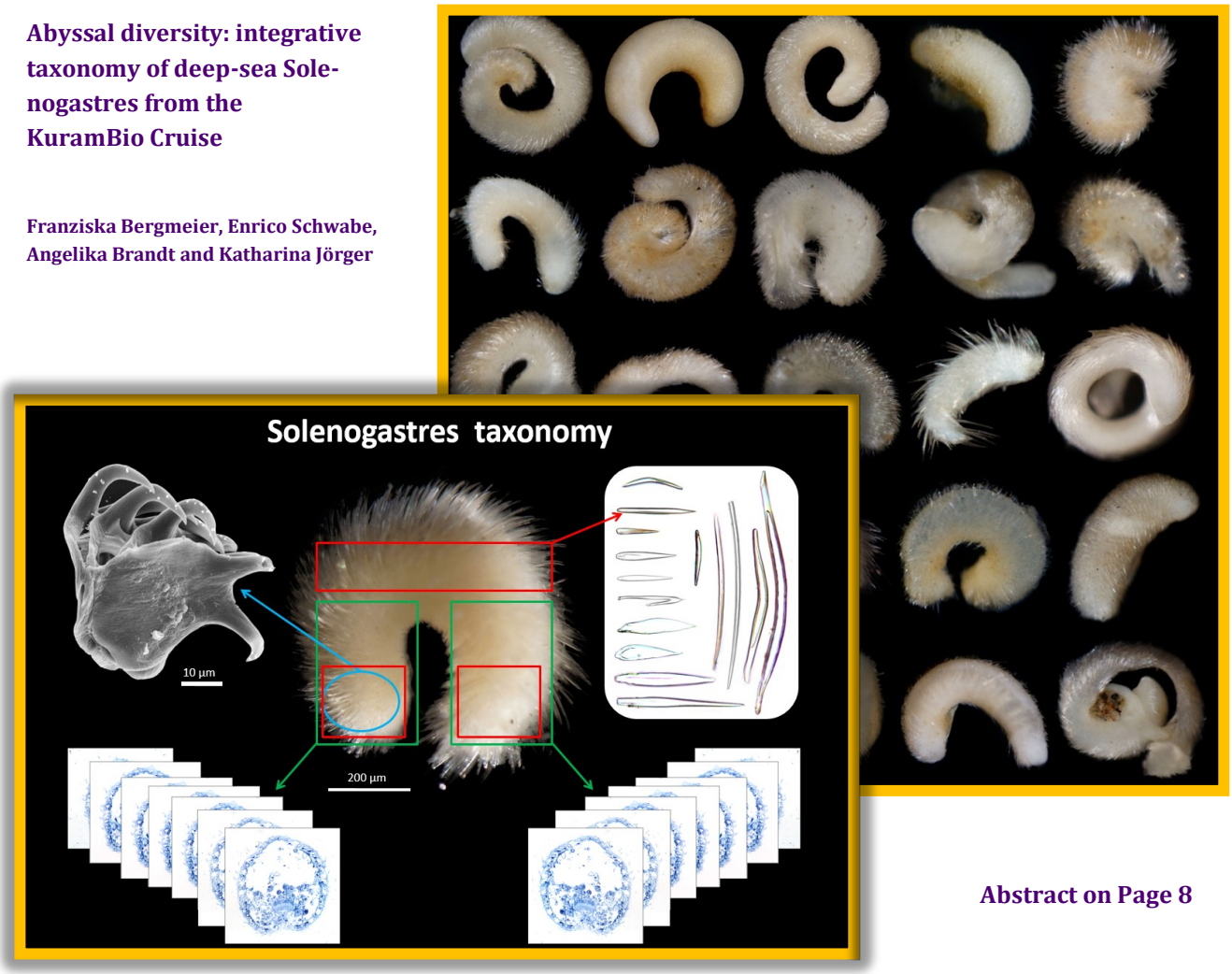
NUMBER 66 FEBRUARY 2016

Contents

Includes abstracts from the Molluscan Forum 2015 such as -

Abyssal diversity: integrative taxonomy of deep-sea Solenogastres from the KuramBio Cruise

Franziska Bergmeier, Enrico Schwabe, Angelika Brandt and Katharina Jörger



Abstract on Page 8

The Malacological Society of London was founded in 1893 and registered as a charity in 1978
(Charity Number 275980)

EDITORIAL

It is always a pleasure to edit the February issue of *The Malacologist* because it is the issue which reports on the Malacologists Forum. One is always guaranteed an eclectic mix of presentations, the abstracts of which are presented here.

The Forum was divided into symposia on a range of topics including "*Palaeomalacology and behaviour", "Systematics and phylogeny" "Environment & Ecology*" and "*Conservation & Physiology*". This exciting set of presentations ranged from the development of tools to investigate the population biology of economically important whelks (presented by Phil Hollyman who won a presentation award at the Forum—see page 12) to Jurassic bivalves to *Nautilus* being bored by *Octopus* (sic). The latter presentation included a piece of video explaining how the work was done. In a new development for *The Malacologist,* the presenter Auke-Florian Hiemstra agreed to make his video available on U tube (see the bottom of page 5). On the theme of video and in the interests of molluscs and education (one of the Objects of the Society), I have included a link below (in Malacological Miscellany) that some readers might find entertaining.

Another new development in this issue comprises two articles under the heading of *Malacological Backgrounds* (pages 26-29). We all operate within our own specialities and this means that there are bound to be areas in which we lack knowledge or expertise. To this end, based on Forum presentations, I commissioned two short review articles each divided into two sections (1) What are …..and (2) What is the relevance of ….. for malacology. Future possible topics which spring to mind are (i) the Tethys, (ii) antecedents of Molluscs, (iii) the coral triangle, (iv) Bayesian statistics, (v) cellular defence mechanisms (vi) ocean anoxia and (vii) Hennigian cladistics. I am open to offers for these or other articles with this structure. Hopefully these short pieces might be picked up during digital searches by students who might then take an interest in malacology for its own sake.

Prof. Georges Dussart
Canterbury Christ Church University
North Holmes Rd.,
Canterbury
Kent CT1 1QU
U.K.
07732 30 70 71
georges.dussart@canterbury.ac.uk

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 3rd Edition (1985), edited by W.D. Ride *et al.*].

MALACOLOGICAL MISCELLANY

Follow the link below if you would like to see the performance of two rather sweet songs about snails…..

https://youtu.be/q67Rmcew9D0

Spot the mollusc ?

Molluscan Forum 2015

Natural History Museum, London 19 November 2015

ORAL PRESENTATIONS

Schedule

09.00 - 10.00 Registration & coffee

10.00 - 10.55 Session I: Palaeomalacology & Behaviour

10.00 SUZANNE WILLIAMS: Welcome and introduction to the day
10.10 AUTUMN C. PUGH: Macroevolutionary trends of bivalves through the Lower Jurassic in Bulgaria
10.25 AUKE-FLORIAN HIEMSTRA: The ontology of shell-boring *Octopus* versus *Nautilus* predator-prey interactions
10.40 JITKA MOUTELÍKOVÁ: The effect of sample size and resolution on palaeomalacological interpretaions: a case study from calcareous-fen deposits
10.55 ANNA DZIERŻYŃSKA-BIALOŃCZYK: The scent of death: a few words about the valve movement reaction of the zebra mussel (*Dreissena polymorpha*) to predator kairomomes

11.10 - 11.40 Coffee & poster viewing

11.40 - 13.00 Session II: Systematics & Phylogeny

11.40 JENNIFER ANN AUSTIN: Diversity and systematics of the tropical Indo-West Pacific genus *Phanerophthalmus* (Cephalaspidea, Haminoeidae)
11.55 ALLISON L. FRITTS-PENNIMAN: Genomic evidence for ecological speciation in *Phestilla* nudibranchs (Gastropoda: Opisthobranchia)
12.10 FRANZISKA S. BERGMEIER: Abyssal diversity: integrative taxonomy of deep-sea Solenogastres from the KuramBio Cruise
12.25 BASTIAN BRENZINGER: A small snail with a difficult name, and implications for the heterobranch tree of life
12.40 TROND R. OSKARS: Broad sampling and molecular phylogenetics reveals rampant paraphyly in Haminoeidae (Heterobranchia)
12.55 SUZANNE WILLIAMS: Announcements, Arrangements and Awards etc.

13.00 - 14.00 Lunch break

14.00 - 15.15 Session III: Environment & Ecology

14.00 JANA BUD'OVÁ: Land snails along latitudinal gradient in Europe
14.15 ALICE K. BURRIDGE: Epipelagic distribution of planktic gastropods along a meridional transect in the Atlantic Ocean
14.30 ANNA HOLUBOVÁ: Influence of environment on morphological and structural characteristics of European snails
14.45 VERONIKA HORSÁKOVÁ: Diversity and ecology of European fen mollusc fauna: state of the art
15.00 EDWARD WORT: Phylogeography of *Gibbula umbilicalis* (Gastropoda: Trochidae) in the Bay of Biscay

15.15 - 15.45 Tea break & poster viewing

15.45 - 17.00 Session IV: Conservation & Physiology

15.45 PHIL HOLLYMAN: Developing tools to improve stock assessment for the common whelk, *Buccinum undatum*: validation of growth line formation in statolith microstructures
16.00 CHRISTOPHER HOBBS: The decline of the Shining Ramshorn Snail, *Segmentina nitida*
16.15 HILDUR MAGNÚSDÓTTIR: Shell phenotype classification of the common whelk (*Buccinum undatum* L.) in Breiðafjörður
16.30 VLADIMÍR SKÁLA: DNA traps in the pond snail *Lymnaea stagnalis*: searching for a novel defence response against pathogens
16.45 SUZANNE WILLIAMS: Closing remarks.

17.00 - 18.30 Wine social & final poster viewing

POSTERS

LUCA DA SOIS: Greenhouse gastropods of the Hortus Botanicus of Leiden: check-list, distribution and comparison with previous collection

MOHD ZACAERY KHALIK: Shell evolution of *Georissa* (Gastropoda: Hydrocenidae) from Malaysian Borneo

CHRISTINA LAIBL: Angel of the Sea - 3D reconstruction and microanatomy of *Clione limacina* (Phipps 1774)

ASIF LALDIN: Using DNA to differentiate and identify dubious species within the freshwater mussel *Dreissena* genus in Greater London waters

KATHARINA C.M. VON OHEIMB: Phylogenetic assessment of *Cyclophorus* spp. (Caenogastropoda: Cyclophoridae) from Vietnam

ALEJANDRO ROMAN-GONZALEZ: *Yoldia eightsi* a recorder of climatological coastal recorder

MALCOLM T. SANDERS: The implication of taxonomic opinion over Cainozoic to Recent gastropods diversification pattern. The example of the frog snails (Tonnoidea: Bursidae)

DEBORAH WALL-PALMER: Shelled heteropods - overlooked in ocean acidification research

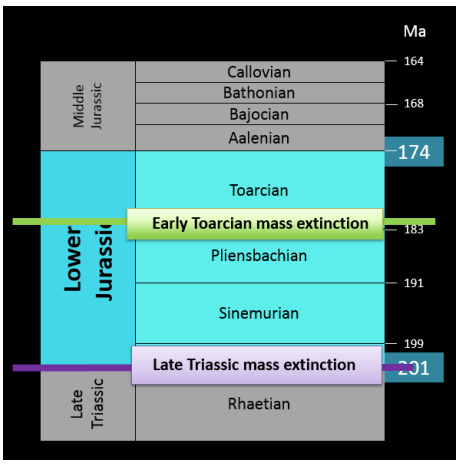
SOPHIE WEBSTER: Ecological basis of reproductive isolation in divergent ecotypes of *Littorina saxatilis* in the UK

Molluscan Forum 2015

Organised for the
Malacological Society of London
and the
Natural History Museum, London
by
Andreia Salvador, Natural History Museum
&
Dr Suzanne Williams Natural History Museum
(email: s.williams@nhm.ac.uk)

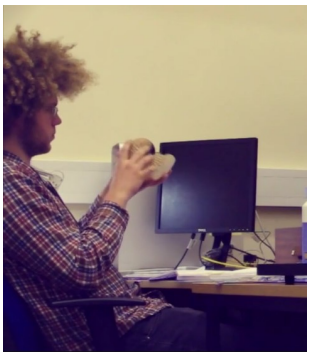
Macroevolutionary trends of bivalves through the Lower Jurassic in Bulgaria

Autumn Pugh[1], Crispin Little[1], Ivan Savov[1], Paul Wignall[1], Robert Newton[1], Lubomir Metodiev[2] & James Riding[3]
[1]School of Earth and Environment, University of Leeds, Leeds, UK, LS2 9JT
[2]Geological Institute, Bulgarian Academy of Sciences, Acad. G. Bonchev Str. Bl. 24, 1113 Sofia, Bulgaria
[3]British Geological Survey, Keyworth, Nottingham, United Kingdom, NG12 5GG
Email: ee11acp@leeds.ac.uk



Lower Jurassic (174Ma-201Ma) witnessed extreme global environmental changes, influencing the stability of marine ecosystems through this time. At the beginning of the Lower Jurassic, ecosystems were in a state of recovery following the late Triassic mass extinction event and suffered a benthic crisis at the end of the period, in the early Toarcian(180Ma). Despite the importance of tracking the long term faunal trends of ecosystem recovery, stability and collapse through this critical 27myr time period, relatively few studies have documented in detail the ecological changes between the two extinction events. We present a quantitative palaeoecological analysis of invertebrate macrofauna, predominantly bivalves, from the upper Hettangian - upper Toarcian sedimentary successions in North West Bulgaria. This location has a more direct link with the open ocean and therefore more likely to be representative of world-wide biotic changes. Differences in faunal compositions, leading up to and during the early Toarcian shows the extinction event and associated environmental changes had different manifestations in Bulgaria compared with North-West Europe.

The ontogeny of shell-boring *Octopus* versus *Nautilus* predator-prey interactions



Auke-Florian Hiemstra[1,2], Menno Schilthuizen[1,2]
[1]Naturalis Biodiversity Center, Leiden, NL
[2]Institute of Biology Leiden, Leiden University, Leiden, NL
Email: aukeflorian.hiemstra@naturalis.nl

To complete our picture of predatory boring by *Octopus*, this study focuses on the rate and pattern of *Octopus* predation in pre-adult stages of *Nautilus*, which encompasses the first 15 years of life. Dry shells from several natural history museum collections were used for this study. In the 555 examined shells, 334 borings were found. For adult *N. pompilius* 136/242 (56.2%) were bored, while for juvenile *N. pompilius* 41/154 (26.6%) were bored. Of the juvenile *Nautilus* 8/52 (15.4%) have multiple borings while 68/179 (38%) of the adult *Nautilus* have multiple borings. One adult *Nautilus* has 6 borings and one juvenile *Nautilus* has 5 borings, both of which set a new record. In adult *Nautilus*, there appears to be no preference to bore on the left or right side of the shell: thus 129 borings are on the left side (48%) and 140 borings on the right side (52%). In juveniles, though, there is a clear difference in left and right borings, with 47 borings on the left (75,8%) and 15 borings on the right (24,2%) which is a statistical difference. Not just all species of *Nautilus* are attacked by *Octopus*; their predation also has a big impact on all ages.

Editor's note

This presentation was accompanied by a video clip which can be seen at the following url :-

https://www.youtube.com/watch?v=mH6ykRIOB1c

The effect of sample size and resolution on palaeomalacological interpretations: a case study from calcareous-fen deposits

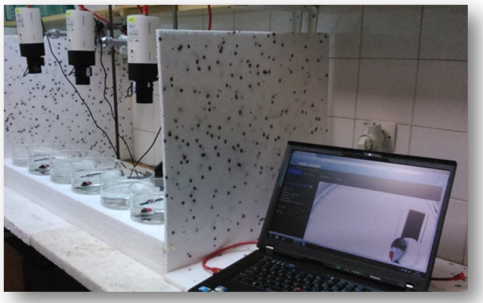
Jitka Moutelíková & Michal Horsák
Department of Botany and Zoology, Faculty of Science, Masaryk University, Brno, Czech Republic
Email: jitka.moutelikova@gmail.com

Traditionally, in central Europe, quaternary mollusc successions are almost exclusively approached on the basis of dug pits, with samples of larger volumes and rather coarser resolution. Although several studies have dealt with the effect of sampling design on palaeoecological interpretation (mainly in palynology), in palaeomalacology this effect has not yet been investigated. We aim to test (1) if and to what extent smaller sample size underestimates species richness and (2) if fine resolution sampling is worth the effort. We studied fossiliferous sediments of the Holocene age excavated at the Mituchovci spring fen (the White Carpathian Mts, SW Slovakia). Three molluscan successions, differing in sample size (100 ml vs 350 ml) and resolution (5 cm vs ~15 cm), were collected at this single site during 2010 and 2012. Over 36 thousand specimens of 76 species were determined. Using rarefaction method, the differences in volume sizes did not have a significant effect on the species richness in this type of environment. Hence, 100 ml samples are sufficient for the analyses in tufa deposits. Although the thickness of sampled layers had no influence on the palaeoecological interpretation, we observed a shift in molluscan diversity peak when different resolutions were applied. Furthermore, the layers of finer resolution allowed a detailed radiocarbon dating and better understanding of trends in species dynamics.

The scent of death: a few words about the valve movement reaction of the zebra mussel (*Dreissena polymorpha)* to predator kairomones

Anna Dzierżyńska-Białończyk, Jarosław Kobak
Department of Invertebrate Zoology, Faculty of Biology and Environmental Protection, Nicolaus Copernicus University in Toruń, Poland
Email: ann.dzierzynska@wp.pl

The zebra mussel *Dreissena polymorpha* is an invasive species. It creates numerous colonies and is a vector of changes in the environment. Despite many studies on its behaviour, few concern the pattern of valve opening and closing. The aim of our research was to understand how the zebra mussel reacts to the presence of kairomones of a predator (the roach *Rutilus rutilus*). We supposed that the scent of fish was a stress factor which may reduce the overall time spent with open valves and mean percentage of gape aperture, as well as induce specific elementary events, such as short opening periods to reduce the contact with the external environment. We also expected different reactions of zebra mussels to the scents of fish fed with *D. polymorpha* and chironomid larvae.



The testing system

Mussels and roach were collected from the Włocławek Reservoir (Central Poland) and used in laboratory conditions. The experiment consisted of 4 variants: (1) with kairomones of roach fed with *D. polymorpha*, (2) with kairomones of roach fed with chironomid larvae, (3) under control conditions (without scent of roach) and (4) with crushed conspecifics releasing the alarm substance, which is a "side effect" of foraging in nature. All experiments were video-recorded and evaluated with the behaviour analysis software, Noldus Ethovision®XT. This program follows the movement of a colour mark on a mussel valve, resulting in a time series of percentage valve openings (relative to the maximum gaping). The results show that *D. polymorpha* does not exhibit any specific reactions to the scent of predatory fish. However, it decreases its total gaping time, particularly with widely open valves, in the presence of the conspecific alarm substance. Moreover, the alarm substance induces elementary events (valve openings and closings) with higher amplitude (i.e. 'longer' movements). Thus, contrary to other behavioural changes, exhibited in the presence of predators in other studies (crawling, attachment, climbing), valve movement reactions are displayed only in response to a direct danger, indicated by the presence of a predator foraging at the moment (resulting in the production of the conspecific alarm signals).

Gape measurement

Diversity and systematics of the tropical Indo-West Pacific genus *Phanerophthalmus* (Cephalaspidea, Haminoeidae)

Jennifer Ann Austin[1,2] and Manuel António Malaquias[2]
[1]Department of Biology, Faculty of Mathematics and Natural Sciences, University of Bergen, Norway
[2]Phylogenetic Systematic and Evolution Research Group, Department of Natural History, University Museum of Bergen, University of Bergen, Norway
Email: jennifer.austin@student.uib.no

Phanerophthalmus smaragdinus crawling on seagrass

Phanerophthalmus is a genus of Cephalaspidea gastropods in the family Haminoeidae restricted to intertidal and shallow waters of the tropical Indo-West Pacific. All species are very similar and their taxonomy is poorly understood. Seven of nine nominal species are accepted as valid but little is known about their relationships and evolutionary history. This project aims to revise the systematics of the genus *Phanerophthalmus*, infer the phylogeny and biogeographic relationships of species, the trophic interactions, and to produce new insights into the processes driving biological diversification in the tropical Indo-West Pacific. We use an integrative taxonomic approach combining fine-scale anatomical dissections and molecular phylogenetics to revise the taxonomy and infer the relationships of species. Characters of the shell, digestive system (radula, jaws, gizzard plates), and male reproductive system are studied by light and scanning electron microscopy. Bayesian phylogenetic trees based on two mitochondrial (CO1 and 16S rRNA) and one nuclear marker (28S rRNA) are generated. Ancestral-state reconstruction methods, coupled with the phylogeny and the geographical distributions of species will be used to infer the geography and mode of speciation. So far, 10 specimens have been dissected and 12 specimens sequenced. A preliminary COI Bayesian phylogenetic tree was produced based on our novel sequences and an additional 11 sequences available from elsewhere. Preliminary results showed that the most relevant morphological characters to distinguish between species seem to be the male reproductive system and to a lesser extent the gizzard plates and radula, whereas the shell and jaws were very conservative among different taxa. The gizzard plates show an overall similarity in shape within the genus, but small and apparently informative differences in the arrangement and distribution of rodlets was noticed. Also, the radula showed a slight variation between some species in the structure of the rachidian tooth, but the significance of these subtle differences require further assessment. Eight species have been recognized in our molecular tree, one more than those accepted presently as valid. The genetic distance between species (uncorrected p-distance) varied from a minimum of 10,7% to a maximum of 19,4%.

Genomic evidence for ecological speciation in *Phestilla* nudibranchs

Allison Fritts-Penniman[1]; Gusti Ngurah Mahardika[2]; Paul Barber[1]
[1]Department of Ecology and Evolutionary Biology, University of California Los Angeles, CA, USA
[2]Indonesian Biodiversity Research Center, Udayana University, Denpasar, Bali, ID
Email: afrittspenniman@ucla.edu

The larvae of many marine species travel long distances via ocean currents. As such, there appear to be insufficient dispersal barriers in marine ecosystems to attribute the great diversity of species solely to vicariance. However, coral reefs provide many opportunities for diversification through ecological niche specialization. For example, corals often host other invertebrates and fishes in mutualistic or parasitic relationships. Symbiotic relationships are known to promote ecological speciation in insect-plant systems, but this process is relatively unexamined on coral reefs.

P.minor* on *Porites cylindrica
Raja Ampat

P.minor* on *Porites lobata
Raja Ampat

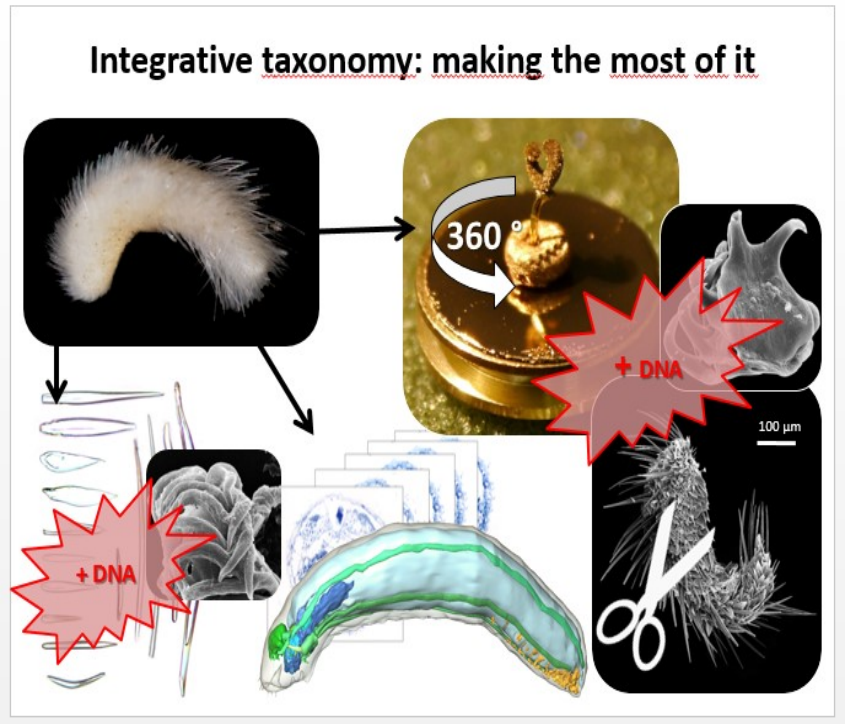
CONTINUED ->

Nudibranchs in the genus *Phestilla* live and feed upon specific coral hosts. Previous work demonstrates that host shifts have occurred and may be the mechanism for speciation. Unfortunately, it is nearly impossible to infer the exact circumstances of speciation after species have been reproductively isolated for some time. Instead we examine the processes influencing ongoing population divergence within one species, *Phestilla minor*, which lives on coral species in the genus *Porites*. We sequenced and genotyped genome-wide single nucleotide polymorphisms (SNPs) using restriction-associated DNA from nudibranch specimens collected from two common *Porites* hosts at multiple locations in Indonesia. Over 6,000 SNPs were used for population structure analyses and statistical tests to detect loci under natural selection. Preliminary results reveal strong divergence between the Indian and Pacific Ocean basins regardless of coral host, indicating that geographic barriers to gene flow do exist. However, within the Pacific, populations collected from the same host are connected by gene flow over long distances, while populations from different coral hosts have diverged despite close proximity. These results imply that coral host acts as a stronger barrier to gene flow than purported geographic barriers in the Pacific Ocean. The existence of extremely differentiated SNPs (outlier loci) between host-separated populations reveals the important role of natural selection in this ecological divergence.

Abyssal diversity: integrative taxonomy of deep-sea Solenogastres from the KuramBio Cruise

Franziska S. Bergmeier[1], Enrico Schwabe[2], Angelika Brandt[3] and Katharina Jörger[1,2]
[1]Systematic Zoology, Ludwig-Maximilians-University, Munich, Germany.
[2]Section Mollusca, SNSB-Bavarian State Collection of Zoology, Munich, Germany.
[3]Centre of Natural History (CeNak), University of Hamburg, Hamburg, Germany.
Email: franzi.bergmeier@gmail.com

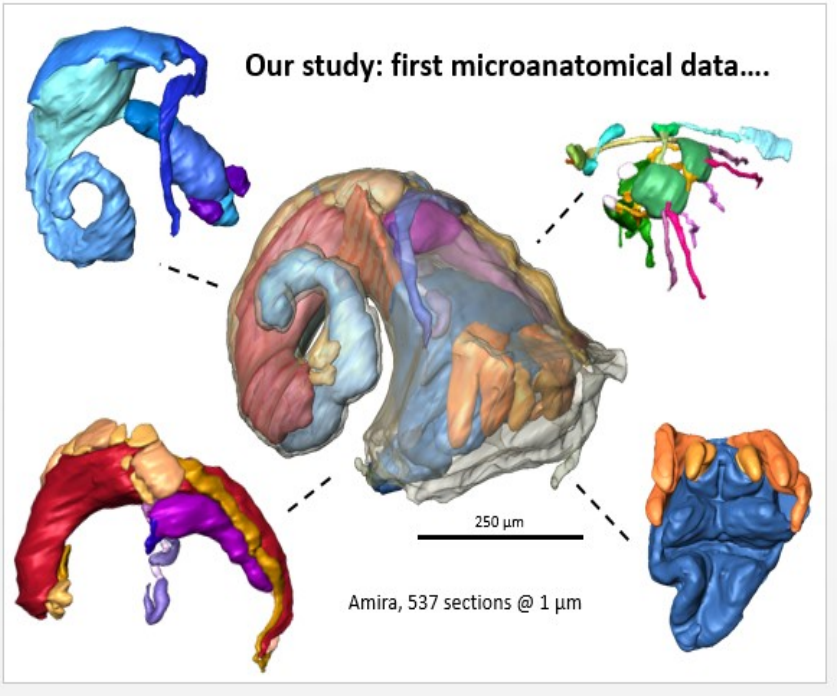
The Solenogastres (Neomeniomorpha) comprise a group largely neglected in biodiversity and biogeography studies, despite their regional commonness and global distribution. This neglect is probably promoted by a bulky taxonomy, which requires intensive morphological and microanatomical analyses for the identification of these aplacophoran, worm-shaped molluscs to family level and beyond. During the KuramBio (Kuril-Kamchatka Biodiversity Study) cruise on board the R/V *Sonne* in 6456, the Kuril-Kamchatka trench and the adjacent abyssal plain were explored using standardised sampling gear. A camera-equipped epibenthic sledge retrieved 37 specimens of Solenogastres at 8 different stations from abyssal soft clay sediments (4830-5780 m). The neomeniomorph diversity within these samples proved species rich, with 14 preliminary identified morphospecies discovered via light microscopic investigations . However, many of those lineages were only represented by minute singletons, making the extraction of the character-mosaic needed for species delineation challenging. We developed an integrative taxonomic workflow, which allows us to maximize the information content retrieved from each singleton. We prepare the specimens for 360° examination by scanning electron microscopy (SEM) for detailed analyses of the scleritome. Based on the in-depth morphological re-investigations, we found additional characters to further delineate the material into 18 morphospecies. Subsequently, we examined the radulae and extracted DNA from the SEM-samples, to generate molecular barcodes of the ultrastructurally studied specimens. Some specimens were serially sectioned for histological investigations. The number of potentially new species found during our study by far exceeds the previously known neomeniomorph diversity from the Far Eastern seas of Russia. Additionally, we double the global number of Solenogastres species reported from abyssal depths, indicating that the abyss harbours a yet undetected diversity of Solenogastres. Furthermore, we hope that the integrative work-flow might serve as a basis to make neomeniomorph taxonomy more accessible in future studies on the biodiversity and biogeography of deep-sea regions.



A small snail with a difficult name, and implications for the heterobranch tree of life

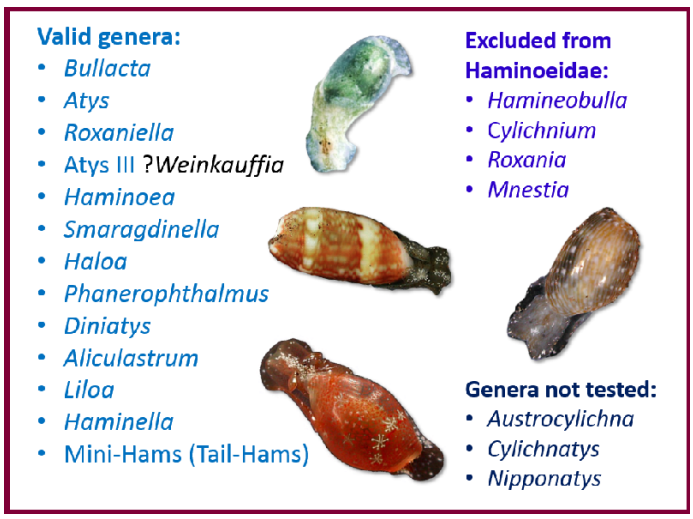
Bastian Brenzinger[1,2], Yasunori Kano[3], and Michael Schrödl[1,2]
[1]SNSB - Bavarian State Collection of Zoology, Munich, Germany
[2]Biocenter/Ludwig Maximilian University of Munich, Planegg-Martinsried, Germany
[3]Atmosphere and Ocean Research Institute, The University of Tokyo, Chiba, Japan
Email: bastian.brenzinger@arcor.de

Tjaernoeia exquisita (Jeffreys) is a millimeter-sized marine gastropod from the Eastern Atlantic with a golf-ball like ornamented shell and peculiar head anatomy. It has a complicated taxonomic history but is currently classified as i*ncertae sedis* among paraphyletic "lower" Heterobranchia, which link euthyneuran Gastropoda to Caenogastropoda. Except for images of the shell, a single radula, and sketches of external morphology, nothing is known about the anatomy of this enigmatic snail, and phylogenetic placement remains elusive. For the first time, we here present preliminary data from molecular sequences and on the soft body anatomy derived from 3D reconstruction based on histological serial sections. We highlight potential phylogenetic implications, and discuss these results in the light of current hypotheses for the heterobranch tree of life.



Broad sampling and molecular phylogenetics reveals rampant paraphyly in Haminoeidae (Heterobranchia)

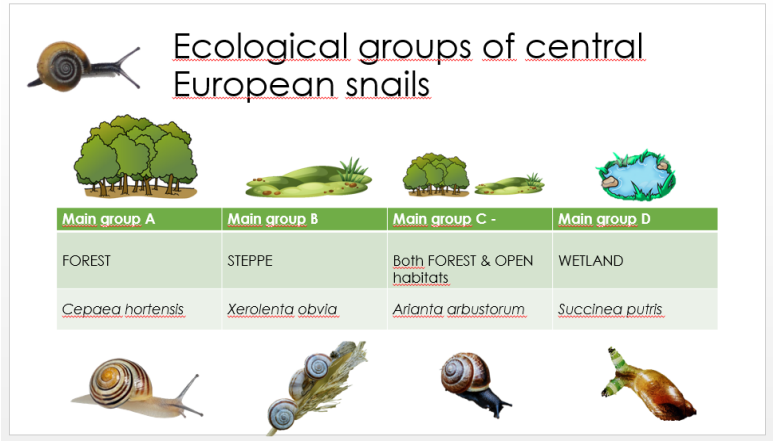
Trond Oskars[1], Chin Chin Too[2], David Rees[3], Paula Mikkelsen[4], Manuel Malaquias[1]
[1]Section of Taxonomy and Evolution, Department of Natural History, University Museum of Bergen, University of Bergen, Norway; Trond.Oskars@uib.no, Manuel.Malaquias@uib.no.
[2]Monash University Malaysia; cctoo1@student.monash.edu.
[3]Department of Biology, Faculty of Mathematics and Natural Sciences, University of Bergen, Norway; David.Rees@uib.no
[4]Paleontological Research Institution and Department of Ecology and Evolutionary Biology, Cornell University, Ithaca NY 14850
Email: pmm37@cornell.edu



The Haminoeidae is the most diverse family of the Cephalaspidea, with 42 nominal genera and 13 to 17 genera commonly recognized as valid but several of them remain of doubtful validity or uncertain systematic affiliation. In the past haminoid taxa were based mostly on shell morphology, leading to extensive taxonomic confusion due to intraspecific variation and interspecific similarity of the shells. This work is an extended follow up of that presented by Malaquias *et al.,* during the last World Congress of Malacology (Azores, 2013) and aims to test in a molecular Bayesian phylogenetic framework the monophyly of the family Haminoeidae and to define its generic composition and investigate the evolutionary relationships within the family. We have now extended the taxon set to 119 samples and have used five molecular markers (mitochondrial: COI, 16S rRNA; nuclear: 18S rRNA, 28S rRNA, Histone-3). The analysis rendered 13 groups of generic status and high levels of paraphyly were observed suggesting a need for a profound redefinition of most traditional genera. A new classification of the Haminoeidae is attempted.

Land snails along latitudinal gradient in Europe

Jana Buďová[1], Lucie Juřičková[2], Arnošt Šizling[3]
[1]Department of Ecology, Charles University, Prague, Czech Republic
[2]Department of Zoology, Charles University, Prague, Czech Republic
[3]Center for Theoretical Study, Prague, Czech Republic
Email: budova.jana@seznam.cz

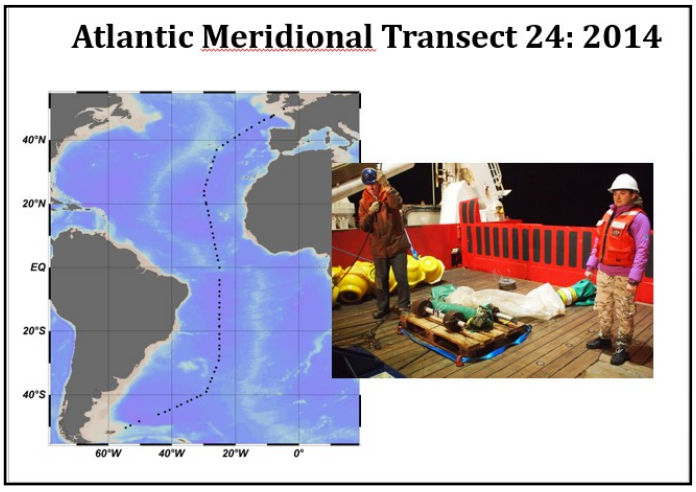


Latitudinal gradient of biodiversity is the oldest and one of the most studied ecological patterns on Earth. Decrease of diversity towards the poles was observed for many different taxonomic groups including mollusks. Our aim was not (only) to describe the changes of number of species along the gradient, but to identify and describe morphological changes on snail shells along the gradient and eventually discuss their adaptive role and importance for snail diversity and spatial distribution. Our data also provide an opportunity to test changes in the realized niche for a number of land snail species on a continental scale. We collected samples along a transect through Europe including Norway, Germany, France, Spain to Morocco in south. Every 50 km litter samples were collected and records made of abiotic factors of the environment and plant community composition we. All specimens of snail species were identified and included in our morphometric analyses. Morphometric analyses are still in progress and not available for all the localities. Our results are therefore still only preliminary.

Epipelagic distribution of planktic gastropods along a meridional transect in the Atlantic Ocean

Alice K. Burridge[1,2], Erica Goetze[3], Deborah Wall-Palmer[4], Serena Le Double[2], Jef Huisman[2] & Katja Peijnenburg[1,2]
[1]Naturalis Biodiversity Center, P.O. Box 9517, 2300 RA Leiden, The Netherlands
[2]Institute for Biodiversity and Ecosystem Dynamics (IBED), University of Amsterdam, P.O. Box 94248, 1090 GE Amsterdam, The Netherlands
[3]Department of Oceanography, University of Hawaii at Manoa, 1000 Pope Road, Honolulu, HI 96822, USA
[4]School of Geography, Earth and Environmental Sciences (Faculty of Science & Environment), Plymouth University, Drake Circus, Plymouth, Devon PL4 8AA, UK
Email: Alice.Burridge@naturalis.nl

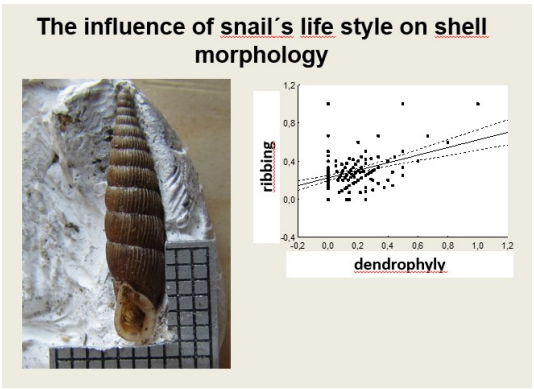
Shelled pteropods and heteropods are planktic gastropods that are involved in numerous pathways of organic carbon export and are potentially good indicators of the effects of ocean acidification. Gaining more insight in their current ecological preferences is important for predicting species-specific sensitivities to ocean changes. However, the diversity of planktic gastropods and their distribution patterns are still poorly known, especially for the Atlantic Ocean. Here, we quantitatively examined diversity and distribution patterns for euthecosomes, pseudothecosomes, gymnosomes and heteropods across a meridional transect in the Atlantic Ocean (AMT cruise 24). Planktic gastropods were collected at night from the upper ~300 m at 31 locations ranging from 46°N to 46°S. Firstly, we estimated species diversity (both species richness and evenness) and abundance across stations. Secondly, we derived inter-station similarities from cluster analysis and non-metric multidimensional scaling (nMDS) of the Bray-Curtis indices of species composition to examine consistency with Longhurst's biogeochemical provinces. The species richness of pteropods and heteropods was highest between ~30°N and ~30°S. Pteropod abundances were highest south of 40°S, while highest heteropod abundances were found between ~30°N and ~30°S. Especially among pteropods, we observed species with strong preferences for particular oceanographic provinces. Observed distribution patterns could be highly specialised, e.g. restricted to subtropical gyres or warm equatorial waters, or much broader, e.g. between ~35°N and ~35°S. The distinct species distributions of pteropods and heteropods, suggest that they will probably respond individually to ocean changes.



Influence of environment on morphological and structural characteristics of European snails

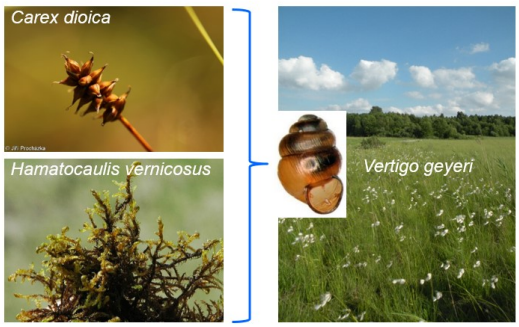
Anna Holuboá[1], Lucie Juřičková[1], Arnošt Šizling[2]
[1]Department of Zoology, Charles University in Prague, Faculty of Science, Prague, Czech Republic,
[2]Center for Theoretical Study, Charles University and the Academy of Sciences of the Czech Republic, Prague, Czech Republic
Email: holuboa@natur.cuni.cz

In this study, I explored the relationships among morphological characteristics of European land snail shells, their environment and life strategies. I assembled a database of morphological traits, characteristics of the environment and life strategies of land snails from the literature. This file was merged with unique dataset from field sampling along a latitudinal gradient through Europe and the morphological characteristics of each species were averaged on real populations from particular sites. This package was analyzed by multivariate linear regression (GLM). The colour pattern is significantly correlated with latitude and occurs mainly in gastropods with wider shells. Large shell width also appears mainly in shells with a smooth shell surface and shallower suture. Snails at lower altitudes mostly have calcified shell lips. Snail species with teeth in the mouth of shell, with ribs on the shell surface, and larger relative height of the shell, live mostly in areas with higher calcium content in the leaf litter. Deep sutures on the shell are more frequent in shells from sites with higher rainfall seasonality. Especially in areas with higher seasonal rainfall, we find fewer gastropods with periostracal structures on the shell; however, they are more frequent in areas with canopy forests. In the populations of long-lived gastropods, there are fewer species with teeth in shell, with a ribbed shell, and with periostracal structures on the shell surface. In communities of long lived snails, species of smaller relative height occur. On the other hand, tree and/or rock dwelling snails tend to have a large relative height, although higher abundance of flat-shelled snails were found among them. Tree snails also tend to have ribs on their shells; by contrast, ground dwelling snails tend to have smooth shells.



Diversity and ecology of European fen mollusc fauna: state of the art

Veronika Horsáková & Michal Horsák
Department of Botany and Zoology, Faculty of Science, Masaryk University, Brno, Czech Republic
Email: veronika.horsakova@seznam.cz



Fens are groundwater-fed wetlands covered with low-productive vegetation, harbouring a large number of rare and endangered habitat specialists with low competitive abilities. Therefore, fens are considered hot-spots of biological diversity with a high conservation importance. Since 2000 we have explored and sampled molluscan assemblages at ca. 500 fen sites across the continental Europe. We have realized that fen molluscan assemblages can be extremely diverse and support the occurrence of critically endangered habitat specialists and relicts prom the Late Glacial. In this contribution we address several questions, such as: Why are fens perfect model habitats to reveal new insights into biogeographical, ecological as well as evolutionary issues? What is the reason for unique fen molluscan diversity? What is the current distribution of relict land snail species across Europe? Why are all snail species living in fens so small? What are the main ecological gradients driving the species richness and composition of molluscan fauna in different European regions? How can we estimate the age and historical development of fen habitats? What are the advantages of complementary research of molluscs, vascular plants and bryophytes? Do we know something about the phylogeography and postglacial spreading of relict snail species? Why are fens and their biota so endangered? And maybe something more...wait for it!

Phylogeography of *Gibbula umbilicalis* (Gastropoda: Trochidae) in the Bay of Biscay

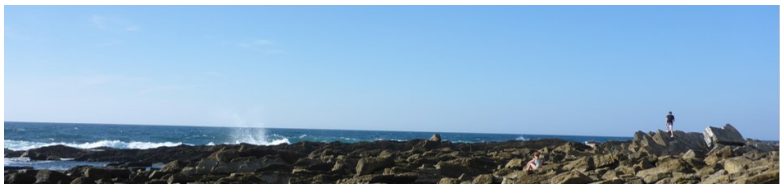
Edward Wort[1,2], Stephen Hawkins[1], Ellinor Michel[2], Marc Rius[1], Suzanne T. Williams[2] & Phillip Fenberg[1]
[1]Ocean and Earth Science, University of Southampton, Southampton, UK
[2]Department of Life Sciences, Natural History Museum, London, UK
Email: ew6g09@soton.ac.uk

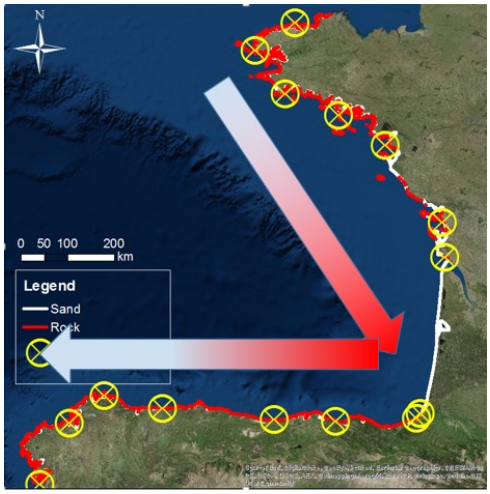
A key factor influencing geographic distribution and population connectivity of rocky intertidal species is habitat availability. Between the Gironde estuary and Biarritz, a distance of approximately 200km, there is no rock, with the exception of a few coastal defences and concrete blockhouses. Recent fieldwork found no *Gibbula umbilicalis* at these artificial rocky habitats, although it was present at all of the 18 naturally rocky habitats sampled from Vilagarcia on the north-west coast of

CONTINUED…..

...CONTINUED

Spain to Barfleur in northern France. The species range does however extend beyond these sampling sites from Scotland to Morocco. This raises the question of whether any factors, such as the habitat gap, limit genetic connectivity for *Gibbula umbilicalis*. This is particularly interesting as the larval duration is estimated at less than one day, the same as *Patella rustica*, which has never been found north of the habitat gap. The partial mitochondrial genome was sequenced at the Natural History Museum and sites with maximum variation between a Portuguese and UK specimen were selected to show as much intraspecific variation as possible. The diameter to height ratio was also used as an indicator of morphological differentiation.



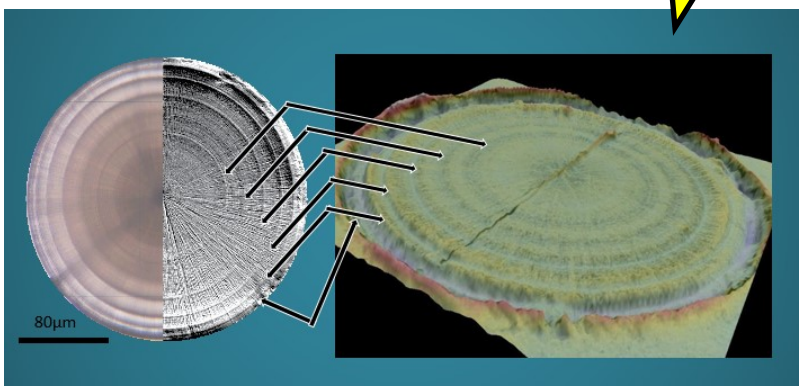


Developing tools to improve stock assessment for the common whelk, *Buccinum undatum*: validation of growth line formation in statolith microstructures

Phil Hollyman[1], Simon R. Chenery[2], David Righton[3], Melanie Leng[2], Chris Richardson[1]
[1]School of Ocean Sciences, College of Natural Sciences, Bangor University, Menai Bridge, Anglesey, LL59 5AB
[2]The British Geological Survey (BGS), Nicker Hill, Keyworth, Nottingham, NG12 5GG
[3]Centre for Environment, Fisheries and Aquaculture Science (CEFAS), Pakefield Road, Lowestoft, Suffolk, NR33 0HT
Email: osp20b@bangor.ac.uk

Award Winner

The UK fishery for the common whelk *Buccinum undatum* is one of the largest in Europe, with a value of £16.3million in 2014. The increase in overseas demand for whelks has driven an expansion of the fishery in recent decades, leading to several documented population declines. Stock assessment is problematic as length-based age and maturity assessments are ineffective, highlighting the need for a robust age determination method. The aim of this project is to validate the periodicity of growth rings present in the calcium carbonate statoliths located in the foot of the whelk. Analogous in function to the fish otolith, the statolith contains a high resolution archive of past growth. Using Secondary Ion Mass Spectrometry (SIMS) the annual trace element profiles in statoliths from 3 locations spanning the length of the UK (the Shetland Isles, the Menai Strait (North Wales) and Jersey) were reconstructed at a 2µm resolution. This highlighted clear cycles of 24Mg with minimum values that correspond to the visible statolith rings. This has been supported with the stable oxygen isotope analysis of the matching shells to reconstruct historical seawater temperature, giving a second reliable age for each animal. The results indicate that the visible statolith rings are a good indication of age containing clear annual trace element cycles, which match the number of reconstructed temperature cycles. This validation of statolith growth rings provides a new age determination technique, which could potentially lead to improved management of *B. undatum* f isheries through age-based analytical stock assessment.



President Suzanne Williams congratulates Philip Hollyman for winning the prize for the best oral presentation

The decline of the Shining Ramshorn snail, *Segmentina nitida*

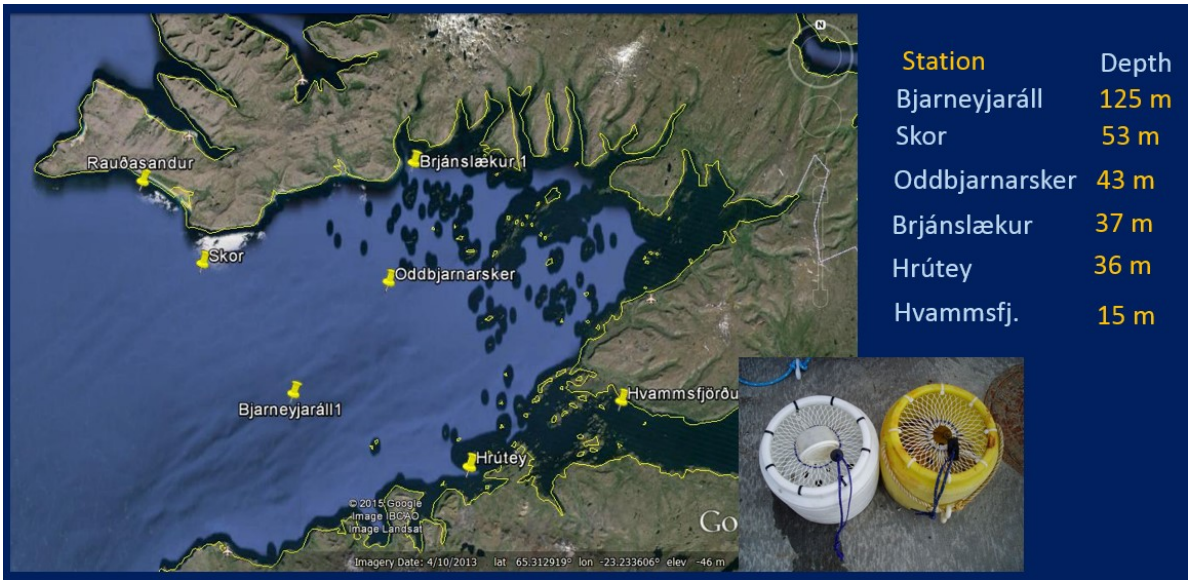
Christopher Hobbs, Chris Harvey, & Phil Buckley
School of Human and Life Sciences, Canterbury Christ Church University, ct1 3jz Kent, UK
Email: chris.hobbs@canterbury.ac.uk

The Shining Ramshorn Snail, *Segmentina nitida*, a small rare freshwater snail found predominantly in drainage ditches and marshland, has seen a marked decrease in population size (~80%) over the last 50 years in the UK. This has been attributed mainly to the over-dredging of drainage ditches as part of land management, as well as eutrophication caused by run-off of fertiliser from agricultural land. Despite this decline in the species, there is very little protection for this species outside of nature reserves, as it is no longer on the IUCN Red Data Book for Invertebrates since the change of guidelines in 1994. This paper will present recent data (2015), with comparisons with data from previous surveys in 1996, 1999, 2005, and 2011 to document the decline of this species over the last 20 years and give an accurate current distribution and abundance of the species to update its protection status. Using historical datasets and GIS mapping, it will be shown how the range and abundance of *S. nitida* has changed in the Kent area since 1997. This project also aims to assess the optimal breeding conditions, development and growth, and the population genetics of this endangered species. With of these aspects combined, this project will help to update the conservation status of *S. nitida* in the UK and provide valuable information on its ecology.

Shell phenotype classification of the common whelk (*Buccinum undatum* L.) in Breiðafjörður

Hildur Magnúsdóttir[1,2], Snæbjörn Pálsson[1], Kristen Marie Westfall[1,3], Zophonías Jónsson[1] and Erla Björk Örnólfsdóttir[2]
[1]Faculty of Life and Environmental Sciences, University of Iceland, Reykjavík, Iceland
[2]Department of Aquaculture and Fish Biology, Hólar University College, Hólar, Iceland
[3]Vör – Marine Research Center at Breiðafjörður, Ólafsvík, Iceland
Email: him5@hi.is

Throughout the centuries the subtidal gastropod *Buccinum undatum*, or common whelk has served both as a subject of interest for the naturalist and as a source of food and bait. The common whelk is found on both sides of the N-Atlantic Ocean and is an important predator and scavenger in many subtidal communities. Described by Carl Linnaeus in 1758, it was early on known for its variability in shell morphology and several morphotypes have been described. Recent years have seen several life history and population genetic studies of the common whelk in different countries and in Iceland extensive studies have been done in this field in Breiðafjörður. The main results from Breiðafjörður are that whelks from different areas within the bay are genetically differentiated over distances as short as 13 km and life history traits such as growth rate, age distribution, size at sexual maturity, vary between areas. However, these new studies lack a description and analysis of the whelk's striking variation in shell morphology. In the present paper, several methods are combined to form a comprehensive classification system of shell phenotypes for the common whelk in Breiðafjörður; traditional morphometrics, geometric morphometrics and shell colour analysis.



DNA traps in the pond snail *Lymnaea stagnalis*: searching for a novel defence response against pathogens

Vladimír Skála[1], Anthony J. Walker[2] and Petr Horák[1]
[1]Department of Parasitology, Charles University in Prague, Prague, CZ
[2]School of Life Sciences, Kingston University, Kingston upon Thames, UK
Email: mich007@email.cz

More than a decade ago, it was discovered that activated mammalian neutrophils form an extracellular meshwork of chromatin and granule proteins to trap and kill pathogens such as bacteria. Further observations revealed that these neutrophil extracellular traps (NETs) occur in other vertebrates, and that they can also trap or kill eukaryotic uni/multicellular parasites. Although considerable effort has been made in identifying similar structures in invertebrates, knowledge concerning molluscs remains poor. Formation of extracellular trap-like fibers (ET-like fibers) was described in two bivalves, *Mytilus edulis* and *Crassostrea gigas*. Our study aims to investigate production of ET-like fibers in the snail *Lymnaea stagnalis* and elucidate their importance in defence against various snail pathogens (e.g. bacteria and/or trematode parasites). Isolated snail defence cells (haemocytes) were first stimulated with a range of compounds (e.g. phorbol 12-myristate 13-acetate, lipopolysaccharide (LPS), peptidoglycan) for various durations (2-48h) and stained with Sytox green to visualise nucleic acids. Surprisingly, from approximately 5 x 105 haemocytes, only a few fibers protruding from cell nuclei or a few diffuse nuclei were observed with LPS being the most potent stimulant. Moreover, *E. coli* did not evoke these effects. These findings favour our hypothesis that because *L. stagnalis* haemocytes are actively phagocytic cells which produce oxygen/nitrogen compounds, they might not rely heavily on ET-like fibre define mechanisms. Currently, production of ET-like fibers is being studied in *L. stagnalis* experimentally infected with the bird schistosome *Trichobilharzia regenti*, an incompatible trematode that does not survive and develop in the snail. Collectively, the results described above represent characterization of a novel cellular defence mechanism in snails that is considered to be evolutionarily conserved in different animal taxa.

Greenhouse gastropods of the Hortus Botanicus of Leiden: check-list, distribution and comparison with previous collections

Luca Da Sois[1], Mattia Trivellato[1], Menno Schilthuizen[2] and Paul J. A. Kessler[3]
[1]Department of Biology, University of Padua, Padua, IT
[2]Naturalis Biodiversity Center, Leiden, NL
[3]Universiteit Leiden, Hortus botanicus Leiden, Leiden, NL
Email: luca.dasois@studenti.unipd.it

The research of the Hortus botanicus Leiden focuses on South-East Asian plant taxa, and especially collections of Orchids from wild origin are world renown. The garden tries to keep its collection as "natural" as possible, by, e.g., avoiding pesticides. During the last years plant exchange with other botanical gardens has been very much intensified. This provides good conditions for accidental introductions of gastropods into the greenhouses. During a two months study. using a range of different capture techniques, 51 species were collected, of which 22 were aquatic and 29 terrestrial Both typical and rare, endemic and alien greenhouse species are present in the tropical houses of the Hortus. The study of the distribution of the species and the analysis of their presence in the past (using data from the collection of Naturalis Biodiversity Center) provided useful information on gastropod habitats. In the Greenhouse hosting South-East Asian orchids, there were seven species of which three Charopidae were not identifiable. More data are needed on the identification of these species. The study was made in one half of the greenhouses of the Hortus so it is necessary to expand the study to get a realistic image of the gastropods. This research is useful in order to make comparisons of the malacofauna present in different greenhouses and also represents an opportunity for the visitors to learn more about these often overlooked animals.

Shell evolution of *Georissa* (Gastropoda: Hydrocenidae) from Malaysian Borneo

Mohd Zacaery Khalik[1,2,3] and Menno Schilthuizen[1,2]
[1]Naturalis Biodiversity Center, Darwinweg 2, 2333 CR Leiden, The Netherlands
[2]Institute of Biology Leiden, Faculty of Science, Universiteit Leiden, 2333 BE Leiden, The Netherlands
[3]Department of Zoology, Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia
Email: zacaery12@gmail.com

Gastropod shell characters are ideally suited to understand character evolution and evolutionary diversification. In this study I am proposing to explore the shell character evolution of minute land snails from the genus *Georissa* (Family: Hydrocenidae). This poorly-known genus occurs throughout Southeast Asia, and is particularly rich in shell-shape diversity in Borneo. The animals are known to occupy limestone hills, although they also occur, at lower density, on other rocky substrates. Extensive morphometric study is proposed by using micro-computed tomography on a µCT-scanner and the application of recently-developed models for quantifying shell shape. This research will be carried out to give insights in the character evolution and diversification, long-term patterns and dynamics of adaptation, and conservation of these minute land snails.

Angel of the Sea - 3D reconstruction and microanatomy of *Clione limacina* (Phipps 1774)

Christina Laibl[1,2], Theresa Kuhl[1,2], Peter Kohnert[1,2] and Dr. Michael Schrödl[1,2]
[1]SNSB Bavarian State Collection, Münchhausenstraße 21, D-81247 Munich, Germany
[2]Department Biology II,Ludwig-Maximilians Universität, Großhadernerstraße 2 82152, Planegg-Martinsried, Germany
Email: c.laibl@campus.lmu.de

The Pteropoda are a holopelagic group of marine gastropods. They are divided into shelled Thecosomata and shell-less Gymnosomata. Gymnosomes are highly specialised for a carnivorous lifestyle with modifications particularly for hunting and ingestion of thecosome prey. Within the Gymnosomata, *Clione limacina* (Phipps 1774) fullfills an important role within marine food webs as a predator of the thecosome species *Limacina helicina* (Phipps 1774). *C. limacina* also serves as a model organism in physiology and neuroscience. Despite their well-examined physiology and neuroanatomy, there is a lack of current information about morphology and taxonomic relationships within the Gymnosomata. Only a few efforts have been made to explore gymnosome microanatomy. In the present study, the general morphology and all major organ systems are reconstructed three-dimensionally, and therefore present the first full anatomical investigation focusing on a specimen of *C. limacina* from western Greenland. The results basically confirmed and enhanced former descriptions. The digestive system shows buccal cones, hook sacs, and a short intestine as adaptations to the carnivore lifestyle. *C. limacina* lacks the gastropod digestive gland, and has a modified stomach with a digestive epithelium instead. The ganglia of the nervous system are not strongly fused. In particular, the buccal ganglia have long connectives to provide good flexibility upon capturing their prey. Remarkably, there was a highly developed copulatory apparatus in the otherwise not fully mature hermaphrodite reproductive system. In absence of a shell, gymnosomes may need alternative defensive mechanisms. Herein, several epithelial glands with putative defensive characteristics were discovered. In addition to the accomplished morphological analysis of the gymnosome pteropod *C. limacina*, molecular data is being generated for an integrative taxonomical approach and towards reconstructing the evolution of putatively specific prey and predator relationships among pteropods.

Using DNA to differentiate and identify dubious species within the freshwater mussel *Dreissena* genus in Greater London waters

Asif Laldin[1], Ruth Kirk[1], Stephen Mowat[2], Scott Lawton[1]
[1]Molecular Parasitology Laboratory, School of Life Sciences, Chemistry and Pharmacy, Kingston University London
[2]Zoological Society of London, London
Email: K1462298@kingston.ac.uk

Dreissena polymorpha (Pallas) and *Dreissena bugensis* (Andrusov) are two species of invasive bivalves native to the Ponto-Caspian region. They are regarded as some of the most dangerous invasive species in terms of risk of arrival, establishment and detrimental ecological effects. The extent of species invasion is largely unprecedented with all continents except Antarctica affected. *Dreissena polymorpha* was first recorded in the UK in 1824 while *D.bugensis* was first recognised in 2014. Since their arrival, the species have placed an immense strain on freshwater ecosystems resulting in significant economic and ecological damage. Species assignment and identification has been a contentious matter with many conflicting reports. Over the last 25 years, more focus has been placed on molecular methods of identification as opposed to outdated methods relying heavily on morphological characteristics. Despite extensive work on populations in mainland Europe and North America, there are no detailed studies on the molecular identification or variation of *Dreissena* in the UK. Molecular data generated from several sites across London have indicated that morphological identification of these organisms is largely inaccurate By using a combination of markers including the mitochondrial cox1 and the nuclear ribosomal internal transcribed region, it has been possible to accurately identify *D. polymorpha* as well as *D. bugensis* existing in close sympatric populations. This approach has not only allowed improved resolution in mussel identification but has also identified the first putative hybrids between *D. polymorpha* as well as *D. bugensis*, further complicating their taxonomy.

Phylogenetic assessment of *Cyclophorus* spp. (Caenogastropoda: Cyclophoridae) from Vietnam

Katharina von Oheimb, Parm Viktor von Oheimb, Jonathan Ablett & Fred Naggs
Life Sciences Department, The Natural History Museum, London, United Kingdom
Email: katharina.von.oheimb@gmx.de

The limestone karst forests of Vietnam harbour an extraordinarily rich biodiversity of terrestrial gastropods. Species of the operculate land snail genus *Cyclophorus* are among the most prominent taxa in these habitats. *Cyclophorus* spp. are characterised by large shells with conspicuous colour patterns. The phylogenetic relationships of the Vietnamese *Cyclophorus* species and the evolutionary processes that have shaped their diversity, however, are still unknown. Given this background, we studied the phylogeny of *Cyclophorus* spp. from Vietnam based on mitochondrial DNA sequence data. Recently published sequences of South East and East Asian *Cyclophorus* were included in our dataset. The phylogenetic analysis revealed different lineages of the genus being present in Vietnam. We detected relatively close relationships of Vietnamese taxa to species from East Asia but also from peninsular Malaysia (*Cyclophorus perdix tuba*). This ongoing project aims to further unravel the phylogenetic relationships of Vietnamese *Cyclophorus* species and to evaluate the role of limestone karsts in shaping their diversity and distribution.

Yoldia eightsi a recorder of climatological Antarctic coastal recorder

Alejandro Roman-Gonzalez[1,2], Ian Hall[1], Caroline Lear[1], James Scourse[2], Paul Butler[2], Lloyd Peck[3], Martin Ziegler[4]
[1]School of Earth and Ocean Sciences, Cardiff University, Cardiff, UK
[2]School of Ocean Sciences, Bangor University, Anglesey, UK
[3]British Antarctic Survey, Cambridge, UK
[4]Department of Earth Sciences, Utrecht University, Utrecht, Netherlands
Email: Roman-GonzalezA@cardiff.ac.uk /
osse1c@bangor.ac.uk

The use of the growth record present in the carbonate structures of marine organisms is known as sclerochronology. The Antarctic bivalve nuculanid *Yoldia eightsi* (Courthouy 1839) has the potential to provide valuable scleroclimatological information for the past few decades for coastal environments. *Y. eightsi* has a widespread distribution, a relatively extended lifespan (up to 60yr) and synchronous population growth, qualities which are crucial for the development of scleroclimatological proxies. A pilot study showed a negative correlation between shell growth and duration of fast ice ($r = -0.44$, $d.f.=24$, $P \leq 0.01$) and a positive correlation between shell growth and winter sea surface temperatures ($r=0.43$, $d.f.= 24$, $P \leq 0.05$) for specimens collected from Signy Island, South Orkney Islands. The recent construction of three new chronologies from Rothera station, Adelaide Island, West Antarctic Peninsula, will allow the development of new regional scleroclimatological proxies for the region, which is experiencing the most rapid warming in the southern hemisphere. Furthermore, multisite comparison within sampling locations around Rothera station provide an insight into the complex local oceanography of Ryders Bay. In addition, a study into *Y. eightsi* ontogeny shows an 11.5 yr endogenous growth rhythm, independent of environmental conditions, that may be related to reallocation of energetic resources during gametogenesis. Understanding the different ontogenetic growth patterns is not only important for its biological / ecological value but also because it strengthens climatological interpretations derived from sclerochronological proxies.

The implication of taxonomic opinion over Cainozoic to Recent gastropods diversification pattern. The example of the frog snails (Tonnoidea: Bursidae)

Malcolm T. Sanders[1,2] , Nicolas Puillandre[2], Michel Laurin[1], Didier Merle[1]
[1]Centre de recherche sur la paléobiodiversité et les paléoenvironnements CR2P – UMR 7207 – CNRS, MNHN, UPMC, Muséum national d'Histoire naturelle, Sorbonne Université, 8 rue Buffon, 75005 Paris, France
[2]Institut de Systématique, Evolution, Biodiversité ISYEB – UMR7205 – CNRS, MNHN, UPMC, EPHE, Muséum National d'Histoire Naturelle, Sorbonne Universités, 43 Rue Cuvier, F-75231 Paris, France
Email : msanders@edu.mnhn.fr

The effects of variation in taxonomic opinion between "splitters" and "lumpers" have been debated intensely, both in conservation biology and in macroecology. However, the impact on diversification analyses has received little attention and has largely been ignored by many users of macro-evolutionary models, especially concerning fossils. Bursidae happen to be a good example because they are a relatively small family, representing probably less than a hundred species (fossils included). They are known from the late Palaeocene to the recent and their palaeontological record is considered to be rather good due to their large size and mainly nearshore habitat. Furthermore, being known from pre-Linnaean times and their complex ornamentation led to a great disparity of taxonomic opinions regarding relationships within the family. Indeed there is a clear "lumping" tendency for fossil species in opposition to the "splitting" of extant ones. In this studies we show the sheer variation of bursid diversity considering maximal lumping (~70 species) and maximal splitting models (~160 species) through time. We also discuss which models best fit geological events and if it is consistent with Cainozoic diversification patterns. The implications of these results, in particular in diversification analyses, are also discussed.

Shelled heteropods – overlooked in ocean acidification research

Deborah Wall-Palmer[1], Alice Burridge[2,3], Katja Peijnenburg[2,3], Richard Kirby[4], Malcolm Hart[1] and Christopher Smart[1]
[1]School of Geography, Earth and Environmental Sciences, Plymouth University, Drake Circus, Plymouth, PL4 8AA, UK.
[2]Naturalis Biodiversity Center, Darwinweg 2, 2333 CR Leiden, The Netherlands.
[3]Institute for Biodiversity and Ecosystem Dynamics (IBED), University of Amsterdam, P. O. Box 94248, 1090 GE Amsterdam, The Netherlands.
[4]Marine Biological Association, Citadel Hill, Plymouth, PL1 2PB
Email: deborah.wall-palmer@plymouth.ac.uk

Current research has highlighted the shelled (thecosome) pteropods as under threat from ocean acidification. Thecosome pteropods are microscopic, planktonic gastropods that produce thin shells of aragonite, a form of calcium carbonate that is susceptible to dissolution at low carbonate saturation levels. The surface ocean habitat of thecosomes is also the region that will be first, and most, affected by anthropogenic lowering of the carbonate saturation. Consequently, thecosome pteropods are useful indicators of changes at the ocean surface and have become the focus of much recent ocean acidification research. Another group of calcareous gastropods, likely to be equally vulnerable, for which no ocean acidification research has been carried, out are the shelled heteropods, or *Atlantidae*. Atlantids are not closely related to the thecosome pteropods, however, they are also microscopic, planktonic, aragonite-shelled and living at the surface of the ocean. Atlantids are selective, visual predators, which suggests that they are an important part of the zooplankton. However, we still know little about other aspects of their ecology and research is needed to understand this potentially threatened group. Here we present new findings on atlantid biogeography and abundance in the Atlantic Ocean, which can help us to understand the environmental requirements of atlantids and to gain insight into their position in the ocean food web. While atlantids are not as abundant as thecosomes in the Atlantic Ocean, they are likely to be just as important to the ecosystem. Considering these factors, we propose that atlantids should be included in future ocean acidification research. As predators (unlike the thecosomes), atlantids may respond differently, revealing a different perspective on the effects of ocean acidification.

Ecological basis of reproductive isolation in divergent ecotypes of *Littorina saxatilis* in the UK

Sophie Webster[1], John Grahame[2], and Roger Butlin[1]
[1]Department of Animal and Plant Sciences, University of Sheffield, Sheffield, UK
[2]Faculty of Biological Sciences, University of Leeds, Leeds, UK
Email: Sophie.webster86@gmail.com

The intertidal gastropod *Littorina saxatilis* has emerged as a model system for studying ecological speciation. Pairs of locally adapted, phenotypically divergent ecotypes can be found on multiple shores, yet they are not reproductively isolated and gene flow still occurs. Although there are a number of comparative genomic studies on the *L. saxatilis* ecotypes in the UK, there are few empirical studies on the ecological basis of reproductive isolation (RI). Distinguishing the relative contribution of these ecological barriers to gene flow is crucial to understanding how divergence with gene flow is maintained in natural populations. Therefore, reciprocal transplants were performed between divergent ecotypes in two study sites, Thornwick Bay in East Yorkshire, and Dunbar in East Lothian. Habitat preference, immigrant inviability, parasite-mediated RI, differential fecundity and intrinsic prezygotic isolation in each ecotype were measured. Results of these transplants suggest that primary forms of RI vary between populations. Habitat preference behaviours were shown to be a more important contributor to RI in Thornwick Bay, but immigrant inviability was found to be a more important barrier to gene flow in Dunbar. In addition, a number of reproductive barriers were found to be common to both sites, such as parasite-mediated RI and intrinsic prezygotic isolation. Overall, a number of mechanisms are contributing factors towards RI in *L. saxatilis* in the UK. The evidence suggests a number of processes are providing partial reproductive barriers, thus acting to reinforce reproductive isolation between the ecotypes. It has also revealed that similar patterns of phenotypic divergence can result from different underlying ecological processes.

Presidetn Suzanne Willkiams preparing to give the award for the best oral presentation

Book Review

A Systematic Revision of the land snails of the Western Ghats of India. Dinarzarde C. Raheem, Harold Taylor, Jonathan Ablett, Richard C. Preece, Neelavara Ananthram Aravind and Fred Naggs. Tropical Natural History, Supplement 4, November 2014. 294pp.

The Western Ghats of India contain a rich, largely endemic, terrestrial mollusc fauna, and the region is widely recognised as a major biodiversity hotspot whose biota is under severe threat. As broadly defined by Bawa *et al.* (2007), it runs some 1500 km from the southern tip of the Indian peninsula, along its western side as far north as the boundary between the states of Gujarat and Maharashtra. It is a predominantly mountainous region, which stretches inland some 100 km throughout most of its length but towards the south may extend eastwards over 300 km. Bawa *et al.* excluded the narrow western coastal plain, but for the purposes of the present study this has been included.

Our knowledge of the terrestrial mollusc fauna of India in general, and the Western Ghats in particular, is based principally on studies carried out in the 19th and early 20th centuries, culminating in the publication of three volumes of *The Fauna of British India* (Blanford & Godwin-Austen, 1908; Gude, 1914 & 1921). However, this and earlier literature fails to provide an adequate means of species identification today, being based on out-of-date taxonomy, often lacking adequate descriptions, and in most cases wanting suitable illustrations.

The stated aims of the authors of this book are to provide a taxonomically updated, fully illustrated list of the land-snail species described to date from the Western Ghats, and to attempt to critically evaluate and clarify their nomenclature and taxonomy, as well as to provide some details of their geographical distribution. In these various objectives they succeed magnificently.

There is a comprehensive introduction which sets the historical scene, and covers the region's geography in great detail. The bulk of the book is devoted to a systematic treatment of the taxa. The taxonomy used is as up-to-date as is possible given our current state of knowledge. A total of 299 species (as well as a further 38 so-called 'varieties') are recognised as actually or, in a small number of cases, potentially occurring in the region. Some 70% of these are endemic to the region. Each taxon is treated uniformly. There is a short synonymy listing the original description and referencing *The Fauna of British India.* This is followed by an account of the known distribution, the original locality information, and details of the type and other material together with any necessary discussion, frequently including a lectotype or, more rarely, a neotype designation. This systematic text is accompanied by a series of illustrations; in the vast majority of cases finally these comprise photographs of four views of the shell of the type specimen. In the rare cases where there is no type material to photograph, illustrations from the early literature or photographs of non-type specimens have been reproduced.

It is wonderful to have all this information readily to hand in a single, extremely well-written and excellently produced publication. The photographs are uniformly of superb quality and will provide an invaluable aid to identification. Importantly, the book will be made openly available online, as well as in the form of an interactive database accessible at: http://www.westernghatsnails.

It is the authors' hope that this book will provide a much-needed stimulus to future research and conservation efforts in this biologically important area; I am confident that this will be the case, and they are to be congratulated on an outstanding achievement.

References

Bawa, K.S., Das, A., Krishnaswamy, J., Karanth, K.U., Kumar, N.S. and Rao, M. 2007. *Ecosystem Pro*fi*le (Western Ghats & Sri Lanka Biodiversity Hotspot) – Western Ghats Region*. A report prepared by the Critical Ecosystems Partnership Fund, *F*inal version, May 2007.

Blanford, W.T. and Godwin-Austen, H.H. 1908. *The Fauna of British India including Ceylon and Burma, Mollusca. Testacellidae and Zonitidae*. Taylor and Francis, London.

Gude, G.K, 1914. *The Fauna of British India including Ceylon and Burma, Mollusca-II. Trochomorphidae-Janellidae.* Taylor and Francis, London.

Gude, G.K, 1921. *The Fauna of British India including Ceylon and Burma, Mollusca-III. Land Opercullates.* Taylor and Francis, London.

Dr Peter Morden

TRAVEL GRANT REPORT

Attending CIAC 2015 on a Travel Award given by the Malacological Society of London

Rita Franco-Santos
Alfred Wegener Institute for Polar and Marine Research, Bremerhaven, Germany
Email: ritinhamf@hotmail.com

Cephalopod researchers gather on a triannual basis for the Cephalopod International Advisory Council (CIAC) conference (www.ciac2015.com). The latest one was held on November 2015, when over 240 researchers from 30 countries met in Hakodate, Japan. This was an expensive destination, and so I began looking for financial aid. I was fortunate enough to be granted a Malacological Society of London Travel Award, which contributed to my attendance of the event.

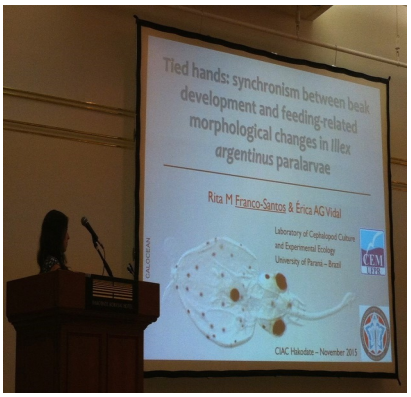
Conference logo

.

During the first two days I participated in the workshop "Artificial fertilization and squid handling". Although there were talks on current aquaculture-related research, it was mostly a hands-on experience. It was quite exciting to learn the techniques needed to artificially obtain squid paralarvae, and to watch the embryos develop during the course of the conference. This acquired skill will hopefully facilitate future studies I have in mind.

The remaining days were teeming with interesting talks and posters on diverse areas, such as behavior, genetics, life history, climate change, and culture and welfare. I gave a presentation on the feeding ecology of *Illex argentinus* paralarvae, and presented a poster on stress conditions in *Octopus vulgaris* paralarvae culture, and another on the "Young Cephalopod Researchers" group, an initiative to engage young scientists in communication and collaboration.

During CIAC I was able to meet and talk to many old and brand-new friends. These conversations are inspiring to a young scientist, and foster creativity and the emergence of scientific ideas and curiosity, which will hopefully make me a better and more productive scientist. I was also able to establish new connections, which could result in more collaborative science and the advancement of our research fields.



The presentation which contributed to my being granted a Travel Award from the Malacological Society of London.

CIAC conference participants.

TRAVEL GRANT REPORT

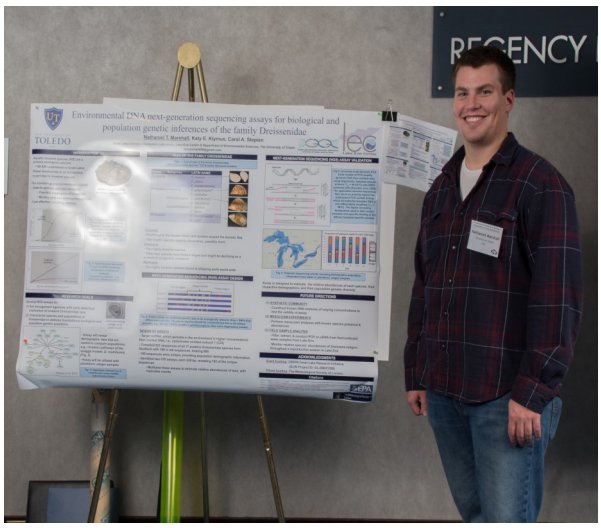
2nd International Meeting on Biology and Conservation of Freshwater Bivalves

Nathaniel Marshall[1] & Daniel Symonds[2]
[1]Great Lakes Genetics/Genomics Laboratory, Lake Erie Center & Department of Environmental Sciences, University of Toledo, Toledo, Ohio, USA
Email: ntmarshall406@gmail.com
[2.] Stream and River Ecology Lab, Ohio State University, Columbus, Ohio, USA
Email: symonds.13@osu.edu

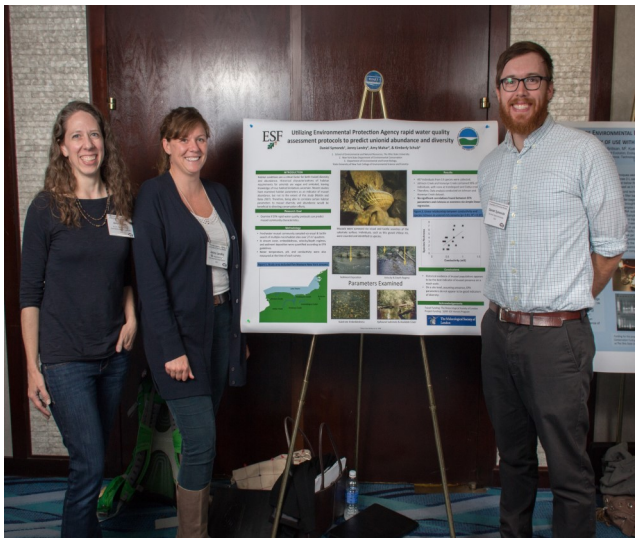
The 2nd International Meeting on Biology and Conservation of Freshwater Bivalves October 4-8, 2015 provided an ideal opportunity for us to present some of our previous research as well as current work in which we have undertaken as new PhD students. Being in close proximity to Buffalo, New York allowed for easy access to attend this conference, but funding obtained through the Malacological Society of London made it possible, as we both have recently moved to new universities and have little outside funding at the moment. We met as Masters students at the University of Texas at Tyler, from which we presented the poster titled "*Can ecological niche models predict potential fish hosts*? *A case study with East Texas threatened unionids."* Individual posters based on Marshall's PhD project and Symonds' undergraduate thesis were also presented.

The conference was a unique opportunity to network with international malacologists, whose work we've read but never met in person. With 57 oral talks and 23 poster presentations, over a variety of topics bivalve related, much knowledge was exchanged. The oral presentation from invited speaker Dr. Caryn Vaughn set the tone for the meeting, discussing the ecosystem services of freshwater bivalves, reaffirming the importance of these organisms and the scientists exploring their biology. A slew of international speakers provided insight into problems not necessarily experienced in the United States, many revolving around the 'prima-donna' species, *Unio crassus*. This is where the benefit of this meeting was really shown, as novel approaches to global problems were discussed in depth. We offer special thanks to Dr. Knut Mehler and the organizing committee for the excellent lunch spreads.

Marshall took this opportunity to meet in person with Dr. David Strayer, who will be a part of his PhD committee, organising logistics for a summer of study at the Cary Institute, where Dr. Strayer is a freshwater ecologist. Symonds took this opportunity to reunite with his former employers at the New York State Department of Environmental Conservation (NYSDEC), where he began as a young malacologist intern five years prior. We also made plans to begin the analysis of the large-scale dataset the NYSDEC is amassing through their statewide inventory project. We again would like to thank The Malacological Society of London for funding our travel, through two separate awards, to attend this meeting. By pooling our awards we were able to fully fund this trip; without it we most likely would not have been able to attend.



Nathaniel Marshall



Daniel Symonds

RESEARCH GRANT REPORT

Diet and Cone Snail venom evolution

Mark A Phuong

Department of Ecology and Evolutionary Biology, University of California, Los Angeles, CA, 90095, USA
Email: markphuong@gmail.com]

Introduction

Although diet is believed to be a major factor underlying the evolution of venom, few comparative studies examine both venom composition and diet across a radiation of venomous species. Here, we examined the influence of diet on venom evolution in cone snails (Family: Conidae), a hyper diverse group of over 700 predatory marine snails that typically prey on either worms, molluscs, or fish using a cocktail of venomous neuropeptides (known as conotoxins or conopeptides). Each species' venom repertoire is estimated to contain 50-200 peptides that are typically short in length (~10-30 amino acids long) and target ion channels and neuroreceptors of their prey. Conotoxins are classified into more than 30 gene superfamilies (e.g., A superfamily, M superfamily, etc.) usually based on the similarity of the signal sequence, a region containing roughly 20 hydrophobic amino acids at the beginning of conotoxin precursor peptides.

Here, we use comparative phylogenetic methods to analyse ecological data from past studies in conjunction with venom duct transcriptomes to test two major hypotheses that attempt to explain venom composition patterns in cone snails: (1) traditional prey taxonomic categories (e.g., worms, molluscs, fish) should predict gene superfamily expression and (2) that dietary breadth is positively correlated with conotoxin complexity. Although conotoxin gene superfamilies generally do not provide predictive information on peptide function, past studies contend that the broad taxonomic categories of major prey types should determine which gene superfamilies are critical venom components for prey capture. For example, the A-superfamily was suggested to not be important for vermivorous (worm-eating) species because it was not detected in the venom duct transcriptome of *Conus miles*, a vermivore. Although few broad comparative studies exist that examine variation in venom composition patterns across cone snail taxa, prey taxonomic class remains the dominant framework by which the evolution of cone snail venom is studied and forms the basis for categorisation of conotoxins on ConoServer, a molecular database of known conotoxins. In terms of dietary breadth, much of the support for a relationship between conotoxin complexity and diet diversity comes from species with diets atypical of cone snails (e.g. highly specialized or extremely broad). Thus, like in other venomous systems, a formal test of this hypothesis has not yet been carried out.

Results

To examine the relationship between venom composition and diet in cone snails, we extracted the mRNA from 12 phylogenetically disparate cone snail species, including 10 vermivores (worm-eating), one molluscivore, and one generalist. We synthesized RNAseq libraries and multiplexed all individuals on a single Illumina HiSeq 2000 lane.

To account for phylogenetic non-independence in analyses between diet and venom composition patterns, we inferred a maximum likelihood phylogeny in RAxML using 821 putatively orthologous loci and generated a time tree using the program r8s with two fossil calibrations from previous studies. The phylogeny was highly resolved with all but two nodes having 100% bootstrap support (Figure 1).

We found strong support for a highly significant, positive relationship between venom composition complexity and dietary breadth across cone snails (Figure 2), suggesting that diverse venoms are required to subdue diverse prey. Although rarely invoked in venom studies, this relationship corroborates patterns predicted by Van Valen's niche variation hypothesis (1965), which posits that individuals or populations with wider niches should display greater phenotypic variance. Overall, our results corroborate the key role of diet in influencing patterns of adaptive venom evolution in cone snails.

We discovered 2223 unique conotoxin precursor peptides that encoded 1864 unique mature toxins across all species, >90% of which are new to this study. In addition, we identified two novel gene superfamilies and 16 novel cysteine frameworks. Each species exhibited unique venom profiles, with venom composition and expression patterns among species dominated by a restricted set of gene superfamilies and mature toxins (Figure 1).

We measured venom composition overlap using the similarity statistic Schoener's D and performed an analysis of variance (ANOVA) to determine whether the distribution of conotoxin overlap values differed depending on whether or not the pairwise species comparison consisted of (a) a generalist and a vermivore, (b) a molluscivore and a vermivore, or (c) two vermivores. Our results showed no difference in the distribution of D values among species that do or do not share the same diet.

To test the relationship between dietary breadth and venom complexity, we retrieved Shannon diversity index values (H′) representing prey diversity consumed by the cone snails in this study from the literature. Using a phylogenetic generalised least-squares (PGLS) analysis, we found a significant positive relationship between H′ and the number of mature toxins (PGLS, $\lambda = 1$, $P < 0.001$).

CONTINUED ->>

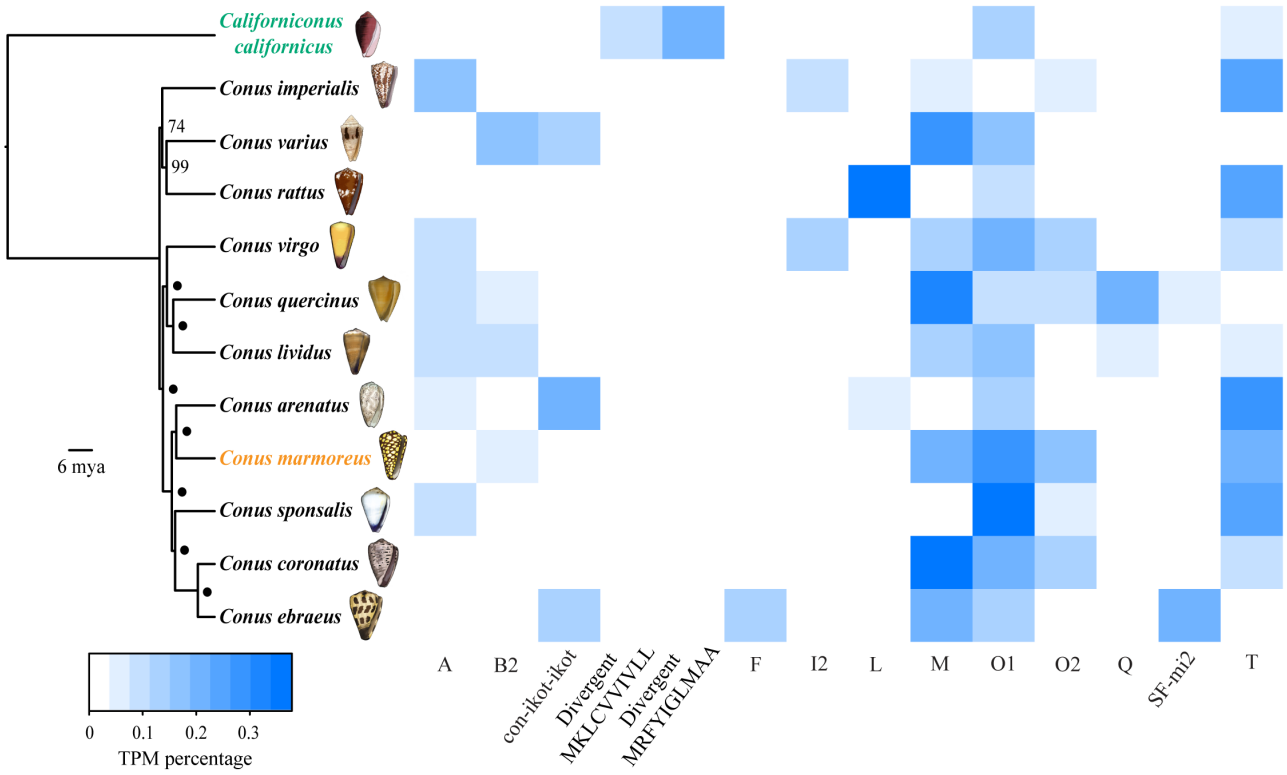


Figure 1. Conotoxin expression in a phylogenetic context. Time-calibrated maximum likelihood phylogeny of Conidae species sequenced in this study generated from 821 loci. Values at nodes represent bootstrap support and • indicates bootstrap support = 100. The Tree is rooted with *Californiconus californicus*. Taxa are colored by diet (green = generalist, black = vermivore, orange = molluscivore). Heat map shows relative contribution (measured as percentage of total conotoxin TPM per species) of gene superfamilies that contributed to at least 10% of overall conotoxin expression in at least one species.

Discussion

Contrary to common wisdom derived from many previous studies of cone snail venom, our results show unequivocally that prey class performs poorly in predicting conotoxin composition patterns among cone snail species. The poor predictive power of diet class on venom composition patterns may be due to several factors. Estimated nonsynonymous substitution rates for conotoxin genes are the highest across metazoans and these extraordinary rates of molecular evolution may be more likely to promote divergence rather than convergence in venom composition. Alternatively, the lack of predictive power may be in part, due to how categories are constructed for venom components and diet classes. Prey specialisation exists at the level of protein function, but it is known that conotoxins targeting similar neurological targets can evolve convergently in several gene superfamilies. Therefore, characterising conotoxin composition patterns by gene superfamilies does not fully measure functional similarities and differences in conotoxins between species. Prey classes may not explain conotoxin composition patterns potentially due to an over generalisation of the diversity present within the vermivorous category. Vermivory, as traditionally used in Conidae studies, is broadly defined and includes a wide variety of taxa that represent hemichordates, echiurans, and several polychaete families that diverged ≥ 400 million years ago. Future studies that account for the taxonomic breadth of worms and the functional diversity of conotoxins may better predict patterns of venom composition among species.

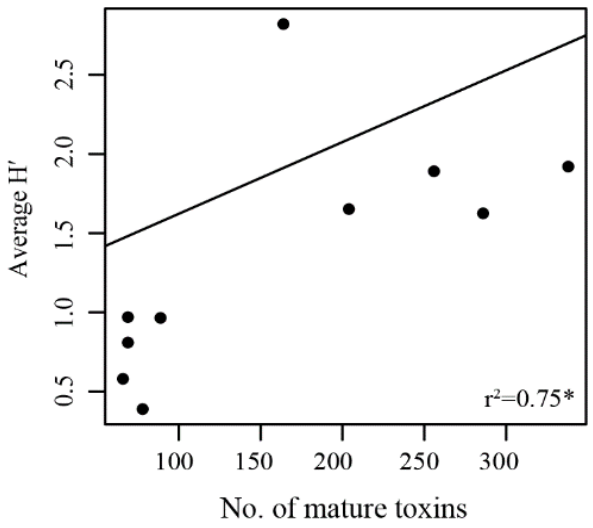


Figure 2. Dietary breadth and conotoxin complexity. Correlation between dietary breadth (Averaged H′) and the number of mature toxins. Graph is labelled with correlation coefficients. *denotes significant correlation from a PGLS analysis.

Editor's note—Also see the bottom of page 32 regarding *Conus* stings.

RESEARCH GRANT REPORT

Getting the most out of minute singletons: molecular data from SEM-samples in Solenogastres (Mollusca)

Franziska Bergmeier[1], Roland Melzer[2], Gerhard Haszprunar[1,2], Katharina Jörger[1,2]

[1]Systematic Zoology, Ludwig-Maximilians-University Munich, Germany
[2]SNSB-Bavarian State Collection of Zoology, Munich, Germany

Introduction

Identification of Solenogastres, a small clade of marine aplacophoran molluscs, requires time-consuming investigations of various character sets (i.e. scleritome, radula, and histology of the foregut glands and reproductive system), resulting in a broad neglect of these species in biodiversity surveys (Todt 2013). Molecular barcodes can facilitate re-identification of Solenogastres in future research, but need to be unequivocally connected to actual taxonomic names. Ideally, a single specimen can be subdivided for sacrificing e.g., the mid-body region with few morphological characters for molecular analyses. However, many Solenogastres are minute (i.e., <2mm), which hampers division for molecular and morphological approaches. Moreover, combining characters investigated on multiple individuals might create chimera as cryptic species co-occurri(Bergmeier *et al.* 2016). The present project aims to combine examination via scanning electron microscopy (SEM) from all body regions of singletons with subsequent DNA-extraction and amplification of molecular barcodes. We test different drying and extraction protocols to establish a workflow of this technique for molluscs, which has so far only been successfully applied to tiny insects (i.e., Thysanoptera; Kumar *et al.* 2014).

Material and Methods

We used three different morphospecies of cavibelonian and pholidoskepian Solenogastres, each with multiple individuals (nine per species, body sizes between 0.7 mm and 2.5 mm), for a critical evaluation of the various methodologies. Specimens were collected between 2009 and 2012 and were fixed and stored in 96% ethanol.
We combined three different SEM-drying protocols (critical point (CP), hexamethyldisilazane (HMDS) and 100% ethanol (EtOH)) with three standard DNA-extraction methods (spin columns (SC), CTAB buffer and a 'quick-and-dirty' approach via boiling in extraction buffer (EB) adapted from Kumar *et al*. (2014)) on the 27 specimens, so that each drying protocol was combined with each extraction method on one specimen of each morphospecies. We then extracted DNA from the SEM-samples and compared the DNA concentration and COI sequence quality. For a schematic depiction of the workflow, see Fig. 1.

Step 1: Drying of specimens for SEM

(i) Critical Point: Specimens rehydrated in 80%, 70% ethanol, 15 min each; followed by dehydration in graded acetone series (70%, 80%, 90%, 100%, 15 min each; 2x 100%, 30 min). Dried in a Baltec CPD 030 (Leica Microsystems) in CO_2;

(ii) HMDS: Specimens transferred to 100% EtOH, exchanged twice (15 min each); exchanged for 1:3 solution of HMDS and 100% EtOH followed by 1:2 solution of HMDS and 100% EtOH (30 min each); exchanged for 100% HMDS and slowly evaporated overnight;

(iii) 100% EtOH: Specimens transferred to 100% EtOH, exchanged twice for 100% dehydrated EtOH (15 min each);

Step 2: Mounting for 360°-SEM

We mounted the dried specimens on 'carousels' to enable 360° SEM-investigations of the scleritome characters from all body regions. We used colloidal silver G 302 (Plano GmbH) to mount them at the tips of short snips of tungsten or silver wire (Fig. 2b) and stuck these into lumps of Leit-C-Plast plastic conductive carbon cement (Neubauer Chemikalien), placed on self-adhesive carbon stickers on the SEM-stubs. Afterwards we coated them with gold (Fig. 2c) in an Argon atmosphere for 240 sec in a Polaron sputter coater (GaLa Gabler Labor Instrumente Handels GmbH).

Step 3: Documentation of scleritome via SEM

Specimens were investigated under a LEO 1430 VP SEM (10-15kV) (Zeiss). If necessary, specimens were repositioned by turning the wires in a different angle in the central plastic conductive carbon cement.

Step 4: DNA-extraction of SEM samples

We transferred the sputtered specimens into tubes, and ground them in the respective buffers using plastic pestles. We applied three protocols of DNA-extractions:

- **Spin column**: using the DNeasy Blood & Tissue Kit (QIAGEN), following the manufacturer's protocol.
- **CTAB**: standard precipitation method using a CTAB buffer and ß-mercaptoethanol followed by chloroform and isoamyl alcohol.
- **Extraction buffer**: boiling in DNA lysis buffer containing KCl, Tris-HCL, Tween20 and NP40 (see and Dickey *et al.* 2012 and Kumar et al. 2014). After DNA-extraction we measured the DNA concentration using a Qubit Reader 2.0 (ThermoFischer Scientific).

CONTINUED ->>

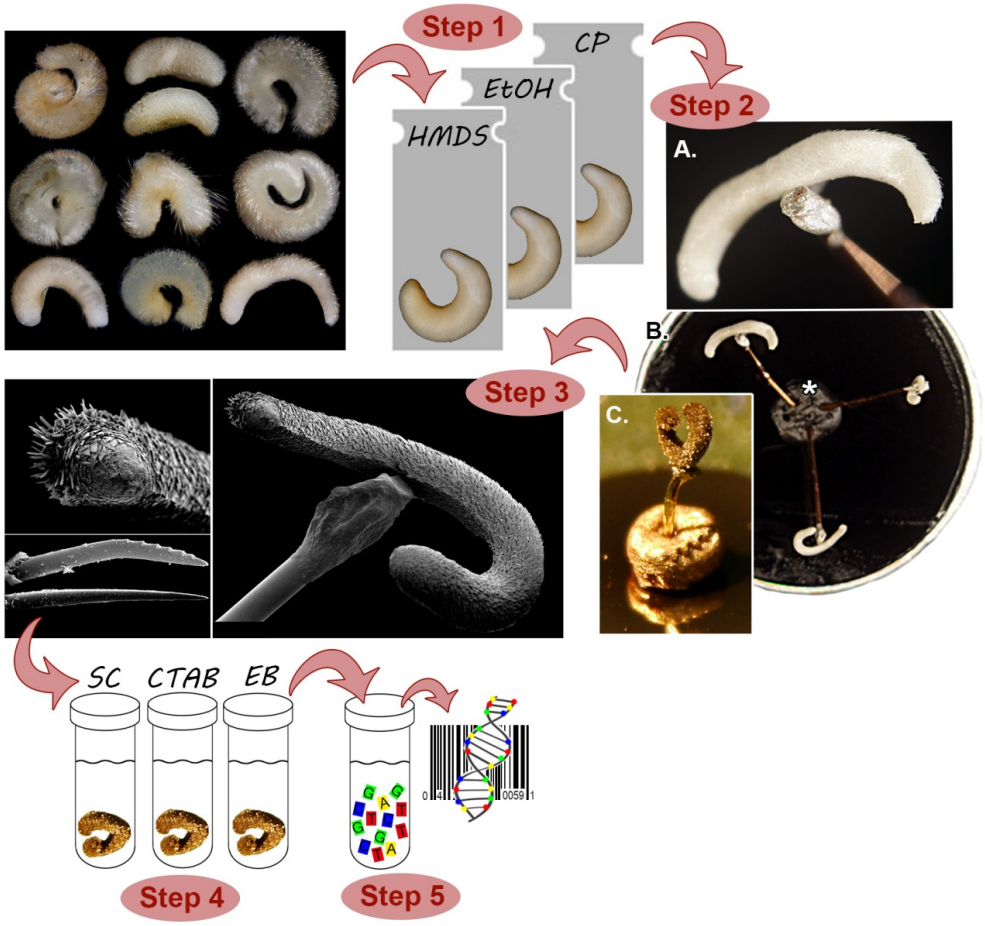


Fig. 1: Workflow on how to combine SEM with molecular barcoding. A. Specimen mounted on tungsten wire using colloidal silver. B. 'Solenogaster carousel' with three specimens, asterisk marks plastic conductive carbon cement. C. Single specimen mounted for rSEM, after sputter coating with gold.

Step 5: Barcode amplification

We amplified cytochrome *c* oxidase subunit I (COI) with the HCO-LCO primer set (Folmer *et al.* 1994) using the Phire Hot Start II polymerase (ThermoFischer Scientific) in PCR protocols with varying annealing temperatures (initial step at 98°C for 30 sec, (denaturation at 98°C for 5 sec, annealing at 51°C/52°C for 5 sec, elongation at 72°C for 20 sec) x 35, final elongation at 72°C for 1 min, cooling at 4°C). We purified PCR products using the DNA purification kit NucleoSpin Gel and PCR Clean-Up (Machery-Nagel) following the manufacturer's protocol. Cleaned PCR products were sent off for cycle sequencing (Big Dye 3.1) and sequencing on an ABI 3730 capillar sequencer by the Genomic Service Unit of the Ludwig-Maximilians-University, Munich.

Results and Discussion

SEM

The 'solenogaster carousels' are advantageous for regular mounting: the carousel allows turning of specimens without damaging them, thus enabling coverage of all taxonomically important body regions of a single individual (i.e., spicules of mouth and atrium, body scleritome, foot groove, dorso-terminal sense organ, copulatory or abdominal spicules) and the production of rotational scanning electron micrographs (rSEM, see Cheung *et al.* 2013). Due to the carousel construction we were partially struggling with strong charging artifacts, and 6 of 27 specimens were lost during preparation and SEM examination. At least for Solenogastres with a scaly scleritome, direct mounting on self-adhesive carbon stickers with subsequent flipping was a more secure and faster method.

CONTINUED ->>

Molecular data

After SEM investigations, the remaining 21 specimens were used for testing the three different extraction methods. We boiled 9 specimens in extraction buffer following the protocol of Kumar *et al.* (2014), which resulted in the consistently highest DNA concentrations of the three methods ranging from 7.54 ng/µl to 45.8 ng/µl. CTAB extraction on five specimens yielded DNA concentrations between <0.5 ng/ml (in one specimen) and 61.6 ng/µl. Spin column extraction was used on seven specimens and resulted in DNA concentrations of <0.5 ng/µl (in three specimens) to 10.7 ng/µl. Despite the high DNA measurements for the EB-protocol,we were unable to amplify COI from any of the EB-samples, indicating that this 'quick-and-dirty' approach successfully used for insects investigations might not lead to clean enough DNA for amplification in molluscs. From the five CTAB-extracted specimens, four COI barcodes were successfully sequenced. Of the seven spin column extracted specimens, only three yielded COI sequences (failure corresponds to the ones with lowest DNA concentration <0.5 ng/µl, indicating that DNA-extraction might have failed in these cases). The comparably low success rate in COI amplification corresponds to our experience when handling non-SEM treated Solenogastres and therefore rather points to a general problem with COI primers and PCR protocols rather than an influence from the SEM investigation.

Conclusion and outlook

Due to the low numbers of Solenogastres available to the present project, our initial exploration of methods does not allow for a sound statistical evaluation. Nevertheless, our study provides some experience to other researchers aiming to combine molecular approaches with SEM examination in minute molluscs:

We were able to extract DNA and amplify COI independently from the applied drying protocol, suggesting that critical point drying (with previous dehydration in acetone) and drying via HMDS and 100% EtOH are equally suitable for subsequent molecular analyses. However, simple EtOH evaporation caused strong shrinkage artifacts, thus it should be avoided in cases like Solenogastres, which have a thin cuticle.

The EB-protocol established for insects (Kumar *et al.* 2014) failed on our material, whereas standard CTAB precipitation and spin-column extraction both successfully yielded DNA with subsequent amplification success. Spin-columns had a higher total failure in DNA-extraction that CTAB but more data is needed to compare both methods reliably.

In conclusion, generating molecular sequence data from specimens previously dried, sputter-coated with gold and examined via SEM can be conducted without any adjustment of standard lab. routines. We are currently working on a broader application of this method to Solenogastres collected during the Kurile-Kamchatka Biodiversity (KuramBio) Expedition, where numerous specimens were sampled from abyssal depths. Currently 18 morphospecies have been identified using SEM, including many lineages new to science and only represented by singletons. Using CTAB extractions, DNA has been successfully extracted from most individuals to provide molecular barcodes for easier identification in future research.

Acknowledgements

We would like to sincerely thank the Malacological Society of London for the research grant to FSB, which made this project possible.

References

Bergmeier, F. S., Haszprunar, G., Todt, C. & Jörger, K. M. (2016). Lost in a taxonomic Bermuda Triangle: comparative 3D-microanatomy of cryptic mesopsammic Solenogastres (Mollusca). *Organisms Diversity and Evolution*. (in press)

Cheung, D. K.-B., Brunke, A. J., Akkari, N., Souza, C. M. & Pape, T. 2013. Rotational Scanning Electron Micrographs (rSEM): A novel and accessible tool to visualize and communicate complex morphology. *ZooKeys*, 328, 47-57.

Dickey, A. M., Shatters, R. G. & Mckenzie, C. L. 2012. A comparison of two methods of eluting insect DNA from flinders technology associates cards. *Florida Entomologist*, 95, 790-793.

Folmer, O. & Vrijenhoek, R. 1994. DNA primers for amplification of mitochondrial cytochrome c oxidase subunit I from diverse metazoan invertebrates. *Molecular Marine Biology and Biotechnology*, 3, 294-299.

Kumar, V., Seal, D. R., Osborne L. S. & McKenzie, C. L. 2014. Coupling scanning electron microscopy with DNA barcoding: a novel approach for thrips identification. *Applied Entomology and Zoology*, 49, 403-409.

Todt, C. 2013. Aplacophoran mollusks—Still obscure and difficult? *American Malacological Bulletin*, 31(1), 181–187.

Fens

Veronika Horsáková
Department of Botany and Zoology, Faculty of Science, Masaryk University, Brno, Czech Republic
Email: veronika.horsakova@seznam.cz

WHAT IS A FEN?

Although they may not attract as much attention as for instance rainforests and coral reefs, fens are important hot-spots of biological diversity that display a number of ecologically unique features. But first of all, let's explain the term "fen". Fens are permanently moist wetlands supplied with groundwater. This feature separates fens from bogs that are supplied solely with atmospheric precipitation. Due to limited nutrient availability caused by waterlogging, fens are covered with low-productive vegetation consisting mainly of low sedges and bryophytes (Fig. 1). Fens sustain relatively cooler and more humid microclimate compared to the surrounding landscape, and harbour cold-adapted species otherwise restricted to alpine, boreal and arctic environments. At present fens cover vast areas in northern Europe while being only scattered and isolated in most of the temperate zone. They represent target ecosystems for biologists, ecologists and nature conservationists, and moreover, along with bogs they constitute a globally important carbon sink buffering against the climate changes that are now underway.

HOW A FEN IS IMPORTANT TO MALACOLOGY

Fens, specifically the calcareous ones, provide shelter for remarkably species-rich mollusc communities. In a plot of only 16 square meters one can encounter up to 32 mollusc species. Although to a certain extent fens represent extreme environments, they meet the most important ecological requirements of molluscs, i.e. high moisture and sufficient amount of calcium (in regions with calcium-rich bedrock). Interestingly, there is a significant over-representation of small-sized taxa; the majority of species are up to 5 mm in size. Because of the poor vegetation productivity (compared to other plant communities) fens provide few suitable winter shelters in which molluscs could survive periods of freezing. However, small species are favoured over large ones under such conditions as they have lower water mass in their bodies, which enhances their ability to supercool. It is also crucial to notice that fens harbour several habitat specialists and relicts from the Pleistocene and the Early Holocene. For instance, two Annex II species, *Vertigo genesii* and *V. geyeri*, represent rare relicts from the Late Glacial entirely restricted to undamaged fens, as well as another glacial relict, *V. lilljeborgi* (Fig. 2). All the three mentioned relicts occur in the UK, although their distribution is rare and scattered, mainly across the upland and coastal regions of the British Isles. These species were largely distributed throughout central Europe after the climate amelioration during Pleistocene/Holocene transition. Nowadays, they occur mainly in Scandinavia and the Alps, however, some populations were left behind during range shifts in isolated fen refugia at lower latitudes and altitudes. Thanks to a sediment accumulation in fens, we can trace the occurrence of these species through time, and (combined with analogous data about pollen and macrofossil remains) draw conclusions about the succession and historical development of a particular site (Fig. 3). In the end, it needs to be mentioned that glacial relicts are highly endangered by changes in water regime, groundwater-level fluctuations, nutrient enrichment, and any other human-induced impact on fens. Many fens nowadays undergo overgrowing by reeds, grasses, shrubs and woods, with rare light-demanding plant species becoming extinct, alongside the extinction of sensitive mollusc communities. In losing fens, we also lose substantial part of the Earth's biota, with hardly any chance to restore these ecosystems once they have been shifted out of their equilibrium. It is our challenge to prevent their further destruction and contribute to appropriate management and conservation.

Further reading

Hájek, M., M. Horsák, P. Hájková and D. Dítě. 2006. Habitat diversity of central European fens in relation to environmental gradients and an effort to standardise fen terminology in ecological studies. *Perspectives in Plant Ecology, Evolution and Systematics* 8: 97-114.

Horsák, M. and N. Cernohorsky. 2008. Mollusc diversity patterns in Central European fens: hotspots and conservation priorities. *Journal of Biogeography* 35: 1215-1225.

Schenková, V. and M. Horsák 2013. Refugial populations of Vertigo lilljeborgi and V. genesii (Vertiginidae): new isolated occurrences in central Europe, ecology and distribution. American *Malacological Bulletin* 31: 323-329.

CONTINUED ->

Figure 1. Fen vegetation is sharply distinct from the surrounding plant communities. It is sparse and low-productive. In spring and early summer it is often distinguished by blooming cotton-grass (*Eriophorum* spp.). At present, the highest concentration of well-preserved fens is found in the boreal zone, and montane regions. Photo V.

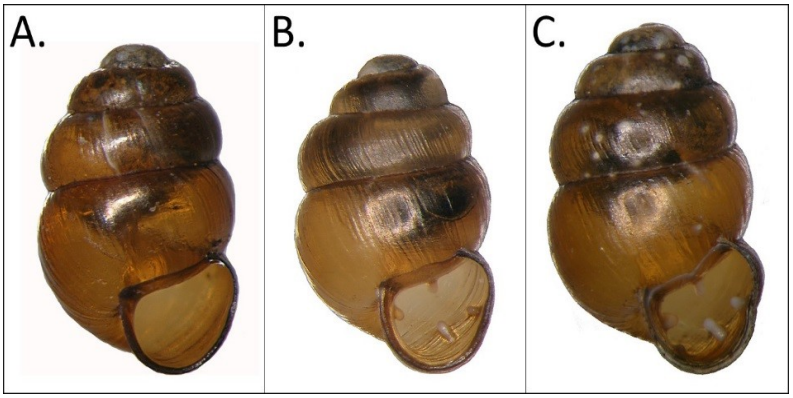


Figure 2. Three land snail species considered Late-Glacial relicts in central Europe. *Vertigo genesii* (A) and *V. geyeri* (B) inhabit calcium-rich fens, whereas *V. lilljeborgi* (C), as one of few European species, inhabits rather acidic, calcium-poor fens. Shell height of these species is only ca. 2 mm. Photo M. Horsák.

Figure 3. Calcium-rich sediments of calcareous tufa-forming fens provide excellent conditions for preservation of rich fossil mollusc communities. Thus, they can be used for fine resolution reconstruction of habitat development throughout the Holocene.
Photo M. Horsák.

MALACOLOGICAL BACKGROUNDS

Gyres

Alice K. Burridge

[1] Naturalis Biodiversity Center, P.O. Box 9517, 2300 RA Leiden, The Netherlands
[2] Institute for Biodiversity and Ecosystem Dynamics (IBED), University of Amsterdam, P.O. Box 94248, 1090 GE Amsterdam, The Netherlands

WHAT ARE GYRES?

Marine biologists often discuss observed patterns of distribution, abundance, genetic structuring and connectivity of marine taxa in the context of how ocean currents behave. But what are currents? And especially, what are gyres?

Ocean currents are generated by a number of physical processes (Fossette *et al.,* 2012). The wind stress, to a large extent caused by the Coriolis force, results in friction at the ocean surface. The Coriolis force is caused by the rotation of the earth and will cause the winds and currents to turn to the right at the Northern Hemisphere and to the left in the Southern Hemisphere (Stewart, 2008). There is no Coriolis force at the equator. The wind stress at the ocean surface causes Ekman currents that corresponding with the Coriolis force turn further to the right in the north or to the left in the south with increasing depth in a spiral manner. Drag causes the Ekman spiral to weaken with depth. The average flow direction over depth is directed 90 degrees to the right or to the left. The effect of Ekman currents is variation in sea surface height, generating horizontal gradients in water pressure. Balanced by the Coriolis force, the pressure gradients result in persistent currents (called geostrophic currents) that flow along areas of equal pressure. These are responsible for basin-scale patterns of ocean circulation (Figure 1; Fossette *et al.,* 2012).

Gyres in the ocean also exist because of this process. For example, in the Atlantic Ocean there is a northern, and a southern subtropical gyre. Because there is no Coriolis force at the equator it is not surprising that gyres are not situated around the equator. The subtropical gyres have a high central pressure and a geostrophic flow that is strongest along the edges, clockwise in the Northern Hemisphere and counter-clockwise in the Southern Hemisphere. However, the strength of the geostrophic flow along the edges of the gyres is not homogeneous. A larger pressure gradient perpendicular to the geostrophic current will strengthen it. For example, because of the direction in which the Earth rotates, this gradient is larger at the western side of the North Atlantic gyre. Hence, in the western part of it the strongest geostrophic current occurs: the Gulf Stream (Fossette *et al.,* 2012; Atlantic Ocean discussed in more detail in Ziveri *et al.,* 2004). The strongest currents may appear to be chaotic because of the drag that comes along with high current speeds, resulting in meandering patterns and eddies (small, temporary "gyres"), but do remain persistent (Fossette *et al.,* 2012).

HOW GYRES ARE IMPORTANT FOR MALACOLOGY

Gyres are especially important for molluscs that are part of the marine zooplankton because their dispersal depends on ocean currents. There are two separately evolved orders of holoplanktonic gastropods: pteropods (sea butterflies, mucus web feeders; Figure 2) and heteropods (sea elephants, visual predators; Figure 3). Burridge *et al*. (submitted) show that the species composition, diversity and abundance of pteropods and heteropods in the upper 300 metres of the water column differ between the Atlantic gyres, equatorial Atlantic and below the southern gyre, where the Atlantic merges into the Southern Ocean. Burridge *et al*. (2015) demonstrated that within a pteropod genus (*Cuvierina*), one taxon was endemic to the north and south Atlantic gyres while another was endemic to the equatorial Atlantic. Hence, the gyres, and ocean currents in general, may cause persisting barriers to dispersal for some taxa. At the same time these barriers themselves can be ecological niches in which speciation occurs. Thus, the oceans provide more biodiversity and a less homogeneous species community than has long been assumed or expected based on land mass barriers alone (Norris *et al.,* 2000). We have yet to discover much of this biodiversity.

Further reading

Burridge A.K., Goetze E., Raes N., Huisman J., and Peijnenburg K.T.C.A. 2015. Global biogeography and evolution of *Cuvierina* pteropods. *BMC Evolutionary Biology* **15:** 39.
Burridge A.K., Goetze E., Wall-Palmer D., Le Double S., Huisman J., and Peijnenburg K.T.C.A. Submitted. Abundance and distribution of pteropods and heteropods along a meridional transect in the Atlantic Ocean.
Fossette S., Putman N.F., Lohmann K.J., Marsh R., and Hays G.C. 2012. A biologist's guide to assessing ocean currents: a review. *Marine Ecology Progress Series* **457**: 285 – 301.
Norris R.D. 2000. Pelagic species diversity, biogeography, and evolution. *Paleobiology* **26**(4): 236 – 258.
Schmitz W.J. Jr. 1996. On the world ocean circulation, Vol. 1. Some global features: North Atlantic circulation. *Woods Hole Oceanographic Institution Technical Report WHOI* **96**(3): 1 – 141.
Ziveri P., Baumann K.H., Böckel B., Bollmann J., and Young J.R. 2004. Biogeography of selected Holocene coccoliths in the Atlantic Ocean. In: Thierstein H. and Young J.R., eds. *Coccolithophores: from molecular processes to global impact.* Springer Verlag.

CONTINUED ->>

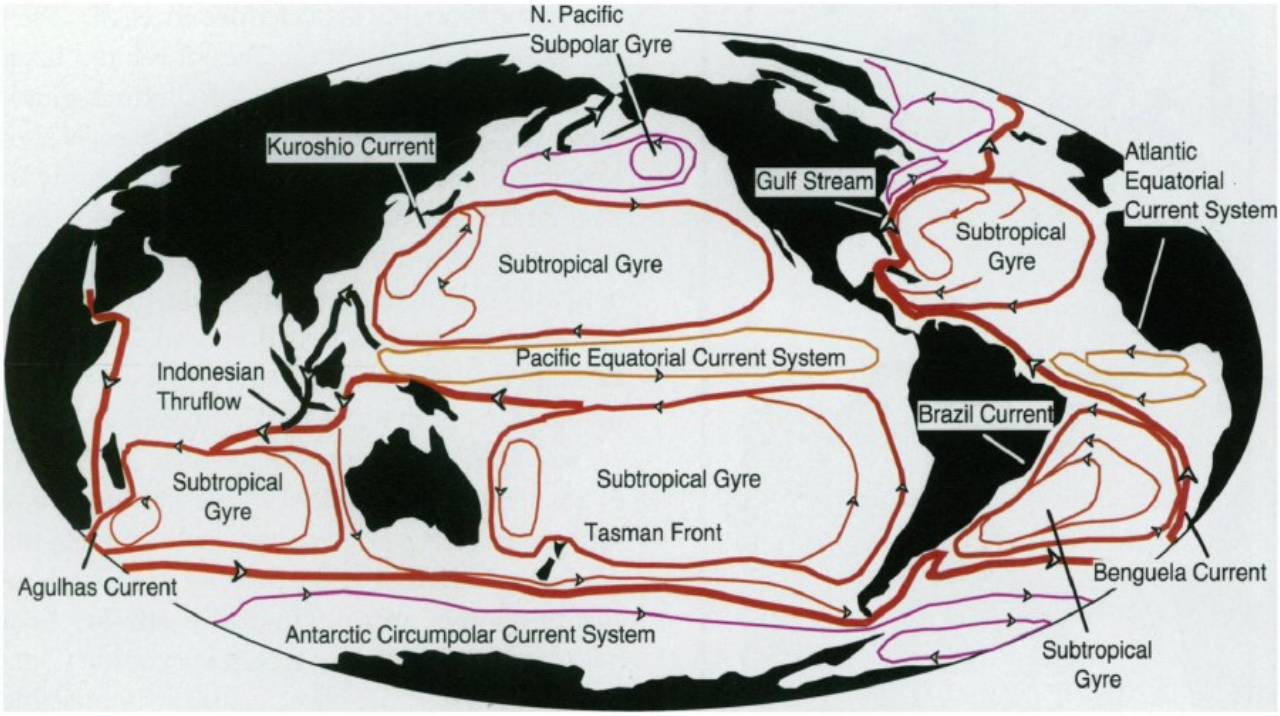


Figure 1. Overview of major surface-water currents. Thick lines depict currents that can exchange water between water masses; thin lines illustrate circulation within major current systems (From Norris, 2000 after Schmitz, 1996).

Figure 2. Adults of the epipelagic Atlantic pteropod species *Cuvierina atlantica* (approx. 1 cm in length) have a bottle-shaped aragonite shell and two soft, wing-shaped parapodia that enable vertical migration in the water column. (Photographed alive, Peijnenburg & Goetze, AMT22 expedition, 2012).

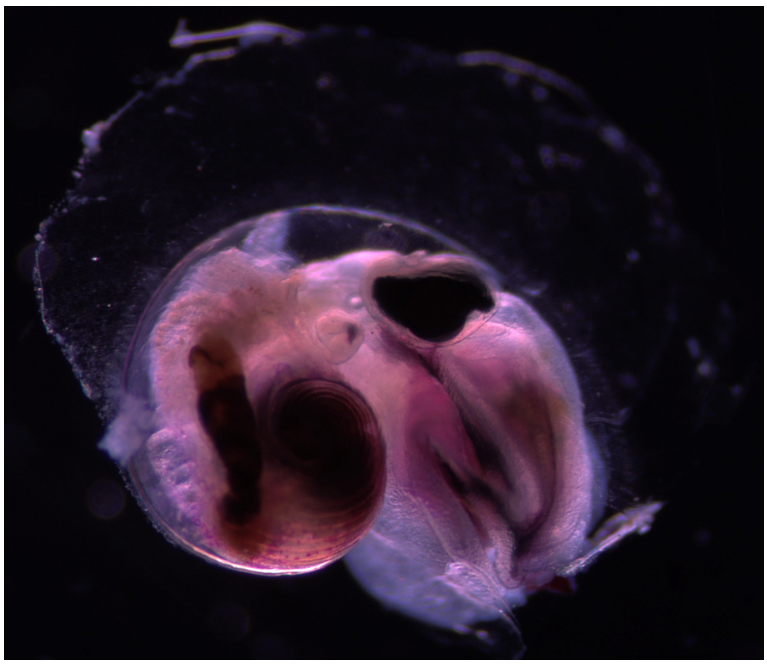


Figure 3. A juvenile *Oxygyrus inflatus* heteropod (adult diameter 1 cm) with clearly visible eyes is retracted into its aragonite shell with a distinct keel. All members of the Atlantidae family can retract their bodies into their shells. (Photographed alive, Burridge & Goetze, AMT24 expedition, 2014).

Notices

Malacological Society of London Research Awards

The Research Grants scheme was established to commemorate The Society's Centenary in 1993. Under this scheme, The Society currently anticipates awarding at least five Junior Research Grants per year, and up to five Senior Research Grants per year, each with a value of up to **£1,500**, to support research on molluscs that is likely to lead to publication. The maximum amount available should not be considered as a 'target'; rather requests for monies should reflect the research that is proposed.

Junior Research Grants are conferred on students and researchers without professional positions, but without regard to nationality or membership of The Society. Senior Research Awards are aimed at established researchers in professional positions, but without regard to nationality. Applicants for Senior Research Awards must be members of The Society. Preference for both award types is given to discrete research projects that fall within the subject areas covered by The Society's journal, *Journal of Molluscan Studies*. Applicants should bear in mind these criteria when submitting an application. In addition applications will be assessed in terms of scientific merit, significance and justification of budget requested, and the degree to which the proposed research will benefit the scientific aspirations of the applicant. Successful applications to the Junior Research Grants scheme that are concerned with the study of Bivalvia may be awarded as Sir Charles Maurice Yonge Awards.

The closing date for the **Junior Research Grant** scheme is **15th December**. The closing date for the **Senior Research Grant** scheme is **15th June**. Applications should be made by email sent to MSL_awards@nhm.ac.uk. Please include your surname and the award proposed in the subject line of the email. Applicants will be notified of the outcome of their application after the subsequent Annual General Meeting. The Society's preferred method of payment is PayPal.

Recent Marine Gastropods from the Azores Archipelago

On behalf of
Sérgio Paulo Ávila Campos Marques
For those interested in malacology and for those with a strong interest on marine biogeography, please take a look on a badly needed revision, regarding the Recent Marine Gastropods from the Azores Archipelago (NE Atlantic), by Cordeiro et al. It can be downloaded from:
https://www.researchgate.net/
publication/292720933_Checklist_of_the_littoral_gastropods_Mollusca_Gastropoda_from_the_Archipelago_of_the_Azores_NE_Atlantic
Contact sergio.pa.marques@uac.pt

World Congress of Malacology July 2016 in Penang Malaysia.

On behalf of Jesús Souza Troncoso Secretary Unitas Malacologica
Link to the website to participate in the World Congress of Malacology. http://wcm2016.usm.my/
Contact troncoso@uvigo.es

Support Tanzanian curator in her quest to document local invertebrate species, many new to science

On behalf of Katharine Corriveau
Christine Ngereza, the Senior Curator of Invertebrate Zoology at the National Museum of Tanzania, is crowdfunding to fund her research documenting the local invertebrate diversity in Kilimanjaro mountain home gardens (including many mollusca species). There is little financial support for her in Tanzania so I am helping her out by sharing her campaign with relevant organizations such as the Malacological Society of London - if you could share the following story with your members that would be great!
Email: katharine@instrumentl.com

Christine Ngereza<https://www.instrumentl.com/campaigns/christinengereza/> is the Senior Curator of Invertebrate Zoology at the National Museum of Tanzania, and she is looking for your support in sharing or donating to her crowdfunding campaign<https://www.instrumentl.com/campaigns/christinengereza/>.
Christine has spent her entire career documenting invertebrate diversity in East Africa, but there remains much more to be done. She is building up collections at her institution, primarily of gastropods, but knows she needs help to document the vast number of invertebrates inhabiting the region (many of which are yet undescribed).

CONTINUED =>

CONTINUED

Christine feels that she may be one of the only woman scientist in all of Africa studying land snails, which makes it really difficult for her to find support. As a result, she has made it her mission to transfer her passion for "bugs", as she calls it, to local children, in the hopes that they may be inspired to become scientists like her someday. Her latest project involves bringing local school children out to survey the invertebrate populations present in the home gardens of Kilimanjaro mountain, as these environments are becoming critical refugia for invertebrate species as the region becomes more urbanized. However, she cannot accomplish this goal without raising the $2,000 she needs for supplies, transportation, and educational materials. Please consider helping her cause by sharing her campaign with your networks or even making a small donation to her campaign on Instrumentl<https://www.instrumentl.com/campaigns/christinengereza/>!
Katharine Corriveau
Co-founder/COO Instrumentl
Katharine@Instrumentl.com<mailto:Katharine@Instrumentl.com>
[https://docs.google.com/uc?id=0By0g1RG1bzg9NmxRaExCM3Myenc&export=download]

Joint Meeting of the American Malacological Society and the Western Society of Malacologists

On behalf of Ángel Valdés
The American Malacological Society and the Western Society of Malacologists hold their annual meetings jointly in Ensenada, Mexico from June 12 through June 16, 2016.
The venue will be the School of Marine Science of the Universidad Autónoma de Baja California. The conference will feature an AMS-sponsored symposium on *Phylogenomics of mollusks* organized by Dr. Kevin Kocot, as well as field trips to the Valle de Guadalupe (wine tasting and cultural experiences) and Erendira-San Quintin (natural history). We are looking for individuals interested in organizing thematic sessions or workshops. Please contact me directly at aavaldes@cpp.edu if you have ideas about potential sessions.

18th Mid-Atlantic Malacologists meeting

On behalf of Elizabeth K. Shea, Ph.D., Curator of Mollusks, Delaware Museum of Natural History
Saturday 2 April 2016 at the Delaware Museum of Natural History in Wilmington, DE
This informal, one-day event is designed to facilitate contact among professional, amateur, and student biologists who study mollusks. All topics and taxa are welcome! Talks start around 9:30 and go until 4:30 with a break for lunch. Presentations (15 minutes max.) cover topics as diverse as current research, trip reports, and collection issues. There are no dues, officers, abstracts, or publications associated with the meeting. The DMNH collection and library are available for use before or during the meeting. Interested participants should make arrangements with Mr. B. Alex Kittle, Mollusk Collection Manager (akittle@delmnh.org) so specimens or books can be pulled in advance. More details can be found on our website (http://www.delmnh.org/mid-atlantic-malacologists-mam-meeting)

"2,400 Years of Malacology"

On behalf of Alan Kabat and Gene Coan
The 2016 edition of "*2,400 Years of Malacology*" – a catalog of biographical and bibliographical articles about those who studied and collected mollusks – is now on the website of the American Malacological Society:

http://www.malacological.org/2004_malacology.html

The 2016 edition is just over 1,254 pages. It includes three additional documents containing collations of a number of important references for malacological systematists, including collations of several malacological journals, and a detailed collation of the Küster edition of Martini-Chemnitz (1837-1920) that synthesizes the data from a number of previously published collations.

Both notices on this page are over their deadlines. Readers might however, still be interested in making contact.

Auction of malacological publications

I have been tasked with the distribution of a fairly large private marine and freshwater mollusks library to be sold in sections in silent auction at the end of the month. The book list is only being distributed to scientists/ naturalists in the hopes that the material actually goes to someone who can use it. The library has over 675 items and has been divided into collections representing THREE general subject areas: (1) FRESHWATER/ TERRESTRIAL MOLLUSKS, (2) MARINE MOLLUSKS, and (3) MARINE BIOLOGY. Each of the three collections is to be sold SEPARATELY as a unit via silent auction; with each going to the highest bidder(s). Northeast Natural History & Supply will be overseeing the auction and eventual dispersal of the collection. Offers can be submitted via email to unionid@comcast.net or in writing to the address provided below.

Among the marine mollusks and marine invertebrates portions of the collection can be found Agassiz' "*Coral Reefs of the Tropical Pacific ("Albatross Expedition")", "Catalogo de la Malacofauna Antartica Argentina*" by Carcelles, Alfred Russell Wallace's (1881) "*Inland Life or the Phenomena and Causes of Insular Faunas and Floras*", various reports of Alexander Agassiz' "Albatross Expedition", Sowerby's *"Thesaurus Conchyliorum", "Molluscan Taxa Described by Tadashige Habe*" by Okamoto, all six volumes of Libbie Hyman's "*The Invertebrates*" and an early complete set of "*Contributions of the Bermuda Biological Station."*

The land/freshwater portion of the collection includes such works as *"Fresh Water Mollusks of Mozambique*" by Azevedo et al., "*Studies in the Achatininae, Anatomie, Phylogenie und Historische Biogeographie der Ampullariidae*" by Berthold, Burch's *"Freshwater Snails of North America", "Natural History and Propagation of Fresh-water mussels"* by Coker *et al*., "*Monographic Survey of South African non-marine Mollusca*" by Connolly, *"Recent Lymnaeidae*" by Hubendick, Bequaert's *"Land Mollusks of the Belgian Congo", "Monograph of American Corbiculidae"* (1865) by Temple Prime; and a rare signed and dedicated copy of "*Disposito Systematica Conchyiarum Terrestrium et Fluviatilium quae Adservantur in Collectione Fratrum Ant. Et Ju Bapt. Villa"* by Villa and Villa (1841).

Among the 675 items are over two dozen works signed by their authors, as well as a late 20th Century copy of Darwin's "Geologic Observations… of South America Visited during the Voyage of the H.M.S. Beagle" thrown in; just for good measure. Each list is available digitally in Portable Document Format (pdf file) upon request by electronic mail (unionid@comcast.net) or in writing to Northeastern Natural History & Supply. Collection lists are also available for viewing online at: https://sites.google.com/site/northeastnaturalhistory/home/classroom-news/invertebratezoologylibraryupforauction.

Jay Cordeiro, Northeast Natural History & Supply Co**.,** 24 North Grove Street, Middleboro, MA 02346
USAunionid@comcast.net
Online: https://sites.google.com/site/northeastnaturalhistory/

Human injuries from *Conus* stings

Have you ever been stung by a *Conus*? Do you know of anyone who has been stung by a *Conus*?

Long ago (in another century), I published an account of all known cases of human injury and fatality due to envenomation by *Conus.* At that time (1958) there were 25, of which five were fatal. In a book chapter five years later I was able to add a dozen more recent and previously unreported cases, making a total of 37, of which 10 were fatal. For the next 20 years or so, I attempted to update these records in a database but I did not organize it for publication. It now contains 105 records (35 fatal). Unfortunately, I did not rigorously attempt to update the database after about 1983. Now, having been invited to contribute an updated report to a special issue of an international journal, I would like to take advantage of the improvements in communication afforded by the internet to do so. In addition to the update, I also propose to attempt interpretation of the symptoms and therapeutics in light of modern knowledge of diversity and biochemistry of the known conotoxin venom components of the species involved.

I thus invite contributions of information about recent or previously unreported cases of humans stung by any members of the family Conidae, no matter what species nor the degree of severity. Please contact me, preferably during the next two weeks (the submission deadline of my report is looming), and I will send you a standard form on which to enter whatever information you are able to glean about the case(s).

Below I cite the references to the papers I mentioned above, and I would be pleased to send collaborators reprints (pdf or paper---only a few of the latter remain). The first report includes a portrait that purports to be of the author; it doesn't seem to resemble him very closely!

1958. Recent cases of human injury due to venomous marine snails of the genus *Conus*. *Hawaii Medical Journal*, 17: 528-532.

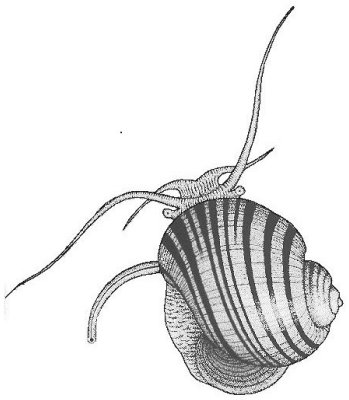
1963. Venomous marine snails of the genus *Conus*. In: *Venomous and Poisonous Animals and Noxious Plants of the Pacific Area,* B. Halstead, ed., pp. 7-96. Pergamon Press, Oxford.

Alan J. Kohn, Dept. of Biology, Box 351800, University of Washington, Seattle, WA 98195, U.S.A.

Email: kohn@uw.edu

THE MALACOLOGICAL OF SOCIETY OF LONDON

Registered Charity No. 275980



ANNUAL GENERAL MEETING 2016

Wednesday 13th April 2016, 13.00 - 18.00

Flett Lecture Theatre, Natural History Museum, Cromwell Road, London, SW7 5BD

Schedule:

13.00 - 14.00 MSL Annual General Meeting
14.00 - 14.15 Introduction - Dr Suzanne Williams
14.15 - 15.15 Michael Schrödl: *Slugs, snails and their allies: news and lessons from heterobranch systematics*
15.15 - 15.45 Coffee break
15.45 - 16.45 Gonzalo Giribet: *Molluscan phylogenetics in the era of genomics*
16.45 - 17.00 Closing remarks
17.00 - 18.30 Wine reception

Society Awards and Grants

The Malacological Society of London makes a number of Awards and Grants. These are in addition to financial support for meetings, including travel bursaries to the Molluscan Forum.

Research Grants

The Research Grants Scheme was established to commemorate the Society's Centenary in 1993. Under this scheme, the Society anticipates making **at least five awards each year**, each with a value of **up to £1500** to support research on molluscs that is likely to lead to publication. The closing date for applications each year is **15th December**. Grants are preferentially conferred on students and researchers without professional positions, 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 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. The conditions of the award, notes of guidance and an application form are on the Society's website at **www.Malacsoc.org.uk**

Travel Grants

Travel Grants are available as bursaries to support attendance at a conference or workshop relevant to malacology. Grants are preferentially conferred on students and researchers without professional positions. The value of each of these awards is **up to £500**, and the Society anticipates that **at least five awards** will be made annually. The application should have the support of the project supervisor. In years when a UNITAS Congress is held, a number of these awards are likely to be used to support participation at this meeting. There are two closing dates each year, **30th June** for travel starting between 1st September of the current year and 28th February of the following year, and **15th December** for travel starting between 1st March and 31st August of the following year. The conditions of the grant, notes of guidance and an application form are on the Society's website at **www.Malacsoc.org.uk** Preference will be given to members of the Society.

Sir Charles Maurice Yonge Awards

Successful applications for Research Grants or Travel Awards that are concerned with the study of **Bivalvia** may be awarded as Sir Charles Maurice Yonge Awards.

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 **1st November**. 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 by post, not email, to the **Honorary Awards Secretary,** Dr Suzanne Williams, Natural History Museum, Cromwell Rd., London. SW7 5BD

Enquiries may be made by post, or by email to s.williams@nhm.ac.uk

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 &/ or paper copies of the *Journal of Molluscan Studies* and such circulars as may be issued during their membership. The society's Web Site 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 86 ($5^{3\,1\,0}$) 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. A paper copy of the Journal is available for ordinary members who are willing to pay a hard-copy premium. Members also receive access to *The Malacologist*, the Bulletin of the Society, which is issued twice a year. In February and August.

Meetings

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 fee structure

Ordinary Members: Journal on-line only £45
Ordinary Members: Journal on line and printed £70
Student Members: Journal on-line only £25

Methods of Payment

(1) Sterling cheque to "The Malacological Society of London".

(2) Banker's standing order to: HSBC (Sort code 40-16-08 Account no. 54268210) 63-64 St Andrew's Street, Cambridge C32 3BZ

(3) Overseas members wishing to pay electronically should should use
IBAN GB54MIDL4016084268210
SWIFT/BIC MIDL GB22

(4) Credit card: Overseas members ONLY may pay by credit card: the Society can accept VISA and MasterCard payments only. Please provide the Membership Secretary with your card number and expiry date, card type (VISA or MasterCard.), the name on the card, and the cardholder's address (if this differs from your institutional address). Receipts will only be sent if specifically requested.

Institutional Subscriptions to the Journal

Enquiries should be addressed directly to Oxford University Press, Walton Street, Oxford OX2 6DP, U.K.

Change of Member's Address

Please inform the Membership Secretary of a change of postal or email address

---

APPLICATION FOR MEMBERSHIP OF THE MALACOLOGICAL SOCIETY OF LONDON

I wish to apply for (please mark your choice)

Ordinary Members: Journal on-line only £45	
Ordinary Members: Journal on line and printed £70	
Student Members: Journal on-line only £25	

I enclose a cheque payable to "The Malacological Society of London" for my first annual subscription.

Title . . . . Name . . . . . .

Department . . . . . Institution . . . . . .

Street . . . . . City . . . . . .

Post /Zip Code . . . . . Country . . . . . Email . . . . . .

Malacological Interests . . . . . .

Signature . . . . . Date . . . . . .

Please send the completed form and cheque to the Membership Secretary:

Dr Rowan Whittle, British Antarctic Survey, High Cross, Madingley Rd., Cambridge, CB3 0ET, UK
roit@bas.ac.uk.