Fifth International Scalidophora Workshop

Federal University of Paraná

Pontal do Sul, Brazill 2019-01-21

Program and Abstracts

	Monday (28/01)	Tuesday (29/01)	Wednesday (30/01)	Thursday (31/01)	Friday (01/02)*
8h30 - 9h	Welcome	Field trip and lab work (Instructors: Hiroshi Yamasaki, Maria Herranz, Núria Sanchez, Matteo Dal Zotto, Alejandro Martínez, Kasia Grzelak).	Field trip and lab work (Instructors: Hiroshi Yamasaki, Maria Herranz, Núria Sanchez, Matteo Dal Zotto, Alejandro Martínez, Kasia Grzelak).	Field trip and lab work (Instructors: Hiroshi Yamasaki, Maria Herranz, Núria Sanchez, Matteo Dal Zotto, Alejandro Martínez, Kasia Grzelak).	Final discussion, perspectives, announcements.
9h - 10h	1 - History of the Scalidophoran studies (Fernando Pardos)				
10h - 11h	2- Morphology, systematic and evolution of Scalidophora (Andreas Schmidt-Rhaesa)				
11h - 12h	3- Kinorhyncha (Martin Sørensen)				
12h - 14h	Lunch	Lunch	Lunch	Lunch	Lunch
14h - 15h	4- Loricifera (Reinhardt Møbjerg Kristensen)	Lab work (Instructors: Hiroshi Yamasaki, Maria Herranz, Núria Sanchez, Matteo Dal Zotto, Alejandro Martínez, Kasia Grzelak).	Lab work (Instructors: Hiroshi Yamasaki, Maria Herranz, Núria Sanchez, Matteo Dal Zotto, Alejandro Martínez, Kasia Grzelak).	Lab work (Instructors: Hiroshi Yamasaki, Maria Herranz, Núria Sanchez, Matteo Dal Zotto, Alejandro Martínez, Kasia Grzelak).	Tour around to the Paranaguá Bay, and closing dinner.
15h - 16h	5 - Priapulida (Andreas Schmidt-Rhaesa)				
16h - 16h30	*Coffee Break*	*Coffee Break*	*Coffee Break*	*Coffee Break*	
16h30 - 18h30	6 - Gaps and perspectives for the study of the Scalidophora (André Garraffoni, Katrine Worsaae, Peter Funch, Michael Boyle)	Oral communications (15 - 20 minutes each)	Oral communications (15 - 20 minutes each)	Oral communications (15 - 20 minutes each)	

* Closing dinner and Fandango at Ilha das Peças

Host:

Financial support:

Contributed talks for the Scalidophora Workshop – program suggested by MVS

Tuesday

16:30 Alejandro Martínez García

Microscopic lords of the underworld: a review on cave meiofauna with emphasis on marine scalidophoran taxa

16:55 Ricardo Neves and Reinhardt M. Kristensen

New records on the rich loriciferan fauna of Roscoff (France): Description of two new species of the genus *Nanaloricus* and a new genus of Nanaloricidae

17:20 Glafira Kolobasova, Jan Raeker and Andreas Schmidt-Rhaesa

A new species of macrobenthic priapulid from the White Sea?

17:45 Reinhardt M. Kristensen, Andrew J Gooday and Aurélie Goineau

Loricifera inhabiting spherical agglutinated structures in the abyssal eastern equatorial Pacific nodule fields

18:10 María Herranz, Maikon Di Domenico, Martin V. Sørensen and Brian S. Leander

The enigmatic kinorhynch *Cateria styx* Gerlach, 1956 – a sticky son of a beach

Wednesday

16:30 Rebecca Varney, Peter Funch, Martin V. Sørensen and Kevin Kocot

The kinorhynch transcriptome

16:55 Phillip Vorting Randsø, Hiroshi Yamasaki, Sarah Jane Bownes, Maria Herranz, Maikon Di Domenico, Gan Bin Qii and Martin Vinther Sørensen

Phylogeny of the Echinoderes coulli-group – a cosmopolitan species group trapped in the intertidal

17:20 Kasia Grzelak and Martin V. Sørensen

Kinorhynch diversity around Svalbard: spatial pattern and environmental drivers

17:45 Caio Lopes Mello, Ana Luiza Carvalho, Laiza Cabral de Faria, Leticia Baldoni and Maikon Di Domenico

Distribution patterns of the aberrant *Franciscideres* (Kinorhyncha) in sandy beaches of Southern Brazil

18:10 Diego Cepada, David Álamo, Nuria Sánchez and Fernando Pardos

Evolutionary Allometry in Kinorhynchs

Thursday

16:30 Hiroshi Yamasaki, **Birger Neuhaus, Kasia Grzelak, Martin V. Sørensen and Kai H. George**

Investigation of kinorhynchs on seamounts and surrounding area in the Mediterranean Sea, northwestern Atlantic Ocean and Arctic Sea

16:55 Martin V. Sørensen, Stephen Landers, Ricardo Neves and Reinhardt M. Kristensen

Deep-sea Scalidophora from the US West Coast

17:20 Matteo Dal Zotto, Hiroshi Yamasaki and Birger Neuhaus

New species of *Condyloderes* (Kinorhyncha: Cyclorhagida) from the Mediterranean Sea

17:45 Nuria Sánchez, Fernando Pardos and Pedro Martínez-Arbizu

Deep Metal: Deep-sea Kinorhyncha from the polymetallic nodule fields of the CCFZ

18:10 Fernando Pardos, Nuria Sánchez and Diego Cepeda

Dragons of the Caribbean: the Curse of Bob Higgins

18:35 Martin V. Sørensen

The workshop special issue: Editorial process and manuscript preparation

Outside In: Investigating Scalidophora with the Tools of Developmental Biology

Michael J. Boyle[1], Maria Herranz[2]

[1] Smithsonian Marine Station at Fort Pierce, Florida USA
[2] Biodiversity Research Centre, University of British Columbia, Vancouver, Canada

Abstract

Research tools utilized in the field of developmental biology promote a comprehensive understanding of animal diversity and evolutionary trends. One or more of these tools, including embryology, confocal laser scanning microscopy (CLSM), transcriptomics, and gene expression by whole mount in situ hybridization (WMISH) have been successfully applied to comparative studies on the development and/or morphology of two scalidophoran groups (Priapulida, Kinorhyncha). These initial efforts, although challenging, are important steps toward uncovering scalidophoran ancestry, as well as insights into the molecular and morpholocial evolution of body plans within Ecdysozoa, and the Metazoa. We present a brief overview of developmental tools applied to spiralians, and recently extended to Scalidophora with our studies on the architecture of muscular and nervous organ systems in Kinorhyncha. An example of interest is the integrated segmentation of *Echinoderes* as revealed by CLSM.

Allometry of segments and spines of the phylum Kinorhyncha

Diego Cepeda[1], Nuria Sánchez[2], Fernando Pardos [1]

[1] Department of Biodiversity, Ecology and Evolution; Faculty of Biological Sciences, Complutense University, Madrid, Spain.
[2] Laboratoire Environnement Profond, Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER), Plouzané, France.

Abstract

Allometry determines relevant modifications in metazoan morphology and biology and is affected by many different factors such as ontogenetic constraints and natural selection. Linear mixed model approach and reduced major axis regression were performed to explore evolutionary interspecific allometric trends between the total trunk length and the segments and spines lengths in the phylum Kinorhyncha at three taxonomic levels: the whole phylum, class and family. Statistically significant results were found in all the trunk segments, meaning that these body units grow proportionally correlated with the body, conversely to the results obtained for the analysis of spines. Developmental and morpho-physiological constraints could lead to negative allometry in the first and last segments, as these body regions in kinorhynchs are essential to implement some of the main biological functions such as feeding and locomotion. The differential arrangement of cuticular appendages, glandular and sensory structures between the considered taxonomic groups seems to cause different evolutionary trends, as positive allometry may appear if a segment requires more space to accommodate a large number of organs and appendages and viceversa. The presence of sexual dimorphism could also define positive allometry of a segment as a need to harbour the sexually dimorphic appendages and their associated structures. These results are the first approximation to allometry in the phylum Kinorhyncha, but additional analyses are needed in order to confirm the considered hypothesis.

New species of *Condyloderes* (Kinorhyncha: Cyclorhagida) from the Mediterranean Sea

Matteo Dal Zotto[1,2], Hiroshi Yamasaki[3,4], Birger Neuhaus[3]

[1]Department of Life Sciences, University of Modena and Reggio Emilia, via Campi 213/d, I-41125 Modena, Italy
[2]Consortium for the Interuniversity Center of Marine Biology and Applied Ecology, viale N. Sauro 4, I-57128 Livorno, Italy
[3]Museum für Naturkunde, Leibniz Institute for Evolution and Biodiversity, Invalidenstr. 43, D-10115 Berlin, Germany
[4]Senckenberg am Meer, Abt. Deutsches Zentrum für Marine Biodiversitätsforschung DZMB, Südstrand 44, D-26382 Wilhelmshaven, Germany

Abstract

Two new kinorhynchs belonging to the species-poor genus *Condyloderes* (Cyclorhagida: Centroderidae) are described herein. These taxa were discovered in the Gulf of Castellammare (Tyrrhenian Sea, Sicily, Southern Italy) and off Livorno (Ligurian Sea, Tuscany, Central Italy), respectively, and represent the first species of *Condyloderes* described from the Mediterranean basin. *Condyloderes* sp. 1 is distinguished from the congeners by bearing middorsal acicular spines not only on segments 1 to 9, but also on segment 10 in both sexes, and by a combination of pairs of lateroventral acicular spines on segments 1 to 9, an extremely short midterminal spine, cuspidate spines subdorsally on segment 3, paradorsally and sublaterally on segment 7, in lateral accessory position on segments 2 and 9, and ventrolaterally on segments 5 and 8. *Condyloderes* sp. 2 is characterized by a combination of middorsal acicular spines on segments 1 to 10 in both sexes, similarly to *Condyloderes* sp. 1, lateroventral acicular spines on segments 1 to 9, a pair of cuspidate spines ventrolaterally on segments 5 and 8, and in lateral accessory position on segment 9. Both species are characterized by the presence of the type-6 sensory spot, whose description is ongoing. *Condyloderes* sp. 1 and *Condyloderes* sp. 2 show similar sexually dimorphic traits, i.e., the male bearing laterodorsal acicular spines on segment 10, and the female showing lateroventral acicular spines on segment 10, ventromedial appendages on segments 6, 7, and 8 (*Condyloderes* sp. 1), or on segments 5, 6, 7 (*Condyloderes* sp. 2), and gonopores at the anterior margin of the sternal plate of segment 11. Beyond the taxonomic and biogeographical interest, the description of these new taxa provides additional insights for ongoing taxonomic and phylogenetic investigations on the whole family Centroderidae. Eventually, morphological notes and data on the distribution of *Condyloderes multispinosus* (McIntyre, 1962) within the Mediterranean Sea are reported.

Kinorhynch diversity around Svalbard: spatial pattern and environmental drivers

Katarzyna Grzelak[1,2], Martin V. Sørensen[3]

[1] Laboratory of Polar Biology and Oceanobiology, Faculty of Biology and Environmental Protection, University of Łódź, Łódź, Poland
[2] Polish Academy of Sciences, Institute of Oceanology, Sopot, Poland
[3] Natural History Museum of Denmark, University of Copenhagen, Copenhagen, Denmark

Abstract

Kinorhynchs, inhabit most marine sediments, from the shallow waters to the abyssal depths. Despite their ubiquitous distribution, information on their taxonomic composition and distribution patterns at the local and regional scale is rare, particularly for the Arctic region. To address this gap in our knowledge, we compared kinorhynchs community structure in different localities: north off Svalbard, in the Barents Sea and Svalbard fjords. Sample locations covered a wide depth gradient (300-2200 m), different sea ice conditions, subsequent quantity and quality of organic matter reaching the seafloor, as well as different sediment characteristics.

Out of 78 samples collected at 26 stations, seventy-six yielded kinorhynchs representing in total eighteen species. Patterns of species abundance and shift in their occurrence across the stations were pronounced. Three distinct kinorhynch assemblages were observed: 'fjord assemblage' dominated by *E. eximus* and characterized by the highest standing stock and diversity; 'open water assemblage' with *E. arlis* as dominant species and 'north off Svalbard assemblage' characterized by the presence of *E. drogoni* and *E. peterseni*, but the lowest abundance and diversity.

We found significant correlation between sediment particle-size diversity and mud dragon diversity and their community structure, which provides support for the importance of small-scale habitat heterogeneity in the maintenance of local diversity and its influence on species co-existence. Surprisingly, food-related variables did not contribute significantly to the model, which could suggest that food partitioning did not influence on promoting diversity. However, it is the first study of arctic kinorhynch ecology and further research is needed to get a more comprehensive understanding of the environmental drivers for turnover in mud dragon diversity and distribution.

The enigmatic kinorhynch *Cateria styx* Gerlach, 1956 – a sticky son of a beach

María Herranz[1], Maikon Di Domenico[2], Martin V. Sørensen[3], Brian S. Leander[1]

[1] Departments of Zoology and Botany, University of British Columbia. Biodiversity Research Centre, 2212 Main Mall Vancouver, BC, V6T 1Z4, Canada
[2] Centro de Estudos do Mar, Universidade Federal do Paraná, Pontal do Paraná, Brazil.
[3] Natural History Museum of Denmark, University of Copenhagen, Øster Voldgade 5-7, DK-1350 Copenhagen, Denmark

Abstract

Since its discovery in the mid-1950'ies, *Cateria* has always been an enigmatic kinorhynch genus due to its aberrant worm-like shape and extremely thin cuticle. However, the rare occurrence of the two known species (*Cateria gerlachi* and *Cateria styx*) only found intertidally in sandy beaches, and the poor preservation of the type material has hampered detailed studies of the genus over time. Now, more than sixty years after the original description of *Cateria styx*, we present an extensive morphological and functional study based on new material collected from its type locality in Macaé, Brazil. We combine live observations with detailed scanning electron microscopy data, new light microscopy material, confocal laser scanning microscopy and three-dimensional rendering. Results reveal that *C. styx* displays a complex array of cuticular structures (spines, spinoscalids and extraordinarily complex cuticular ornamentation) that we interpret to be adaptations for mechanical adhesion, through friction and interlocking, in an interstitial habitat. The most conspicuous and unique structure likely used for adhesion in *C. styx* is the dorsal organ that is hydrostatic and retractable. Additional morphological traits observed in *C. styx* include: reduced number of spinoscalids; extremely elongated primary spinoscalids that cannot be completely retracted in the trunk; presence of sixteen elongated hairy patches in the introvert; fifteen trichoscalids that vary in length; the absence of a neck; and high intraspecific variation in the number and position of glandular openings in the trunk.

A new species of macrobenthic priapulid from the White Sea?

Glafira Kolobasova[1], Jan Raeker[2], Andreas Schmidt-Rhaesa[2]

[1] M.V.Lomonosov Moscow State University, Moscow, Russia
[2] University Hamburg, Hamburg, Germany

Abstract

We report the finding of specimens of priapulids collected near the White Sea Biological Station. One of these clades is close to *Priapulus caudatus* and may represent this species, whereas the other clade is likely to represent a new species. The genetic distances between *P.* sp. and *P. caudatus* are large when compared to within-species distances. In four studied marker genes, two mitochondrial (16S, CO1) and two nuclear (18S and 28S), *Priapulus* sp. forms a clade, which is clearly separated from *P. caudatus*. Phylogenies for all the studied genes are robust and allow us to consider two sympatric species of *Priapulus* in the White Sea. Investigation of the morphological characters (pharyngeal teeth, scalids, caudal papillae, tail, colour, size) show some variation, but the differences do not clearly characterize the two clades. There are some unique characters in particular specimens, which must be regarded as individual modifications, this accounts especially to the pharyngeal teeth. Only a restricted number of specimens could be investigated, but the main problem is that even for the best known species, *Priapulus caudatus*, the complete series of character changes during development is not well documented. Therefore, it is difficult to compare stages of priapulids of different size and presumably different age. Molecular genetic analyses are very helpful, but the exact morphological characterization of species remains a challenge for future investigations.

Loricifera inhabiting spherical agglutinated structures in the abyssal eastern equatorial Pacific nodule fields

Reinhardt M. Kristensen[1], Andrew J Gooday[2], Aurélie Goineau[2]

[1] Natural History Museum of Denmark, Section for Biosystematics, Universitetsparken 15, DK-2100 Copenhagen Ø, Denmark
[2] National Oceanography Centre, Southampton, University of Southampton Waterfront Campus, European Way, Southampton SO14 3ZH, UK

Abstract

Loriciferans are known to survive in extreme environments, most notably in the case of a recently described *Spinoloricus* species from a hypersaline anoxic Mediterranean basin ("Hell on Earth"). Our new discovery of members of the genus *Rugiloricus* inside spherical agglutinated structures from sediment samples collected in the manganese nodule fields of the eastern Clarion-Clipperton Zone (CCZ), abyssal eastern equatorial Pacific, demonstrates that these tiny animals are able to bring fresh surprises. Nearly all developmental stages of a *Rugiloricus* species were found inside soft, flexible, 'cyst-like' agglutinated spheres, from the first instar larva and large free larva to the two stages of the postlarva inside the larval exuvium. Only the adults were missing. The 'cyst-like' structures hosting the loriciferans were almost certainly not created by the animals themselves. Their origin is unclear, although similar agglutinated spheres from the same study areas contain cells that resemble allogromiid foraminifera, suggesting that they are most likely made by foraminifera. One of our CCZ samples also yielded a single free specimen of the loriciferan genus *Pliciloricus* that was not hidden inside an agglutinated structure. This specimen is particularly interesting because, like Pandora's Box, it has all stages inside the larval exuvium, first the larval exuvium itself with the two toes, then a very thin postlarval exuvium, and finally the adult male with two testes filled with mature spermatozoa.

Microscopic lords of the underworld: a review on cave meiofauna with emphasis on marine scalidophoran taxa

Alejandro Martínez García

[1] Institute for Water Research, Italian National Research Council.

Abstract

Subterranean environments represent biodiversity reservoirs harboring disharmonic faunal communities with high endemism. They encompass young discrete habitats thus providing independent replicates of comparable evolutionary processes. Study of subterranean communities might then be important not only for understanding the evolutionary history of many taxa, but also major ecological and evolutionary processes. Unfortunately, while meiofauna represents an important component of cave biodiversity, it has been often neglected due to lack of time and expertise for targeted collecting, as well as inadequate taxonomic capacity. Consequently, the significance of meiofauna in cave systems may have been overlooked and so seriously obscuring our understanding of macro-ecological and evolutionary patterns in cave environments. We here present preliminary results based on descriptive analyses of a newly assembled dataset consisting of records of animals in all types across worldwide subterranean aquatic environments, although focusing on marine and anchialine caves. The dataset includes ca. 70,000 records (ca. 30,000 primary) from 2700 references checked so far, accounting ca. 1700 meiofaunal species, mostly crustaceans, such as podocopid ostracods (265 species), as well as cyclopoid and harpacticoid copepods (ca. 800 species). Scalidophorans in caves have been poorly studied, and are represented nine species. Potential taxonomic and geographical biases of our dataset are discussed, along with the different number of cave exclusive species recorded in each group. Our database confirms that further research about cave meiofauna is crucial to an accurate assessment of the biodiversity patterns of cave assemblages, providing support for evidence-based conservation.

New records on the rich loriciferan fauna of Roscoff (France): Description of two new species of the genus *Nanaloricus* and a new genus of Nanaloricidae

Ricardo C. Neves[1], Reinhardt M. Kristensen[2]

[1] Department of Biology, University of Copenhagen, Universitetsparken 13, 2100 Copenhagen Ø, Denmark
[2] Natural History Museum of Denmark, University of Copenhagen, Universitetsparken 15, 2100 Copenhagen Ø, Denmark

Abstract

Loricifera is a phylum of microscopic animals that live only in marine environments. The phylum was described in 1983 from the study of the first reprentative specimens found off the coast of Roscoff, France. From this pioneering investigation a single species was described, *Nanaloricus mysticus* Kristensen, 1983, which was accommodated in the family Nanaloricidae Kristensen, 1983. Since then, 38 loriciferan species have been described from several locations worldwide and accommodated in this family or in one of the other two subsequently described families, Pliciloricidae Higgins and Kristensen, 1986 and Urnaloricidae Heiner and Kristensen, 2009. In addition, a type of larval stage known as the Shira larva, *Tenuiloricus shirayamai* Neves and Kristensen, 2014 was recently described and listed as *incertae sedis* within Loricifera because of its unique morphology. Here we describe new species of *Nanaloricus* nov. sp. 1 and *Nanaloricus* nov. sp. 2 from the locality Trezen ar Skoden, where also *Armorloricus elegans* Kristensen and Gad, 2004 and *A. davidi* Kristensen and Gad, 2004 weere found. Furthermore a new Nanaloricid genus collected from Trezen ar Skoden is under description. The genus is unique because the female has two seminal receptacles – never seen in any other loriciferans.

Distribution patterns of the aberrant *Franciscideres* (Kinorhyncha) in sandy beaches of Southern Brazil

Caio Lopes Mello[1], Ana Luiza Carvalho[1], Laiza Cabral de Faria[1,2], Leticia Baldoni[3], Maikon Di Domenico[1].

[1] Center for Marine Studies, Federal University of Paraná State, Pontal do Paraná, Brazil
[2] Center for Marine Biology, University of São Paulo, Brazil
[3] Rio Grande University Foundation, Rio Grande, Brazil

Abstract

Extreme physical conditions affect the meiofauna occurrence and distribution in highly hydrodynamic environments such as sandy beaches. Several meiofaunal organisms exhibit high abundance on sandy beaches, while kinorhynchs are scarces in this habitat. We describe the abundance and distribution of the kinorhynch *Franciscideres kalenesos* on sandy beaches. Sediment samples were collected on two intermediate-dissipative sandy beaches of Southern Brazil. For the regional study six transects (on each beach) were delimited and divided into two distinct profiles (sandbars and rip currents). Transects were divided into three hydrodynamic zones (Shoaling zone, Surf Zone, and Swash zone). For the local scale, six transects with six points in each transect were georeferenced. We used additive model selection for the regional study and geospatial interpolation for the local scale study. The highest abundance was found in the surf zone. The presence of this organism occurred in patches, changing among sites, but mainly at the surf zone. These patches were abundant in places with fine sand. At local scale, the higher abundances were immediately after the wave breaking zone. Thus, the distribution pattern of *F. kalenesos* was related to the hydrodynamic zones in intermediate/dissipative beaches. Also, the distribution pattern of *F. kalenesos* occurred in a narrow strip of the beach, located in a high turbulence zone. Within this zone, they showed patches separated every 30 meters. We highlight that their hydrophilic mucus, capable of returning them to the sediment, may explain their presence in turbulent habitats.

Dragons of the Caribbean: The Curse of Bob Higgins

Fernando Pardos[1], Nuria Sánchez[1,2], Diego Cepeda [1]

[1] Department of Biodiversity, Ecology and Evolution, Universidad Complutense, Madrid, Spain
[2] Institut Français de Recherche pour l'Exploitation de la MER, Laboratoire Environnement Profond, France

Abstract

The Caribbean Sea is limited by an extensive island arch formed by the Great and the Lesser Antilles, and by the continental Central America. The aim of the present communication is to show the state-of-the-art of our study on the diversity of the phylum Kinorhyncha in the area. So far, only three Caribbean localities have yielded kinorhynch species descriptions, namely Carrie Bow Key (Belize), Bocas del Toro (Panama) and Mochima Bay (Venezuela), plus a single record from the Dominican Republic. However, 114 samples of sediment stored at the Smithsonian Institution and collected by R. P. Higgins throughout the whole area await study. Fifty of them have been processed up to date, yielding 8 new species from 5 different genera, and 10 new records of already known species. This suggests that the kinorhynch diversity in the area is far higher than previously known. In addition, the study will complement another extensive survey of the phylum in the Gulf of Mexico. This way, the seas of Central America will become one of the best studied hot spots of kinorhynch diversity.

Phylogeny of the Echinoderes coulli-group – a cosmopolitan species group trapped in the intertidal

Phillip V. Randsø[A], Hiroshi Yamasaki[B], Sara Bownes[C], Maria Herranz[D], Maikon Di Domenico[E], Gan B. Qi[F], Martin V. Sørensen[A]
[A] Natural History Museum of Denmark, University of Copenhagen, Denmark
[B] Museum für Naturkunde – Leibniz Institute for Evolutionary and Biodiversity Research at the Humboldt University, Berlin, Germany
[C] University of KwaZulu-Natal, Durban, South Africa
[D] Departments of Zoology and Botany, University of British Columbia, Vancouver, Canada
[E] Federal University of Paraná, Curitiba, Brazil
[F] Tropical Marine Science Institute, National University of Singapore, Singapore

Abstract

Within the most species-rich kinorhynch genus, *Echinoderes*, we find a putatively monophyletic species group, the so-called *Echinoderes coulli*-group. The remarkable morphological similarities of the *E. coulli*-group species and the fact that the group has a global distribution even though most of the species are restricted to intertidal habitats, has led to the hypothesis that dispersal and speciation within the group has been driven by the process of continental drift. However, this has never been confirmed empirically. With morphology and two molecular loci, COI and 18S, we calculated phylogenetic trees by analyzing datasets separately and in combination using Maximum Parsimony, Maximum Likelihood and Bayesian Inference. Using different models of evolution in combination with different statistical approaches, we show that two major clade divergences were consistent with historic drifting of continents, suggesting that vicariance and fragmentation of the Tethys Ocean probably played an important role for the speciation within the *E. coulli*-group. Furthermore, we found that reconstructions of past tectonic drifting since the Devonian (416-359 Mya) were able to explain present species distribution, and suggest that the group originated in a supposedly vast shallow marine environment found in northeastern Gondwana by mid-Late Silurian 426-416 Mya.

Deep Metal: Deep-sea Kinorhyncha from the polymetallic nodule fields of the CCFZ

Nuria Sánchez[1], Fernando Pardos[2], Pedro Martínez-Arbizu[3]

[1] Institut Français de Recherche pour l'Exploitation de la MER, Laboratoire Environnement Profond, France
[2] Universidad Complutense de Madrid, Spain
[3] Deutsches Zentrum für Marine Biodiversitätsforschung, Germany

Abstract

Polymetallic nodule areas are currently in the spotlight due to their potential commercial and strategic interest for metals such as nickel, copper, cobalt and rare earth elements. It is expected that nodules will be mined in the near future in order to face the growing demand of these metals. The polymetallic nodule fields occur in deep-sea bottoms with low sedimentation rates, where nodules lie on the soft sediment increasing the heterogeneity of the environment (hard and soft substrates). These areas are beyond national jurisdiction and its regulation is handled by the International Seabed Authority (ISA), for whom it is mandatory to identify the fauna associated with the areas of nodules to make accurate environmental impact predictions and establish mining regulations before the concession of the exploitation.
Our study is focused on the kinorhynch diversity, abundance and community structure in the Global Sea Mineral Resources N.V. (GSR) license area at the Clarion-Clipperton Fracture Zone (CCFZ) in order to assess how meiofaunal organisms may be affected by seafloor mining activities, which not only will remove the nodules (decreasing the heterogeneity and habitat availability) but also resuspend sediment that otherwise stays very stable. Thus, we explore the kinorhynch community and the geographic distribution of kinorhynch species at the nodule fields, which is crucial for their effective preservations. Finally, our research allows us to investigate whether or not some taxa are specialized in a specific area or habitat (nodules/soft sediment) and, if so, to predict the potential impact of nodule mining on kinorhynch diversity and on the whole meiofauna community to some extend too.
For this purpose, samples from 120 stations were studied. A total of 720 specimens were sorted and studied, of which, 560 of were juveniles and 160 adults, leading to the discovery of a considerable amount of new kinorhynch species: 13 new plus five already known species. These 18 species belong to seven families and ten genera. Deep-sea nodules field harbors species of *Echinoderes*, *Fissuroderes*, *Cephalorhyncha*, *Meristoderes*, *Semnoderes*, *Condyloderes*, *Campyloderes*, *Dracoderes*, *Cristaphyes* and *Mixtophyes*, with *Echinoderes* being the most abundant genus in our samples (89 adult specimens). The observed homogeneity of the community is of paramount importance to determine impact and preservation zones, but a cautionary approach is needed as the identifications are based only on morphospecies. Therefore, further barcoding studies are required to elucidate the presence of cryptic species.

Deep-sea Scalidophora from the US West Coast

Martin V. Sørensen[1], Stephen C. Landers[2], Ricardo Neves[3], Reinhardt M. Kristensen[1]

[1] Natural History Museum of Denmark, University of Copenhagen, Copenhagen, Denmark
[2] Department of Biological and Environmental Sciences, 210A MSCX, Troy University, Troy AL 36082, USA
[3] Biological Institute, University of Copenhagen, Copenhagen, Denmark

Abstract

Knowledge about deep-sea scalidophorans has increased considerably within the last few years. New species of several different kinorhynch genera have been described from the Kuril-Kamchatka Trench by A. Adrianov and N. Maiorova, and H. Yamasaki, B. Neuhaus and K.H. George have found and described new species of *Echinoderes* on deep-sea plains around sea-mounts in the East Atlantic and Mediterranean Sea. Furthermore, new and known species of Kinorhyncha and Loricifera have recently been collected from foot of the continental slope off Oregon and California at the US West Coast.

These latter studies resulted in the description of two new species of Loricifera, as well as eight new species of Kinorhyncha. Already known species from the deep-sea stations included: *Echinoderes hakaiensis*, known from shallow water localities in British Columbia, *E. unispinosus*, known from deep-sea localities in the NE Atlantic, *Fissuroderes higginsi*, known from New Zealand in the SW Pacific, and *Condyloderes kurilensis* known from abyssal plains near the Kuril-Kamchatka Trench in the NW Pacific. The studies furthermore indicated that two new species of *Condyloderes* might co-occur in the deep-sea off California and on the northern continental shelf of the Gulf of Mexico. This suggests that deep-sea kinorhynchs may show distributional ranges that are considerably larger than species of the otherwise rather regionally restricted continental kinorhynch fauna. In addition, the new species of *Condyloderes* indicated that adult moulting might happen within the genus, and revealed the presence of dimorphism among adult females.

Investigation of kinorhynchs on seamounts and surrounding area in the Mediterranean Sea, northwestern Atlantic Ocean and Arctic Sea.

Hiroshi Yamasaki[1, 2], Birger Neuhaus[1], Katarzyna Grzelak[3, 4], Martin V. Sørensen[5], Kai Horst George[2]

[1] Museum für Naturkunde, Leibniz Institute for Evolution and Biodiversity, Berlin, Germany
[2] Senckenberg am Meer Wilhelmshaven, German Center for Marine Biodiversity Research (DZMB), Wilhelmshaven, Germany
[3] Laboratory of Polar Biology and Oceanobiology, Faculty of Biology and Environmental Protection, University of Łódź, Łódź, Poland
[4] Polish Academy of Sciences, Institute of Oceanology, Sopot, Poland
[5] Natural History Museum of Denmark, University of Copenhagen, Copenhagen, Denmark

Abstract
Although meiobenthic animals possess special characteristics, such as small body size, little spatial mobility, no planktonic life stages, etc., they often show wide distribution patterns. The phenomenon is called the "meiofauna paradox". The mechanisms which cause the meiofauna paradox have been investigated and discussed by several meiobenthologists. Seamounts potentially play a role in the distribution of meiobenthos, however, relatively few faunistic studies have been done about marine meiobenthos on seamounts.
Kinorhyncha is a phylum comprising of exclusively marine meiobenthic species. It often shows a high abundance in meiobenthic taxa, next to nematodes and harpacticoid copepods, and has been reported worldwide, from polar to tropical regions and from intertidal to abyssal depths. Despite the ubiquitous occurrence of kinorhynchs, the fauna has been scarcely investigated on and around seamounts.
In the presentation, we will show the results of the first comprehensive faunistic investigations of kinorhynchs from seamounts in the Northeastern Atlantic Ocean, the Mediterranean Sea, the Arctic Sea, and deep-sea floor close to the seamounts. Six new and two undescribed species have been described so far, namely *Echinoderes apex, E. bathyalis, E. meteorensis, E. multiporus, E. pterus, E. unispinosus*, and *Echinoderes* sp. 1 and *Echinoderes* sp. 2 both in Yamasaki et al. (2018). In addition, at least three new species of Echinoderes and one new cyclorhagid species are in preparation for publication. None of these species are identical to the species found on the continental shelf, whereas *E. apex, E. multiporus* and *E. pterus* occur at least on two seamounts. Furthermore, *E. pterus* has been found also on the deep-sea floor. The other species have been found either only on a summit of a seamount or only on the deep-sea floor. These results indicate that seamounts seem to have a unique fauna and ecosystem itself, being independent from other shallow waters, but being more related to other seamounts and/or to deep-sea floor.