ISSN 1759-1406

The Malacologist

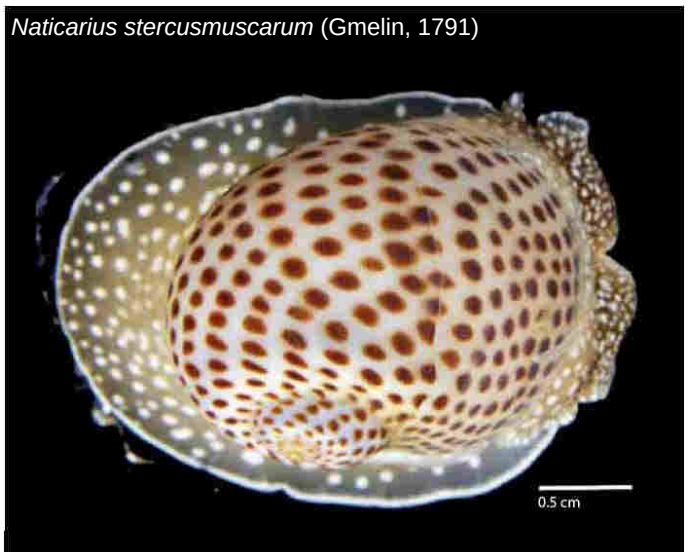
The Bulletin of The Malacological Society of London

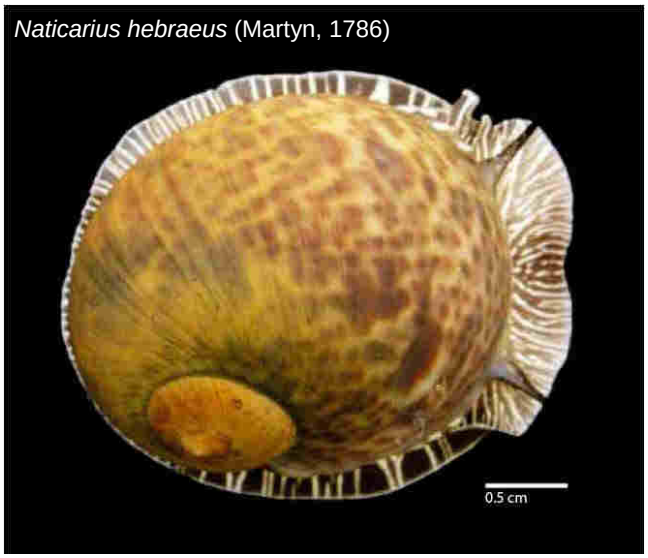
NUMBER 56 FEBRUARY 2011

Molluscan Forum 2010

Last November saw young malacologists from across Europe meeting at the Natural History Museum. The abstracts of the thirty three presentations start inside on page 3. This annual event has grown in appeal and this year it was arranged to immediately precede the meeting of the Systematics Association in the Museum. It is planned to repeat this combination again in November 2011.

The pictures below are from the presentation on competition and niche differentiation in sympatric naticids in the Bay of Campese by Carina Marek (Justus Liebig University, Giessen, Germany).





Contents

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

EDITORIAL

Scientific Diversity

Thumbing through the pages of this issue, I am pleased by the diversity of scientific enquiries and methodologies which molluscs support. In the Forum abstracts alone, we find studies of ocean acidification and ancient atmospheres, the changing fauna of our coasts, the destruction of Turkish sea wrecks, discrepancies in the recorded degrees of sub-speciation in snails with simple and complex shells, and weird modes of reproduction - androgenesis (p.9). I hope that retaining an awareness of this diversity is an antidote against the tendency for scientific research to channel us into narrow fields of enquiry.

Please don't forget to tell me or the membership secretary (R.COOK@KINGSTON.AC.UK) if you change your email address.

Please send me contributions for the next (August 2011) issue by mid-July. Short original articles, reviews and news items are welcome, as well as reports of recent or forthcoming meetings. Time-sensitive information, e.g. about forthcoming meetings, for inclusion in the Updates for April, June, October or December should reach me by the start of the relevant month.

Please remember to keep articles and abstracts "as short as possible but as long as necessary" and avoid or explain specialist terms. Where appropriate, include a reference to a more detailed account, and illustrations. Copyright on all illustrations remains with the originator.

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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.*].

NEWS

Left-handed snails foil snakes

A single gene governing left-right reversal should result in rapid speciation, because a dextral and a sinistral snail have difficulty in mating. The camaenid genus of snails *Satsuma* contains both sinistral and dextral species, but speciation from reproductive incomparability at a single locus requires some selection for the reversal that will offset the mating disadvantage. SE Asian pareatid snakes are dietary specialists of terrestrial snails and slugs, and most have asymmetrical mandibular teeth that favour feeding on the predominant dextral snails. The Japanese pareatid *Pareas iwasakii* strikes at a snail from behind at a leftward angle and extracts the snail from its shell by protracting and retracting its mandibles. The snake can rarely grasp a sinistral snail, and this may more than offset the sinistral individuals' reproductive disadvantage. Snail speciation by reversal has been accelerated in the range of pareatid snakes, and the molecular phylogeny of *Satsuma* snails reveals repeated speciation.

Hoso M *et al. 2010. Nat. Commun.* 1:133 doi: 10.1038/ncomms1133

http://news.bbc.co.uk/go/pr/fr/-/earth/hi/earth_news/newsid_9264000/9264808.stm [Includes video sequence.]

Marine shell amplifies snail's bioluminescence

The small Australian planaxid *Hinea brasiliana*, sometimes called clusterwink snails, produces pulses of blue-green light when tapped or in the presence of potential predators, even when within its shell. The opaque shell is very efficient in transmitting and diffusing light, making the light source appear much greater – but is highly selective for the blue-green light the snail generates, and not other colours. As well as scaring predators away, the signals may also attract the predators' predators – a concept known as the burglar alarm hypothesis.

Dehyn D & Wilson N. 2010. *Proc Roy Soc Ser. B.* doi: 10.1098/rspb.2010.2203

Ovorubin makes apple snail eggs indigestible

Pomacea canaliculata lays clusters of bright pink eggs above water, and they have almost no predators. Ovorubin is not only the source of the warning coloration, but is also a potent proteinase inhibitor which binds trypsin but does not inhibit bacterial growth. It thus limits predator's ability to digest eggs, a similar defence to that shown by plants. This finding follows on from the first neurotoxin discovered in an egg.

Dreon MS *et al.* 2010. *PLoS ONE* 5(12): e15059 doi: 10.1371/journal.pone.0015059

Oyster and mussel glues

The natural cement used by oysters contains only 10% protein, and 90% inorganics like calcium carbonate – 5 times more protein than the shell, and with evidence of cross-linking. Rather than a hard, inorganic cement like oysters, mussels produce a soft organic glue which is predominantly protein-based with little inorganic content. Understanding oyster cement could lead to a bone or dental cement, and to new anti-fouling coatings on ships' hulls, while mussel glue has inspired an experimental medical adhesive which may be useful in transplanting pancreatic islets in type I diabetes.

Oysters: J R Burkett *et al.* 2010. *J. Am. Chem. Soc.* DOI: 10.1021/ja104996y.

Mussels: C Brubaker *et al.* 2010. *Biomaterials*, 31, 420.

Therapeutic uses of molluscs in ancient Greece

Texts from the ancient Greek and early Byzantine periods record 38 marine invertebrates used for therapeutic properties, with molluscs being the dominant group. Treatments concentrated on digestive, urinogenital and skin disorders.

Voultsiadou E. 2010. *J. Ethnopharmacol* 139(2), 237-247.

Ammonite diet revealed by X-rays

Although ammonite fossils are widely used to date rock strata and correlate these strata across wide regions, their biology is poorly understood. A study using synchrotron X-ray microtomography has shown details of their delicate radular teeth in an uncoiled, late Cretaceous ammonite, together with their planktonic prey.

I Kruta *et al.* 7 Jan 2011. *Science* 331 (6013), 70-72.
http://www.bbc.co.uk/news/science-environment-12127790

How do bivalves recognize food particles?

Suspension-feeding bivalves use biochemical cues to recognise food particles. Lectins in the mucus of gills and labial palps agglutinated mammal erythrocytes and several marine microalgae. Feeding experiments with micro-

Continued on page 23

Molluscan Forum 2010

Natural History Museum, London 30 November 2010

Organised for **The Malacological Society of London** and the **Natural History Museum**, London by Professor **Mark Davies**, University of Sunderland (email: mark.davies@sunderland.ac.uk) and **Martine Claremont**, Imperial College London & Natural History Museum (email: m.claremont@nhm.ac.uk)

Complex evolution in the Neotropics: understanding Caribbean marine biogeography using *Bulla occidentalis* as a model species

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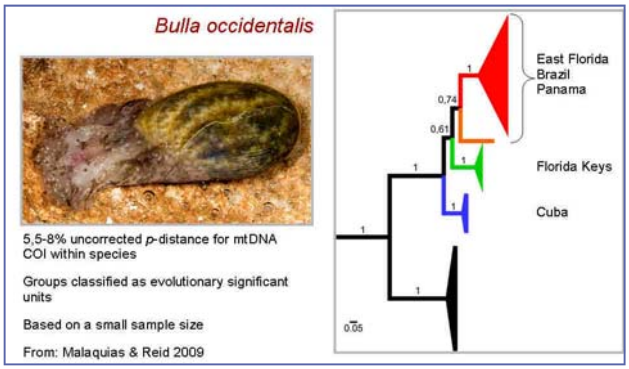
This is a new project undertaken within the framework of a master programme recently started by the first author. The focus area is the Western part of the Tropical Atlantic biogeographic realm (WTA), known for its complex marine biogeography. Several studies on marine invertebrates and fish across the WTA realm showed deep phylogeographic breaks within species. The reasons underpinning this phylogenetic structure are still to be fully understood, but possible causes are numerous, e.g. pleistocene glaciation cycles, freshwater influx from the Amazon and ocean current patterns. Recently, Malaquias & Reid (2009) detected four distinct clades in the gastropod *B. occidentalis* sufficiently distant to be regarded as evolutionary significant units (ESUs).



These clades corresponded roughly to separate geographic localities within the WTA realm, but limited geographical sampling and a small number of specimens unfortunately hampered any sound explanations for the observed pattern. The main goals of this project are: 1) to further investigate, and uncover historical reasons for the present phylogeographic pattern of *B. occidentalis*, and 2) to shed light on the evolutionary patterns and processes of marine life in the WTA. An expanded sample set from throughout the WTA will be analysed using a combination of different methods to address the questions posed by our two main goals. Knowledge about phylogenetic relationships and population genetics inferred from molecular data will be combined with ecological, palaeontological, oceanographic and historical geologic data. Nested Clade Phylogeographic Analysis (NCPA), population genetics statistics and novel model-based Bayesian approaches will be used to test phylogeographic hypotheses. This combination of methods will hopefully lead to a full understanding of the processes behind the observed phylogenetic break in *B. occidentalis* as well as contribute to an increased understanding of the complex marine biogeography and evolution in the WTA realm.

Parasitic influences on the host genome using the molluscan model organism *Biomphalaria glabrata*

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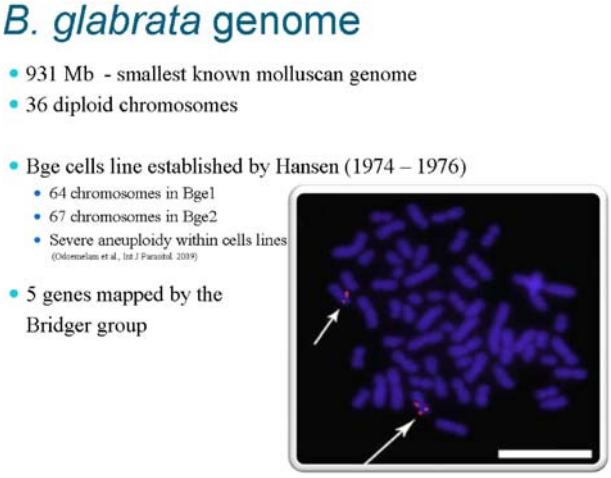
The fresh water snail Biomphalaria glabrata is an intermediate host for *Schistosoma mansoni* parasites, causing one of the most prevalent parasitic infections in mammals, known as schistosomiasis (*Bilharzia*). Due to its importance in the spread of the disease and to develop new control measures *B. glabrata* has been selected for whole genome sequencing and thus a molluscan model organism.



This study will investigate the influence on genome behaviour in the snail by the parasite and ways we can interfere with this host -parasite interaction. For the first time responsive genes have been positioned in the interphase nuclei of ex vivo cells from the whole snail. We are also developing protocols for the genome sequencing project and have successfully developed a robust chromosome spreading procedure for *B. glabrata* chromosomes derived from the ovo-testis.

Fishing for genes involved in biomineralisation and the effects of ocean acidification on shell development in *Crassostrea gigas* Thunberg, 1793

Frauke Bagusche[1], Chris Hauton[1], Clive Trueman[1] & Stephane Pouvreau[2]
[1]School of Ocean and Earth Science, University of Southampton, National Oceanography Centre, Southampton, UK;
[2] Dpt. de Physiologie Fonctionnelle des Organismes Marins, Institut Français de recherche pour l'exploitation de la mer (iFReMeR), Station d'Argenton, Argenton en Landunvez, France . email: frauke.bagusche@noc.soton.ac.uk

Increasing atmospheric carbon dioxide (CO_2) concentrations caused by the burning of fossil fuels have led to greater CO_2 uptake by the oceans over the past two centuries. The dissolution of carbon dioxide in ocean produces carbonic acid, which disrupts seawater carbonate equilibria and can make the deposition of carbonate poly-

morphs energetically unfavourable. This process is termed Ocean acidification (OA). The growing awareness of OA and its impacts on marine calcifiers has emphasized the need to understand the molecular mechanisms of biomineralisation, which underpin shell development in bivalves. The Pacific oyster, *Crassostrea gigas*, is an ideal model organism to examine these processes as it is: 1) a globally-important commercial species, 2) the hatchery rearing of larval stages is well constrained, and 3) studies have established an ontogenetic switch in deposition of carbonate polymorphs from aragonite in veliger larvae to calcite in adult shells. However, little is known about genes involved in biomineralisation and this study therefore aims to identify some of the molecular mechanisms involved in calcification processes during the development of *C. gigas*, as well as possible impacts of changes in environmental conditions such as temperature and pH. Additionally this study will identify how changes of gene expression correlate with the expression of different biomineral microstructures in the developing shell. Using degenerate PCR and GeneFishing™, in combination with an *in silco* search of available EST databases; a list of potential target genes has been developed including putative genes involved in calcium regulation in developing tissues (e.g. calmodulin, dentin sialophosphoprotein, and perlucin). Future analyses, like quantitative real-time PCR, will identify changes in gene expression during ontogenetic development under different environmental conditions. Scanning electron microscopy and infrared spectroscopy will then be used to describe and analyse shell microstructures and components and to correlate changes in gene expression with end-point differences in shell structure. [POSTER]

Physiology of chiton lineages: does oxygen metabolism reflect inherited adaptations to ancient atmospheric conditions?

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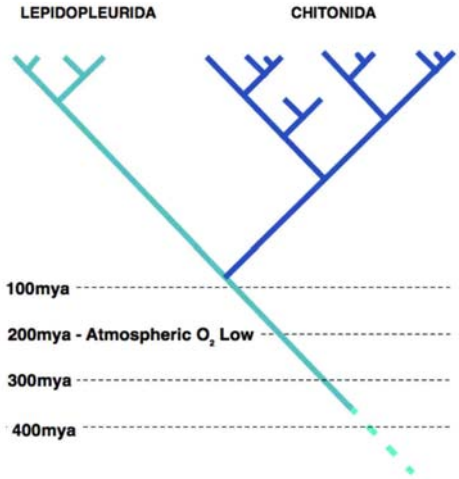
We present the results of a study designed to assess the responses of different lineages of mollusc to decreasing dissolved oxygen concentrations, and thus the role of historical climate variations in determining the physiological tolerances of extant taxa. Chitons are a mollusc group possessing an extremely ancient evolutionary lineage with a fossil record suggesting they have undergone little morphological adaptation in hundreds of millions of years. It is thought physiological adaptation may be similarly minor. The group is composed of two major clades; the Lepidopleurida and the more recently derived Chitonida. As the more ancient lineage the Lepidopleurida survived a historical atmospheric CO_2 high, subsequent to which the Chitonida diverged. As such, chitons are a model group for examining how physiological traits may reflect adaptations to past atmospheric conditions. The oxygen consumption of chitons was examined through placing them in a sealed chamber with a known volume of seawater kept at constant temperature. Decreases in oxygen concentration were determined by means of an electrode measuring changes in



electrical conductivity, a relationship known to be proportional to dissolved O_2 concentration. Individual specimens were subsequently preserved, valves removed and dry tissue weight determined, which was used to normalise O_2 use per unit weight of tissue. The resulting data was analysed for differences in metabolic consumption of oxygen across the two clades. Similar data collected in 2008 from Pacific species of chiton were analysed in the same way. As climate change proceeds the combined effects of rising atmospheric CO_2, ocean acidification and warming are predicted to decrease the dissolved O_2 content of seawater. As well as helping to assess the future impacts of climate change on particular taxa, and thus on habitats and biodiversity, this work may also act as a taxonomic tool to clarify the phylogenetic relationships of certain taxa. The precise shape of the molluscan family tree has been a subject of intense debate for many years, and it is hoped that this work could help clarify the structure of the molluscan phylogeny through extension to other groups within the phylum.

Hydrobia acuta neglecta in Scotland?

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There are six sites in Scotland where the brackish water gastropod *Hydrobia acuta neglecta* (Muus, 1963) has been recorded. There are few reference specimens found in British Museums but samples from three of the six sites are in the National Museums Scotland. One of these sites, Loch nam Madadh, North Uist, Outer Hebrides is a special area of conservation (SAC). Gastropods of the family Hydrobiidae are common in brackish water and marine environments. *H. acuta neglecta*, the rarest of the hydrobids, has been recorded from a few UK sites. Often different hydrobid species, *Peringia ulvae* (Pennant T. 1777), *Ventrosia ventrosa* (Montagu 1803) and *Hydrobia acuta neglecta* may be found together in the same habitat. Uncertainty exists over the identification of *H. acuta neglecta* which is readily confused with *V. ventosa*, and consequently questions the accuracy of their geographic distribution. We hope to clarify *Hydrobia* spp. identification and distribution within Scotland. [POSTER]

Phylogeny and phylogeography of the genus *Sphincterochila* (Gastropoda, Pulmonata, Helicoidea)

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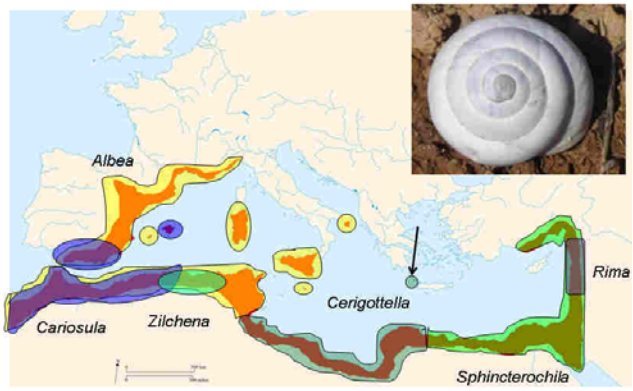
The genus *Sphincterochila* Ancey, 1887 is a terrestrial gastropod with a circum-Mediterranean distribution, from the north-west of Italy to the south of Turkey, extending throughout the east of the Iberian Peninsula and north of Africa. It is also present in some Mediterranean islands. The genus is characterised by a thick, calcareous, white shell, without any additional colour pattern. The shell is globular or more or less prominently keeled. The different species are well adapted to live in an arid or semi-arid climate. As many as six different subgenera have been decribed, *Sphincterochila* (*Sphincterochila s. str.*), *S.* (*Cariosula* Pallary, 1910), *S.* (*Zilchena* Forcart, 1972), *S.* (*Albea* Pallary, 1910), *S.* (*Rima* Pallary,1910) & *S.* (*Cerigottella* Gittenberger, 1993) (*sensu* Schileyko, 2005).



However the number of species and the phylogenetic relationships of *Sphincterochila* taxa are still unclear. Thus in this work we present a molecular phylogeny for the genus *Sphincterochila* based on sequence data from two mitochondrial genes, COI & 16S rRNa. In this work eight species have been analyzed by DNA sequencing. Three of them, *Sphincterochila candidissima* (Draparnaud, 1801), *S. Cariosula* (Michaud, 1833), and *S. baetica* (Rossmässler, 1854), included samples collected from their whole distribution range. Besides, we have studied samples of *S. saharica* (Debaux, 1887) from Algeria, *S. sardoa* (Kobelt, 1888) from Sardinia, *S. Insularis* (O. Boettger, 1894) from Andikithira (Greece), and *S. zonata* (Bourguignat, 1853) & *S. prophetarum* (Bourguignat, 1852) from Israel. More than 100 specimens have been included in this preliminary study with the aim of resolving the phylogeny and phylogeography of this interesting genus, as well as to identify snails' passive transport phenomena through the Mediterranean region.

Genus *Pseudamnicola* (Gastropoda: Hydrobiidae): a "tiny" example of endemism and biodiversity.

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[2]Department of Animal Ecology & Systematics, Justus Liebig University, Giessen, Germany email: diana@mncn.csic.es

In 1878, Paulucci proposed the new genus *Pseudamnicola* to distinguish European species from American species of *Amnicola* Gould & Haldeman 1840. *Pseudamnicola* is a group of minute (tiny) freshwater snails distributed throughout Europe, Western Asia and Northern Africa, belonging to the family Hydrobiidae (Stimpson 1865). Currently, this genus contains two subgenera: *Pseudamnicola* (*Pseudamnicola*), distributed in the Mediterranean basin and *Pseudamnicola* (*Corrosella*) (Boeters 1970) found only in eastern Europe. Previous studies have demonstrated that Spain is one of the European countries with the largest number of known Hydrobiidae taxa, though a complete deep revision of the family in this area is still pending. Of 30 *Pseudamnicola* species reported for Europe, 11 are described from the Ibero-Balearic region, making this area a hotspot for the genus. In spite of being one of the most diverse genera of hydrobiids, there are few works that combine molecular analyses with detailed morphological descriptions, mainly due to the small size and simplified anatomy of *Pseudamnicola* spp. The current work focuses on a revision of this genus by combining anatomical, biogeographical and molecular analyses (mitochondrial genes 16S and COI). Preliminary analyses utilizing population from the Iberian Peninsula and Baleric Islands indicate the existence of five new *Pseudamnicola* species in southern Spain (Betic Mountains), demonstrating the high degree of biodiversity and endemism in this genus. On a Europe-wide level, a phylogenetic analysis of the genus is being performed indicating the existence of the two described subgenera and even an additional third one. Species of *Pseudamnicola* (*Pseudamnicola*) and *Pseudamnicola* (*Corrosella*) are well supported although relationships within these clades are less well resolved, raising the need for more rapidly evolving molecular markers. Joining these results with the deduced biogeographic patterns and representative apomorphies of each species should lead to a more comprehensive evolutionary history of the group. [POSTER]

Manila clam *Ruditapes philippinarum* in the United Kingdom

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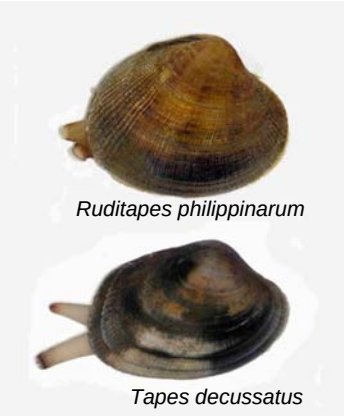
Ruditapes philippinarum

Tapes decussatus

Ruditapes philippinarum is a bivalve mollusc native to the Western Pacific with a distribution from temperate down to tropical climates. In Asia it is an important commercial species that has been maricultured extensively. It was introduced into Europe in the 1970s for aquaculture purposes and later into the United Kingdom in the 1980s. It has since become an economically important species across both Europe and the UK. Trials undertaken by MAFF in the 1980s had come to the conclusion that this would be a perfect species for aquaculture due to its fast growth rate, and the idea that it would be unable to become naturalised due to the temperature regime. This was however found to be incorrect and now the Manila clam has become established in many

bays and harbours along the South Coast of England. These populations have become heavily exploited by fishing due to the high commercial value of the Manila clam. My study has looked at the distribution of the Manila clam along the south and eastern coast of England and we have found evidence of several populations with the most northerly population being in Suffolk. The study has also looked more in detail at a population located in Holton Heath in Poole Harbour, Dorset. Monthly samples from the last three years have been collected with a few exceptions and point to the conclusion that the mean size in this population is declining, however there are more adults per unit area in the colonised areas. This appears to be due to increasingly intense fishing pressures removing the larger individuals and a good year for recruitment. Anecdotal evidence on numbers of fishing boats sighted at this location over time also points to the fact that this area may no longer be economically viable as a fishery, a fact confirmed by the average size of the clams and also the maximum sizes collected by this study.

Towards an objective approach to identify biodiversity hotspots: insights from gastropod diversity of ancient Lake Ohrid

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Department of Animal Ecology and Systematics, Justus Liebig University Giessen, Germany. email: torsten.hauffe@bio.uni-giessen.de

Biological diversity typically shows a heterogeneous spatial distribution, featuring both areas with reduced and elevated biodiversity. The latter areas are often called biodiversity hotspots. This term, however, has originally been proposed for conservation issues, applying the criteria of species richness, endemism and species threat. Unfortunately, so far no objective measure exists for identifying hotspots. We here aim to present such an objective approach using gastropod diversity from ancient Lake Ohrid as an example. The three criteria species richness, endemism and species threat, were integrated into a null model. a presence-absence matrix of 64 gastropod species at more than 200 collecting points was permuted 4999 times with fixed row and column sums in order to preserve species richness and species frequency. The randomized matrix was used to compute the extent of occurrence and depth distribution of each species, thus providing an objective endemicity index for each species. Moreover, these two features were shown to be reliable predictors of habitat decline and number of locations and, thus, allowed to recalculate species-specific IUCN threat categories. Then, for each species a specific value characterizing this geographical range and threat status was generated, and summed up to the overall heat-value for each collecting point. Subsequently, this permuted null model was compared to actual data. Interestingly, our analysis revealed that species richness is not the main predictor of biodiversity hotspots in Lake Ohrid. Moreover, all points that were classified as hotspots showed a spatial autocorrelation at shallow parts of the rocky south-eastern shore of Lake Ohrid and at the adjacent feeder spring complex of Sveti Naum. We discuss these findings in the context of lake-level fluctuations, possible environmental constraints, and implications for conservation. [POSTER]

The biodegradation boundary of woody detritus in mangrove forests, determined by the sharp change between shipworms (Bivalvia, Teredinidae) and terrestrial biodegrading organisms

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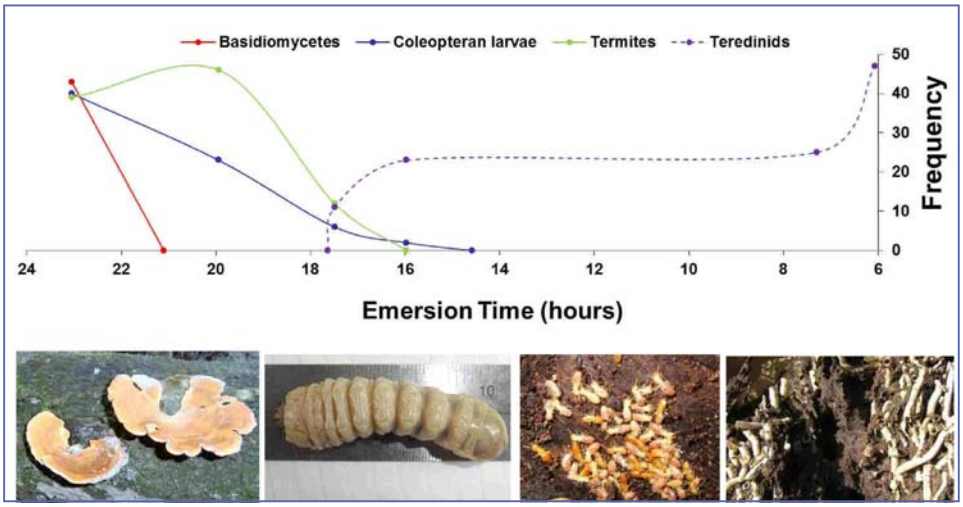
Teredinids are bivalve molluscs that bore into fallen wood. They colonise large woody detritus (LWD) in mangrove environments. When inside the LWD the teredinid bivalves will excavate extensive tunnels as they develop. There has been limited attention towards the activity of the Teredinidae for their role with processing LWD in mangrove systems. LWD decay processes were mapped within a 2 ha mangrove forest in east Sulawesi, Indonesia. The volume (litres), salinity and shore height above sea level of each LWD sample encountered was recorded. Necromass ($m^3 ha^{-1}$) was greater in the high intertidal zone, when compared to the low intertidal areas. The LWD decay processes found and identified in the mangrove were basidiomycete decay recorded only in the high intertidal zone (2.4 metres above sea level). Termites and coleopteran larvae were found from the landward edge, but no lower than 1.7 metres above sea level. However, teredinid molluscs were recorded from a sharp boundary at 1.92 metres above sea level and extending to below sea level. No difference of salinity was found between the lower heights above sea level. Thus, it is unlikely that salinity is the driving factor towards the terrestrial/marine degradation boundary. However, in areas where teredinid activity was recorded, emersion time was found to be statistically lower compared to all other shore heights. Therefore, it is likely that emersion time is driving this sudden change of biodegradation processes. In addition, the tunnels created by the teredinids become niches for many cryptic fauna communities when vacant. The cryptic fauna found in the teredinid tunnels differ from the cryptic fauna living in fallen wood processed by terrestrial biodegraders. If sea level height increases as predicted, there will be potential ecologi-



cal implications towards the biodegradation of fallen wood and the resident cryptic fauna within the fallen wood due to the biodegradation boundary moving higher up the shore line, thus changing the biodiversity within LWD and the nutrient flux of LW D.

Tolerance to increased sodium chloride concentrations of painter's mussel (*Unio pictorum*, Linnaeus 1758) and duck mussel (*Anodonta anatina*, Linnaeus 1758)

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Road de-icing salts are widely applied during winter but there is a lack of knowledge on their ecotoxicological effects on freshwater invertebrates. The study presented here tested the effects of acute 96 h exposures to sodium chloride in two freshwater mussel species, the painter's mussel (*Unio pictorum* L.) and the duck mussel (*Anodonta anatina* L.). Ecotoxicological effects of high NaCl concentrations were detected in both species, with *U. pictorum* being more sensitive. The response of both species used did not follow classical dose-response patterns, with medium concentrations of 5 $g.L^{-1}$ NaCl revealing greatest toxicity. Delayed mortality during the recovery phase following the exposure was frequently observed, suggesting that long-term effects of short, acute exposures should be considered in ecotoxicological tests. In conclusion, the differences in the ecotoxicological response patterns of freshwater mussels compared to other test organisms suggest that they should be better considered in studies of stressor effects in aquatic systems. [POSTER]

Genetic analysis of populations of the swan mussel *Anodonta cygnea* by established microsatellite markers

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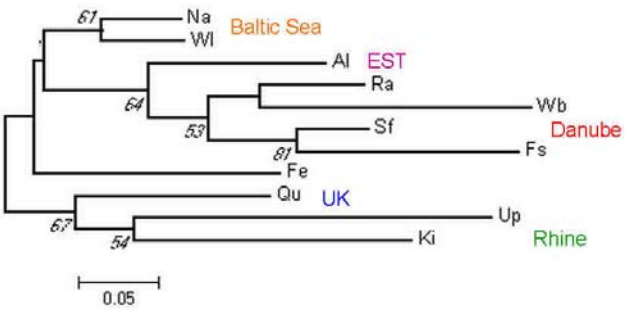
Freshwater mussels belong to the most endangered animal group worldwide. Reasons for their decline include habitat fragmentation, pollution and other anthropogenic influences. One of the biggest groups of freshwater mussels, the Unionoida, is additionally dependent on the presence of specific host fish, which unionoid larvae are parasitic on. Knowledge of the spatial distribution of a species' genetic population structure is essential for conservation planning and can additionally be useful for an understanding of life history variation. In the present study the genetic composition of 11 European swan mussel (*Anodonta cygnea*) populations (213 individuals) from Germany, Austria, Estonia and the UK, using seven recently developed microsatellite markers to determine the genetic differences among and within *A. cygnea* populations from different drainage systems, as well as among the drainages themselves. Before microsatellite analysis, species were determined using RFLPs. Seven of the eight microsatellite loci were polymorphic, with the number of alleles ranging from 3 to 18. The eleven mussel populations varied considerably in number of alleles and allelic richness, observed and expected heterozygosity and F_{IS} (inbreeding coefficient). Those populations which exhibited deviation of the Hardy-Weinberg equilibrium were combined with a high inbreeding coefficient. It could be detected that the genetic variation among populations within a drainage is higher than between drainage systems. Few populations revealed a larger relatedness to populations of other drainages than to some within the drainage of origin. Therefore the present study provides the first insight into the genetic constitution of the species *A. cygnaea* in Northern and Central Europe.



Neighbour-joining tree of populations based on DA distances (Nei et al., 1983)

Phylogeography and subspecies classification of the landsnail *Clausilia dubia* in eastern Austria (Gastropoda: Pulmonata: Clausiliidae)

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According to the common classification by Klemm (1960) the door snail *Clausilia dubia* (Draparnaud, 1805) is divided into 14 subspecies assigned to three geographic (topographic) units. This classification was mainly based on morphological traits of the shell, especially size, colour and ribs. Nordsieck (2002) criticised that classification arguing that clausilids cannot be determined by such unspecific criteria. He considered structures of the clausilial apparatus to be taxonomically more important. Thus he revised the classification of Klemm (1960) and divided *C. dubia* into only two subspecies, *C. d. dubia* s.l. and *C. d. vindobonensis* s.l. (Nordsieck, 2002). In our study *Clausilia dubia* will be analyzed for the first time by combining morphological and DNA sequence data. Partial sequences of the genes for COI and 16S rRNA will be obtained from individuals collected at 55 sample sites in eastern Austria. The phylogenetic conclusions will be interpreted with respect to the two previously postulated classification systems. [POSTER]

Zospeum: luminaries of the dark - barcoding highlights an old taxonomic conundrum besetting microsnails (Pulmonata, Ellobioidea, Carychiidae)

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Microsnail taxonomy demonstrates a challenging and complicated history. This complexity, confounded by the paucity of well-distinguished anatomical and conchological features, high morphological intraspecific variability and morphological stasis amidst troglobitic microsnails, renders species identification particularly difficult. Modern molecular taxonomy

via DNA barcoding, i.e. delimitating species with a mitochondrial-encoded 650 bp fragment of the cytochrome c oxidase subunit 1 (COI) gene, is especially reliable for species recognition. Our studies of the carychiidae as a well-designated taxonomic group, have demonstrated that intraspecific and interspecific genetic variability can clearly be separated. We present a DNA barcoding approach to designate species comprising the genus *Zospeum* Bourguinat, 1856. These minute (< 2mm), blind and colorless snails are endemic to the Pyrenees, the central European alps and the Dinarid alps of southeastern Europe. Moreover, new reports indicate that they have been found in Korea and China. Our investigation presents a DNA barcoding and scanning electron microscopic (SEM) illumination of *Zospeum* (Pulmonata, Ellobioidea, Carychiidae) species collected in Slovenian and Croatian caves. Factors such as their minute size, the lack of clearly distinguishing interspecific conchological characters and the strong selective pressure associated with subterranean habitats underscore the effectiveness of this taxon as the ideal model to test the efficacy of this novel method. Moreover, its use as a modern taxonomic tool may well help to reveal the enormous cryptic diversity of other troglobitic and stygobiont mollusks. [POSTER]

Smart from the start!? Developmental changes in the central ganglia system of the Hawaiian Bobtail squid (*Euprymna scolopes* BERRY, 1913

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Cephalopods have been of great interest to science for a long time. In comparison to *Loligo*, *Sepia* and *Octopus*, which are frequently investigated, *Euprymna scolopes* is easier to handle due to its smaller body size. Recently, there has been some study done by Lee *et al*. (2009), focusing on genes and proteins. There is no histological background on this species. For investigating the structure of the central nervous system, two techniques will be coupled. X-ray microtomography will be used for 3D-reconstruction and volume measurements in Amira. A histological preparation is to follow for a more detailed analysis. First investigations show that the ganglia system of *Euprymna scolopes* is a concentrated mass of ganglia, which can be told apart because of the specific structure of two distinguishable layers. Most of the ganglia can already be found in the earliest stages investigated here, some of the more peripheral parts develop later. [POSTER]

Habitat and microhabitat requirements of *Vertigo moulinsiana* Dupuy 1849 (Gastropoda: Pulmonata, Vertiginidae) in Poland.

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Vertigo moulinsiana is an Atlantic-Mediterranean vertiginid snail. It occurs rarely in Poland and is listed under Annex II of the European Habitat Directive. The mollusc is known from calcareous wetlands and one of the most important factors influencing the distribution of *Vertigo moulinsiana* is groundwater level. There is very little information about Polish populations of Desmoulin`s whorl snail and our researches provide some new data about the species. The studies were conducted in 2008 and 2009 on 3 sites of *Vertigo moulinsiana*. All were located in lowlands: two in the small Pliszka and Ilanka river valleys in northwestern Poland, and one in the Nida river valley in southeastern Poland. The sites in northwestern Poland had approximate areas of 15 ha each. We collected 138 individuals: 76 from near Pliszka and 62 from near Ilanka. Locations were covered mostly by *Carex acutiformis* and *Carex paniculata* and the individuals were found in the humid layer of dead litter. The exception was late summer 2009 when the snails were climbing on plants. The most important factors influencing their presence were litter layer humidity and tree canopy shading. The humidity above the litter layer was an important factor for climbing snails. In southeastern Poland, the 10 ha study area is covered in equal parts by two types of habitat: sedge (*Carex elata*) and sweetgrass and sedge (*Glyceria maxima* and *Carex elata*). Individual numbers and level of groundwater were monitored every month, from May to November, each year. It was found that the individuals of Desmoulins whorl snail occur in the highest number in places overgrown with sweetgrass and sedge, and in both types of habitat the individuals occur in the highest number in places where groundwater was close to the ground surface. Suitable microclimatic conditions for snails probably provide the interactions between the type of vegetation and groundwater level. [POSTER]

Competition and niche differentiation of sympatrically occurring naticid species (Gastropoda: Naticidae) in the Bay of Campese (Giglio Island/Italy), and observations on a colour form of *Naticarius stercusmuscarum* (Gmelin, 1791)

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The Naticidae (moon snails) are a predatory caenogastropod family consisting of about 260-270 Recent species. Naticids are worldwide in distribution and present in all marine habitats ranging from shallow water to the abyssal. The distribution of the Naticidae in the Mediterranean sea has been described by several authors, but, prior to our study, only three naticids had been identified for Giglio Island (Italy). We investigated the biodiversity of naticids of Giglio Island in more detail and recognized a total of nine species, six of which were found coexisting in the Bay of Campese. The present study focuses on niche differentiation of the four dominant sympatric naticid species in Campese Bay (*Naticarius hebraeus* (Martyn, 1786), *Naticarius stercusmuscarum* (Gmelin, 1791), *Neverita josephinia* (Risso, 1826), and *Tectonatica sagraiana* (Orbigny, 1842)). Research on naticid ecology has only been conducted partially, and has never been discussed in the context of sympatrically living species and niche differentiation. All studied species are burrowers, they are carnivorous and specialized to feed on shellfish by drilling the shells of their prey. We analyzed distribution, feeding behavior, and anatomical characters to detect differences in their behaviour and ecology that could help to determine if the species reduce competition and live in coexistence. Our results indicate a distinct separation between the species based on different distribution patterns and predation. Since *T. sagraiana* lives predominantly within deeper regions (11-20 m) of Campese Bay, this species is separated from the remaining naticids that

occur mainly between 2-8 m depth. All naticids prefer the common bivalve *Venus gallina*. There are differences between the species concerning prey handling time and borehole location. Surprisingly, *N. stercusmuscarum* and *T. sagraiana* show cannibalistic behavior, and all studied naticids feed on carrion.
Furthermore, we found several shells and one living specimen of a deviant form of *N. stercusmuscarum*. Conchological differences coinciding with behavioral peculiarities focussed our attention on this animal. Future anatomical and molecular analyses will have to clarify if *N.* cf. *stercusmuscarum* represents a distinct (sub)species or is only a variety of *N. stercusmuscarum*.

The illustrations on page 1 are from this talk. More information on this topic is in Huelsken T, Marek C, Schreiber I Schmidt I & Hollmann M, 2008. The Naticidae of Giglio Island. *Zootaxa*, 1770: 1-40.


Ticha Orlice river showing floodplain and valley slopes

Corbicula invasion in European rivers: three mitochondrial lineages and a unique mode of reproduction

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Native to Asia, Middle East, Africa and Australia, the genus *Corbicula* is one of the main pest bivalves in European freshwater ecosystems since the 1980s. Presently, very few data are available on which *Corbicula* species have invaded Europe, their entry point and their colonization routes. Moreover, the taxonomy of the genus *Corbicula* is very controversial, mainly due to a high phenotypic plasticity and a very unique asexual reproductive mode in the invasive lineages, androgenesis. Androgenesis is a form of unisexual reproduction corresponding to a strictly paternal inheritance. After the fertilization of an egg by an unreduced and biflagellate sperm, the female pronucleus is expulsed as two polar bodies but the mitochondria are retained. Androgenetic sperm can also parasitize oocytes from different *Corbicula* lineages, a kind of egg parasitism, resulting in a disjunction between nuclear and mitochondrial lineages as well as between morphology and mitochondrial haplotype. The aim of this study, the first to focus globally on the genus in Europe, is to determine which *Corbicula* lineages invaded Europe and if those invasive lineages are reproducing sexually or through androgenesis. We combined morphological analyses with the sequencing of the mitochondrial genes COI, Cyt *b* and 16S. In addition, we investigated the sperm morphology of *Corbicula* individuals from different European populations in order to determine their reproductive mode since androgenesis is characterized by biflagellate sperm. Finally, we started karyotyping *Corbicula* individuals from River Meuse (Belgium), polyploidy being another indication of the unisexual mode of reproduction of the invasive lineages. [POSTER]

The role of the river and its floodplain in land mollusc distribution in a fragmented landscape

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The aim of this study was to assess the role of floodplains as biocorridors for terrestrial snail dispersal. We hypothesised that assemblages in the river alluvium should be more homogeneous in species composition than those in the forest slopes above the river. We also want to analyse whether a river can constitute a substantial barrier against the spread of snail species inhabiting forest slopes. The study was conducted on 33 woodland plots arranged in three parallel transects in the Tichá Orlice river valley (E Bohemia, Czech Republic). One transect was in an altered river floodplain and the remaining two on the slopes of the valley. As expected, the median value of the Jaccard similarity coefficient was highest on the floodplain (50%), although significant difference was obtained only for one of the slope transects. Variation partitioning of slope transect assemblages showed that the pure effect of affiliation to the right or left bank was relatively high, in contrast to connectivity, which had a small and nonsignificant pure contribution. Thus, the studied river segment and its floodplain seems to constitute a barrier for snails rather than biocorridor. Further results suggested that the effect of current landscape fragmentation and permeability are overridden by environmental differences -the variation in studied mollusc assemblages was above all driven by niche based processes rather than dispersal-driven elements.

The Family Philinidae (Mollusca: gastropoda) in Scandinavia: systematic revision of species with a molecular phylogenetic analyses

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Philinidae is a family of cephalaspidean gastropods characterised by fragile internal plate-like shells, strong parapodia and missing jaws. They occur in muddy substrates from shallow water to the deep sea, feeding upon forams and small molluscs. Cephalaspid taxonomy is very complex and prone to changes since species have been described mostly based on shells alone and those can be very similar particularly between species of the same genus, leading to high taxonomic uncertainty. Philinidae is a paradigmatic example of this; the white body colour of the animals, the extreme similarity between shell shape and ornamentation, coupled with their reduced size lead to an almost arbitrary recognition of species. Eleven to 13 species of Philinidae included in two genera are recognized in Scandinavia (Lemche, 1948; Hansson, 1998; Brattegard & Holthe, 2001). Lemche's 1948 work is likely the most comprehensive study about northern European cephalaspids, however the author only included outline drawings of the shells and very little or no information at all on the morphology and anatomy of species, making the use of this work very difficult and ambiguous.

Hansson's 1998 and Brattegard & Holthe's 2001 works are merely checklists based on comprehensive surveys of scientific and technical literature without a critical evaluation and revision of the taxonomy of species. Here we present an overview and first results of a new project undertaken within the framework of a master degree programme, aiming to revise the systematics of the Scandinavian Philinidae, with emphasis on the Norwegian species, by establishing the valid names and synonyms, while providing characters to discriminate between species. Shells, external morphology, and anatomical characters (e.g. radula, gizzard plates, and male reproductive system) will be studied through fine dissection work, scanning electron microscopy and compared with type material. Species will be barcoded using the mitochondrial COI gene and molecular phylogenetic hypotheses inferred to help delimit species. [POSTER]

The number of subspecies may be influenced by the complexity of shells

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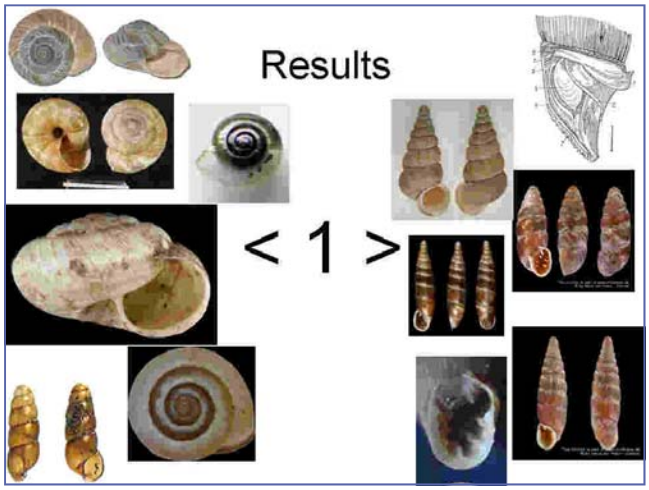
The textbook definition of species and subspecies are well known by biologists. However, routine malacological taxonomical practice often involves subjectivity with respect to determining boundaries for species and subspecific entities. Using the Fauna Europaea database, I was looking for patterns in the number of subspecies within European terrestrial molluscs. Taking genera including more than 10 species into account, I found two separate groups. In the clausiliid group, the mean number of subspecies was about 20 subspecies per 10 species, whereas in the hygromiid group, this ratio was 2 subspecies per 10 species described. In taxonomic descriptions of hygromiids about 8-9 shell characters were mentioned, whereas this number is 13-16 in case of clausiliids. The reason why clausiliids have an order of magnitude more subspecies than the hygromiid group can partly be explained by complexity of shells and the subjectivity of taxonomists. I suggest that this might play an important role in terrestrial mollusc taxonomy. Therefore, the number of species is more comparable than the number of subspecies in comprehensive studies (i.e. in comparing tempo of evolution), and it is possible that cryptic subspecies are present in taxa with simpler shell structure.



Local adaptation in the Land snail, *Cepaea nemoralis*

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The land snail *Cepaea nemoralis* is highly polymorphic in directly observable shell characters, which are under genetic control. There is a consistent association of shell colour and habitat type, implying that natural selection is acting to shape patterns of divergence on a local scale. A genome scan was performed to identify loci linked to regions of the genome under selection. Loci with elevated levels of differentiation, compared to a neutral model, are potentially linked to regions of the genome under selection. Two open-woodland population pairs were sampled and scored at a few hundred amplified fragment length polymorphism (aFLP) loci. Three aFLP loci were revealed to be under selection in one population pair and another three in the other population pair. It is unclear why the loci under selection are not repeated between the two pairs. These loci are potential candidates for further molecular analysis, but further analysis is needed. [POSTER]

Molecular systematic of *Pyramidula* (Gastropoda, Pulmonata)

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Pyramidula is a genus of terrestrial gastropods whose distribution in the Palaearctic Region extends to almost all Europe, Mediterranean area and central Asia. They have a trochoid shell, more or less flattened with a broad umbilicus and they are small, not exceeding 3 mm of diameter. The genus in the Palaearctic Region includes six species. *Pyramidula pusilla* is the most widespread and common in Europe, occupying the entire Mediterranean region and Central and Western Europe. *P. rupestris* occurs in the entire Mediterranean region and Central Asia. *P. umbilicata* has a Lusitanian-Atlantic distribution. *P. jaenensis* is an endemism of the Iberian Peninsula. *P. chorismenostoma* with the body whorl separated from the rest of the shell is present in Greece, Crete, Aegean islands and Western Turkey. *P. cephalonica* occurs in Croatia, Greece and Turkey. There is a controversy about a seventh form (*P. hierosolymitana*) from Israel, which some authors consider as a distinct species and others as a subspecies of *P. rupestris*. Until now, the identification of the species has been done using morphological studies exclusively based on shell parameters because there are no differences in the reproductive system. The parameters used in taxonomy were the maximum diameter, the diameter of umbilicus, the total height and the coloration. Some of these shell parameters are correlated so the morphological criteria seem to be not enough to deduce the taxonomy and the need for complementary characters becomes evident. The aim of the present study is to review the taxonomy and phylogeny of the genus using molecular markers, specifically the sequences data from two mitochondrial genes, COI and 16S. Molecular data will be compared with the currently established morphospecies. At present, four species of the genus are being analyzed (*P. umbilicata*, *P. pusilla*, *P. rupestris* and *P. jaenensis*). Samples have been collected in the Iberian Peninsula and surroundings, as France, British Isles and Balearic islands. Future studies will include all the species of the genus and samples from the whole geographical range. [POSTER]

Morphology and reproduction in three populations of the southern Ocean brooding bivalve *Lissarca miliaris*

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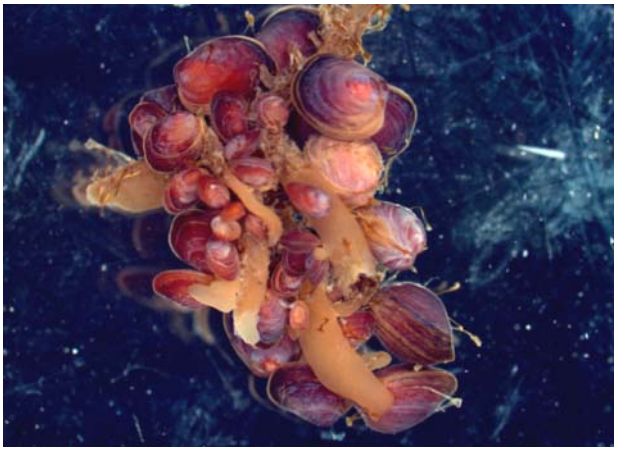

Brooding is a common and successful reproductive trait in antarctic bivalves. *Lissarca miliaris* is a small shallow water brooding bivalve with a distribution spanning the Magellan region, the sub-Antarctic islands and the continental Antarctic. Populations of *L. miliaris* are often found in shallow waters (0-30m) although populations exist to depths of 270m. Three populations of *L. miliaris* from Livingston Island, King George Island and Signy Island have been investigated for differences in shell morphology and reproductive stages linked to local habitat characteristics. While no differences in shell morphometrics have been observed between the three sites, maximum shell dimensions of bivalves from Livingston Island are smaller and a difference in growth rate is observed. Histological examinations of specimens collected at all sites during the Antarctic summer revealed both male and female gonads to be ripe and also the presence of previtellogenic oocytes in mature males near the adductor muscle measuring between 10 and 69 µm. Larger primary oocytes measuring 218-569 µm are found within the gonads of females and two adult females have been observed with these larger oocytes extruded into the mantle cavity. Oocyte sizes differ between King George Island and Livingston Island. The female:male ratio in the populations was assessed and the sex ratio is changing with shell size. The current results suggest that this species may switch between female and male with an intermediate hermaphrodite stage. A quarter of the reproductive populations appear to be male with ripe testis and previtellogenic oocytes. In the male gonads of specimens from Signy Island parasites were observed which might have possible effects on the fertility of the population.

Mollusc assemblages in fens of southern Scandinavia: variation along the gradient of mineral richness

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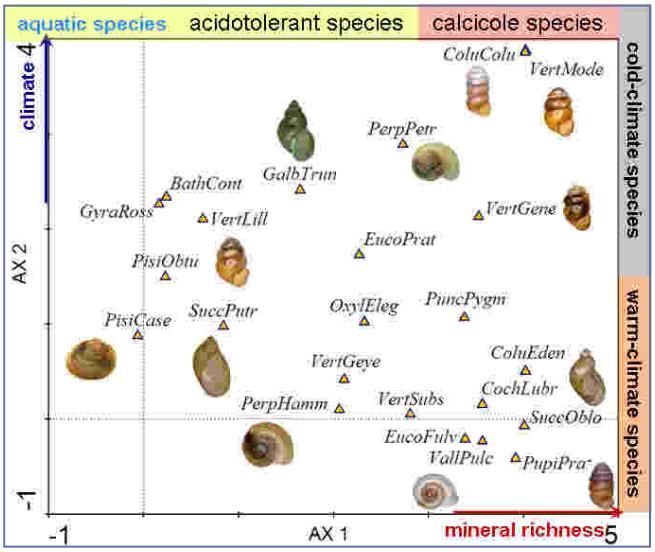
Spring fens are ecologically specific biotopes which can harbour diverse mollusc assemblages. Species composition and diversity of fen mollusc faunas are driven especially by the gradient of mineral richness (i.e. changes of ground water chemical parameters, mainly calcium and magnesium) that accounts for sharp changes of fen biota from mineral-poor (acidic) to mineral-rich (calcareous) fens. As the calcium content appears to be a limiting factor for molluscs in fens, species richness and abundances usually tightly increase with increasing mineral richness in spring fens. The mollusc fauna changes along the mineral richness gradient of spring fens were studied in detail in the Western Carpathians and Bulgaria. In this contribution we present new results from fens in southern Scandinavia. The field work was conducted in August 2006 within the territory of southern Norway and Sweden. Altogether 43 fen sites were sampled in order to cover the entire ecological variation of fens, especially in respect of the mineral richness gradient. Water conductivity and pH, geographic coordinates and altitude were measured in the field. Vegetation relevé was recorded at each site and climatic parameters (mean temperatures and precipitations) were compiled for each site. The data were processed using Statistica, PC-ORD and CANOCO packages. A total of 45 mollusc species were found in the studied fens. Mollusc assemblages consisted of typical northern cold-climate species (e.g. *Vertigo genesii*, *Columella columella*, *Vertigo arctica* and *Vertigo lilljeborgi*) as well as common central European species (e.g. *Cochlicopa lubrica* and *Perpolita hammonis*). Both number of species and individuals increased with increasing mineral richness, and water conductivity explained these changes better than water pH. Species densities and abundances of terrestrial snails were more tightly associated with the mineral richness than those for the entire assemblages. The major gradient in mollusc data was controlled by the mineral richness, the second one was associated with the climate variation, strongly correlated with altitude. The main direction of mollusc species turnover was associated with that observed for vegetation, and plant species composition was found to be the best predictor of overall variation in mollusc data.



Nudibranchs of the Bay of Antsiranana, Madagascar

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Nudibranchs are marine gastropods that have always been very popular with recreational divers due to their extremely diverse and colourful appearances. Over 3000 species are currently recorded and hundreds more are yet to be described.. However, knowledge about their biology

and ecology in tropical waters is limited and especially so in Madagascar. This study aimed to increase the species list of nudibranchs for the Bay of Antsiranana, as well as collect quantitative data on their distribution and substratum preferences. Several species that had not been reported by previous Frontier surveys of the Bay were found. These include *Thecacera pacifica*, *Chromodoris sinensis*, *Chromodoris magnifica*, *Chromodoris boucheti* and *Mexichromis mariei*. Of these *Chromodoris sinensis* has previously only been reported from around Japan and China, indicating a considerable range extension for this species. Most species found in the Bay over the period of survey activity by Frontier belong to one of three common families; Chromodorididae (43%), Phyllidiidae (34%) and Polyceridae (20%). Quantitative data in relation to the main families found in the Bay of Antsiranana and possible reasons for their distribution will be assessed. [POSTER]

The rapid destruction of a wreck in Turkish waters by a suspected invasive teredinid (Teredinidae, Bivalvia)

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This report describes the rapid destruction of the deliberately sunk replica of a historic shipwreck, the Uluburun III, in less than four years. Sample retrieval was carried out over a period of one week, from the 7th - 14th of August at the site of the wreck. Two teredinid species were identified, *Nototeredo norvagica* and *Teredethyra dominicensis*, as well as the amphipod *Chelura terebrans*. The invasive *T. dominicensis* was the dominant species representing 92% of the pallets found. Variations in pallet sizes are considerable, indicating that recruitment occurred on more than one occasion. As this species has planktotrophic development, larvae will disperse some distance from the parent population. These considerations suggest that *Teredothyra dominicensis* has become an established species in Mediterranean waters. The means of introduction of this new species are explored in the report.

Above: Replica of Uluburun III being sunk in October 2006. Right: In August 2010, teredinids have left only the mast and keel.

Pupilla pratensis (Gastropoda: Pupillidae) in the Czech Republic and Slovakia - its ecology and conchometrical distinction from *P. muscorum* and *P. alpicola*

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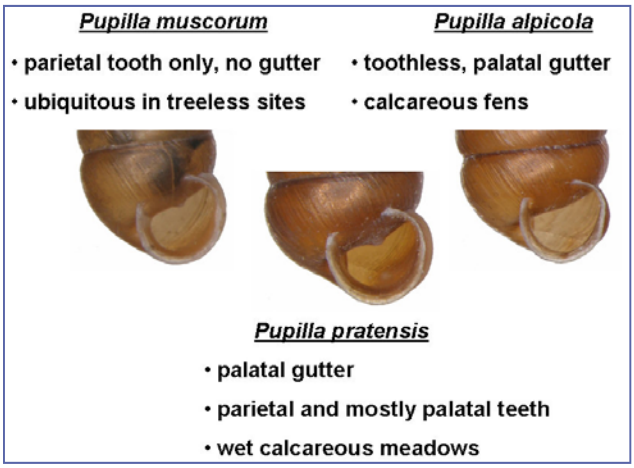
Pupilla pratensis (Clessin, 1871) was recently confirmed as a distinct species based on morphological, ecological and molecular evidence. Based on revision of voucher materials and field research we documented six populations of *P. pratensis* in the Czech Republic and one in S W Slovakia. The revision also showed that all previously reported records of *P. alpicola* from the Czech Republic belonged in fact to *P. pratensis*. We observed that using multidimensional PCA analysis of shell measurements it was possible to distinguish *P. pratensis* from *P. muscorum* with no overlapping specimens. *Pupilla alpicola* was almost completely different from *P. muscorum* with only few overlapping specimens, contrary to *P. pratensis* which was mostly impossible to distinguish from *P. alpicola* based on shell measurements used. Shell width was the best single shell measurement for distinguishing between *P. pratensis* and *P. muscorum*. Czech and Slovak populations of *P. pratensis* occurred in calcium-rich fen meadows which perfectly match with the site characteristics of this snail reported from Scandinavia. We assume that the observed morphometric differences between *P. pratensis* and *P. muscorum* can also be useful for distinguishing the species outside the Czech territory and for palaeoecological studies where only empty shells are available. Since these species occupy ecologically different habitats their reliable identification in fossil material can improve the reconstructions of past environments.



Food preferences of land snails in a river floodplain inhabited by invasive plants

Štepánka Ševčiková & Lucie Juřičková.
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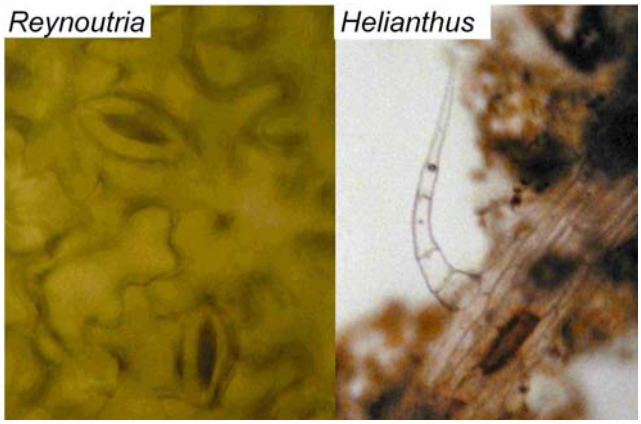
This work is focused on food preferences of land snails in river flood-plains inhabited by invasive plants. The most important invasive plants were chosen: *Impatiens glandulifera*, *Helianthus tuberosus*, *Reynoutria sachalinensis*, *R. bohemica*, *R. japonica*. Only a few snail species occur on these plants but in large abundances. We chose some of the

most abundant species - *Succinea putris* and *Urticicola umbrosus* as model organisms. Food preferences of land snails has been studied for many years by many authors, nevertheless there is practically no work dedicated to the invasive plants as a potential snail food. First, in our project, we can demonstrate the palatability of invasive plant species for the native snails. For this purpose, we apply routinely used food-preference tests and faecal analysis with fluorescent dyes. An analysis of faeces without dyes is a method commonly used in research on snail food preferences. It is necessary to find some structures characteristic for the plants, which we can use to identify the plants. In this project we intend to try fluorescence dying of the faeces, which is a method often used in a research of food preferences of some taxa e.g. mites, but which has never been used for the molluscs so far. [POSTER]



The effects of temperature and pressure on early life stages in the common whelk *Buccinum undatum*

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The effects of temperature and hydrostatic pressure on shallow-water fauna is crucial for understanding the evolutionary adaptations observed in related species living at different depths or latitudes. It gives us indications as to the challenges which populations overcome in order to evolve or migrate from one area to another. This is particularly important in the more vulnerable early life stages in which most changes in distribution take place through dispersal. Gastropods from the Buccinidae family are found widely distributed across the oceans. Here, we investigate temperature and pressure effects on survival and respiration in the early life stages of the common whelk *Buccinum undatum*. This is a shallow-water buccinid found on both sides of the North Atlantic from northern Iceland down to the southern coast of England. Its adult temperature distribution is -0.5 to 19°C. Its depth distribution is generally 0 to 100 m. We investigate the full temperature range found through early ontogeny using samples collected from Southampton waters, UK. Egg masses were developed at temperatures of 6, 10, 14 and 18°C. Developmental time from egg laying to juveniles hatching varied across the temperatures, from 7 weeks at 18°C to 21 weeks at 6°C. Hatching juveniles were then pressurised to between 1 and 400 bar. A decrease in both respiration and survival is observed with increasing pressure. The greatest effect is seen at pressures above 200 bar where a large drop in respiration rate is observed (e.g. at 10°C respiration drops from 0.0052m oxygen/hour/g to 0.0022 m oxygen/hour/g). Survival also drops from 100% to below 40%. Survival is observed in juveniles for 24 hours at pressures of up to 300 bar at 6, 10 and 14°C and 200 bar at 18°C. These results help us to understand the evolutionary links between related populations from different areas of the oceans. They also give insight into the potential for future range shifts with regard to latitude and depth due to environmental constraints such as climate change. [POSTER]

What, if anything, is a unionid? *Coelatura* Conrad, 1853 and the monophyly of the Unionidae (Bivalvia: Unionoida)

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The family Unionidae is the largest of the six freshwater mussel families, with around 670 species. The majority of unionid species are found on northern continents, with some lineages extending southward onto continuous Gondwanan fragments. Previous family-level phylogenetic analyses of the Unionoida had insufficient taxon sampling to test the traditional classification. As a result, there is disagreement in the literature about the monophyly of the Unionidae, primarily concerning the placement of the African species, *Coelatura aegyptiaca*. Analyses of mitochondrial data typically place *Coelatura* outside the larger Unionidae clade, confounding efforts to determine where and when this family originated. To test the phylogenetic position of *Coelatura* and the monophyly of the Unionidae, we specifically targeted Southeast Asian and African genera not sampled in previous molecular phylogenetic studies. We obtained sequence data of the mitochondrial cytochrome oxidase subunit I gene and the nuclear 28s ribosomal gene for 37 palaeoheterodonts as well as two outgroup taxa. Both parsimony analysis and Bayesian inference robustly recover *Coelatura* as a member of the Unionidae. We will discuss these results in the context of the biogeography of the family and the evolution of freshwater mussels generally.

This research was funded by a grant from the USA National Science Foundation (DEB-0732903). [POSTER]

Phylogeny of the family Aglajidae(Gastropoda: Cephalaspidea) and systematic revision of the genus *Chelidonura*: preliminary results

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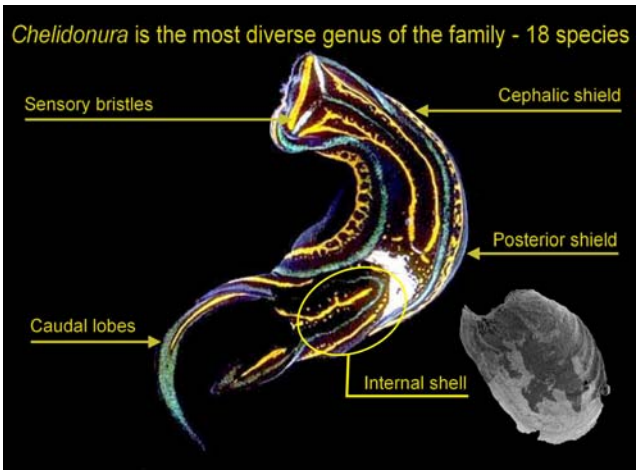
Aglajidae is a family of marine opisthobranchs occurring worldwide in tropical and temperate habitats, inhabiting coral reefs, rocky shores, and soft bottoms. Systematic work has been based mostly on the description of the external morphology whereas data on the anatomy and internal shells remain poorly known for most species. Description of species based on juvenile forms and chromatic variations have been common and this led to a confusing taxonomy with high numbers of synonym names. The genus



Chelidonura is the most diverse of the family, with over fifteen species worldwide. A multilocus coalescent Bayesian framework (based on mitochondrial COI, 12S rRNA, and 16S rRNA genes and nuclear 28S rRNa and Histone-3 genes) will be used to infer species trees. This will be combined with morphological and anatomical information in order to discriminate between species and generate species-level phylogenies to hypothesize on the origin, diversification patterns, and biogeography of the Aglajidae. Here, we present a preliminary molecular phylogeny obtained from COI sequence data largely gathered from Genbank. Characters of the external morphology and new anatomical data of *Chelidonura* species are discussed and a summary on the present knowledge of Aglajidae systematics is given. This project is funded through a doctoral grant to the first author by the Consejo Nacional de Ciencia y Tecnologia (CONACYT - México), fellowship BAZS/188890/2010.

Do geographically distinct populations of *Cylindrus obtusus* (Gastropoda: Pulmonata: Helicidae) differ in their mode of reproduction?

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The hermaphroditic land snail *Cylindrus obtusus* (Draparnaud, 1805), the only species of the genus *Cylindrus*, is an endemic in the Austrian alps specialised on limestone habitats at high elevations from 1600 to 2500 m asl (Bisenberger *et al*. 1997). Due to its restrictions in habitat selection it has a patchy distribution on isolated mountain tops. In general, *Cylindrus obtusus* has quite a homogenous shell morphology (Adensamer 1962). Previous analyses of the genital anatomy have shown that the eastern populations are highly variable in the distal genital tract, whereas central and western populations are homogenous with respect to their genital morphology (Schileyko 1996). Preliminary microsatellite analyses revealed a high excess of homozygosity in eastern populations suggesting an altered mode of reproduction within these populations (Kruckenhauser *et al*. 2010). To verify this assumption, further investigations of the genital anatomy will be performed. I will carry out a morphometric analysis of the distal female genital tract on a high number of populations covering the whole distribution range of the species. Furthermore, a histological investigation of the mucus glands should elucidate whether these structures are still functional. [POSTER]

Photos from the Forum talks and poster session. Top left: Organiser Martine Claremont (right) checks Verena Huber's powerpoint file. Top centre: Society secretary Tom White (facing) talks with Richard Preece. Top right: Poster session. Bottom left: assembling for the start of second session. Bottom right:: more posters.

The Integral role of the Teredinidae in Mangrove Ecosystems

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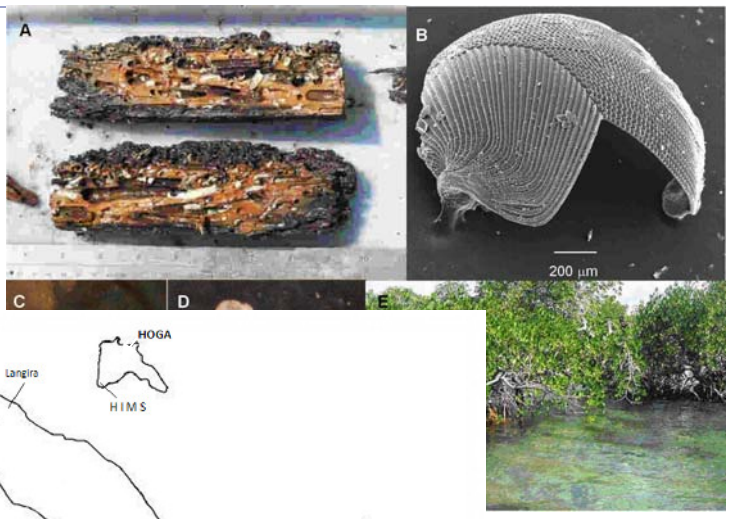
The wood boring bivalve family Teredinidae have a close association with mangrove habitats (Plaziat 1984). The relationship depends on the amount of fallen wood available, and the intricate hydrodynamics of mangrove systems, which facilitates the distribution of the woodborers. The primary production of mangroves can be as much as 50% wood, which when dead provides a tremendous amount of substrate to the teredinids. Teredinids are the dominant degraders of woody detritus in fringing mangroves (fig 1), but research into plant detritus-animal interactions within mangrove ecosystems is limited. A comprehensive analysis of the decay processes on the large woody detritus would therefore add to our knowledge of the trophodynamics within mangrove ecosystems. Information on the effect of teredinid activity in mangroves is particularly sparce (Robertson, 1991). We only have rough estimates of the amount of wood processed by the teredinids (Duke *et al.* 1981, Robertson and Daniel, 1989, Filho *et al*. 2008); this impairs our understanding of the nutrient flow between the trophic levels of fringing mangrove systems (Robertson and Daniel 1989, Robertson 1991, Davis *et al*. 2003). If we knew accurately the volume of wood consumed, we could determine the carbon flux during the decomposition of mangrove wood. The wood boring activity of the teredinids creates extensive burrows within the wood substratum and these are home to a diverse array of cryptofauna populations (Cragg and Hendy, 2010), which may not otherwise be found in mangrove habitats.



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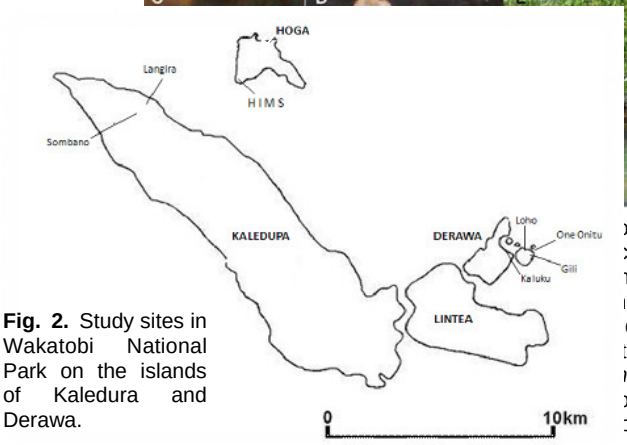

Fig. 2. Study sites in Wakatobi National Park on the islands of Kaledura and Derawa.

Methodology

The interactions between teredinids and decaying wood were studied on six mangrove sites within the 14,000 km² Wakatobi National Park, Tukangbesi Islands, Sulawesi, central Indonesia (fig. 2). Five transects perpendicular to the landward edge ending at the outermost seaward edge were established in both mangrove groups. All large woody debris (LWD) encountered along each transect was assigned to an arbitrary scale of the intensity of wood borer attack. This ranged from 0 (no sign of attack) to 4 (more than 50 percent of surface occupied by tunnels), and is based on British Standard EN275. Sixty wooden panels were placed along the transects in Sombano and Langira mangroves in June 2008, and removed in June 2009 for analysis (see fig 3 for distribution of panels along the transect). After exposure the panels were weighed dry to establish the loss of woody material. All calcareous material from the panels was removed and all panels were dried in an oven for 48 hours at 60°C. Using ImageTool digital analysis software, the longitudinal surface area of the panels was also determined to establish the volume loss of wood due to the activity of the Teredinidae.

The transect highlighted in fig. 3

Niche creation for cryptofauna by teredinid bivalves was also investigated from each of the six mangrove forests. A sub-sample of the large woody debris was analysed back in the lab, and a scale of wood borer attack was assigned to every wood sample. In addition, all cryptic faunal ani-

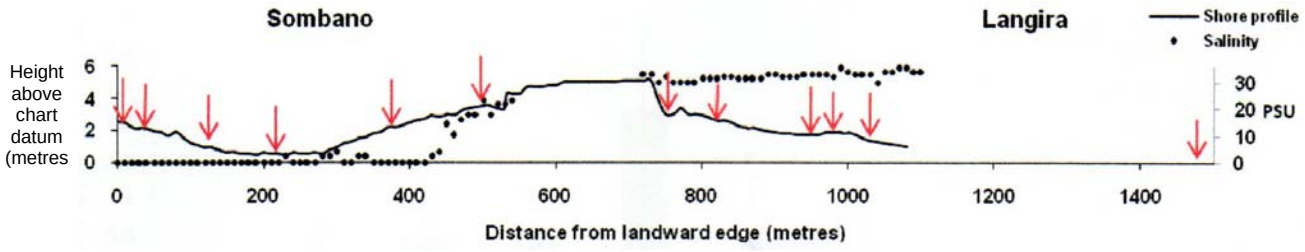

Fig. 3. Shore profile of Sombano and Langira mangroves. The red arrows indicate location of panels and their height above chart datum. The panels extend throughout the mangroves and on to an adjacent fringing reef that surrounds the islands. Salinity (practical salinity units, PSU) are shown as dots. Note the large coral rock plateau that separates the two mangrove systems between 530 and 720 metres, a geomorphological feature characteristic of mangroves in the region.

mals within the wood samples were removed and recorded, to generate a cryptofaunal database. A Shannon-Wiener Index, H', was used to determine the level of cryptofaunal diversity within each of the woody detrital samples.

Results and Discussion

Wooden panels 820 metres or more from land lost significantly more weight than panels closer to land (fig. 4). The inland panels from Sombano (green dots) did not lose woody tissue. This was due to the inability of the planktonic larval teredinids to settle on the wood because of a large coral plateau between 500 and 720 metres (fig 3). However, the majority of panels in the fringing mangrove of Langira (blue dots) lost over 50% of dry weight in just ten months. The panels at 1500 metres demonstrated the greatest loss of lignocellulose (63.9% loss). Five panels at 720 metres (strandline of the fringing mangrove, Langira) revealed no loss of woody material by teredinids. These panels were three metres above chart datum. Langira is exposed to a semi-diurnal microtidal regime with a range of 1.5 metres (Engelhart *et al*. 2007), and the forest is inundated by all high tides. Nonetheless, due to the geographical position of the panels, their exposure to seawater was much less than that of panels lower in the intertidal region. However, at 820 metres (100 metres further into the intertidal zone) 53 % dry weight of the panels had been processed by the teredinids. These panels were 2.6 metres above chart datum, and therefore they had a longer immersion time than panels higher up the shore. This is further corroborated by the weight loss observed in the panels at 1500 metres (fig. 4). These panels were placed sub-tidally at ten metres in depth and recorded the greatest loss of wood (63.9 %), demonstrating that complete immersion enhances teredinid wood-boring activity.

Another way to determine lignocellulose loss is to look at the longitudinal sectional surface area of the panels replaced by teredinid burrows. No borer galleries were found in the cross sectional view of the panels located at 720 metres. However, the loss of cross sectional surface area from panels distributed from 820 to 1500 metres ranged from 41.22 % to 52.54 %: this corroborates previous research (Robertson and Daniel, 1989). However, the volume of lignocellulose lost to teredinid activity is

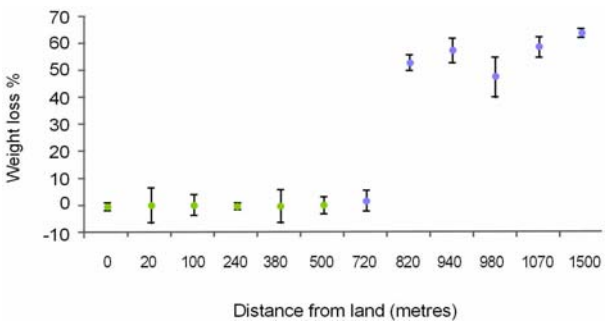

Fig. 4. Loss of dry weight of wood from panels within a mangrove at different distances from land.

highly dependent upon the debris's immersion time. Therefore, location of the LWD relative to shore height is integral for the recycling of LWD.

Counts of cryptofaunal animals in the panels were converted to a Shannon-Wiener Index (H') to determine the level of cryptic community structure. An increased level of teredinid attack does increase the diversity of crypto faunal communities within the decaying woody microhabitats (fig. 5). The increased diversity of fauna was attributed to the increased surface area within the woody debris created by the teredinid burrows. It is known that structurally complex habitats provide a high diversity of species when compared to structurally simple ones (Abele 1974, Macintosh *et al.* 2002).

To investigate the role of the Teredinidae in niche creation for cryptofauna, natural logs in six mangrove sites were also analysed for cryptofaunal diversity. All 343 samples of woody debris were divided into six size categories and diversity of cryptofauna was found to be significantly different in the different size categories (fig 6a). Magurran (2004) states that an increased sample size (here, a larger log) will have greater animal diversity, due to increased resources and potential habitats.

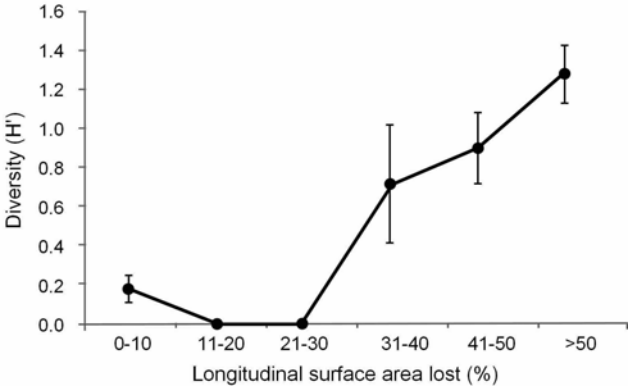

Fig. 5. The extent of cryptofaunal diversity at different levels of teredinid activity, expressed as longitudinal surface area lost.

Nonetheless, figure 6a demonstrates that the cryptic diversity within the woody samples does not increase uniformally with size; rather cryptic diversity increases with teredinid activity (figs. 7 and 8). A Tukey's pairwise comparison highlighted that there is no difference of cryptic diversity between levels three and four of the arbitrary scale. This corroborates the results shown in fig. 5, illustrating that there is no difference in cryptofaunal diversity from decaying wood with 30% or more destroyed by teredinid burrows. Further research is required to determine the intensity of teredinid attack at which cryptofaunal communities are most diverse.

Summary

This study highlights the essential role of these primary wood-borers in processing woody debris (energy flow and nutrient pathways), which is integral to mangrove community structure in fringing regions. Their tunnels facilitate many cryptofaunal communities which cannot bore into the very hard, low-decomposed wood. It is for this reason that the Teredinidae can be classed as ecosystem engineers, driving the cryptic faunal biodiversity in fringing mangrove systems. The teredinids are tremendous excavators of wood, influencing the flux of carbon in mangroves by recycling driftwood (Huggett and Gale 1995) and felled mangrove trees (Robertson and Daniel 1989, Filho *et al.* 2008). If teredinids were excluded from mangroves, there would be a massive build up of

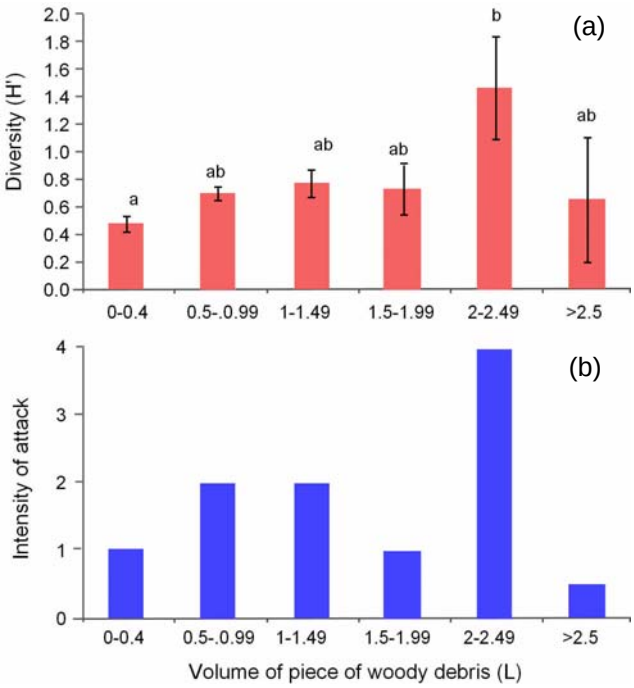

Fig. 6. Variation in (a) diversity of cryptofauna and (b) intensity of teredinid attack on large woody debris of different volumes.

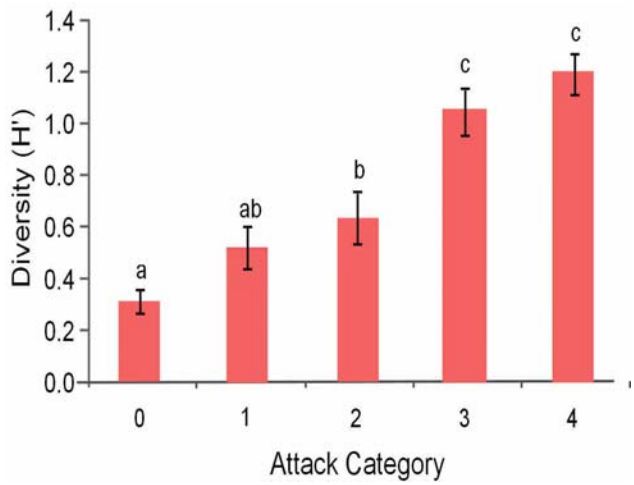

Fig. 7. Level of cryptofaunal diversity associated with different levels of teredinid attack.

detritus and reduced flow of nutrients to adjacent coastal ecosystems.

Acknowledgements

I am most grateful to The Malacological Society of London for their financial support. I would also like to thank Operation Wallacea for use of their facilities – in particular Dr David Smith and Dr Tim Coles, my supervisor Dr Simon Cragg for his expertise - Professor Chris Todd and Dr Richard Barnes for their help and advice. Furthermore, my appreciation and thanks goes out to Kungdang and Amat, and all my research assistants on Derawa for boat transport and accommodation.

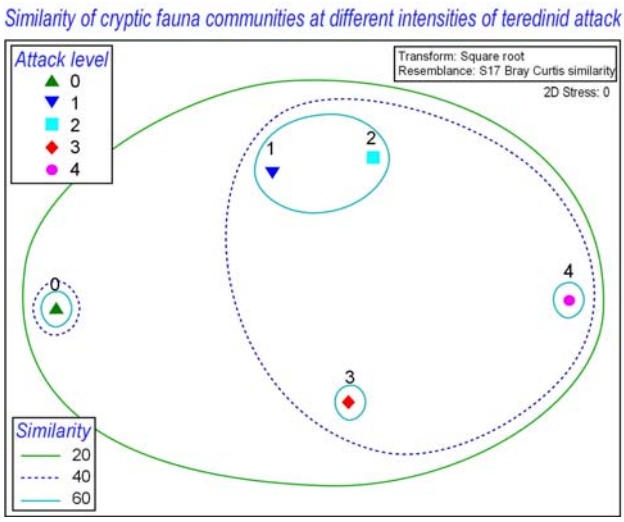

Fig. 8. Multi-dimensional scaling plot, corroborating the differences between levels of teredinid attack intensity.

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BEST STUDENT ORAL PRESENTATION AT UNITAS 2010

Phylogenetic Reconstruction and Shell Evolution of the Subfamily Diplommatininae (Gastropoda: Caenogastropoda: Diplommatinidae)

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The terrestrial micromollusc subfamily Diplommatininae (Gastropoda: Caenogastropoda: Diplommatinidae) is a fascinating group of snails known primarily for their intriguing and unusual shell shapes. This includes large elaborate spines, complex peristomes, and both dextral and sinistral species, as well as the multiple coiling axes seen in some *Opisthostoma* (e.g. *Opisthostoma vermiculum*). This diversity of form begs evolutionary and functional morphology questions. They are highly endemic, and found mainly on limestone outcrops from India to Japan and through Southeast Asia and Oceania. There is even a genus found in South America. This high endemism further incites interest for biogeographical, speciation, and conservation reasons. Additionally, there are new species of diplommatinids being found regularly. Further understanding of the evolution of this family required a phylogeny. Until now, only a phylogeny of the Belau diplommatinids has been completed, by Rebecca Rundell in 2008. Her work highlighted that the current taxonomy does not reflect the evolutionary relationships.

Thus, a molecular phylogenetic reconstruction, with five gene markers and 61 samples, was undertaken to discover more about the evolution of these snails. The phylogeny was reconstructed using parsimony, maximum likelihood, and Bayesian methodologies. The results clearly demonstrate the monophyly of this clade, but reject the Cochlostomatinae as the sister group. Thus Diplommatininae and Cochlostomatinae were split into separate families: the Diplommatinidae and the Cochlostomatidae.

Looking within the revised Diplommatinidae, the phylogeny separates this family into five main clades. Species were mainly associated together by their common biogeographies and chiralities. The basal clade (A) contains sinistral members from east of the Wallace line, suggesting this family originated in that region. It is made up of the paraphyletic genera *Palaina, Hungerfordia,* and *Diplommatina.* The second clade (B) contains the genus *Opisthostoma*, which is shown to be monophyletic, and its sister genus *Arinia*. Southeast Asian *Diplommatina* make up most of the remaining phylogeny (clades C, D, E), except for the sole South American genus, *Adelopoma*. This unexpected placement of *Adelopoma* within the Southeast Asian *Diplommatina* suggests a complex dispersal pattern that will require

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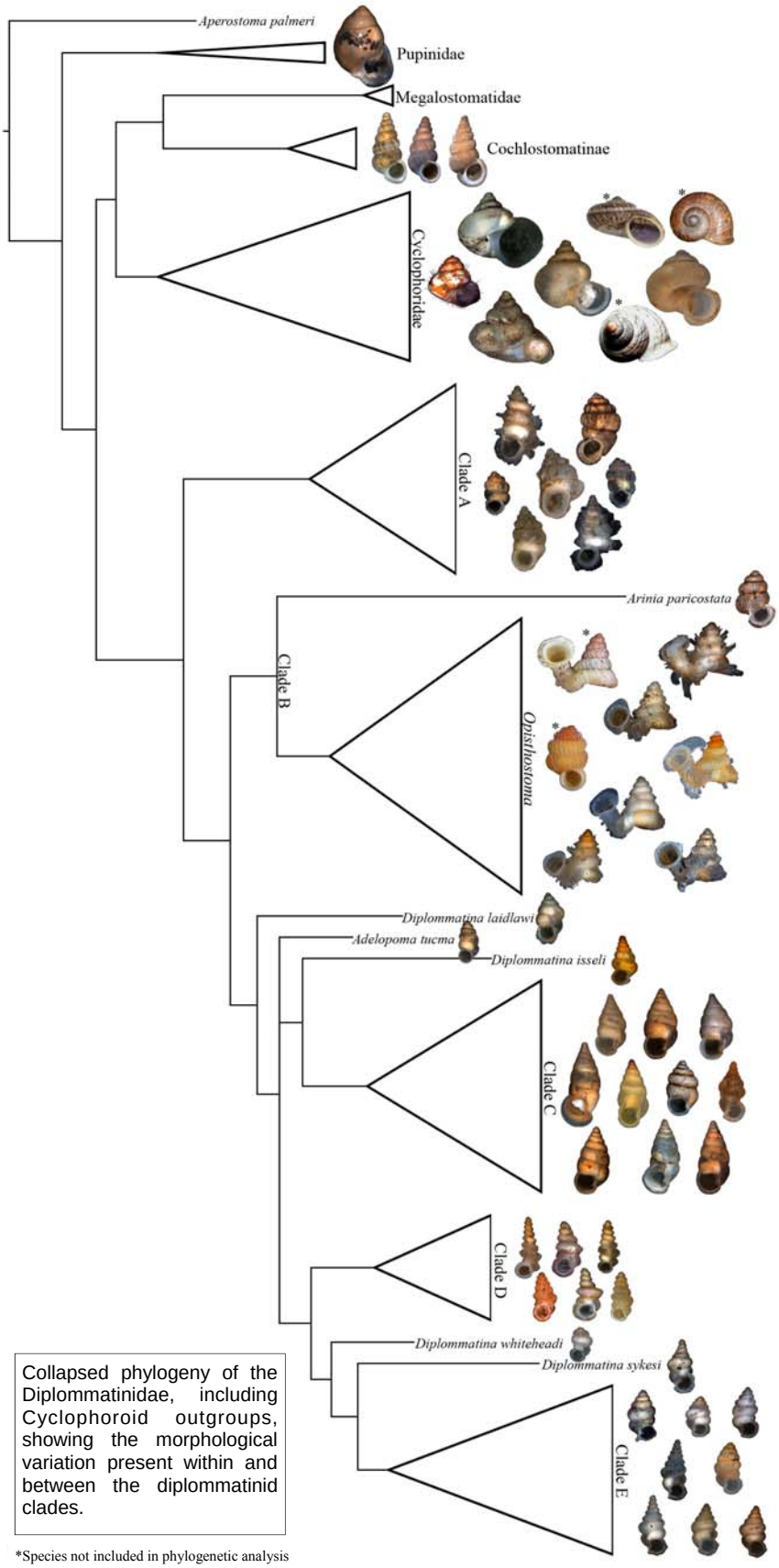

Collapsed phylogeny of the Diplommatinidae, including Cyclophoroid outgroups, showing the morphological variation present within and between the diplommatinid clades.

*Species not included in phylogenetic analysis

The financial statements on this and the next two pages have been removed from the Web version

THE MALACOLOGICAL SOCIETY OF LONDON

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The 118th Annual General Meeting of The Malacological Society of London will take place at 1245 on 7th April 2011 in the Flett Theatre, The Natural History Museum, London, during the lunch break of The Society's meeting *Chemosymbiotic molluscs and their environments: from intertidal to hydrothermal vents.*

Agenda for AGM

1. Apologies for absence
2. Minutes of the last (117th) AGM
3. Matters arising
4. Financial report, including approval of Auditors
5. Annual report of Council (delivered by the Vice President)
6. Awards
7. Election of Council
8. Any other business

	Current Council	**Nominations**
	2010-2011	**2011-2012**
AGM meeting number	**117**	**118**
President	Mark Davies (2)	Mark Davies (3)
Vice Presidents	Suzanne Williams (2)	Suzanne Williams (3)
	David Aldridge (1)	David Aldridge (2)
Councillors	Manuel Malaquias (3)	VACANT
	Simon Cragg (3)	Robert Cameron (1)
	Ellinor Michel (2)	Ellinor Michel (3)
	Elizabeth Platts (1)	Elizabeth Platts (2)
	Richard Preece (1)	Richard Preece (2)
	Fred Naggs (1)	Fred Naggs (2)
Journal Editor	David Reid	David Reid
Bulletin Editor	Stuart Bailey	Stuart Bailey
Treasurer	Katrin Linse	Katrin Linse
Membership Secretary	Richard Cook	Richard Cook
Hon. Secretary	Tom White	Tom White
Web Manager	Tony Cook	Tony Cook
Awards Officer	Tony Walker	Tony Walker
Hon. Archivist	Georges Dussart	Georges Dussart

Numbers indicate years in post; posts are for 3 years.
Council intends to co-opt Jon Ablett, Martine Claremont and Simon Cragg onto Council for the coming year.

News, continued from page 2

spheres coated with neoglycoproteins resulted in ingestion. The results suggest that particle selection relies on interactions between surface carbohydrates of food particles and lectins in mucus of feeding organs.
Espinosa E P *et al.* 2010. *Biol. Bull.* 219(1), 50-60.

Ancient ancestry of left/right asymmetry

Chordates, arthropods and molluscs show L/R asymmetry for certain organs, and recent results show that part of the molecular pathway setting L/R asymmetry in chordates is conserved in snails, leading to a prediction that signalling molecule Nodal and transcription factor Pitx were expressed on the right side of the bilaterian ancestor. These results help us understand how chirality is controlled in snail shells and how the dorso-ventral axis in the chordate lineage became inverted.
Grande C & Patel NH. 2009.*Cold Spring Harb Symp Quant Biol* 74, 281-7.
Olivierio M *et al.* 2010. *Am J Med Genet A*. 152A(10), 2419-25.

Female winkles mask sex to avoid excess matings

While male fitness increases with repeated matings in promiscuous species, female fitness levels out after an optimal number of matings because of the costs of courtship and copulation. Females would benefit if they could then avoid detection by males. Whereas females of 3 species of *Littorina* reveal their sex in their mucus trails, *L. saxatilis*, present at much higher density, do not add a sex-specific cue to their trail. The authors suggest this is one of few examples of masking gender to obtain fewer matings.
Johannesson K *et al.* 2010. *PLoS One*, 5(8), e12005.

Molecular aspects of chemoreception in *Aplysia*

Molluscs inhabit a chemically driven world in which many key events such as aggregation, defence, courtship and mating are mediated by water-soluble pheromones. A large family of rhodopsin-like G-protein coupled receptors are expressed in the rhinophores of *Aplysia*. These chemoreceptors are only distantly related to those already known in vertebrates, insects and nematodes.
Cummins S F & Degnan B M. 2010. *Communic & Integr Biol* 3:5, 423-426.

So that's why sensitisation occurs in *Aplysia*.

At last, the large body of work on sensitisation (enhancement of withdrawal reflexes following noxious stimulation) of *Aplysia* has an ecological context. The noxious stimulus, formerly an electric shock, can be provided by the attacks of a spiny lobster *Panulirus interruptus*, with a similar intensity and learning time for the withdrawals.
Watkins A J *et al.* 2010. *J. Neurosci*. 30(33), 11028-31.

Learning from slugs

The land slug *Limax maximus* is a model system for learning and memory, using odours as conditioned stimuli. This review emphasizes how *Limax*'s odour information processing circuits incorporate features in common with mammals – cellular and network oscillations for computing odours and use of NO to control network oscillations. Learning and memory formation are localised in the procerebral lobe where selective gene activation occurs during odour learning, and odour learning can take place in an isolated brain, permitting analysis of the circuits and synapses linked to learning and memory.
Watanabe S *et al.* 2008. *Learn Mem*, 15(9), 633-42.

Sex determination model for oysters

In oysters sex is partly determined by environment, but genetic factors are also important. Sex ratios in the Pacific oyster suggest a single major gene with two genotypes, *FM* being male and *FF* maturing as male or female. Such a model can produce stable polymorphism but fails to match some observed sex ratios. An alternative 3-genotype model is proposed featuring two types of females, a protandric *FM* and a fixed female *FF*.
Hedrick PW & Hedgecock D. *J. Hered.* 101(5), 602-611.

Sacoglossa: kleptoplasty gained and lost

The Sacoglossa are shown to be monophylic, with two sister clades, the shelled Oxynoacea + Cylindrobulla, and the non-shelled Plakobranchacea. Kleptoplasty, the retention of chloroplasts from food algae, was acquired in non-functional form in the basal group, became functional in the Plakobranchacea clade, and lost in the Volvatellidae lineage.
M T Kajita *et al.* 2010. *Biol. Bull.* 219(1), 17-26.

Molecular phylogeny of Pterioidea

The pearl oysters and their relatives are a diverse lineage of epifaunal marine bivalves distributed throughout tropical and sub-tropical continental shelf regions. Recent studies have challenged their monophyly, but this study strongly supports the monophyly of the Pterioidea although none of the previously defined families are monophyletic (save Pulvinitidae).
Temkin I. 2010. *BMC Evol. Biol*. 2010, 10:342

Reassessing Serialia

The Monoplacophora show marked seriality of ctenidia, atria, muscles, and nephridia, suggesting a segmented ancestry. Polyplacophora also show some seriality. More recently this seriality has been seen as a derived condition.. The first DNA sequence from a monoplacophoran placed Monoplacophora within Polyplacophora, and the

Continued on page 26

***Diplommatininae, c**ontinued from page 18*

more data to explain. The remaining *Diplommatina* split into three clades: a sinistral clade (C) from Borneo, with a single dextral exception; a sinistral clade (D) from Thailand and Malaysia; and a dextral clade (E) with mixed biogeographical origins. This phylogeny shows that there is rampant paraphyly, and that *Diplommatina* in particular requires revision.
Mapping shell morphologies onto the phylogeny shows the widest morphological diversity in the basal clade. The remaining clades have relatively conserved overall shell morphologies. Ancestral state reconstruction with both maximum likelihood and parsimony suggest a sinistral origin for the Diplommatinidae, with three reversals to dextrality, occurring in clade B, clade E, and *Diplommatina calvula* from Borneo (within clade C).
Biogeographically, this phylogeny suggests much higher rates of dispersal in this family than would be expected due to their size. Furthermore, it suggests a complex biogeographical history including multiple invasions of, at least, Borneo and Belau.
Overall, this work has led to a much better understanding of the evolution of the Diplommatinidae, and has produced a framework on which further studies can be based.

BOOK REVIEWS

J.W. Tunnell, J. Andrews, N.C. Barrera & F. Moretzsohn

Encyclopedia of Texas seashells: identification, ecology, distribution, and history

Texas A&M University Press, Corpus Christi
2010 Hardback £44.50
ISBN-13: 978-1-60344-141-4 512 pp. Full colour. 28x22 cm

The coast of Texas may be associated with images of endless sandy beaches and the longest chain of barrier islands in the world but, as one of the introductory chapters of this fine encyclopaedia demonstrates, Texas is in fact home to a wide range of marine habitats. There are bays, lagoons, salt marshes, mangroves, oyster banks, seagrass beds and subtidal coral reefs, supporting a diverse molluscan fauna. Only natural rocky shores are missing, and even these are substituted by jetties and sea walls. In this largely sedimentary environment, molluscs themselves provide building material—oysters and clams have been used for roads, railway embankments and 'shellcrete'.

This large volume is a comprehensive updating of Andrews' (1977) *Shells and shores of Texas*. Whereas the earlier book covered 325 species, this total is here increased to 900, based on a generation of new taxonomic research, the inclusion of offshore and deep water species, and the use of the recently completed inventory of the fauna of the Gulf of Mexico. One of the reasons for this large total is the mixing of warm temperate (Carolinian) and tropical (Caribbean) faunas in the Gulf. All of the shelled species are illustrated by colour photographs of their shells, and the shell-less forms by drawings or photographs of living animals. It could be argued that electron micrographs would have illustrated the sculptural details of micromolluscs with greater clarity, but nevertheless the illustrations are of a very high standard. Usefully, there are numerous text boxes with examples of shell variation, growth stages and cases of taxonomic uncertainty. Descriptions are good and the bibliography comprehensive. Synonyms are given, but for complete listings the reader is referred to Rosenberg's Malacolog website. The higher classification is that of recent standard works (e.g. Bouchet & Rocroi, 2005, for gastropods and Mikkelsen & Bieler, 2008, for bivalves), although 'old fashioned' schemes (arguably less labile than the latest phylogenetic classifications) are used for some popular groups, e.g. families of Conoidea and the genera *Cypraea* and *Conus*. In the main, there is impressive coverage of recent systematic research work.

A few small errors and omissions are inevitable in such an ambitious work (e.g. *Bulla occidentalis* not *striata*; Turbinoidea no longer recognized; image of *Stewartia floridana* is *Phacoides pectinatus*); corrections and updates will surely be made in future editions of what will become a standard reference work for identification of western Atlantic molluscs. A persistent irritation in the systematic sections and glossary is the sometimes poor or ambiguous language, especially when discussing concepts in nomenclature and molecular systematics. The text would have benefited from careful editing by an experienced systematist.

David G. Reid

Elisabeth Tova Bailey 2010

The Sound of a Wild Snail Eating

USA: Algonquin Books $18.95, UK: Green Books £12.95
ISBN: 978 1 900322 91 1

The title of this book appealed to me because I remember the rhythmic sound of a snail rasping away on a canvas sheet in a darkened lab, a chance occurrence which led to studies of feeding behaviour.

In this little book (a 3 hr read), the author describes her increasing empathy towards a snail accidentally brought into her sickroom along with some wild flowers. Like pet cats or dogs, the snail never questions, nor has it expectations, but it does entertain and educate. As she carefully observes her tiny companion, she also starts reading malacological treatises – revealing how, like a pet owner, she acquires some of her companion's attributes, as she "glided further into the dusty mollusc volumes". Some of the literature dates to the late 1800s, but she picks out some gems which more scientists might usefully employ today – such as Audesirk's entreaty to scientists to 'think like a snail' to uncover hidden attributes. This is plainly akin to Nagel's question "What is it like to be a bat?" Unfortunately, the author also relays accounts of 'group intelligence' as when snails effect a mass escape by their weight of numbers.

This is a thought-provoking essay into the extent to which man can relate to invertebrate species. There are journals, books, conferences and even Master's courses devoted to anthrozoology. Most deal with mammals, yet I know that snails often evoke positive emotions, as spiders do negative ones. Do we relate to an individual, or to the species, and is the relationship altruistic or in terms of 'usefulness' – Bailey, while pitying the snail she thinks she has given indigestion shows sympathy for herself should it die and abandon her. In the end, I was left saddened to think that the ability to enjoy the sense of wonderment in the natural world has become an uneasy concept for scientists.

Bill Bailey

BOOK NEWS

David G Herbert 2010

The introduced terrestrial Mollusca of South Africa

SANBI Biodiversity Series 15. South African National Biodiversity Institute, Pretoria. ISBN 978-1-919976-56-3. This is a 108 pp PDF downloadable for free from www.sanbi.org/index.php?option=com_docman&task…id…

43 colour photos and numerous maps, charts and line drawings. It comprehensively reviews 34 species considered introductions. The history of introductions is summarized – introductions continue at 2 species per decade, mostly from Europe, and their composition shows similarity to that of S Australia, reflecting similar colonial histories and temperate climates. Most of the book is devoted to each species - description, habitat, date of introduction, and observations on behaviour, reproduction and parasite transmission. Some potential future pest gastropods are also considered.

Liberto F, Giglio S, Reitano A, Colomba MS & Sparacio I. 2010

Molluschi terrestri e dulciacquicoli di Sicilia della collezione F Mina Palumbo di Castelbuono

Palermo, Danaus . 134 pp. With 159 fig. (153 in colour). Euro 20.00. Order from naturama@tin.it. 15% discount to members of The Malacological Society of London.

FORTHCOMING MEETINGS

Thursday 7th April 2011

DETAILS ATTACHED

Malacological Society of London and
Department of Zoology, The Natural History Museum

Chemosymbiotic molluscs and their environments: from intertidal to hydrothermal vents

Flett Theatre, Natural History Museum,
Cromwell Road, London SW7 5BD
1000 - 1800h. Use Exhibition Road entrance.

No registration fee, but for catering purposes please let us know if you will be attending.
Organisers: John Taylor and Emily Glover
email: j.taylor@nhm.ac.uk

Thursday 7th April 2011

The Malacological Society of London

ANNUAL GENERAL MEETING

The Society's A.G.M will be held at 12.45 in the Flett Theatre of the Natural History Museum, in conjunction with the above meeting. The Agenda, Nominations and Financial Statements are on pages 19 to 22.

16th-19th May 2011

8th Marine Biological Association Postgraduate Conference
Queens University Belfast

An annual scientific meeting designed to provide a friendly, semi-formal forum within which postgraduate students may present their work and discuss current research developments in marine biology and related disciplines amongst their peers from the UK and beyond.
To subscribe to mailing list email to mbapg2011@qub.ac.uk with MAILIST JOIN as the subject line.

12th-17th June 2011

8th International Conference on Shellfish Safety (ICMSS 2011)

University of Prince Edward Island in Charlottetown, Canada.
Further information: ICMSS 2011

26th June-1st July 2011.

9th International Temperate Reefs Symposium
Sherwell Conference Centre, University of Plymouth, UK

Hosted by The Marine Biological Association of the United Kingdom and University of Plymouth.
Open and Themed Sessions and Workshops. Excursions. Satellite workshop and statistical course.
For further information and to add your details to mailing list visit: www.itrs2011.org

12th – 17th July 2011

VIII CLAMA
8th Latin-American Congress of Malacology
Centro Nacional Patagonico, Puerto Madryn, Argentina

Information: clama2011@cenpat.edu.ar, www.cenpat.edu.ar or www.madryn.gov.ar/turismo

18-22 July 2011

6th Congress of the European Malacological Societies (CEMS)
Alava Campus , University of the Basque Country,
Vitoria-Gasteiz, Spain

Symposia will include:

- Endangered species and hotspots of Biodiversity
- Biogeography and phylogeography of the Mediterranean region and Macaronesia
- Systematics and taxonomy of Western-Palaearctic Mollusca
- Biology, Reproduction and culture of Molluscs
- Ecology
- Invasive Alien Species
- Miscellaneous

Website: http://www.euromalacol2011.eu

24th –29th July 2011

X ISOLBE
10th International Symposium on Littorinid Biology and Evolution

Saint Petersburg State University, Russia.
This symposium will continue the traditions of a multidisciplinary approach and amiable atmosphere, including works on related marine mollusks.
Symposium Committee: Andrey Granovitch & Natalia Mikhailova (co-heads), Anna Gonchar (secretary).
Website: http://isolbe.bio.pu.ru/

BOOK NEWS *continued*

7th International conference on Molluscan Shellfish Safety Nantes, 2009

Accepted manuscripts are now online on www.symposcience.org
When on the website use the path: rechercher dans la base/ accepter les clauses d'utilisation/ 7th International Conference on Molluscan Shellfish Safety.

MalaCo 6 (November 2010)

An electronic free journal with 1-2 issues each year (albeit this issue appears after a 2 year gap), dealing with ecology, biology, systematics and conservation of continental molluscs. Publishing original works, news and identification tools. Papers are in French or English and available on line once accepted. www.journal-malaco.fr

Tentacle 18

The latest and largest ever issue of Tentacle, the newsletter of the IUCN - Species Survival Commission - Mollusc Specialist Group, edited by Robert Cowie, is now available from: http://www.edu/cowielab/
Click on the "Tentacle" button, then "Online issues" and then "Tentacle 18".

Popeja J Jr, Vendrasco MJ, Darrough G.

Upper Cambrian Chitons (Mollusca, Polyplacophora) from Missouri, U.S.A.

Bull. Amer. Paleontol 379. 81 pp., 23 pls., ISBN 978-0-87710-488-9.
Order online at www.priweb.org or email Paula Mikkelsen pmm37@cornell.edu for a proforma invoice.

Continued at base of page 27

News, continued from page 19

taxon Serialia was created. However part of the monoplacophoran sequence was a result of contamination with Polyplacophora, and sequencing of another monoplacophoran does not show unambiguous support for Serialia.
Wilson NG *et al*. 2010. *Mol Phylogen Evol* 54(1), 187-93.

Credipula, an emerging lophotrochozoan model

A review of recent studies of development of slipper limpets. These studies have produced a well-resolved fate map of embryonic cell lineages, documented the mechanisms for axis determination and D-quadrant specification, gene expression patterns and loss- and gain-of-function assays. In conjunction with genome studies and comparative studies on phylogeny, mode of development, larval biology and metamorphosis, these studies have made these snails a powerful tool in the study of evolution of developmental mechanisms in the Mollusca and the Lophotrochozoa.
Henry JJ *et al.* 2010. *Biol. Bull.* 218(3) 211-29

Nacre evolved in parallel in bivalves and gastropods

The ability to biomineralize is closely linked to the rapid expansion of animal forms in the early Cambrian, when many skeletonized phyla first appear. It is possible, however, that some different molluscan groups evolved their shells independently. A comparison of the genes expressed in nacre - forming cells in the mantles of the bivalve *Pinctada maxima* and the gastropod *Haliotis asinina* showed that, after removing housekeeping genes, less than 10% of all gene clusters were shared. The differences extend to secreted proteins which probably form the shell organic matrix.
Jackson DJ *et al.* 2010. *Molec Biol Evol* 27(3), 591-608.

Texan Unionids

Species rarity and endemism are among the fundamental criteria for establishing conservation priorities. Of the 64 species of freshwater unionid bivalves in Texas, 65% were rare or very rare, including all endemics. Almost all the endemics were found only in streams and rivers where diversity was almost twice that of lentic waters. The human alteration of lotic waters with lentic waters favours common species and reduces rare species.
Burlakova LE *et al.* doi:1016/j.biocon.2010.08010

Estrogen exposure in mussels and gastropods

Experimental exposure of *Mytilus edulis* to 17β-estradiol and synthetic ethinyl estradiol and estradiol benzoate shows that their reproductive physiology, in terms of an increase in vitellogenin and estrogen receptor 2 mRNA expression may be susceptible to damage at the early stage of gametogenesis but not in the mature stage. Exposure of *Planorbarius corneus* and *Viviparus viviparus* to 17β-estradiol prolonged the reproductive season into autumn.
Mussels: Ciocan CM *et al*. 2010. *Envir. Poll.* 158(9), 2977-2984.
Gastropods: Benstead RS *et al*. 2010. *Aquatic Toxicol*. Doi: 10.1016/ j.aquatox.2010.11.005

Mussel populations over huge distances synchronized by local ecological processes

One might expect that the influence of demographic processes and dispersal are confined to local populations, leaving environment to control large scale patterns of abundance. However, a spatial synchrony analysis of a large 6-year data set of *Mytilus californianus* populations along the West Coast of USA provides evidence that dispersal among neighbouring populations interacts with local demographic processes to affect the distribution of abundance over 1,800 km of coastline.
Gouhier TC *et al.* 2010. *Proc Nat Acad Sci* 107(18), 8281-8286.

Do pond snails sleep?

Lymnaea stagnalis spontaneously become quiescent, relaxing foot, mantle and tentacles and ceasing to rasp. They can be aroused by sucrose or tactile stimulation, although they respond less than active snails. Quiescent bouts last *ca* 22 min, and are clustered into *ca* 7 bouts in 13 h separated by almost continuous activity for *ca* 37 h. Time of day had little impact, and there was no evidence of "sleep rebound". Full article available free on line.
Stephenson R & Lewis V. 2011. *J. exp. Biol.* 214, 747-756.

IF NOT DUFFERS, WON'T DROWN

Dear Editor,

I wonder if readers might be interested in an observation from someone who sees slugs only as competitors for his salad crop?

We live on a Welsh hillside and have a large and fairly wild garden. Its population of slugs can only be described as prodigious and the dimensions of some of them, as positively gargantuan. We tried many control methods to no avail. The only way, I decided, was to physically collect and remove them.

I started to go out after dark, armed with a torch, collecting scores of the creatures, of various species, in a large bucket. I couldn't bring myself, as some do, to pour boiling water over them or sprinkle them with salt but took them several days' travel away and dumped them, hoping that they would not return. A later refinement saw the collection time move to early morning when the dew was still on the grass. This solved the tricky problem of picking up slugs whilst holding a bucket in one hand and a torch in the other.

One day, obviously regressing to that mixture of curiosity and sadism which sometimes possesses young boys, I took my laden bucket down to our stream and tipped the contents into it. It's a very small stream, less than a metre wide and, at this point, perhaps 5cm deep. The water flow is brisk but not rapid. I stood in the stream in my wellies, observing the slugs. Many were simply washed downstream, rolling along in the current. Others, however, managed to get some purchase on the stream bottom. For a while they were still but then, gradually, they began to move. Some had to orientate themselves properly but every one of them started to move, either towards the left bank or the right bank, all of them at exactly 90º to the direction of flow! Clearly such a tactic is the most promising in the circumstances and offers the best chance of reaching dry land as soon as possible. It's certainly much better than heading upstream and, as we know, downstream is salt.

I was indeed excited at this discovery. I flittered around the internet a bit, vainly looking for corroboration. Finally, I tracked down and phoned a top slug man who expressed interest but I didn't hear from him again. Now, a few years later, still excited, I would like to reveal my "discovery" to a wider audience. Is it perhaps worth further investigation?

Yours sincerely,

Michael Green
michael.green@fountainhead.org.uk

SOCIETY NOTICES

The objectives 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 copy of the *Journal* 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 42 (1976) into the *Journal of Molluscan Studies*. The *Journal* is published in annual volumes consisting of four parts which are received by fully paid-up members and student members. Members also receive The *Malacologist*, the Bulletin of the Society, twice a year.

Meetings

In addition to the traditional researches on taxonomy and systematics, new experimental, chemical and molecular techniques are amongst he topics considered for discussion meetings and papers for publication in future volumes of the *Journal*.

Subscriptions

The Annual Subscription is due on 1st January each year.

- Ordinary Members £45 (or US$ equivalent)
- Student Members £25 (or US$ equivalent)

Methods of Payment

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

(2) Banker's standing order to: The Northern Bank (Sort code 95-01-49), 49-51 University Road, Belfast BT7 1ND, for the credit of "The Malacological Society of London" (a/c 70030422).

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

(4) Overseas members wishing to pay electronically should contact the Membership Secretary (R.COOK@KINGSTON.AC.UK) for SWIFT/BIC and IBAN numbers of our bank.

Institutional Subscriptions to the Journal

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

Awards and Grants - see back page.

Change of Member's Address

Please use the address slip on the *Journal* wrapper to inform us, through Oxford University Press, of a change of address, or inform the Membership Secretary.

APPLICATION FOR MEMBERSHIP OF THE MALACOLOGICAL SOCIETY OF LONDON

I wish to apply for Ordinary*/Student* Membership (*delete one)

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

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

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

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

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

Malacological Interests . . . . . .

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

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

Dr Richard Cook, School of Life Sciences, Kingston University, Penrhyn Road, Kingston-upon-Thames, Surrey KT1 2EE, U.K.

BOOK NEWS *continued from page 25*

Peter Williams 2009

Snail

ISBN: 978 1 86189 528 8 £9.99. $US 19.95.

167 pp 86 illustr, 59 in colour. 190 x 135 mm.

Rebecca Stott 2004

Oyster

ISBN: 1 86189 221 7 £12.95. $US 19.95.

240 pp 117 illustr, 61 in colour. 190 x 135 mm.

These books are in the 'Animal' series from Reaktion Books Ltd, London, which also includes for examples, Ant, Cat, Crow, Salmon, Snake and Tortoise. 'Snail' and 'Oyster' cover the cultural aspects of these invertebrates, but are thin on science. For 'snail' read 'gastropod'. With 'Oyster' be prepared for a surfeit of emotive psychology and oysters in still life paintings.

For Sale

A library containing publications on molluscs and relevant zoological and marine biological texts. The publications include all aspects of malacology and are worldwide in content. They consist of c200 books; 18 serial publications - including 6 complete or long malacological journal runs. 200+ monographic publications, 45 theses (most in printed form) and c6000 malacological scientific papers which include many major works. As such it forms a comprehensive source of information on all aspects of malacology.

Should anyone be interested, in whole or in part, a listing of the contents can be obtained from John Allen. Email:- jallen@udcf.gla.ac.uk

Society Awards and Grants

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

Research Grants

The Research Grants Scheme was established to commemorate the Society's Centenary in 1993. Under this scheme, the Society anticipates making **at least five awards each year**, each with a value of **up to £1500** to support research on molluscs that is likely to lead to publication. The closing date for applications each year is **15th December**. Grants are preferentially conferred on students and researchers without professional positions, without regard to nationality or membership of the Society. Preference is also given to discrete research projects that fall within the subject areas covered by the Society's *Journal of Molluscan Studies*. Applications will be assessed by scientific merit, value of the project, and the extent to which the research will benefit the applicant's scientific aspirations. The successful applicants will be notified by 31st March and announced at the Annual General Meeting. The conditions of the award, notes of guidance and an application form are on the Society's website at **www.Malacsoc.org.uk**

Travel Grants

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

Sir Charles Maurice Yonge Awards

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

Annual Award

This Award is made each year for an exceptionally promising **initial contribution** to the study of molluscs. This is often a thesis or collection of publications. The value of the Award is **£500**. Candidates need not be a member of the Society but must be nominated by a member. There is no application form: the nominating member should send the material for evaluation with a covering letter or letter of support to the Honorary Awards Secretary. The closing date each year is **1st November**. The winner(s) will be notified by 31st March, and announced at the Annual General Meeting.

Applications

Applications for Research Awards and Travel Grants should be sent by post, not email, to the **Honorary Awards Secretary,** Dr Tony Walker, School of Life Sciences, Kingston University, Penrhyn Road, Kingston-upon-Thames, Surrey KT1 2EE. Enquiries may be made by post, or by email to T.Walker@Kingston.ac.uk