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The Bulletin of The Malacological Society of London

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Genetic analyses of the vetigastropod *Gibbula umbilicalis*

Edward Wort, Phillip Fenberg & Suzanne Williams

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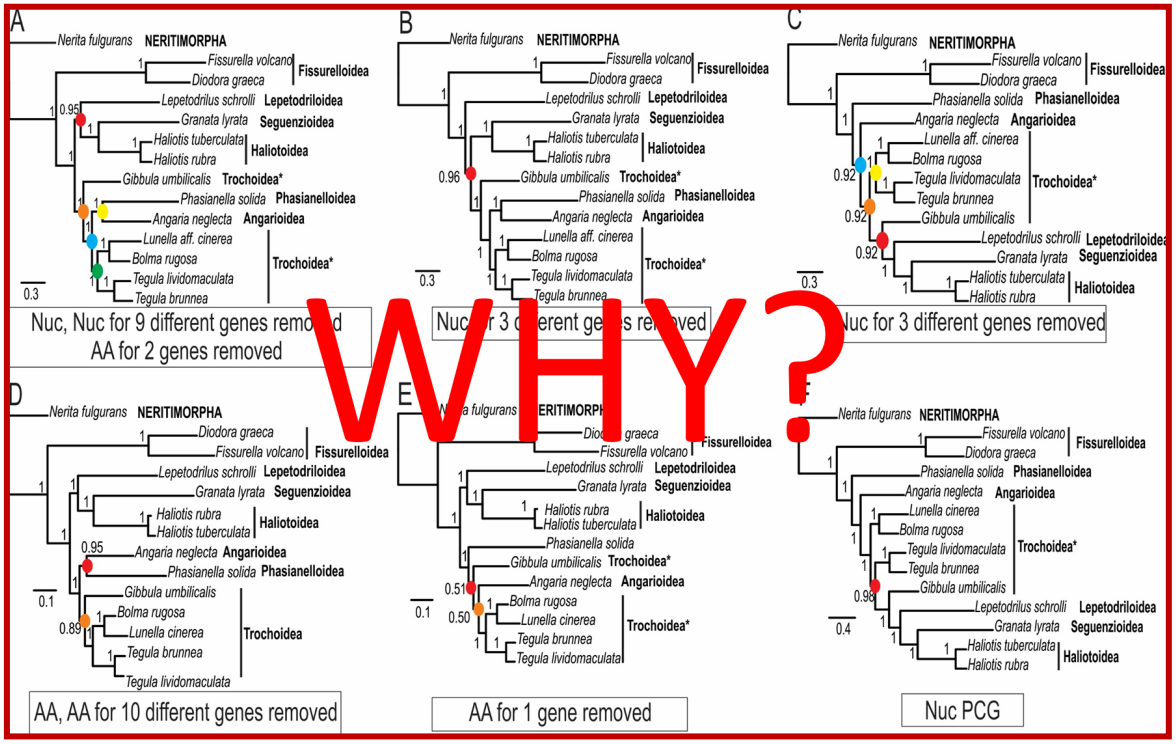

EDITORIAL

Why indeed ? There are lots of reasons to ask why just now. After recently giving a lecture on the medical and economic importance of molluscs, many comments in the ensuing discussion revolved around the question "Why isn't more being done?" For many years, my response to this question has been that unfortunately, the study of molluscs isn't sexy. However, when I look through this issue of *The Malacologist* and see the range of reports emanating from the (Young) Malacologists' Forum, my faith in the sexiness of malacology is rekindled. Predominantly young malacologists presented papers on topics ranging from colour change in the endemic-to-Ireland Kerry slug (page 15), to snails surviving in bird faeces (page 20). The scale of work ranged from parasites in littorinids on a single shore in Yorkshire UK (*L. saxatilis* - page 8) to an Atlantic wide surveys of pteropods (*Limacina* - page 6) . Hopefully this new generation of scientists will take malacology to a new level of interest. To this end, the Forum seems to be growing into an international event in malacology. Presenters came from the Netherlands, Sweden, Germany, Poland, the Czech Republic, Russia, Ireland and France as well as the UK without mentioning the wide international range of collaborators. Such collaboration is now a mainstay of scientific research both in terms of mobility, networking and finance. However, these issues are threatened by Brexit and the political developments in the USA. Another issue is exemplified by the notice posted by Lauren Sumner Rooney and Julia Sigwart (page 33); it is worth a considered read and some thought about the back story. Hopefully all these problems can be navigated successfully, but we continue to work in worrying and unstable times.
Why? Indeed.

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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

Did anyone else hear Council member Jon Ablett, presenting malacological items to the *Museum of Curiosities* on BBC Radio 4? If he decides to take a break from curating molluscs at the Natural History Museum, he could take to the road as a malacological stand-up comedian. A new variety talent is born!

This masked snail was featured on *Have I Got News for You* 31/10/2016

At the Unitas Malacologica (World Congress of Malacology) 2016 meeting in Penang, the Malacological Society of London awarded the following prizes:

Best student poster Geraldine Chang
An attempt to cryopreserve tropical oyster, Crassostrea iredalei spermatozoa in Malaysia
goppietu@gmail.com
Best student oral presentation Fernando Aneiros
Dynamics of corallivorous Drupella snails on coral reefs with the diving-related tourism (Koh Tao, Gulf of Thailand)

Spot the mollusc ?

Molluscan Forum 2016

Flett Theatre
Natural History Museum, London
24th November 2016

NATURAL HISTORY MUSEUM

ORGANISED BY:
THE MALACOLOGICAL SOCIETY OF LONDON
THE NATURAL HISTORY MUSEUM, LONDON

Molluscan Forum 2017

ORAL PRESENTATIONS

09.00 - 09.45 Registration, coffee & set up posters

09.45 - 10.55 Session I

09.45 SUZANNE WILLIAMS: Welcome and introduction to the day
09.55 REBECCA WILSON: The historical size decline of the rocky shore gastropod *Nucella lapillus* across the southern UK
10.10 NICOLA J. BEESLEY: How does *Galba truncatula*, the intermediate host of *Fasciola hepatica*, influence genetic diversity in parasite populations?
10.25 LISETTE MEKKES: A new 3D approach to quantify shell growth in *Styliola* pteropods across the global ocean
10.40 ANNA DZIERŻYŃSKA-BIALOŃCZYK: Friends or cell-mates – responses of the zebra mussel *Dreissena polymorpha* to conspecifics
10.55 AIDAN O'HANLON: Phenotype-environment matching in the Kerry spotted slug *Geomalacus maculosus* (Allman): exposure to UV radiation induces colour change resulting in camouflage

11.10 - 11.40 Coffee & poster viewing

11.40 - 13.00 Session II

11.40 VERONIKA HORSÁKOVÁ: Species richness of European spring fen biota in relation to habitat specialization: untangling the effects of water pH, climate and regional settings
11.55 CHRISTOPHER HOBBS: Geometric morphometric analysis of *Segmentina nitida* throughout Europe
12.10 REBECCA C. HOYLE: Developing a polymerase chain reaction assay for detecting *Schistosoma mansoni* pre-patent infections in *Biomphalaria* snails
12.25 KATHARINA C.M. von OHEIMB: Convergent evolution of shell shape in *Cyclophorus* spp. (Caenogastropoda: Cyclophoridae) from Vietnam
12.40 R.M.L. KENT: Preliminary observations on the timing and patterns of movement in the pulmonate *Onchidella celtica* (Cuvier, 1816)
12.55 SUZANNE WILLIAMS: Announcements, Arrangements and Awards etc.

13.00 - 14.00 Lunch break

14.00 - 15.15 Session III

14.00 MALCOLM T. SANDERS: One for each ocean: resolution of the large scale repartition species complex: *Bursa granularis* (Röding, 1798) (Tonnoidea, Bursidae)
14.15 YUMI NAKADERA: Sperm labelling of hermaphroditic freshwater snails
14.30 JASNA SIMONOVÁ: More evidence for passive dispersal of land snails via birds
14.45 KIMBERLY BERGLÖF: Optimal harvest time of farmed *Mytilus edulis* in southwestern Baltic Sea
15.00 EDWARD WORT: Genetic analyses of the vetigastropod *Gibbula umbilicalis*

15.45 - 17.00 Session IV

15.45 J. BOJKO: Parasites and periwinkles
16.00 AUTUMN C. PUGH: The early Toarcian mass extinction event (Bulgaria)
16.15 PARM VIKTOR von OHEIMB: Community assembly among limestone karst area - Insights from Vietnamese land snails
16.30 THIJS M.P. BAL: Barriers to gene flow in the pteropod *Limacina bulimoides* along a meridional transect in the Atlantic ocean
16.45 SUZANNE WILLIAMS: Closing remarks.

17.00 - 18.30 Wine social & final poster viewing

POSTERS

FRANZISKA S. BERGMEIER: A prickly aplacophoran mollusc from deep-sea plains: first record of an abyssal acanthomeniid Solenogaster in the North-West Pacific

IMOGEN CAVADINO: Grips, ditches, mountains and valleys: Surveying "Living Landscapes" for non-marine molluscs in Gwent, Wales, UK

ANNA DZIERŻYŃSKA-BIAŁOŃCZYK: The habitat preferences of the zebra mussel *Dreissena polymorpha* to different species of unionid clams

JENNIFER GALLICHAN: Documenting the past: The Tomlin Archive

ANNA HOLMES: Trans-Atlantic rafting bivalves – American molluscs on British & Irish shores

ARSENIY A. LOBOV: Can copulatory preferences of littorinids (Mollusca: Caenogastropoda) be explained by mucus trail chemical composition?

ARINA L. MALTSEVA: Do proteins "know" anything about speciation? A lesson from littorinids (Mollusca: Caenogastropoda)

ANNA MARSEWSKA: Snails as accomplice in cases of cercarial dermatitis from Water Valley reservoir in Koszalin (Poland)

AIDAN O'HANLON: The curious case of the colour-changing Kerry slug *Geomalacus maculosus*

KATJA T.C.A. PEIJNENBURG: Assessing species boundaries in the open sea: applying an integrative taxonomic approach to *Diacavolinia* pteropods

HANNAH B. TILLEY: Body size change of marine benthic macroinvertebrates in response to environmental stressors during the Pliensbachian-Toarcian Extinction Event (Early Jurassic)

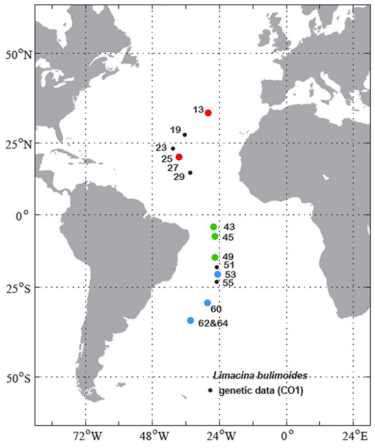
DEBORAH WALL-PALMER: Atlantid heteropods as sensitive indicators of environmental changes

HARRIET WOOD: The *Mollusca Types Catalogue* online

Molluscan Forum 2017 - Abstracts

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

Barriers to gene flow in the pteropod *Limacina bulimoides* along a meridional transect in the Atlantic ocean



Thijs Bal [1,2], Frank Stokvis[2], Erica Goetze[3], Aleksandra Dragozet[4], Katja Peijnenburg [2,4]
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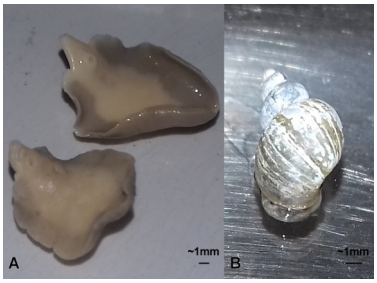
Shelled pteropods are holoplanktonic gastropods whose sensitivity to changes in ocean chemistry makes them potential bioindicators of the effects of ocean acidification. To understand how these plankton populations will respond to climate change we need to study their adaptive potential. To predict the adaptability of a species it is important to know the levels of biological variation (genetic and phenotypic), the spatial distribution of this variation and the degree of gene flow between populations. We studied genetic and phenotypic variation in the pteropod species *Limacina bulimoides* along an Atlantic ocean transect (34ºN - 30ºS, 15 stations) to investigate the spatial structuring of variation. We sequenced partial mitochondrial Cytochrome Oxidase I (COI) and nuclear 28S genes and carried out a geometric morphometric analysis on the shape of adult shells. Using the COI sequences we found high haplotype and nucleotide diversities (N = 334, h = 0.9989 ± 0.0046, π = 0.0336 ± 0.0044) and a major genetic break within the southern subtropical gyre (between northern and southern group Fct = 0.380, $P < 0.00001$). This genetic break is supported by variation in 28S sequences (N = 37). We also found significant evidence of shell shape differences between individuals sampled north and south of this genetic break (N = 115, 78.83% shape variation, F = 20.57, $P = 0.0003$). These results indicate that *L. bulimoides* populations are reproductively isolated and probably represent distinct species. This suggests that the levels of diversity in pteropods and possibly their adaptive potential as well, are currently underestimated.

How does *Galba truncatula*, the intermediate host of *Fasciola hepatica*, influence genetic diversity in parasite populations?



Nicola Beesley, Jane Hodgkinson & Diana Williams
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The presence of *Galba truncatula* is essential to the transmission of the liver fluke, *Fasciola hepatica*, a trematode parasite that causes disease of economic and welfare importance to UK livestock . Knowledge of the interaction between snail and parasite is important when considering what drives parasite transmission, and to define how passage of the parasite through the snail may influence genetic diversity of parasites within sheep and cattle. Following infection, cercariae are shed from the snail and encyst on pasture as the infective metacercariae stage. The distribution of metacercariae in the environment is influenced by clonal expansion within the snail, and the ability to produce cercariae over a prolonged period. Molecular identification of liver fluke infection within snails is achieved by performing an internal positive control PCR to amplify snail DNA, and a second PCR to detect *F. hepatica*. We have developed a panel of microsatellites that allows production of a multilocus genotype (MLG) for *F. hepatica*. Using this panel we have demonstrated high genotypic diversity in the UK liver fluke population, which raised the question of how liver fluke is able to maintain the genetic diversity seen despite the population bottleneck imposed by the snail on the parasite. If a snail can be infected with more than one genotype of liver fluke, which undergo clonal expansion simultaneously, this could overcome the bottleneck. To investigate this, 49 *G. truncatula*, from a laboratory maintained colony, were exposed to liver fluke isolates of known but distinct, MLGs. Two snails showed evidence of infection with more than one genotype, suggesting that multiple infections in the snail could influence the genetic diversity seen. A number of questions remain regarding the influence of the snail on fluke transmission. The tools developed here are now being used to determine which snails are infected with fluke and what governs the susceptibility within different populations of snails to infection. A better understanding of snail-parasite dynamics is essential for developing effective control measures to prevent disease.

Optimal harvest time of farmed *Mytilus edulis* in southwestern Baltic Sea

Kimberly Berglöf[1], Elin Lindehoff[1], Anna Thore[2], Catherine Legrand[1]
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Eutrophication is the most serious threat to reaching a good ecological status in the Baltic Proper. Mussel farming could be a way to reduce eutrophication in coastal areas. Blue mussels (*Mytilus edulis*) are filter feeders and can therefore clean the water by clearing up particles and nutrient recycling. In eutrophication hotspots, nutrient removal can be achieved through mussel harvest. Little is known about blue mussel aquaculture in the Baltic Sea. The low salinity leads to dwarfism in Baltic mussels making them unsuitable for human consumption and less valuable for farming compared with the North Sea or the Atlantic coast. However small mussels could still be used for nutrient mitigation and the harvest could potentially be used for animal feed or fertilizers. In this study the optimal harvest time of a coastal mussel farm in Kalmar sound (southwest Baltic Sea/western Baltic Proper) was investigated and the potential harvest time, yield and quality calculated. The aim was to identify an optimal time for harvest to ensure maximum biomass and nutrient removal. Monthly mussel sampling was performed, including assessment of condition indices and biomass quantity. Weekly analyses of water quality around the mussel growing nets and at a close-by reference site were performed to assess potential impact of the mussel farming on the water column. The percentage of dry meat varied between 11.01±2.36 and 15.63±0.60% and the biomass between 1.64±0.22 and 9.49±2.10 kg/m^2 from May to November 2016. The water analysis of oxygen concentration, pH, salinity and nutrient concentrations showed only small variations between the mussel farm and references site, indicating that the farm has little impact on the environment. The optimal harvest time was proposed to be in March, before the spring spawning event which generally coincides with the spring bloom of algae – since this events leads to large amounts of biomass loss. This study provides important knowledge for the optimization of mussel farming as a measure against coastal eutrophication in the Baltic Sea.

June July

A prickly aplacophoran mollusc from deep-sea plains: first record of an abyssal acanthomeniid Solenogaster in the North- West Pacific

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The deep-sea benthos is one of the largest and most continuous habitats on earth, yet its diversity remains largely unknown. The Kuril-Kamchatka Biodiversity Studies (KuramBio) Cruise set out to explore the benthic fauna of the Kuril-Kamchatka trench and its adjacent abyssal plains. Among the organisms collected with an epibenthic sledge were numerous Solenogastres, a small clade of aplacophoran worm-molluscs, which have their peak in diversity on the continental shelf and in bathyal depths. So far only nine lineages are reported from abyssal depths below 4000 m, thus the 18 morphospecies discovered during the cruise present a surprisingly high diversity. Most of the lineages are new to science, and we present a first characterization of one of these morphospecies encountered at 5385-5400 m. We studied the scleritome by scanning and light microscopy, and used histological serial sections to reconstruct its anatomy. The retrieved data suggest the specimen is a representative of the family Acanthomeniidae (order Cavibelonia). However, a unique character mosaic hampers an unambiguous assignment to one of the three existing genera. This study provides the first record of an acanthomeniid Solenogaster from the North Pacific, considerably expanding the hitherto known distribution of the family from the North and South Atlantic and the Davis Strait (Antarctica). The currently low diversity of Solenogastres from the abyss appears to be a severe underestimation, owing to the general under-sampling of the deep oceans.

Parasites and periwinkles

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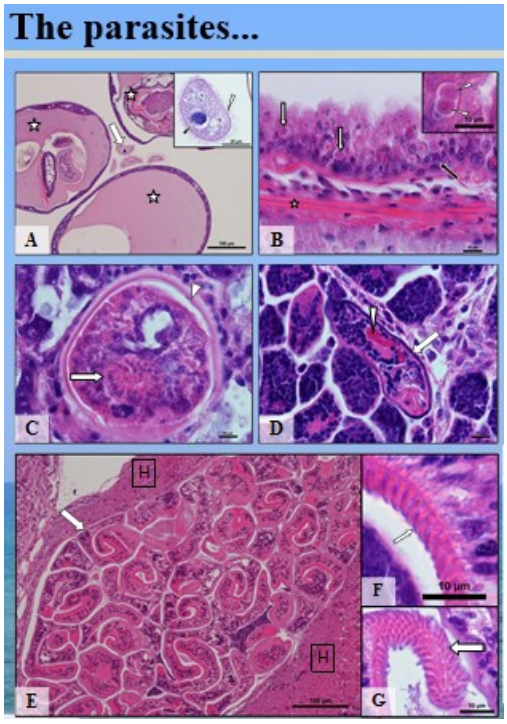

Following on from our previous presentation in 2014, here we present an updated and well-developed story of parasites and periwinkles; we provide an alternate view on the effects and distribution of parasites in intertidal hosts and explore their potential roles in a speciating gastropod.

Littorina saxatilis is a common intertidal gastropod on the shores of the North Atlantic, and an important study species for many sorts of evolutionary investigations. Its congener, *Littorina arcana*, is much less widely distributed, but both species are common at Old Peak, Yorkshire coast, UK. The pathogen profiles of *L. saxatilis* and *L. arcana* from this shoreline were determined histologically for this study and these data add to the wealth of trematode knowledge acquired from these hosts. The pathogen profile of both hosts consisted of a ciliated protist, *Protophrya ovicola*, an unidentified apicomplexan (present in <1% *L. saxatilis*), and three trematode parasites tentatively assigned to *Microphallus similis*, *Renicola* sp. and *Microphallus pygmaeus*. Using this information, the distribution of parasites across the mid and high-tidal shore was explored. Utilising individual pathogen profiles and shell morphometrics, an assessment of parasite-associated morphological change was conducted. We concluded that parasitism appeared not to cause shell-shape change, but rather that snails of a certain shell shape were more likely to display infection. This discovery suggests that not only are there probably shape adaptations in localised populations of these snails but also that these trematode parasites may have some capability to choose where they want to be.

Grips, ditches, mountains and valleys: surveying "Living Landscapes" for non-marine molluscs in Gwent, Wales, UK

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Conservation work in the UK increasingly adopts a "landscape-scale approach" to integrate species and habitat conservation with socioeconomic concerns. In Gwent, south-east Wales, the Gwent Wildlife Trust (GWT) focuses its efforts on increasing biodiversity and connectivity in three "Living Landscape" areas: Gwent Levels, Eastern Valleys and the rivers Usk to Wye. These include coastal, upland and freshwater ecosystems. GWT are keen to know how management practices at their reserves may be influencing the terrestrial and freshwater mollusc fauna. With this in mind, three projects are being carried out on GWT reserves to conduct baseline mollusc surveys, and identify the potential influences of different management practices on mollusc diversity. The projects cover three main habitat types: hay meadows and improved pasture, freshwater drainage ditches (grips & reens), and semi-natural ancient woodland. Two of the projects are comparative studies of similar reserves in the landscape areas, looking at the influence of historical and current management on mollusc diversity and abundance at both sites. Standardised techniques were used to enable future repetition for monitoring or expansion, including the novel method of suction sampling for molluscs in grassland. As the results are analysed there have already been several discoveries, including a locally new record of the ancient woodland specialist *Malacolimax tenellus* (Limacidae). Initial results for one project support the hypothesis that hay meadows are more diverse than improved pasture for molluscs and that GWT's restoration of the latter is having some success. As part of a Natural Talent traineeship and the work of a major public Museum, the project has incorporated public engagement at every stage.

Friends or cell-mates – responses of the zebra mussel *Dreissena polymorpha* to conspecifics

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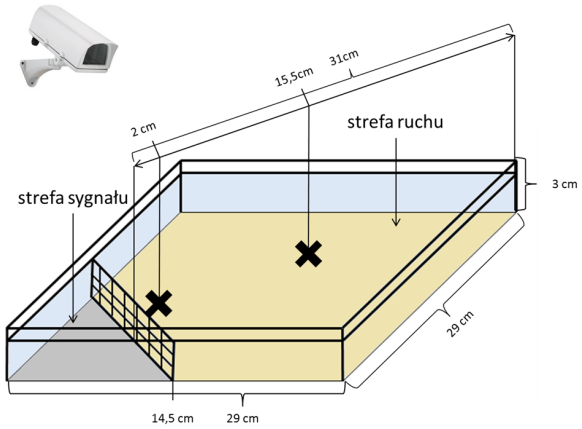

Due to its high invasive potential, the zebra mussel is one of the most studied bivalves. Most studies have focussed on the practical use of this species as an efficient filter feeder or bio-indicator and have indirectly assumed that this mussel was extremely gregarious and created dense 3-dimensional colonies. However, no studies have clearly demonstrated relations between conspecifics and their presumed preference for one another. Life in a mussel colony may involve a compromise between the protection from negative environmental factors (e.g. predators) and deteriorating environmental conditions resulting from the increased density. Also, adult zebra mussels lose their ability to move, which may be a major factor in aggregation. Additionally, a few studies have suggested that *D. polymorpha* prefers harder substrata than conspecifics. All of these premises lead to a hypothesis that zebra mussels may not exhibit such a high affinity for conspecifics as has been assumed. Our aim was therefore to check reactions of *D. polymorpha* to conspecifics. We observed locomotion and valve movement (as evidenced via a colour mark on the shell) of test mussels in the presence of other individuals (physically separated, in different densities). All laboratory experiments were video-recorded and evaluated with behaviour analysing software, following both types of movement. At high conspecific density, 78% of mussels remained in their initial positions (15 cm from the conspecifics), despite the adverse substratum. Relocating mussels did not move directionally in response to conspecific cues. Moreover, mussels spent more time with open valves and opened their valves more widely in the presence of conspecifics. Probably, zebra mussels avoid a direct contact with conspecifics and, if possible, prefer to stay at some distance from them. The fact that adult zebra mussels in a colony are fouled by younger conspecifics makes this assumption more likely. The longer opening time may indicate some kind of competition among crowded mussels for food resources. Our study was supported by a grant of the Polish National Science Centre No. 2015/17/N/NZ8/01653.

The habitat preferences of the zebra mussel *Dreissena polymorpha* to different species of unionid clams

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Dreissena polymorpha is one of the most invasive species. In many invaded places zebra mussels create numerous colonies which cause major changes in the environment. As a sessile species, it fouls solid substrata such as stones, coarse woody debris, garbage but also boat hulls and hydrotechnical devices, often resulting in permanent damage and financial loss. *D. polymorpha* fouling also has a negative impact on other organisms, in particular on the Unionidae clams. Zebra mussels contribute to a significant load and deformation of Unionidae clams by fouling their shells, particularly near the siphon. This may negatively influence condition and normal function of host clams. We investigated: 1) which species of Unionidae are the most preferred by *D. polymorpha*, 2) does preference change on different substrata and 3) how does zebra mussel fouling influence the physiological condition of Unionidae (its weight). We studied 87 individuals of Unionidae (*Unio pictorum*, *Unio tumidus*, *Anodonta anatina*, *Anodonta cygnea*, *Sinanodonta woodiana*) collected from sandy substratum site and 43 individuals sampled from the muddy substratum site in a dam reservoir. We checked: clam weight, volume and shell surface area, as well as, the weight and number of *D. polymorpha* attached either directly to the unionid shell or to other zebra mussel individuals. Our study revealed that *D. polymorpha* preferred mainly *A. anatina* and *S. woodiana*, whereas *U. tumidus* and *A. cygnea* were overgrown by fewer zebra mussels. The weight/volume ratio (condition index) of Unionidae clams was independent of the degree of zebra mussel fouling. The percentage of *D. polymorpha* attached directly to Unionidae was greater on sand than on the muddy bottom and related negatively to the dreissenid density. The most malformed shells were those of *S. woodiana.* We collected co-occurring clams for our study, thus we can exclude variable availability of dreissenid larvae as the possible cause of differences in fouling intensity. Further studies are needed to discriminate between other potential explanations: unionid shell properties, their burrowing depth or chemical interactions. Our study was supported by internal funds of the Nicolaus Copernicus University.

Documenting the past: the Tomlin archive

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John Read le Brockton Tomlin (1864-1954) was one of the most highly respected conchologists of his time. He was a founder member of the Malacological Society of London, and editor for the Conchological Society of Great Britain and Ireland for thirty years. In both societies he also held the post of president for a number of years. Tomlin acquired the already large collection of James Cosmo Melvill in 1919, and continued to expand upon it until its bequest to the National Museum Wales, Cardiff in 1955, when it was estimated to total over one million specimens. As a true collector, Tomlin had also amassed a unique library of molluscan books and reprints, and his personal correspondence archive. The archive mainly comprises the correspondence between Tomlin and his many shell associates around the world, accumulated during his lifetime. It is estimated to contain well over a thousand documents which we are cataloguing and digitally imaging . The content of the archive mostly concerns the everyday business of maintaining a large collection. The cataloguing process has unearthed many interesting finds. It has brought to light fascinating aspects of the lives of the people who contributed to the archive, recounting collecting expeditions and voyages, personal illness and hardship, war, dinner invitations and even Christmas cards. It is an archive not only of scientific history, capturing a bygone era of collecting but also an archive of personal and social history.

Geometric morphometric analysis of *Segmentina nitida* throughout Europe

Christopher Hobbs & Chris Harvey
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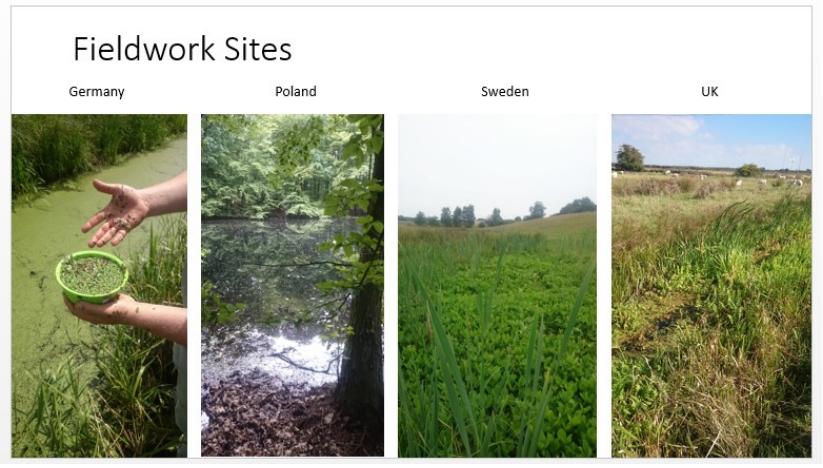
The Shining Ramshorn Snail, *Segmentina nitida*, a rare freshwater snail found predominantly in drainage ditches and marshland, has seen a marked decrease in population (~80%) over the last 100 years in the UK. This has mainly been attributed to the over-dredging of drainage ditches as part of land management, as well as eutrophication caused by run-off of fertiliser from agricultural land. Despite this decline of *S.nitida*, there is little protection for this species outside of nature reserves, as it is no longer on the IUCN Red Data Book for Invertebrates since guideline changes in 1994. This paper will present 2D geometric morphometric analyses of *S. nitida* samples from Poland, Germany, Sweden, and the UK, to identify morphological patterns and differences within and between populations. This work will be later be used in conjunction with population genetics analysis of the same samples, to identify relationships between morphological and genetic divergence of populations. The work is part of a larger PhD project looking at various aspects of *S. nitida*, including 3D geometric morphometrics, population genetics, breeding, and improved sampling for this rare snail.



Trans-atlantic rafting bivalves – American molluscs on British & Irish shores

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American molluscs attached to plastic debris were recently discovered on British and Irish beaches. Violent storms pounded the shores of the UK and Ireland in 2013-2014 resulted in anthropogenic waste which was churned up and cast ashore. Bait pots, fishing spools, buoys and other items were discovered on beaches in western Ireland and Cornwall and Devon in England. Attached to these 'rafts' were numerous invertebrate species that were later identified as originating from the SE coast of USA. Of the molluscs the majority were bivalves, in particular byssally-attached species. Are these rafting species potential invasives?

Local refuse on shore In the Azores

Species richness of European spring fen biota in relation to habitat specialization: untangling the effects of water pH, climate and regional settings

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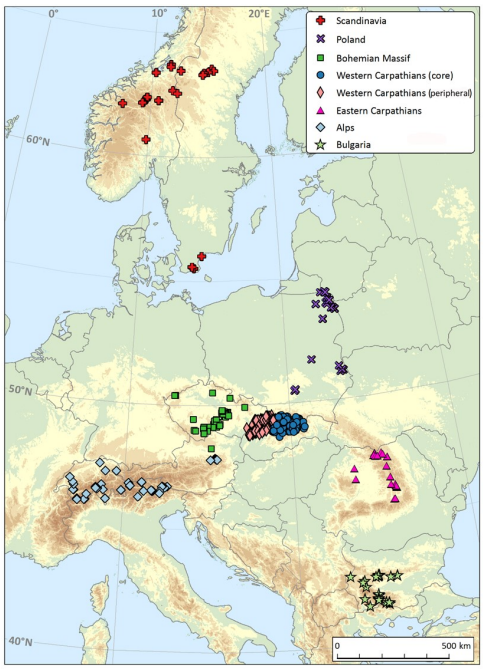
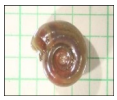


Water pH is an important driver of species diversity in groundwater-fed fens. However, species richness-water pH relationships may differ for habitat specialists and matrix species (i.e. those occupying the adjacent habitats), as these two groups evolved under different environmental conditions. In this study we aimed to inspect the large scale richness-pH relationships of molluscs, vascular plants and bryophytes, calculated separately for specialists and matrix species, and to discuss the processes and mechanisms underlying the potential differences. The samples were collected at 495 well-preserved open fens located in continental Europe, using the same protocol over the entire area. Richness-pH relationships were calculated using generalized linear models. Species richness was significantly related to water pH ($P<0.01$) in both specialists and matrix species of all studied taxa. The amount of variation explained by the models and the positions of richness maxima along the water pH gradient varied among the taxa and between the specialist and matrix species, presumably reflecting their physiological requirements as well as ecological and historical settings of the regions. We also found that Southern Scandinavia was clearly over-represented in specialists of all groups and that Southern Scandinavia, Poland and the Alps were over-represented in relicts. On the other hand, regions with mostly small, isolated and fragmented sites were generally over-represented with matrix species. We conclude that besides a conservation focus on regions with a high number of specialists and relict species, a special effort should be made to stop further fragmentation and destruction of fen habitats, which can result in the replacement of habitat specialists by matrix species.



Developing a polymerase chain reaction assay for detecting *Schistosoma mansoni* pre-patent infections in *Biomphalaria* snail

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Schistosoma mansoni is a trematode parasite, utilising *Biomphalaria* snails as intermediate hosts; resulting in intestinal schistosomiasis in humans. As disease control focus shifts from managing morbidity to transmission control, the development of sensitive and specific monitoring tools are required. Identifying infections within the snail population is an efficient method of determining transmission dynamics, a better understanding of which would facilitate development of more accurate models and evaluate the impact of control interventions. Because pre-patent infections are more prevalent than patent infections within snail populations, this study aimed to develop a sensitive Polymerase Chain Reaction (PCR) to detect *S. mansoni* pre-patent infections within snails. The previously designed Sm1-7 and SmF/SmR primers were investigated, using a range of cercariae and *Biomphalaria* samples stored in SCAN (Schistosomiasis Collection at the Natural History Museum). Specificity and sensitivity of the primers was assessed and their ability to detect pre-patent infections investigated. The primers ability to detect S.*mansoni* DNA in snail DNA pools was evaluated, assessing its application for mass screening. An optimal PCR assay was developed and evaluated on *Biomphalaria* held in SCAN from Nyamahona, Tanzania. The Sm1-7 primers were rejected as they produced amplification products from non-schistosome cercariae. The SmF/R primers demonstrated the ability to detect pre-patent infections 24hrs post-exposure, showing high specificity against other trematode cercariae and high sensitivity detecting adult worm DNA down to 1.84pg. The developed PCR assay detected 44.1% of infections as oppose to 16.9% identified by cercarial shedding in *Biomphalaria* from Nyamahona, Tanzania. These results demonstrate the potential of this PCR assay in determining pre-patent *S. mansoni* infections in the field, This PCR is a new and invaluable tool in evaluating *S. mansoni* transmission and control interventions. Such tools are of ever increasing importance as focus moves towards elimination.

Preliminary observations on the timing and patterns of movement in the pulmonate *Onchidella celtica* (Cuvier, 1816)

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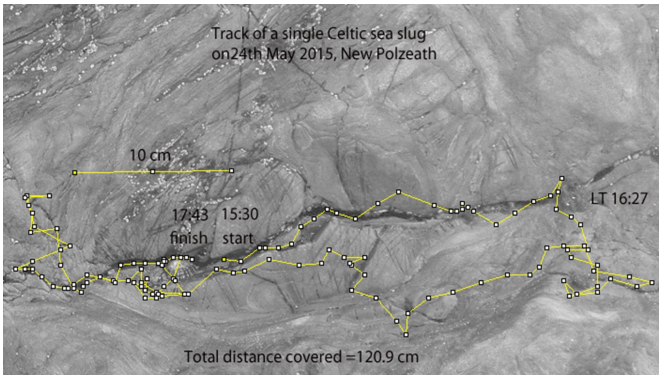
The Celtic sea slug, *Onchidella celtica,* is an air-breathing intertidal gastropod mollusc, and the only British member of Onchidiidae, a family of pulmonates. It is a Lusitanian species with its northern limit of distribution in the south-west of England. It is an obligate crevice dweller on semi-exposed and exposed rocky shores characterized by a mussel and barnacle community. Time-lapse photography was used to record the activity of *O. celtica* emerging from crevices on a rocky shore at New Polzeath, North Cornwall during 66 periods of tidal emersion from April 2016 to September 2016 (including consecutive day and night tidal emersions during two complete semilunar periods). Movements were tracked manually using the Fiji image analysis platform, and the results analysed using R-Studio software. The results include the geometry and dynamics of 220 tracks of Celtic sea slugs emerging from a single crevice to forage and mate during the two semi-lunar periods. Although the duration, distance, and pattern of the movements varied considerably, most Celtic sea slugs returned to their home crevice before the time of low tide. The pattern of movement varied in complexity from a simple single loop to multiple looping and complex meandering, and from no overlapping between outward and homeward tracks to complete overlapping. Preliminary analyses using Maximum Likelihood Estimation (MLE) indicates that *O. celtica* foraging conforms well to the Levy Walk foraging hypothesis. Movement patterns appear to differ with slug length and between mating and non-mating individuals. The number of Celtic sea slugs foraging varied greatly on consecutive days throughout each semilunar period. There was no clear correlation between numbers foraging and air temperature, wind speed, wind direction, precipitation, humidity and cloud cover, but the numbers foraging tended to decrease with surf height (Pearson Correlation r = -0.599; $P < 0.001$). Celtic sea slugs emerged, foraged on the open rock, and returned to their home crevice at all hours of the day and night. However, the maximum emergence and foraging activity occurred between 18:00 and 21:00. The implications of these results with regard to searching, foraging, and homing hypotheses are discussed.



Can copulatory preferences of littorinids (Mollusca: Caenogastropoda) be explained by mucus trail chemical composition?

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Two groups of morphologically and phylogenetically closely related species of *Littorina* marine mollusks, the 'obtusata' (*L. obtusata*, *L. fabalis*) and the '*saxatilis*' (*L. saxatilis*, *L. arcana*, *L. compressa*) sympatrically inhabit the intertidal zone of the North Atlantic. These species are characterized by similar breeding season and reproductive behaviour. The existence of mechanisms preventing interspecific breeding and supporting reproductive isolation might therefore be expected. The characteristics of a mucus trail made by a snail during locomotion may be a key cue for a mate choice. Snails were collected from wild populations, placed individually into Petri dishes and left to creep. Mucus trail chemical compositions were analysed for males and females of each of five sister species and *L. littorea* as an outgroup using liquid chromatography-mass spectrometry (LC-MS). Mucus was collected and LC-MS-analyzed. Jaccard's dissimilarities coefficients based on presence-absence data were used for cluster analysis. Considerable variation in mucus composition was revealed among individuals of either different or the same species. Only five compounds among 108 used for analysis were common to all examined samples. Two of them proved to be halogenated alkaloids of yet unknown structure. We failed to find any differences between mucus compositions of conspecific males, females and immature or infected individuals in all five species of the "*obtusata*" and "*saxatilis*" groups, but such differences were revealed for *L. littorea*. Comparative interspecies analysis showed that *L. saxatilis* / *L. arcana* pair and *L. obtusata* formed the separate sister-clusters, while *L. compressa*, *L. fabalis* and *L. littorea* – a mixed cluster, was outer to three species mentioned above. The results are compatible with the hypothesis of a mucus trail as a species-specific cue for a mate choice. This could represent the molecular background for possible mechanisms of prezygotic reproductive isolation in *Littorina* sympatric populations. However, our data for mucus chemical composition cannot explain the copulative preference for females as mates, observed in nature (224 copulative pairs collected from wild populations were evaluated for conspecific mating). This work was supported by RFBR grant 15-04- 08210 and the Research Center "Molecular and Cell Technologies" of St. Petersburg State University.

Do proteins "know" anything about speciation? A lesson from littorinids (Mollusca:Caenogastropoda)

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The assumption of genomic monopoly in inheritance prompted direct interpretation of genomic history into organismal history. Since the first reliable description of nongenetic inheritance mechanisms and inference of its evolutionary implications, the proteomic and transcriptomic data should not be ignored when speciation is considered. Here we assessed evolutionary informativeness of proteomic data using 10 littorinid species from several geographic locations. The tree based on Jaccard's dissimilarities of proteomes was compared with classic morphological and consensus molecular trees. The genetic and proteomic trees were similar in shape, with interspecific differences being stronger than differences among locations. The only exception was proteomically (and genetically) similar *Littorina saxatilis* / *L. arcana*, for which geographic location was the strongest factor. However, there were several minor inconsistencies between the trees. (1) The proteomic distances expectedly exceeded the genetic ones. (2) The genetically distant species *Echinolittorina subnodosa* / *E. millegrana* and *Littoraria ardouiniana* / *L. melanostoma* appeared relatively closer in the proteomic than in the genetic tree. This might be interpreted as proteomic homoplasy due to biotope sharing. (3) Proteomic distances were greater for close relatives, whose populations live in sympatry in the same locations. This happened with sibling species pair *L. obtusata* / *L. fabalis*, and with *L. compressa* in relation to genetically and ecologically close *L. saxatilis* / *L. arcana*. This also was true for *L. littorea* (*Littorina Littorina* subgenus) versus the *L. neritrema* subgenus species. This may reflect ecological divergence due to adaptation of species to their specific microhabitats, when ecology driven proteome specialization significantly "outruns" the changes of neutral genomic markers. Proteomics is less informative for inter-genera comparisons, because too many proteins are changed and too few are conserved, yielding poor grouping of the genera with comparably high binary dissimilarity. At the same time, the complementarity of proteomic and genomic data can bring additional information with regard to closely related species, where proteomics has higher resolution.
This work was supported by RFBR grant 15-04- 08210 and the Research Center "Molecular and Cell Technologies" of St. Petersburg State University.

Snails as accomplices in cases of cercarial dermatitis from Water Valley reservoir in Koszalin (Poland)

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Freshwater snails belonging to Lymnaeidae and Planorbidae families play a role as the first intermediate hosts for bird schistosomes (Trematoda: Digenea). The larval stages of these parasites - cercariae, released from the snails cause swimmer's itch - itchy skin rash. Numerous cases of swimmer's itch were reported in Summer 2015 from Water Valley reservoir in Koszalin (Poland). For one three-year girl, this parasitic disease lasted for more than one month whereas for an adult male only two weeks. The dermatitis for the child was accompanied by an increase in body temperature to 38 °C and catarrhal changes of the nasal mucosa. The presence of bird schistosomes in the Water Valley reservoir snails was confirmed by post-mortem examinations of host snails gathered in the summer of 2015 and 2016. In total, 419 snails were sampled: 149 individuals of *Lymnaea stagnalis*, 76 *Radix* spp., 68 *Stagnicola palustris*, 131 *Planorbarius corneus* and *73 Planorbis planorbis*. The snails naturally infected with bird schistosomes constituted 4.4 % of all collected specimens. We detected bird schistosome larvae from *Radix* spp., *P. corneus* and *P. planorbis*. Experimental studies at a controlled temperature (19 °C) showed that one *Radix* spp. specimen can release average 1657 (SE±54), and *P. corneus* 895 (SE±178) cercariae per day. Such a large intensity of release even at low prevalence of infected snails determines the risk of swimmers' itch in humans. There are three strong arguments for monitoring bird schistosomes' invasion of snails in areas of water recreation: i) intermediate hosts of bird schistosomes infect common snail freshwater species, ii) waterfowl - the final hosts - are mobile source of bird schistosome infection for snails, iii) the lack of clear data on the fate of penetrating human skin cercariae.

A new 3D approach to quantify shell growth in *Styliola* pteropods across the global ocean

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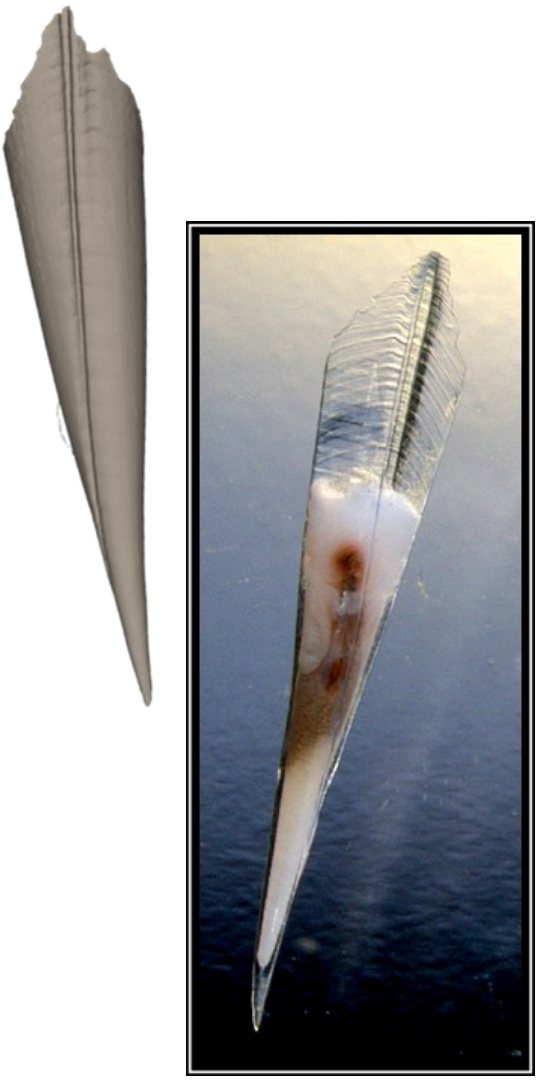

Increased atmospheric carbon dioxide lowers the carbonate ion concentration in the global ocean and makes it increasingly difficult for calcifying organisms to produce and maintain their calcium carbonate shells. As pteropods contain a highly soluble aragonite shell, they are considered as potential indicators of the effects of ocean acidification (OA). Studies of the responses of pteropods to changing ocean chemistry have focused on experimental work on short timescales. However, we know little about calcification of pteropods in their natural habitat and how this may vary across the global ocean. The aims of this study were to describe the ontogeny, quantify shell growth, and test for morphometric differences between Atlantic, Pacific and Indian ocean populations of the pteropod species *Styliola subula*. This species is highly abundant in subtropical gyres and has a deep diel vertical migration pattern (up to depths of 800 m). The shells of *Styliola* pteropods retain their juvenile shell (protoconch), have a cone-like shape with a slightly twisted groove along the length of the shell, and clearly visible growth lines. The shells have only a single true landmark (the tip of the shell), hence, a morphometric approach based on 3D models is more appropriate than the more commonly used 2D geometric morphometric methods. We created 3D models of 48 adult *Styliola* shells, using a microCT scanner and recorded every growth line on mesh models of the entire shell. Ontogeny and shell shape differences were quantified based on the perimeter of each of the growth lines along the groove per individual shell. Shell growth was estimated by dividing the shell length by the number of growth lines. We found no differences between the development, nor growth rates of shells from three different ocean basins. However, the shape of shells from the Indian ocean differed significantly from the northern Pacific and northern Atlantic shells. Our results based on a newly developed 3D method provide general insight into the natural growth patterns of *Styliola* shells and, possibly, their ages and generation times in different parts of the world's ocean.

Phenotype-environment matching in the Kerry spotted slug *Geomalacus maculosus* (Allman): exposure to UV radiation induces colour change resulting in camouflage

Award Winner Best oral presentation

Aidan O'Hanlon, Kristina Feeney, Mike Gormally
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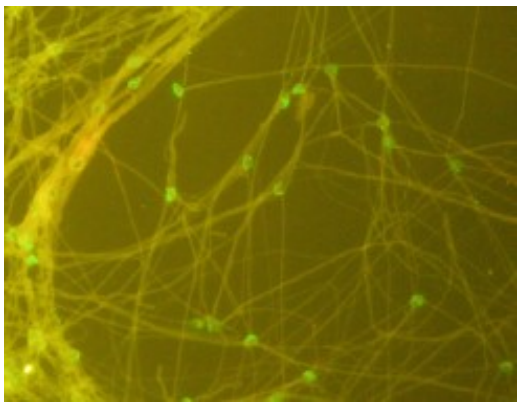
Animal colours and patterns are commonly used in camouflage from predators, social signalling or increasing survival in response to some other environmental stressor. Colour dimorphisms can evolve within populations exposed to different levels of predation or environmental stress and in some cases can arise within the lifetime of an individual as the result of phenotypic plasticity. Many terrestrial slug species (Mollusca: Gastropoda) exhibit variation in skin pigmentation, both between and within species. The Kerry slug *Geomalacus maculosus* (Allman) exhibits two distinct phenotypes: brown animals with cream-coloured spots occur in forest habitats whereas black animals with white spots live in open habitats such as blanket bog. Juvenile slugs hatch as the brown colour morph in both habitats, suggesting that skin pigmentation may be a plastic trait. Both colour forms strongly resemble the substratum in each habitat, with the spots possibly functioning as disruptive camouflage against a heterogeneous background. Our study used digital photography to investigate whether each *G. maculosus* phenotype is distinctively associated with each habitat. Analysis of digital images of wild slugs demonstrated that each colour morph is strongly and positively correlated with colour properties of the background in each habitat, but not with the substrata of alternative habitats, suggesting habitat-specific crypsis. Experiments were undertaken with laboratory-reared juvenile slugs to investigate whether diet or ultraviolet (UV) radiation could induce colour change. No difference in RGB reflectance was observed in juveniles reared on different food treatments after 84 days. Exposure to UV radiation induced the black (bog) phenotype after 84 days, whereas slugs reared in darkness generally became paler. Examination of skin tissue from specimens of each colour morph revealed a higher concentration of melanin in the integument of the black phenotype. These results suggest that colour dimorphism in *G. maculosus* is explained by differential exposure to UV radiation, with each resulting colour morph providing incidental camouflage against their respective substratum in each habitat type and provide, to our knowledge, the first example of morphological phenotypic plasticity in a terrestrial slug.

Juvenile Kerry slugs

Presenting the Award- from left to right

Aidan O'Hanlon, Katrin Linse (Treasurer), Andreia Salvador (Council Member and Forum organiser), Jon Ablett (Awards Officer), Suzanne Williams (President)

Sperm labelling of hermaphroditic freshwater snails



Yumi Nakadera, Aykut Kurt, Steven A. Ramm
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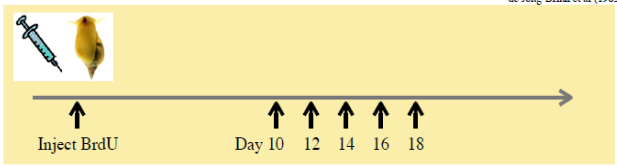
Sperm labelling allows researchers to follow the fate of sperm cells and investigate the wide-range of pre- and post-copulatory processes. By focusing on a particular set of sperm cells, we can examine when and how they are produced, how they are transported within the female reproductive tract, and ultimately how they succeed to fertilize eggs. Therefore, establishing a sperm labelling method is useful for studies of reproductive physiology and evolutionary biology. Here we focus on simultaneously hermaphroditic gastropods that produce sperm and eggs at the same time within the gonad which is an ovotestis. We investigated how the gametes diverge into sperm and eggs within this single organ. To the best of our knowledge, a quantitative approach to spermatogenesis has not yet been reported in gastropods. Therefore, as a first step, we systematically labelled sperm cells of *Lymnaea stagnalis* (L.) using a BrdU-based immunocytochemical assay. BrdU is an analogue form of thymidine, which incorporates into DNA molecules of currently replicating cells, including sperm cells. We hypodermically injected BrdU in a saline solution into *L. stagnalis*, and incubated the snails for 10-18 days ('chase day'). During that time, BrdU-positive cells were expected to proliferate and eventually differentiate into sperm. Then, we collected the sperm cells and by applying specific antibodies, we observed whether they contain BrdU or not, and also how far sperm differentiation (or spermatogenesis) had progressed in each 'chase day'. Based on our preliminary results, I will discuss future research ideas using this versatile sperm-labelling method to further expand the understanding of reproductive system in gastropods.

Methods

1. Register sperm cells
   (1) Inject BrdU solution into soft body of matured *L. stagnalis*
   (2) Incubate the snails for 10-18 days in pairs

de Jong-Brink et al (1985a)



2. Collect sperm cells
   (1) Dissect out seminal vesicles, where they store own matured sperm
   (2) Make sperm suspension in PBS buffer to store at -20 °C

3. Detect BrdU-positive sperm cells
   (1) Prepare sperm samples on adhesive slide glasses
   (2) digest and apply antibodies …

Atlantid heteropods as sensitive indicators of environmental changes

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[2]Naturalis Biodiversity Center, Leiden, The Netherlands
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The atlantids are a family of small (up to 14 mm), aragonite shelled, planktonic gastropods (Pterotracheoidea; Atlantidae) with a wide distribution in tropical, subtropical and temperate waters. Despite their susceptibility to post-depositional dissolution and mechanical damage, atlantids have a fossil record that extends back to the Oligocene and possibly back to the Cretaceous. Yet they are rarely used as proxies or palaeo-indicators of environmental changes. This is largely because of our relatively poor understanding of atlantid taxonomy and biogeography which has led to a lack of information about their optimal environmental conditions. Here we present new research that uses an integrative taxonomic approach, combining shell morphology and DNA barcoding of the COI gene to refine atlantid taxonomy. This research has permitted detailed biogeographic interpretations for some atlantid species, revealing that they inhabit distinct regions with narrow environmental gradients and indicating that they are more specialized than previously thought. This new information suggests that atlantids would be extremely sensitive to environmental change and demonstrates their potential as indicators of such change in the past as well as in the future.

Convergent evolution of shell shape in *Cyclophorus* spp. (Caenogastropoda: Cyclophoridae) from Vietnam

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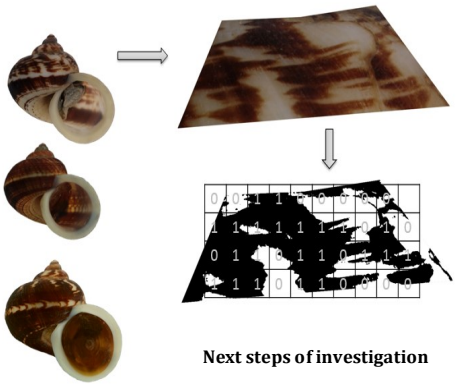
In Vietnam, scattered limestone karst outcrops form functional islands for calcium-dependent land snails. Terrestrial caenogastropods of the genus *Cyclophorus* are very abundant at these karst outcrops and have developed a high level of morphological diversity. While most South East Asian morphospecies of the genus only have relatively restricted distribution ranges, a very widespread morphotype is found in northern Vietnam. To test whether this *Cyclophorus* morphotype in fact represents a single species, or whether it comprises multiple, highly similar species, we used a combined approach of molecular phylogenetic and morphometric analyses. The molecular phylogeny revealed that the widespread *Cyclophorus* morphotype does not form a single clade but comprises several distantly related evolutionary lineages. The morphometric analysis found a high overlap of shell shapes among these lineages and distribution records revealed that they never occur sympatrically at the same karst area. These findings suggest that the widespread *Cyclophorus* morphotype comprises multiple, potentially cryptic species that might have resulted from convergent evolution among the isolated habitats.



Next steps of investigation

One for each ocean: resolution of the large-scale distribution species complex: *Bursa granularis* (Röding, 1798) (Tonnoidea, Bursidae)

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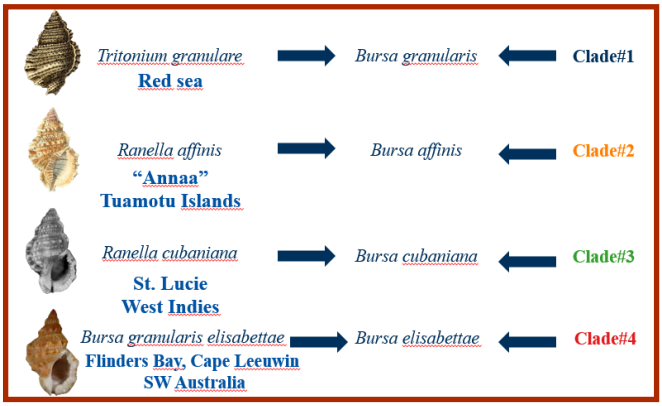

Tonnoideans are marine gastropods known to have an extremely long planktotrophic larval stage, possibly reaching several years. Consequently, they are also supposed to have high dispersal abilities, and for this reason morphologically similar species originating from different localities are regularly synonymized, resulting in fewer species with large-scale distributions. Here we focus on the tonnoidean species *Bursa granularis* (Röding, 1798) (Bursidae). It is supposed to occur in all sub-tropical oceans of the planet with the exclusion of the western shore of Africa, where it is replaced by the closely related species *Bursa scrobilator* (Linnaeus, 1748). We sequenced the CO1 gene for 89 specimens of *Bursa granularis* mainly from the Muséum national d'Histoire naturelle, Paris, and the University of Florida collections, covering a large part of its distribution area. Three species delimitations methods were applied, one based on genetic distance (ABGD) and two based on phylogenetic trees (GMYC and PTP). All analysis suggested that *B. granularis* comprises four distinct species: one is limited to the Caribbean Sea, the other to South West Australia, and the two others are found in the Indo-Pacific, partly overlapping in Vanuatu and New Caledonia. Relying on shell characters, we applied available names currently buried in the synonymy of *Bursa granularis* to each of the four species, a difficult task given the number of available names and the limited conchological synapomorphies identified for some of them. The potential consequences of our results on other molluscs species with long-lived larvae and large-scale distributions are also discussed.

Community assembly among limestone karst areas – Insights from Vietnamese land snails

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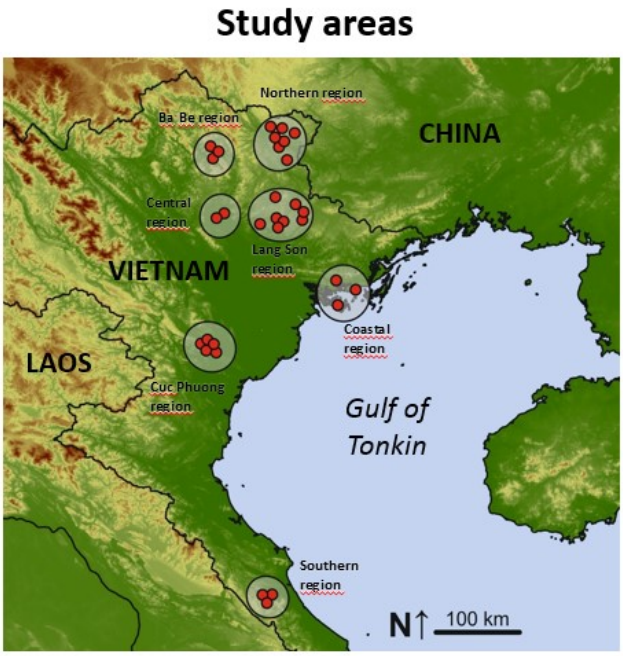

The limestone karst areas of Vietnam harbour an extraordinarily rich biodiversity and various organisms, such as many land snail species, strictly depend on these calcium-rich habitats. For such taxa, individual karst areas can act as functional islands, which are surrounded by dispersal barriers. Among different karst areas, species communities can differ considerably. The exact mechanisms that have shaped the composition of these communities, however, remain largely unknown. Two major processes, which might have been involved in the assembly of the karst communities, are competition between taxa and habitat filtering. In the case of competition being the predominant factor, taxa coexisting in the same karst area are expected to be ecologically less similar than by chance, while habitat filtering would result in a contrary pattern. In the present study the effect of competition and habitat filtering on Vietnamese karst communities are studied based on land snail taxa, using both morphological and phylogenetic data as proxies for ecological similarity.

Assessing species boundaries in the open sea: applying an integrative taxonomic approach to *Diacavolinia* pteropods

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To track changes in pelagic biodiversity in response to ocean change, it is essential to accurately define species boundaries. This can be achieved by an integrative taxonomic approach in which species are described not only based on morphological, but also on molecular, behavioural, ecological and/or geographic characteristics. A particularly suitable, yet challenging, group for integrative taxonomy is the holoplanktonic, shelled pteropod genus *Diacavolinia.* Numerous samples are available in museum collections and their shell shapes enable detailed geometric morphometric analyses. Although 24 morphological *Diacavolinia* taxa have been described, specimens are usually not identified below genus level. We designed an objective method for identifying species boundaries in *Diacavolinia* pteropods by linking incomplete and different datasets, including museum type specimens. We applied an integrative species concept based on congruence between Cytochrome Oxidase I and 28S sequence data, geometric morphometric analyses of shells, and geographic data to a total of 969 specimens and found evidence for reducing the number of species from 24 to 11 or 13 species. In the Atlantic Ocean the number of species should be reduced from seven to two species. In the Indo- Pacific we found at least nine species, comprising at least 13 of the originally described taxa. The most important biogeographic barriers were between the Atlantic and Indian oceans, between the East and Central Pacific and between the Red Sea and Indian Ocean. Biogeographic distributions of revised *Diacavolinia* species were as follows: Atlantic (6 endemic species), South African waters (5 endemic species), Western Indian Ocean (4 species), Red Sea and Gulf of Aden (3 species), Indo-Polynesian (6 species, 1 endemic), Hawaiian waters (3 species, 1 endemic), Sino-Japanese waters (3 species), and East Pacific (3 endemic species). Given the high levels of genetic and phenotypic diversity found among *Diacavolinia* taxa, it is unlikely that different taxa will respond in the same way to future ocean changes.

The early Toarcian mass extinction event (Bulgaria)

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The early Toarcian mass extinction was one of the most important biotic crises of the Mesozoic era, with severe disruptions in the marine realm, resulting in the loss of 15-20% of marine families and genera. This event is closely linked with the Karoo-Ferrar Large Igneous Province, the postulated driving mechanism for severe contemporary geochemical perturbations leading to anoxia and extinction. Despite the global nature of the extinction event, the majority of existing records come from North-Western European epicontinental sedimentary sections. We will present new quantitative palaeoecological and facies data, alongside geochemical records (Sr, C and O, carbonate and organic), from more easterly Tethyan Lower Jurassic sections in North-West and central Bulgaria collected during a recent field season in August 2016, funded by the Malocological Society of London. These data document major sea level fluctuations and track macroevolutionary trends of marine shelf ecosystems from an area closer to the open Tethys Ocean. A lack of black shales in Bulgarian sections, which are well recognised during the Toarcian time interval in the North- West European Boreal Realm, suggests there was a much weaker manifestation of anoxia in the region.

The *Mollusca Types Catalogue* online

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The Mollusca collection held at Amgueddfa Cymru – National Museum Wales is the second largest in the UK and contains some 3200 'type' specimens. The *Mollusca Types Catalogue* was published online in 2012, illustrating our holdings of over 350 holotypes and lectotypes. Each record contains type specimen photographs, label scans, full reference information, collection information and a PDF of the original description available on request. The catalogue continues to grow as our syntypes and paratypes are researched and added. This online resource has allowed us to reach a wider audience and increase access to our collection.

Available online at http://naturalhistory. museumwales.ac.uk/molluscatypes/

Genetic analyses of the vetigastropod *Gibbula umbilicalis*

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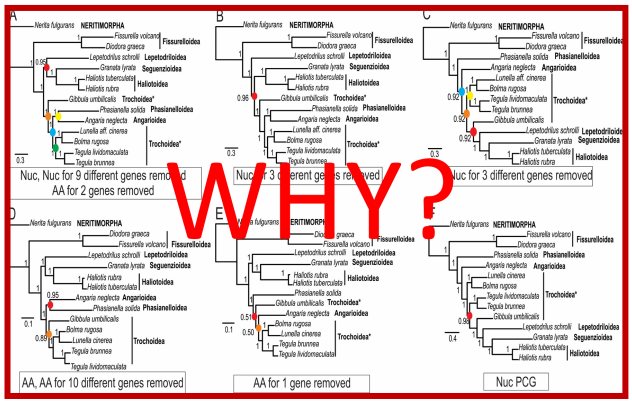

Gibbula umbilicalis is a rocky-intertidal gastropod in the highly speciose family Trochidae found in the north-east Atlantic. The mitochondrial genome for two specimens was sequenced and used in a new phylogenetic analysis for Vetigastropoda, which suggests not only that different genes contribute to different tree topologies but also that positive selection is occurring on at least one gene. Using primers flanking the most variable region of the mitochondrial genome, a population genetic analysis has revealed significant similarities between some sites on the Atlantic coast of France and Spain. This is in spite of a 200km habitat gap made up of sand and artificial hard substrata in the south-west of France, suggesting that the habitat gap may not limit population connectivity between rocky sites in the north of France and the north of Spain. Further population genetic analyses will be carried out using primers designed from the *G. umbilicalis* transcriptome to amplify microsatellites, which may reveal further genetic structure

ALSO SEE PAGE 27

More evidence for passive dispersal of land snails via birds

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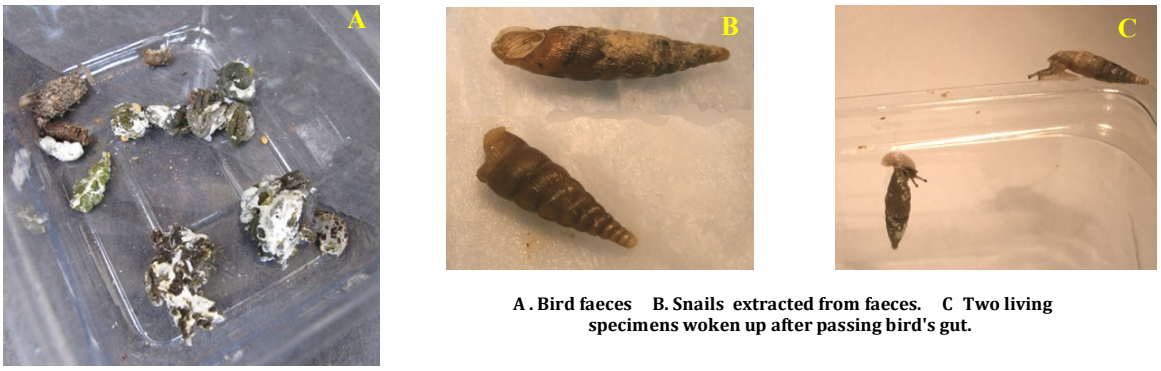
Passive dispersal is fundamental for land snails as they are not capable of moving for long distances. Birds are known as one of the main vectors of their dispersal. Snails can be both attached on the body of a bird (ectozoochory) and be carried in the bird's digestive tract, which, in some cases, they can pass through alive (endozoochory). There are only few experimental studies of snails' endozoochory, recorded for only minute snail species. We examined the ability of larger forest species (up to c. 17 mm in maximum shell dimension) to survive passage through a bird's digestive system. These species were found to live on the isolated islands of deciduous forest in areas of pine plantation unsuitable for snails. Live *Alinda biplicata, Cochlodina laminata* (both Clausiliidae) and *Discus rotundatus* (Discidae) were fed to 54 bird species (Corvidae, Turdidae, Sturnidae and Columbidae) in 14 experimental trials. In addition, minute snail species (*Vertigo* sp., *Carychium* sp.) were also fed to birds. Of 720 snails offered, 14 intact shells were found, of which nine were alive (eight clausiliids and one *D. rotundatus*). This suggests that more than 1% of snails can survive ingestion.



A . Bird faeces B. Snails extracted from faeces. C Two living specimens woken up after passing bird's gut.

Body size change of marine benthic macroinvertebrates in response to environmental stressors during the Pliensbachian-Toarcian Extinction Event (Early Jurassic)

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The Pliensbachian-Toarcian (~183Ma) was an interval of global warming and associated environmental changes which altered terrestrial and marine ecosystems worldwide. Within the extinction interval and its aftermath, fluctuations in body size have been documented in some marine benthic macroinvertebrates. These fluctuations correlate with changing geochemical parameters. This may have conferred a selective advantage in the presence of shifting environmental factors. In this study we recorded body size of 39 Pliensbachian-Toarcian marine macroinvertebrate species from the Cleveland Basin, North Yorkshire. Analyses showed that surficial, filter-feeding functional groups had a greater proportion of surviving taxa in the aftermath of the extinction interval than other functional groups. Each of the measured geochemical proxies of environmental change had a significant relationship with at least one of the species or functional groups. δ98/95Mo (‰) showed the greatest number of significant correlations with individual species, whereas $\delta 13C_{org}$ (‰) displayed more significant correlations with functional groups. Significant relationships between geochemical proxies and sizes of individual species or functional groups support previous evidence that ecological change was probably driven by environmental shifts during this past warming event.

The historical size decline of the rocky shore gastropod *Nucella lapillus* across the southern UK

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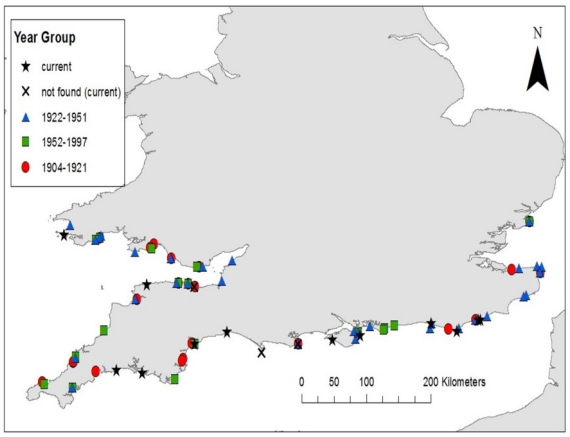
Anthropogenic impacts, such as size-selective harvesting and climate change, are affecting marine species worldwide. The temperature/size rule states that ectotherms growing in warmer conditions will be smaller as adults and warming temperatures often result in decreased growth of individuals. In this study, the change in size of the rocky shore gastropod *Nucella lapillus* is compared spatially and temporally across the southern UK, using natural history collections to allow temporal comparisons to current field data. The results show that the size of *N. lapillus* has significantly decreased over time, which correlates to changes in sea surface temperatures. The maximum height of *N. lapillus* shells has declined by approximately 18 mm over the past 100 years, and the median size of shells in large size-classes declined by 6mm during this time. This species is also on average larger in the West than in the East, and in some locations there has been a local extinction of *N. lapillus* or there are fewer large individuals, potentially due to the negative impacts of TBT pollution. Additionally, the body size of this species is affected on a local scale by biotic and abiotic factors such as community interactions and wave exposure. The spatial and temporal variations in morphology of *N. lapillus* are probably due to a mixture of negative effects caused by indirect anthropogenic impacts and the complex interactions taking place both between species and their environment on rocky shores. the temperature size rule states that ectotherms growing in warmer conditions will be smaller as adults.



Book review

Cephalopods of Australia and Sub-Antarctic Territories

Amanda Reid
CSIRO Publishing, 2016.
ISBN 1486303943, 9781486303946, hardback, 446 pp,

Reviewed by Katrin Linse, British Antarctic Survey, Cambridge

The "Cephalopods of Australia and Sub-Antarctic Territories" is a landmark publication on the biodiversity of nautilus, squid, cuttlefish and octopuses and relevant not only to research scientists but also to stakeholders in fisheries and environmental policy as well as to the general public interested in the ocean. The centrepiece of this comprehensive and informative book is the well-figured section with the detailed descriptions of the 226 cephalopod species occurring in Australian Exclusive Economic Zone and Australian Antarctic Territory. With representatives of over a quarter of all discovered cephalopods, Australian waters host the Earth's highest cephalopod diversity. Dichotomous keys based on morphological features lead the reader first to relevant orders and families and later to genera and individual species. For families, genera and species information is given on diagnostic features, distinguishing characters, animal sizes, biology, habitats and distributions. Species sections include distribution maps as well as figures to assist the taxonomic identification. These figures include drawings of juveniles and adults as well as characteristic features of arms, eyes or cuttle bones as well as photographs of collected specimens or *in-situ*. Together with the comprehensive scientific references, these descriptions represent a most valuable resource for researchers and readers of all walks of life.

Next to the thorough species information, the book provides a cogent review of the current knowledge of cephalopod biology from evolution to biodiversity, from life history to physiology and from fisheries to climate change impacts. It also provides a comprehensive glossary of cephalopod terms, information on how to appropriately fix and preserve specimens and tissues and a checklist of the species occurring in Australian waters.

Australian waters contain the highest diversity of cephalopods (squid, cuttlefish and octopus) found anywhere in the world. They are highly significant ecologically, both as top-level predators and as prey for numerous vertebrates, including fishes, seals, cetaceans and seabirds. Cephalopods of Australia and Sub-Antarctic Territories is a comprehensive guide covering 226 species, which represent over a quarter of the world's cephalopod fauna. With an emphasis on identification, this book includes keys, species descriptions, full-colour illustrations and distribution maps, as well as a summary of the biology and behaviour of cephalopods and fisheries information. This is an invaluable tool for researchers and fisheries experts as well as amateur naturalists, fishers and divers.

Annual Award Winner

Systematics, ecology, and evolution of hydrothermal vent endemic peltospirids (Mollusca: Gastropoda) from the Indian and Southern oceans

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Annual Award winner

Living more than 2000 m deep in the extreme environment of Indian Ocean hydrothermal vents, just beside superheated water exceeding 350°C and rich in hydrogen sulfide, the 'scaly-foot' gastropod is no ordinary snail (Fig. 1). It the only living gastropod with true dermal sclerites, and both the sclerites and the shell are often mineralised with iron sulfide, making it the only animal known to have a skeleton made of iron (Chen *et al*., 2015a). Despite being first discovered as early as 2001 from Central Indian Ridge (CIR) (Van Dover *et al*., 2001; Warén *et al*., 2003) where it is known from two vent fields, Kairei field and Solitaire field (Fig.2; Nakamura *et al*., 2012) on the Central Indian Ridge (CIR), the 'scaly-foot' gastropod still did not have a formal scientific name when we discovered a new population of them in Longqi field, Southwest Indian Ridge (SWIR) in late 2011 (Fig.2; Fig. 3).

At first, the new population was thought to represent a different species from the original population known from Central Indian Ridge (Kairei and Solitaire vent fields), due to the comparatively more numerous and slender sclerites as well as the disjunct distribution. However, detailed morphological studies using electron microscopy and dissection could not reveal any significant differences other than the sclerites. The COI barcoding gene also showed little to no differences with specimens from the other populations. These results all pointed toward the fact that the 'scaly-foot' gastropod on both ridge systems represented one single species. Following discussions with Dr Anders Warén (Sweden Museum of Natural History) and thanks to his generous help, I was able to formally describe the species as *Chrysomallon squamiferum* Chen *et al*., 2015 (Chen *et al*., 2015a). It belongs to the family Peltospiridae, a hydrothermal vent endemic family within Neomphalina, an enigmatic clade of gastropods limited to chemosynthetic ecosystems traditionally included in Vetigastropoda but more recently treated as a separate major clade within Gastropoda. Although populations on both ridge systems represent a single phenotypically rather plastic species (in terms of sclerite development), population genetics analyses using the COI gene uncovered a lack of genetic connectivity between the SWIR population and the CIR populations, suggesting that its dispersal is limited by the continuity of the ridge systems and probably their associated currents (Chen *et al*., 2015b).

Figure 1. Adult specimens of a. *Chrysomallon squamiferum* (from Chen *et al*., 2015b); b. *Gigantopelta chessoia*; c. *Gigantopelta aegis* (from Chen *et al*., 6459e). Scale bar = 1 cm.

Despite a number of studies on the formation and properties of the unique sclerites of *Chrysomallon squamiferum* (e.g., Suzuki *et al*., 2006), the origin and formation of the sclerites have been limited to the hypothesis that they may be duplicated operculum (Warén *et al*., 2003). However, it was later reported that one population carried a true operculum that differed from the sclerites, despite being much reduced (Nakamura *et al*., 2012). By closely examining material from all three known populations I was able to reveal the presence of a true operculum in all three populations. I then carried out histological investigation of the sclerite, comparing with other structures such as the operculum, polyplacophoran scales, and sclerites of the Cambrian fossil *Wiwaxia*. The results indicate that the secretion mechanism and the anatomy underlying the sclerite differs from these known molluscan structures, including its own operculum, and is thus most likely a truly novel structure recently evolved in this taxa and not modified from operculum (Chen *et al*., 2015c).

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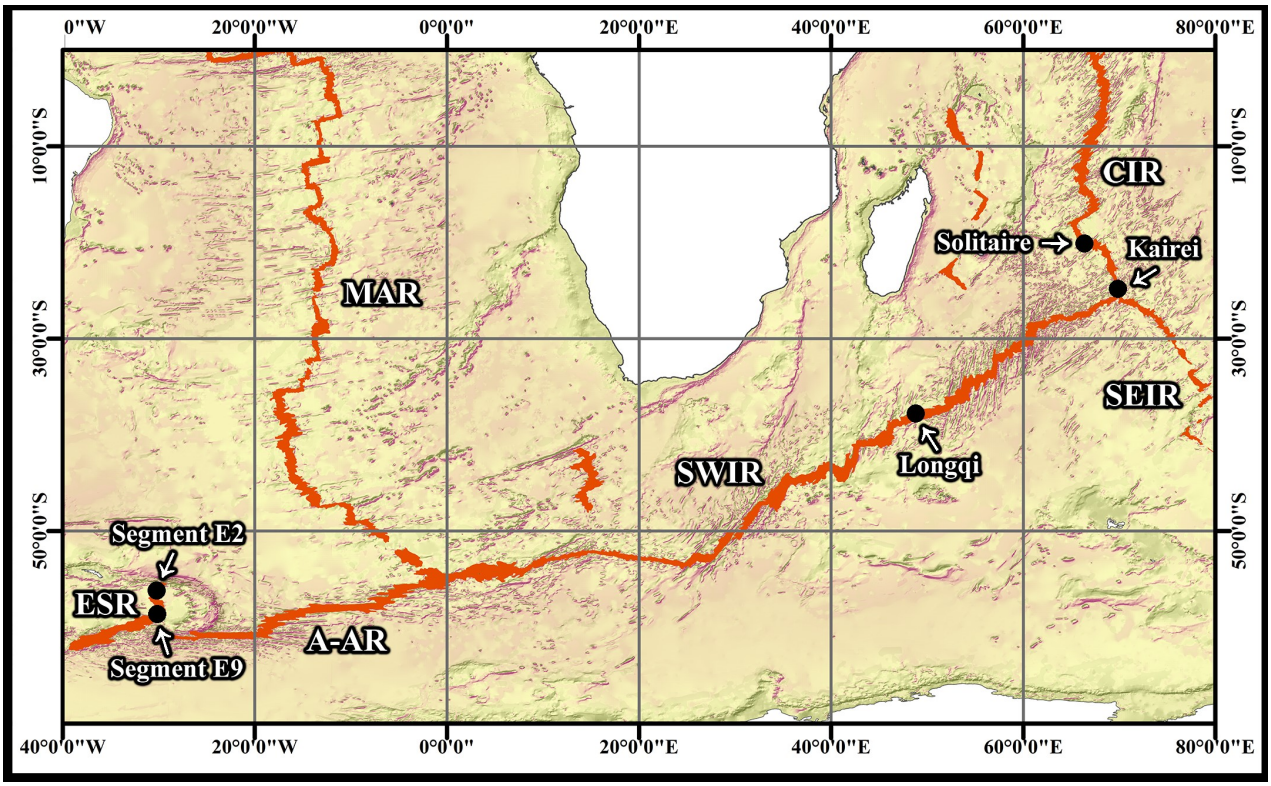

Figure 2. Map of localities where *Chrysomallon* and *Gigantopelta* are known to occur. Solid red indicates spreading mid-ocean ridges. Abbreviations. A-AR: American-Antarctic Ridge; CIR: Central Indian Ridge; ESR: East Scotia Ridge; MAR: Mid-Atlantic Ridge; SEIR: Southeast Indian Ridge; SWIR: Southwest Indian Ridge.

Chrysomallon squamiferum is also known to house endosymbiotic bacteria in an enlarged and highly vascularised oesophageal gland, oxidising hydrogen sulfide to produce energy through chemosynthesis (Goffredi *et al*., 2004; Nakagawa *et al.,* 2014). This means it has a 'factory of food' within its digestive tract and does not need to feed in the literal sense. However, unlike other molluscs with endosymbiotic chemoautotrophic bacteria which house symbionts on the gill where nutrients may be accessed directly, the oesophageal gland is a completely internalised structure suggesting that the host must provide hydrogen sulfide as well as oxygen through its bloodstream. Through serial sectioning of a juvenile specimen to generate a 3D anatomical model, as well as detailed dissection of adult specimens, I was able to reveal that *Chrysomallon* has evolved an extremely hypertrophied circulatory system. This includes a very large heart (4% body volume) with muscular walls, much enlarged gill, large blood vessels, and numerous associated blood sinus (Chen *et al*., 2015d). *Chrysomallon* reaches 45 mm in shell length, an exceptionally large size for peltospirids (averaging around 10-15 mm), indicating a probable gigantism associated with energetic constraints being removed due to the hosting of endosymbionts. As both juveniles (shell length 2 mm up) and adults had the oesophageal gland enlarged to a similar extent (9% body volume), *Chrysomallon* probably relies on endosymbionts for nutrition throughout its post-settlement life.

In Longqi field, SWIR, *Chrysomallon* was found to co-occur with another large gastropod of a similar size (Fig. 3). Morphological and genetic investigations indicated that this is another large sized peltospirid snail, most closely related to an undescribed species found at the Antarctic hydrothermal vents on segments E2 and E9, East Scotia Ridge (ESR). These two species (Fig. 1) do not have dermal sclerites like Chrysomallon but instead possess a large operculum. I erected a new genus, *Gigantopelta,* to house them, naming the ESR species *G. chessoia* and the SWIR species *G. aegis* (Chen *et al*., 2015e). Both species also have their oesophageal gland enlarged to a similar extent to *Chrysomallon*. Stable isotope analyses have indicated they rely on endosymbionts for nutrition. They do not form a monophyletic group with *Chrysomallon* in phylogenetic reconstruction using the COI gene. Currently, further studies are ongoing to understand if they indeed use the oesophageal gland to house endosymbionts, and if so, whether they evolved this independent from *Chrysomallon* or not.

I am honoured to receive the Annual Award from the Malacological Society of London in recognition of my thesis. I would like to take this opportunity to thank my supervisors Prof Alex D. Rogers (University of Oxford), Dr Jonathan T. Copley (University of Southampton), Dr Katrin Linse (British Antarctic Survey, Cambridge), and Dr Julia D. Sigwart (Queen's University Belfast) for their great encouragement and support, without which the completion of my thesis would have been impossible.

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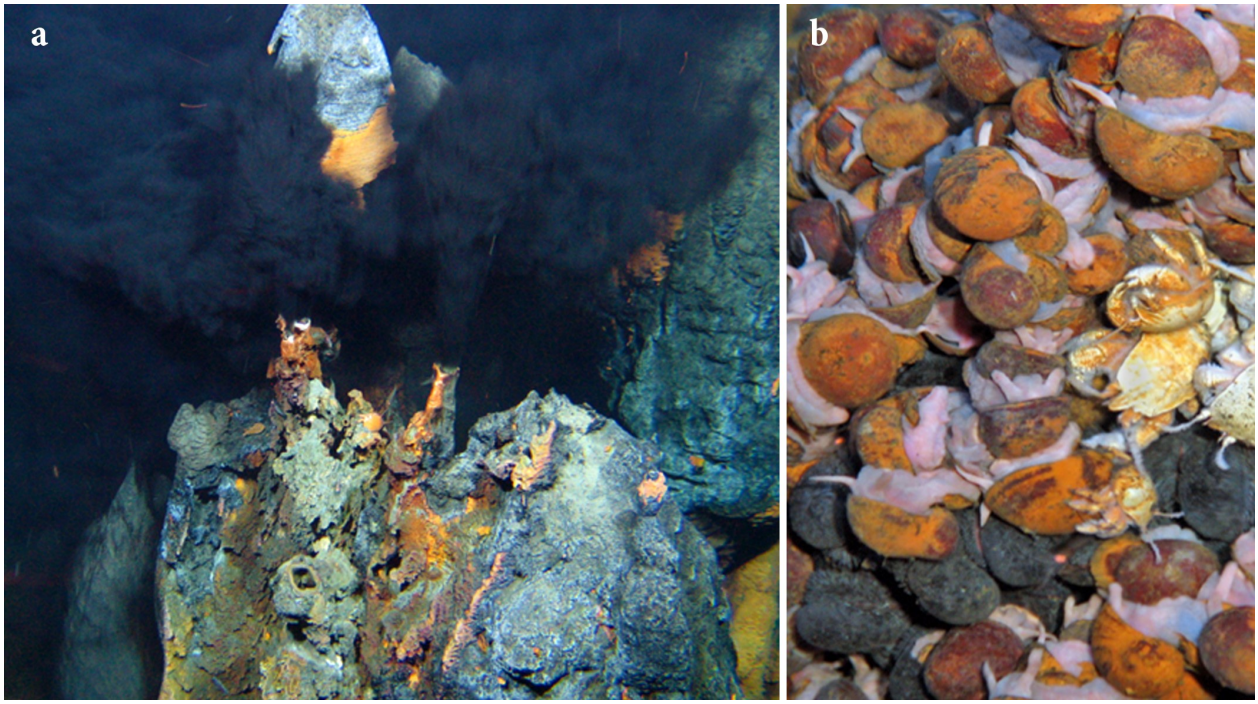

Figure 3. Longqi hydrothermal vent field, Southwest Indian Ridge; a. A black smoker chimney; b. A colony of gastropods comprising *Chrysomallon squamiferum* (black snails) and *Gigantopelta aegis* (rusty snails)

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Research Grant Reports

A highly structured microsnail population in Sabah, Borneo

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Introduction

Land snails greatly benefit from Karst environments, primarily due to the particular mineralogical composition of the calcareous substratum. Some snail species are strictly calcicole: within their distribution range, they are found only on calcareous substrates, as they perform poorly elsewhere. On Borneo, the malacofauna is characterized by rich communities with numerous endemic calcicole species confined to calcareous outcrops and less rich communities between outcrops (Schilthuizen *et al.,* 2003; Clements *et al.,* 2008). The landscape of Borneo presents more than 300 of these limestone outcrops towering the surrounding alluvial lowland (Lim & Kiew, 1997). Many endemic species can be found only on one single hill or in a small group of hills (Liew *et al.,* 2014). These outcrops are, at most, a few hundred meters long and surrounded by either tropical forest or oil palm plantations. The proverbial low dispersal ability of snails, in addition to their calcicole nature and high level of endemism, leads to the assumption that populations on these outcrops are highly isolated and form a characteristic island system with no or little gene flow between each other. Although many studies have been focusing on the description of diversity and snails' community composition (Schilthuizen & Rutjes, 2001; Schilthuizen *et al.,* 2013), the population structure of these calcicole species on Borneo have never been studied with a population genetic approach. The chosen organism for this population genetic study is *Plectostoma concinnum* (Fulton, 1901), a species of microsnail (snails of small dimension, ranging between 1 and 5 mm) highly abundant on the calcareous outcrops of the Kinabatangan Valley, Sabah, Borneo.

Material and Methods

Twelve outcrops along a 30-km stretch of the Kinabatangan river were visited in 2016; outcrops were on both side of the river and clustered in three groups (Fig. 1). Two plots at opposite sides of each outcrop were sampled, for a total of 24 plots sampled. Fifteen individuals of *P. concinnum* per plot were brought to the molecular laboratories of UMS, Kota Kinabalu, and DNA was extracted using E.Z.N.A. Mollusc DNA Kit, Omega. The isolated DNA was used as template to amplify two different fragments through polymerase chain reaction (PCR): a 658-bp fragment of the mitochondrial DNA COI (Folmer et al., 1994) and an approximately 700-bp fragment of nuclear rDNA (nrDNA) of ITS-1 (Hillis and Dixon, 1991). Both PCR products were sent for sequencing to BaseClear, Leiden, the Netherlands, and sequenced in both directions on an ABI PrismTM Sequencer 313091 Genetic Analyzer (Applied Biosystems, Inc.). Aligned sequences were exported to Arlequin 3.5 (Excoffier et al. 2005) to calculate pairwise fixation indices (φST) between outcrops. Estimation and testing were done by bootstrap resampling (10,000 replicates). Sequences were also imported into *MEGA* version 7 (Kumar et al., 2015) to calculate genetic distances using the Kimura 2-parameter model (Kimura 1980). The geographical subdivision of molecular variance among and within outcrops was estimated by a hierarchical AMOVA in Arlequin.

Results

For the COI gene, sequences for 321 individuals were successfully aligned and resulted in 523 bp fragments with 118 polymorphic sites. In total, 39 haplotypes were recognised, each one exclusive of only one outcrop. Due to a poly T-base segment at the 5'-end of the ITS1 fragments, low-quality forward sequences were discarded and only the reverse sequences were used for this marker. Moreover, ITS1 showed a high number of gaps resulting in fewer segments being successfully aligned: 214 sequences were aligned in 244 bp fragments, consisting of 64 polymorphic sites and 36 haplotypes.

Pairwise differentiation. Differentiation indices result (φST) for COI showed very high values among outcrops. All results were significant (*P*-value<0.05) and with values above 0.4, with only four values out of 66 lower than 0.8 (Table.1). φST values for ITS1 failed to significantly separate few different outcrops, resulting in five pairwise comparisons with non-significant results (*P*-value>0.05) and eight pairwise comparisons with a significant *P*-value (<0.05), but with φST values lower than 0.4. φST values for ITS1 were lower than φST values for COI, probably due to the lower resolution of the data.

Genetic distance. Genetic distance values showed very large separation for COI, ranging from 0.01 to 0.13 (Table.1), while results for ITS1 range from 0.001 to 0.08. Because mutation rates differ between different genetic markers, genetic distance results are not comparable between COI and ITS1 sequences. Although incomparable, both results show high values, considering that the studied transect is only 30 km long. The regression analyses for genetic distance versus geographic distance were significant (*P*<0.001) but gave low values for R^2 (0.198), indicating a low correlation between the two distances.

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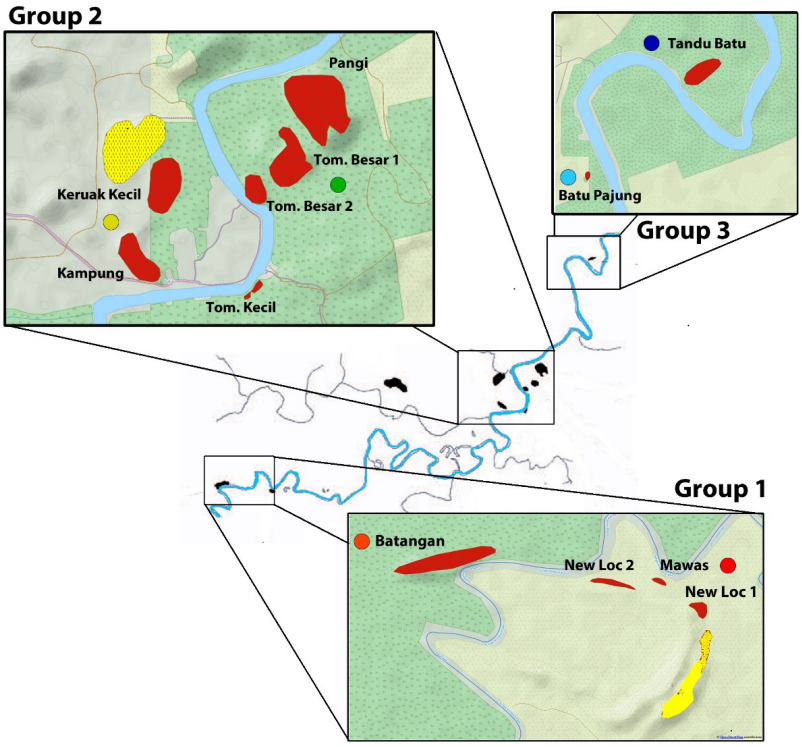

Fig. 1 The 12 outcrops sampled are coloured in red, outcrops in yellow were not considered in this study. Outcrops are divided into three groups according to their position along the river Kinabatangan: Group 1 is ≈ 20km from Group 2 and Group 2 is ≈ 10km from Group 3 (Map edited from Schilthuizen et al., 2006).

AMOVA. The results of the AMOVA revealed that most of the genetic variability was found between geographic groups (75% for COI, 88% for ITS1), but there was also a consistent percentage of variation between outcrops belonging to the same group (20% for COI, only 2% for ITS1). The rest of the variation was found within each outcrop.

Discussion

Our results showed a very high level of genetic divergence, with populations on each outcrop being isolated from each other even at a relatively short distance (significant differentiation between outcrops occurred already at 300 m). This suggests that, at least for strictly calcicole species, dispersal is severely hindered by a non-calcareous substratum. It should be emphasized that this study covers a limited area (a 30 km long transect along a river) compared with previous population genetic studies on landsnails. We could not find any other study presenting a similarly high genetic divergence in such a limited area.

Table. 1 Results for COI: differentiation indices φST (low) and genetic distance (up) between outcrops. All values are significant (P<0.01).

	Batangan	BatuPajung	Kampung	KeruakKecil	Mawas	NewLoc1	NewLoc2	Pangi	TanduBatu	TomangBesar1	TomangBesar2	TomangKecil
Batangan		0.098	0.051	0.045	0.052	0.048	0.055	0.094	0.045	0.098	0.106	0.089
BatuPajung	0.95		0.101	0.102	0.118	0.123	0.115	0.105	0.100	0.113	0.125	0.104
Kampung	0.96	0.96		0.025	0.062	0.070	0.064	0.091	0.058	0.098	0.104	0.088
KeruakKecil	0.94	0.96	0.91		0.068	0.064	0.071	0.099	0.056	0.102	0.110	0.097
Mawas	0.97	0.97	0.98	0.98		0.019	0.006	0.109	0.066	0.117	0.127	0.105
NewLoc1	0.93	0.96	0.96	0.95	0.89		0.017	0.114	0.065	0.119	0.131	0.110
NewLoc2	0.98	0.98	0.99	0.98	0.95	0.91		0.107	0.068	0.114	0.124	0.103
Pangi	0.93	0.93	0.94	0.94	0.96	0.94	0.96		0.108	0.032	0.044	0.007
TanduBatu	0.95	0.96	0.97	0.96	0.98	0.96	0.99	0.95		0.116	0.120	0.104
TomangBesar1	0.84	0.88	0.86	0.87	0.90	0.89	0.92	0.54	0.89		0.038	0.026
TomangBesar2	0.99	0.97	0.99	0.98	1.00	0.98	1.00	0.89	0.99	0.67		0.041
TomangKecil	0.99	0.97	0.99	0.99	1.00	0.98	1.00	0.46	0.99	0.57	1.00	

CONTINUED

The high isolation and divergence of these populations might be a consequence of the characteristically scattered habitat of Bornean limestone outcrops. This study is the first part of a larger population genetic project where more species will be studied to better understand the processes that shape the rich and endemic Bornean microsnail communities.

Acknowledgments

We would like to thank the Malacological Society of London for the early career research grant awarded to GA, which made this project possible. Laboratory costs were financed through a VICI grant awarded to RSE by the Netherlands Organisation for Scientific Research (NWO). Leonel Herrea Alsina assisted with data collection in the field. We thank dr. Liew Thor Seng of the Institute of Tropical Biology and Conservation, University Malaysia, Sabah for his help with planning fieldwork and offering the use of laboratory spaces and materials at the university. Finally, Dr. Isabelle Lackman and Hamidin Braim were very helpful in organising both accommodation and transport in the area of our fieldwork.

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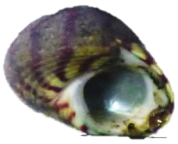
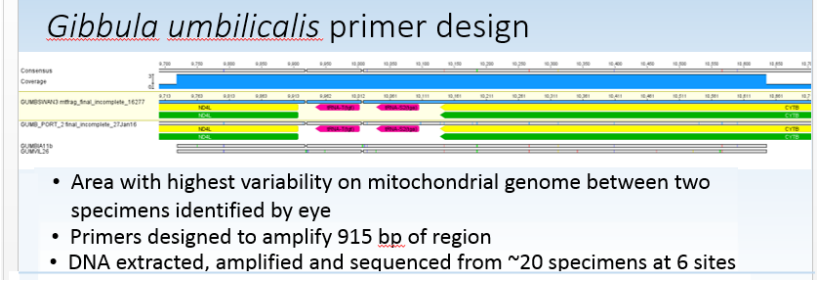
The role of habitat gaps in gene flow of the gastropod *Gibbula umbilicalis* in the Bay of Biscay



ALSO SEE PAGE 19

Edward Wort
Ocean and Earth Science, University of Southampton Waterfront Campus
Southampton, United Kingdom
Email: ew6g09@soton.ac.uk

A key factor influencing geographic distribution and population connectivity of rocky intertidal species is habitat availability. A grant from the Malacological Society was put towards molecular costs of a project examining the role of habitat gaps on gene flow in the gastropod *Gibbula umbilicalis* in the Bay of Biscay. Between the Gironde estuary and Biarritz in France, a distance of approximately 200km, there is no rocky shore, with the exception of a few coastal defences and concrete blockhouses. Genetic samples were taken from 3 sites to the north of this habitat gap and 3 sites to the south. Primers were designed after comparing two almost complete mitochondrial genomes of *Gibbula umbilicalis* specimens from Swanage and Portugal to identify the most variable region in the mt genome. These primers were used to amplify and successfully sequence 83 samples, producing 73 haplotypes. Analyses of these sequences showed no significant difference between the



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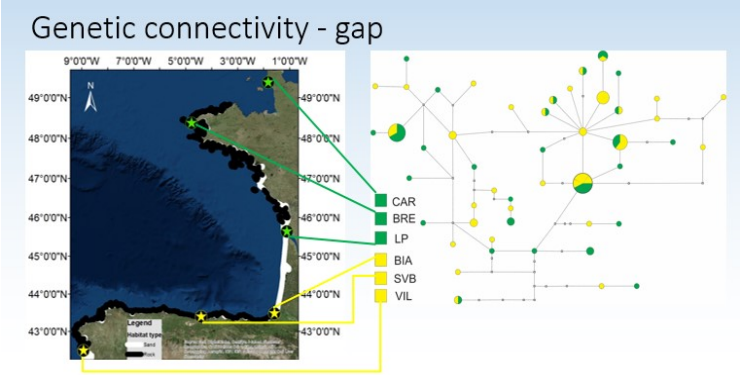
groups of sites north and south of the habitat gap (P >4.9[1] for Fst), possibly due to the highly variable haplotypes. However, some sites showed significant similarity, namely San Vicente de la Barquera with Les Pierrières (Fst=0.054, P=0.026) and San Vicente de la Barquera with Brest (Fst=0.069, P>4.488). This suggests that these sites may be genetically connected and that the habitat gap is not a barrier to dispersal for *Gibbula umbilicalis.* Future work will be carried out using microsatellites on 30 individuals of *Gibbula umbilicalis* from each site. The combined results of these population genetics analyses will then be used in a paper in which the Malacological Society of London will be acknowledged as the principal source of funding.



Obituaries

James H. McLean:

Former LACM Malacology curator **James H. McLean** passed away Friday, November 11th at age 80. Jim joined the museum staff as curator of Invertebrate Zoology in 1964 whilst completing his PhD at Stanford under Myra Keen. He worked to build the IZ section into what would become the world-class sections of Crustacea, Echinoderms, Polychaetes, and Malacology. Jim traveled extensively worldwide to build the mollusk collection and obtained several NSF grants to house the growing collections. Along with LACM Ichthyology curator emeritus Bob Lavenberg, Jim helped to acquire the vast Alan Hancock Foundation and the UCLA collections. He published over 100 peer reviewed papers in major malacological journals, described over 300 molluscan taxa, and was honored by colleagues who named at least 27 species for him. He retired in 2001 but continued his daily routine of research until 2014 when his declining health started to take it's toll. Jim's career goal to produce a monograph of the shelled gastropods of the eastern Pacific from central Baja, California to Arctic Alaska is being continued by 30+ worldwide specialists and will be edited by Daniel Geiger (Santa Barbara Museum of Natural History), Jann Vendetti (NHMLAC Malacology), and yours truly. Jim was a devout liberal, a Rolling Stones fan, and collected succulents from all over the world. This year the Western Society of Malacologists commemorates its 50th anniversary and will be held, appropriately, in Los Angeles at the Natural History Museum of LA County and the University of Southern California with Jann Vendetti as President. Remembrances for Jim (Past WSM president 1974) and Bill Emerson (past WSM president, 1969) will be included. Donations may be made to the James H. McLean Student Grant in Collections-Based Research, see http://westernsocietymalacology.org/grants/james-h-mclean-student-grant-in-collections-based-research/ for details. I will always be grateful to Jim as he hired me in 1988 to fulfill a NSF grant and I'm still here nearly 29 years later.
Lindsey T. Groves

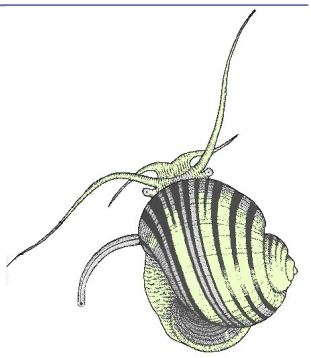
William K. Emerson

William K. Emerson died on October 19, 2016 in New York City. Bill arrived at the American Museum of Natural History in 1955 after receiving his PhD in invertebrate paleontology from Berkeley and retired after 40 years of service in 1995 as Curator Emeritus in the Department of Invertebrates, later Division of Invertebrate Zoology. During his time at the Museum, he studied marine gastropods and scaphopods from the Pacific region, with a focus on their systematics and biogeography. Early in his career, he did extensive expeditionary work in the Pacific focusing on sampling molluscan communities on Pacific Islands that experienced atomic bomb testing in the early 1950's, such as Enewetak Atoll. Among Bill's accomplishments at the Museum was his documentation of Indo-Pacific molluscs on the eastern side of the Pacific Ocean. He reasoned that the larvae of these animals must have dispersed across deep-water barriers during anomalous warm periods, which are currently known as El Nino events. Bill also investigated the effects of oceanic upwelling of cold water on local molluscan populations living along the west coast of North America. Using these insights about modern biogeography, he elucidated the distribution of Pleistocene molluscan communities. In addition to his research papers on molluscan taxonomy and biogeography, Bill published several popular guidebooks to the molluscs of North America. Among his most popular books was "The American Museum of Natural History Guide to Shells: Land, Freshwater, and Marine from Nova Scotia to Florida" co-authored with Morris K. Jacobson, a local shell enthusiast. He also published "Shells from Cape Cod to Cape May" (the 1971 revised edition of their earlier book, "Shells of the New York City Area," 1961), and "Wonders of the World of Shells: Sea, Land and Freshwater" (1971). During the 1960's, he was Chair of the then Department of Living Invertebrates, which covered Recent marine invertebrates including molluscs, crustaceans, and polychaetes. Working with his scientific assistants, first with William Old, and later Walter Sage, Bill assembled one of the largest and best documented malacological collections in the world. He showcased some of these specimens in his exhibit "Hall of Molluscs and Our World" which opened in 1975. This exhibit combined natural history and anthropology, both explaining the habitat and life history of molluscs as well as their use by various cultures. Neil Landman and I are writing a bio-bibliography of Bill for publication. If anyone would like to share remembrances or photos, please let me know.
Paula Mikkelsen

Notices

THE MALACOLOGICAL OF SOCIETY OF LONDON

Registered Charity No. 275980



124th ANNUAL GENERAL MEETING

Wednesday 27th April 2017, 1300 - 1400h

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

The Council of the Society

COUNCIL	SERVING	PROPOSED
	2016-2017	**2017-2018**
Year of existence	123	**124**
President	Suzanne Williams (2)	**Suzanne Williams (3)**
Vice Presidents	John Grahame (2)	**John Grahame (3)**
	Richard Preece (1)	**Richard Preece (2)**
Councillors	Andreia Salvador (3)	**Robert Cameron(3)**
	Robert Cameron(2)	**Simon Cragg (3)**
	Simon Cragg (2)	**Deborah Wall Palmer (2)**
	Elizabeth Platts (3)	**Philip Fenberg (2)**
	Deborah Wall Palmer (1)	**Harriet Wood**
	Philip Fenberg(1)	**Steve Hawkins**
Co-opted	Mark Davies	**Andreia Salvador**
Journal Editor	David Reid	**David Reid**
Bulletin Editor	G Dussart	**G Dussart**
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Facebook manager	Chong Chen	**Chong Chen**
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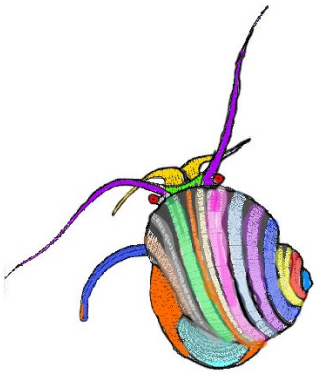
Number in parenthesis indicates years of continuous service in re. election rules

Molluscan Colour and Vision

(Conference associated with Annual General Meeting)



The phylum Mollusca is highly speciose and is the largest phylum in the marine realm. Many species are brightly coloured and patterned and yet nearly all molluscs are thought to be colour blind. Despite their limitations with colour vision, molluscs showcase a myriad of different eye types, many of which are unique in the animal kingdom. In this symposium, speakers will cover a range of topics that highlight the extraordinary nature of colour and vision in molluscs.

Schedule

1030-1100: Registration. Tea and coffee served.
1100-1110: Introduction and welcome.
1110-1130: Jakob Vinther: Fossil colour and molluscan evolution.
1130-1220: Daniel Speiser: The function and evolution of highly-dispersed visual systems in molluscs.
1220-1240: Trevor Wardill: Neural control of squid skin iridescence and its potential role for communication.
1240-1300: Julia Sigwart: Ontogeny and form in chiton shell eyes.
1300-1400: MSL AGM. Lunch catered for all participants by MSL.
1400-1450: Sönke Johnsen: Tricks of light, mirror, and color: The beautiful camouflage of pelagic cephalopods.
1450-1510: Lauren Sumner-Rooney: The repeated evolution of eye loss in deep-sea solariellid gastropods.
1510-1530: Marcel Koken: New lights on biodiversity: natural fluorescence.
1530-1600: Tea and coffee.
1600-1620: Suzanne Williams: Identification of pigments and genes contributing to shell colour in a marine snail.
1620-1640: Nick Roberts: Seeing the world in a different light—polarization vision in cephalopods.
1640-1700: Angus Davison: Cepaea colour polymorphism - why and how do snails vary in their shell colour and banding?
1700-1720: Alexander Arkhipkin: Coevolution in body coloration and camouflage in cephalopods and fish.
1720-1725: Wrap up and thanks.
1725-1900: Wine reception.

The meeting is free but registration is necessary.
Please register by sending an email to the automated account MSL-events@nhm.ac.uk<mailto:MSL-events@nhm.ac.uk>. You will receive a bounce back message to say that you have successfully registered. Please do not send queries to this account. Each participant must register in a separate email.

Speakers

Daniel Speiser, University of South Carolina
http://www.biol.sc.edu/daniel-speiser
Sönke Johnsen, Duke University
http://sites.biology.duke.edu/johnsenlab/
Jakob Vinther, University of Bristol
http://www.jakobvinther.com/Front_page.html
Lauren Sumner-Rooney, Museum für Naturkunde, Berlin
https://www.researchgate.net/profile/Lauren_Sumner-Rooney
Nick Roberts, Bristol University
http://www.ecologyofvision.com/
Trevor Wardill, University of Cambridge
http://www.pdn.cam.ac.uk/directory/trevor-wardill
Angus Davison, University of Nottingham
http://www.angusdavison.org/
Alexander Arkhipkin, Falkland Islands Fisheries Department
http://south-atlantic-research.org/our-people/research-fellows/66-sashaarkhipkin
Marcel Koken, Centre National de la Recherche Scientifique
https://www.researchgate.net/profile/Marcel_Koken
Suzanne Williams, Natural History Museum
http://www.nhm.ac.uk/our-science/departments-and-staff/staff-directory/suzanne-williams.html

Personal library of Dr. Kenneth J. Boss

Dr. Boss was Curator of Malacology and Professor of Biology at Harvard University's Museum of Comparative Zoology from 1966 until his retirement in 2004. His research focused on molluscan systematics; particularly the bivalve families Tellinidae and deep-sea Vesicomyidae, as well as Cuban terrestrial snails. He described 22 mollusk species and one species of polychaete. Much of Professor Boss' personal library went to the Department of Mollusks at the Museum and subsequently to Harvard's Ernst Mayr Library. A thorough biography can be found in Kabat and Johnson (2015- Breviora 544). The bulk of the molluscan literature was sold and disseminated over the past two years. What remains is primarily composed of over 125 works in marine biology with scattered works on other taxonomic groups (including previously uncatalogued freshwater and land mollusks) and general natural history and biographies of naturalists. Publications authored by Professor Boss are not included. Prices are significantly below Fair Market Value to better accommodate students of natural sciences with limited funds who might best make use of the material. A complete catalog list can be found online at: https://sites.google.com/site/northeastnaturalhistory/home/classroom-news/kennethjbosslibraryremainder . Images of many items are available upon request. Please excuse any cross postings and feel free to distribute this list to other interested parties. Items can be shipped both nationally and internationally with U.S. domestic shipping via U.S.P.S., U.P.S. or Federal Express. Within the U.S., USPS Priority or Express Mail are available with insurance and tracking extra. Accepted payment forms include personal checks, bank checks, money orders; and also by credit card via Paypal.

Jay Cordeiro
Northeast Natural History & Supply
unionid@comcast.net

Molluscan paleontology

A fossil mollusk session is planned for the 50th annual Western Society of Malacologists meeting from June 19-23, 2017 at the Natural History Museum of Los Angeles County/University of Southern California, chaired by Austin Hendy (LACMIP Collection Manager) and Lindsey Groves. We welcome any fossil molluscan topic to help make the WSM golden anniversary a truly memorable event. In order to plan this part of the event , we'd like to get an idea in advance of how many interested persons are out there. A fossil/geology field trip to the Palos Verdes Peninsula led by Austin Hendy is also planned.
Lindsey T. Groves
lgroves@nhm.org

Key to Australian freshwater molluscs

A key and information system for all described Australian freshwater molluscs has just gone live at
http://keys.lucidcentral.org/keys/v3/freshwater_molluscs/
Winston Ponder, Anders Hallan, Michael Shea and Stephanie Clark
.

8th EUROMAL - Congress of the European Malacological Societies 10-14 Sept 2017

Seven very successful Congresses of the European Malacological Societies have been held, each hosted by a national Society. Now it is our turn, and on behalf of the The Association of Polish Malacologists, it is our great pleasure to invite you to the historic city of KRAKÓW, POLAND, for the eighth Congress. The Congress brings together both young and experienced malacologists from across Europe and the wider world. The latest advances in all aspects of Malacology will be presented, including the use of malacological research in practical issues of pest control and medicine. It offers the chance to meet potential collaborators from many countries, and to present work in progress for constructive comment. Sessions will cover all aspects of Malacology, determined by the number and relatedness of contributions as talks or posters. Here is an opportunity to showcase your work and find new contacts.
Details available at http://euromal.pl/
e-mail: euromal2017@iop.krakow.pl
Contact: Tadeusz Zając

50th Annual Meeting of the Western Society of Malacologists

Los Angeles, California, June 19-23, 2017.

- Molluscs and Climate Change
- Molluscan Paleontology (June 21)
- 50 years of WSM: A Retrospective
- Terrestrial Gastropods
- Remembrances of James H. McLean & William K. Emerson, WSM Presidents 1974 & 1969
- Icebreaker: evening of June 19
- Banquet: June 22
- Field trips: June 23

Talks and posters concerning almost any aspect of molluscan biology, paleontology, archeology, and anthropology are welcome at the Natural History Museum or USC campus in the Exposition Park neighborhood of Los Angeles.
Early registration and abstract submission open January 9, 2017 and close April 14, 2017:
https://www.eventbrite.com/e/western-society-of-malacologists-50th-annual-meeting-tickets-28744283927
Abstract submission guidelines are here: http://research.nhm.org/malacology/western-society-of-malacologists/
Email formatted abstracts to: jvendett@nhm.org, Use subject line: WSM Abstract_your last name.
Jann Vendetti, Ph.D.
jannvendetti@yahoo.com

Physiomar 17
The Physiology of aquatic invertebrates in a changing world
PHYSIO MAR
Cambridge, UK
18 – 21 September 2017

Tentacle - Mollusc conservation newsletter

Tentacle is the Newsletter of the Mollusc Specialist Group of the Species Survival Commission of the IUCN (International Union for the Conservation of Nature). It is now distributed exclusively on the internet.Tentacle is a **newsletter**, not a peer-reviewed scholarly journal. We want news items and summaries of ongoing projects, not data-rich research articles that should be in the peer-reviewed literature. We especially encourage you to submit illustrations. We prefer color illustrations. The focus is mollusc conservation. New records of invasive species, unless there is an explicit relevance to conservation, will not be accepted . We also like to receive the citations to recent publications dealing with mollusc conservation, however peripherally, and notices of meetings dealing with molluscs, websites dealing with molluscs, etc.
Guidelines for submission of articles are available in the most recent issue of Tentacle (at the link given below).
All previous issues can be seen at http://www.hawaii.edu/cowielab/Tentacle.htm
Robert Cowie, Editor
Justin Gerlach & Kathryn Perez, Associate Editors

International Congress on Invertebrate Morphology
Morphological Lazarisation: Moscow 18-23 August 2017

New technology brings life to historical specimens" at the International Congress on Invertebrate Morphology in Moscow this August, 18th-23rd. Museum specimens remain an invaluable part of our work and are often of stunning quality, even in comparison with more recently obtained material. We want to celebrate this, and the development of modern techniques which help us bring these specimens back to new life. We realise that there may be certain political and personal concerns associated with attending this year's conference, and we want to reassure you that we understand these concerns. Your support of science without borders is very important to us and the International Society for Invertebrate Morphology, to our host committee in Moscow and to the wider community, so we hope that you will join us this summer to celebrate research with our colleagues in Russia. Registration and abstract submission are now open! All presenting authors can submit one oral and one poster abstract.

1st February = Early bird registration deadline. Early bird registration is 250 EUR, increasing to 280 EUR. Note that to request an invitation letter for your visa application, you will need to complete the necessary boxes in the registration form (marked 'for visa support').

31st March = Manuscript deadline for publication in Invertebrate Zoology. If you wish to submit a manuscript related to the symposium, the deadline for submissions is coming up at the end of March. See here for more information.

30th April = Abstract and registration deadline. Note that to request an invitation letter for your visa application, you will need to complete the necessary boxes in the registration form (marked 'for visa support').

Regarding visas, we recommend that all speakers complete their applications as soon as possible after receiving their letter of invitation. Further guidelines are on the ICIM website. http://www.icim4.com

Lauren Sumner-Rooney & Dr Julia D Sigwart
e. j.sigwart@qub.ac.uk

Marine Invertebrate course - Friday Harbor Labs June 12-July 14 2017

Peter Funch (University of Aarhus) and Gustav Paulay will be teaching the Marine Invertebrate course at Friday Harbor Labs this summer. This is an intensive, upper undergrad/graduate "full-immersion" course that covers all animal phyla, using living representatives to study most of them. The course runs June 12-July 14 at FHL
Gustav Paulay
paulay@flmnh.ufl.edu

Unitas Malacological (World Congress of Malacology) 2019

Asilomar Conference Grounds, Monterey Peninsula, California August 11-16, 2019
The hope is for a congress that will depart from taxon-based symposia and focus upon ways that our science integrates with other disciplines, including conservation biology, citizen science, evolutionary biology, evolutionary development and genomics. The theme for 2019 should be "building bridges".

Natural History Museum of Los Angeles County - Student Collections Study Award

The NHMLA Collections Study Awards provide funding for undergraduate and graduate students to visit and study the Malacology and Invertebrate Paleontology (and other collections) of the Natural History Museum of Los Angeles County. http://www.nhm.org/site/research-collections Collections visits must be arranged through the appropriate department's collections manager. The deadline for applications is: April 1st. Applications should be submitted via email to Tyler Hayden (thayden@nhm.org) with "Student Collections Study Award" in the subject line. Prospective applicants should contact the relevant curator and collections manager of the collections they wish to visit before assembling proposal materials. The NHM Student Collections Study Award is open to all undergraduate and graduate students that are currently enrolled in an accredited degree-granting program. International undergraduate and graduate students are welcome to apply, but should contact museum curators if assistance is required to obtain a letter of invitation that could be used in a visa application.
For more information and the application, please see here:
http://www.nhm.org/site/research-collections/grants
http://www.nhm.org/site/sites/default/files/dinosaur_institute/pdf/LACMIP%20Student%20Grant.pdf
Jann Vendetti, Ph.D.
jannvendetti@yahoo.com

19th Annual Mid-Atlantic Malacologists Meeting April 8, 2017

Smithsonian's National Museum of Natural History in Washington, DC for the 19th Mid-Atlantic Malacologists (MAM) meeting. this will be an informal, one-day event designed to facilitate the exchange of ideas among professional, amateur and student biologists interested in discussing any and all topics related to malacology. It is also a chance to visit the amazing collections, see the exhibits, and other sites around town. Talks start at 9:30. Presentations (10-15 minutes max.) cover topics as diverse as current research, trip reports, field techniques, collection issues, and anything else malacology-related . There are no dues, officers, abstracts, or publications associated with the meeting. Since it is at the Smithsonian, notify us at least 1 week prior so that we can arrange with security to get everyone in the building. Please RSVP mid.atlantic.malacologists@gmail.com before March 31. In your email please let us know whether you plan to give a talk.
Kenneth A. Hayes
mid.atlantic.malacologists@gmail.com.

International Conference on Molluscan Shellfish Safety (ICMSS)

GALWAY, IRELAND, 14-18 May, 2017

Confirmed Speakers

* **Jim Oliver**, University of North Carolina
* **Andrew Turner,** CEFAS
* **Donald Anderson,** CINAR
* **Jan Vinjé**, CDC
* **Robert Atmar,** Baylor University
* **Ana Gago-Martínez,** EURLMB

SOCIAL PROGRAMME:
The conference includes a great social programme which will give you time to network with colleagues and enjoy your time in Galway.

- Functional Foods
- Depuration / Predictive Modelling
- Water Quality Management / New Technology for HAB Identification
- Heavy Metals / Pesticides / PAH PCB
- Epidemiology - Outbreak Studies
- Regulations - Governance
- Emerging Methods for Virus Identification / Emerging Toxin Methods
- Risk Assessment
- Data Management
- New Technology
- Industry Challenges / Opportunities / Globalisations
- Toxicology / Bacterial Contamination
- Panel Discussion / Case Studies

WORKSHOPS, 19-20 MAY
- Regulation Workshop
- Virus Methodology
- Phytoplankton Taxonomy
- LCMSMS Technology

FURTHER INFORMATION
E: tricia.walsh@nuigalway.ie
www.icmss2017.com
#ICMSS17

83rd annual meeting of the American Malacological Society

The Delaware Museum of Natural History hosts the 83rd annual meeting of the American Malacological Society in Newark, Delaware July 16-21, 2017. **Reduced rates apply until April 30th**. More information about the meeting, including abstract submission, graduate student travel grants, social events, and the associated iDigBio supported Mollusk Digitization workshop can be found at: http://www.delmnh.org/ams2017/
Registration for meeting, housing and meals can be accessed at: https://www.regpacks.com/reg/templates/build/?g_id=100110534
Sessions include: Mollusks in Peril and Cephalopod Biodiversity,
Elizabeth Shea, Curator of Mollusks, Delaware Museum of Natural History

Society Grants and Awards

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 currently anticipates awarding at least five **Early Career Research** Grants per year (closing date **15th December**), and up to five **Senior Research Grants** per year (closing date **15th June**), 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. Early Career 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 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. 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. 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,** Jonathan Ablett Natural History Museum, Cromwell Rd., London. SW7 5BD
Enquiries may be made by post, or by email to MSL_Awards@nhm.ac.uk

Malacological Society of London—Membership notices

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 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 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

Subscriptions run from January 1st each year.

Membership fee structure
Ordinary Members: Journal on-line only £45
Ordinary Members: Journal on line and printed £80
Student Members: Journal on-line only £25

Methods of Payment

(1) Sterling cheque to "The Malacological Society of London".
(2) Online via the website :-
http://malacsoc.org.uk/membership-form/

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 MALCOLOGICAL 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 £80

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 .....