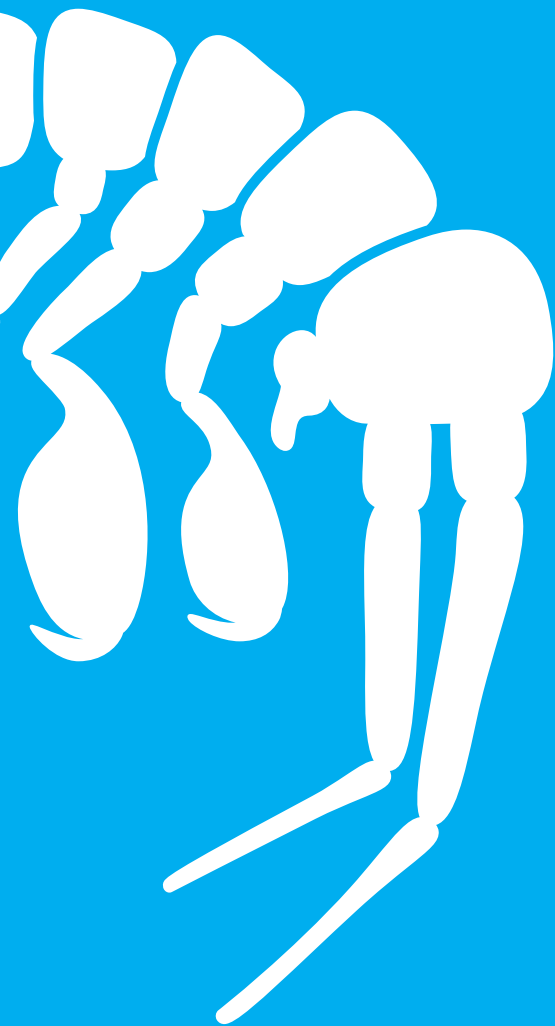




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16TH ICA

INTERNATIONAL
COLLOQUIUM ON
AMPHIPODA

AVEIRO | PORTUGAL
7-11 SEPTEMBER 2015



Book of Abstracts
Programme

16th International Colloquium on Amphipoda
Book of abstracts

Title

16th International Colloquium on Amphipoda: book of abstracts

Coordination

Filipe O Costa, Marina R Cunha

Scientific Committee

Filipe O Costa, Marina R Cunha, Adam Baldinger, Oliver Coleman, Patrícia Esquete, Cene Fišer, Michał Grabowski, José Guerra García, Ed Hendrycks, Anne-Nina Loerz, Murat Özbek, Cristiana Serejo

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Biodiversity // Biogeography // Phylogeny // Ecology // Anthropogenic impact

16th International Colloquium on Amphipoda
Aveiro, 7-11 September 2015

Departamento de Biologia &
Centro de Estudos do Ambiente e do Mar (CESAM)

Universidade de Aveiro

Centro de Biologia Molecular e Ambiental (CBMA)

Universidade do Minho

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Conveners

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Symposium partners

Centro de Estudos do Ambiente e do Mar (CESAM)

<http://www.cesam.ua.pt/>

Centro de Biologia Molecular e Ambiental (CBMA)

<http://cbma.bio.uminho.pt/>

Fundação para a Ciência e Tecnologia (FCT)

<http://www.fct.pt/>

Symposium sponsors

The Conveners wish to thank the following institutions for the support given to the 16th International Colloquium on Amphipoda:

Stabvida

<http://www.stabvida.com/>

Amphipod Newsletter

<http://www.marinespecies.org/amphipoda/newsletter.php>

Lina & Nando

<http://www.fromsupernova.com/>

General symposium information

With more than 40 years of tradition, the International Colloquium on Amphipoda consists on the most relevant meeting point for several generations of amphipodologists, and an exciting forum for scientific exchange among researchers interested in all aspects of amphipod biology and ecology, where students find a unique environment to meet and connect with senior researchers.

Previous conferences have been held in Verona, Italy (1st ICA, 1969), Lyon, France (2nd ICA, 1973), Schlitz, Germany (3rd ICA, 1975), Blacksburg, Virginia, USA (4th ICA, 1978), Lodz, Poland (5th ICA, 1980/1), Ambleteuse, France (6th ICA, 1985), Walpole, Maine, USA (7th ICA, 1990), Lodz, Poland (8th ICA, 1994), Kronenburg, Germany (9th ICA, 1998), Heraklion, Crete (10th ICA, 2000), Tunis, Tunisia (11th ICA, 2003), Cork, Ireland (12th ICA, 2005), Tihany, Hungary (13th ICA, 2007), Sevilla, Spain (14th ICA, 2010) and Szczawnica, Poland (15th ICA, 2013).

Portugal is the hosting country for the 16th International Colloquium on Amphipoda (16th ICA) taking place at Universidade de Aveiro, Aveiro, Portugal, from 7 to 11 September 2015.

Website: <http://16ica.web.ua.pt/>

Email: 16ica2015@gmail.com

Themes

Following a trend for increasing numbers of participants over the last editions, This year 100 researchers interested in amphipod biology from 30 different countries are attending this exciting meeting. The 104 contributions are distributed by the following themes:

Biodiversity and biogeography

Phylogenetics and phylogeography

Morphology

Physiology

Ecology

Anthropogenic disturbance and climate change

Symposium venue

The venue of the 16th ICA is the university campus located between the saltpans and the city centre. The campus of Universidade de Aveiro is renowned for its architecture with many emblematic buildings designed by famous Portuguese

architects. Its buildings are purpose-built for teaching and research, administrative and technical support, and include halls of residence for students and staff, libraries, bookshop, canteens, bars and restaurants, sports facilities, laundry, post office, stores, bank and kindergarten.

The colloquium will take place in the main theatre of the Departamento do Ambiente e Ordenamento (DAO) at ground level near the entrance hall where the help desk and poster stands will be located.

Welcome and registration desk

During the conference the registration and information desk will be located at the entrance of DAO from 8:30 to 17:30. On Monday (September 7) you can join us there from 16.30 for an early registration followed by the Icebreaker reception at 18:00.

Upon registration, participants will receive a welcome package and a name badge. Participants are requested to wear their conference name badges at all sessions and refreshment breaks, and are invited to return these for recycling to the help desk at the conclusion of the conference.

Author guidelines

Author index. An author index is provided at the end of this abstract book. A unique number allocated to each oral or poster contribution allows an easy location of the abstract in the book, as well as its location in the time schedule and poster stands.

Oral presentations. Each day will start with a 45-minutes lecture given by a keynote speaker. All other presentations will be allocated **15 minutes in total**, made up of 12 minutes presentation with 3 minutes for discussion. Speakers using PowerPoint may email their presentations prior to the conference. Otherwise presentations should be brought to the conference on a USB stick and all speakers are requested to hand in their talks to the technician at the help desk as soon as possible and at least the day before their scheduled presentation. Chairpersons of sessions are asked to be present at least five minutes before the session. All speakers are kindly asked to remain within their allocated time.

Posters will be allocated a 90 cm wide x 135 cm high board; your poster must fit within this area. All the material necessary for attaching the poster to the board will be supplied by the organizers. Please ensure your poster is hung up when you first arrive to the conference. Each poster is allocated to a specific stand. Please check your poster number and locate the appropriate stand at the entrance hall. Posters will be displayed for the duration of the conference and can be viewed during coffee and lunch breaks. The main poster session will take place on Tuesday, (September 8) from 17:00 to 19:00; presenting authors are asked to stand by their posters at this time to answer questions.

Social events

Coffee breaks will be served in the entrance hall (DAO) and **lunches** in the Crasto canteen; these are all included with your registration. If you have specified a dietary requirement when completing the online registration, this will have been passed on to the venue and will be available for you.

Icebreaker - Monday, 7th August at the Fábrica – Centro Ciência Viva from 18:00 to 19:00. All participants are invited to join us for the welcome reception prior to the conference, and taste Portuguese wines and some regional products. This function is included with your registration.

Poster session- Tuesday, 8th September, at the University Campus (DAO), from 17:00 to 19:00. Enjoy discussing the posters with the presenting authors over a beer or refreshment. This function is included with your registration.

Conference dinner – Wednesday, 9th September at Quinta do Encontro. The conference dinner will take place in a stylish and modern restaurant, surrounded by a vineyard, over a wine cellar of “Espumante”, the sparkling wine from the region of “Bairrada”, close to Aveiro. A wonderful setting to taste the Portuguese cuisine and wines and enjoy the surprise entertainment. Transportation to and from the dinner location will be provided. This function is included with your registration. Transportation to and from the dinner location will be provided. This function is included with your registration.

Excursions

We will make a colloquium excursion to the city of Porto, the second city of Portugal, close to Aveiro. Porto has been elected Europe’s best destination in 2014, and the historical centre of Porto, an outstanding urban landscape with a 2000-year of history, has been distinguished as UNESCO’s World Heritage Site. There, we will enjoy a cruise in the Douro River and will visit the wine cellars ending with a Port wine tasting. A surprise event will drop us in the city centre where we may experience the liveliness of the streets, visit some sightseeing hallmarks and freely choose a dining place among the generous offer of traditional and modern cuisine available. Transportation to and from Porto will be provided. This function is included with your registration.

Programme of the sessions

Oral presentations

Tuesday, September 8

Opening Session

Chairpersons: Filipe O Costa, Marina R Cunha

9:15 Opening statements and housekeeping information

Keynote talk

9:30 **1** **Coleman CO** - Taxonomy in times of the „Taxonomic Impediment“ – a pessimistic provocation

Biodiversity and biogeography

Chairperson: Anne-Nina Loerz

10:15 **4** **Karaman GS** - Diversity of Amphipoda fauna in Bosnia and Herzegovina

10:30 **5** **Jażdźewski K**, Mamos T, Grabowski M - Taxonomy and distribution of *Gammarus balcanicus*-group in the northern Carpathians

10:45 **Coffee break**

11:15 **6** **Özbek M**, Sezgin M - Distribution of the Ponto-Caspian amphipod species in freshwaters and coastal areas of Turkey

11:30 **7** **Cabezas MP**, Santos AM, Branco M, Xavier R, Guerra-García JM, Sezgin M - Hidden biodiversity and patterns of genetic differentiation in the Mediterranean-Atlantic transition zone: *Dexamine spiniventris* (Costa, 1853) and *Caprella danilevskii* Czerniavskii, 1868 as case studies

11:45 **8** **Frutos I**, Sorbe JC- Suprabenthic amphipods from the Capbreton area (SE Bay of Biscay): Faunal recovery after a canyon turbiditic disturbance

12:00 **9** **Almeida M**, Company JB, Lampadariou N, Cunha MR - Suprabenthic amphipods along an oligotrophic gradient in the bathyal Mediterranean Sea

12:15 **10** **Zeina AF**, Abou Zaid MM - Biodiversity patterns on Red Sea Amphipods associated with the Intertidal macroalgae

12:30 **Lunch break**

Biodiversity and biogeography

Chairperson: Cristiana Serejo

- 14:15 **11 Shin M-H** - Systematic study on the selected groups of marine amphipods from Korea
- 14:30 **12 Horton T**, Lowry J, De Broyer C, Bellan-Santini D, Coleman CO, Daneliya M, Dauvin J-C, Fiser C, Grabowski M, Gasca R, Guerra-García J, Hendrycks E, Holsinger J, Hughes L, Jażdżewski K, Just J, Kamaltynov RM, Kim Y-H, King R, Krapp-Schickel T, LeCroy S, Vonk R, Senna AR, Serejo C, Sket B, Thomas J, Thurston M, Vader W, Väinölä R, White K, Zeidler W - The World Amphipoda Database – updating the global species database
- 14:50 **13 Fišer C**, Eme D, Galassi D, Stoch F, Marmornier P, Zagmajster M, Malard F - From European Groundwater Crustacean Dataset to public database
- 15:10 **14 Radulovici AE**, Ratnasingham S - A BOLD approach to amphipodology
- 15:30 **Coffee break**

Anthropogenic disturbance and global change

Chairperson: Adam Baldinger

- 16:00 **15 Plaiti W**, Naletaki M, Simboura N - Aspects of benthic Environmental Status (ES) of Hellenic Seas (Eastern Mediterranean Sea)
- 16:15 **16 Wiklund A-KE**, Andersson A - Effects on growth and fatty acid composition of *Monoporeia affinis* from a climate induced food change
- 16:30 **17 de-la-Ossa-Carretero JA**, Del-Pilar-Ruso Y, Loya-Fernández A, Ferrero-Vicente LM, Marco-Méndez C, Martínez-García E, Sánchez-Lizaso JL - Response of Amphipoda assemblages to brine discharge: impact and recovery
- 16:45 **18 Rewicz T**, Wattier R, Grabowski M, Rigaud T, Mamos T, Bączela-Spychalska K - Origin, genetic diversity and secondary introduction patterns of the killer shrimp, *Dikerogammarus villosus*, invading Alpine Lakes

Poster session

Wednesday, September 9

Keynote talk

9:00 **2 Guerra-García JM**, Tierno de Figueroa JM, Navarro-Barranco C1 Ros M - A new method to study the diet of amphipods

Ecology

Chairperson: Ed Hendricks

9:45 **19 Jażdżewska AM** - Kuril-Kamchatka deep sea revisited – abyssal amphipods assemblages

10:00 **20 Jiménez A**, Marquina R, Quipúzcoa L, Paredes C, Gutiérrez D - Spatial distribution of Ampeliscidae (Crustacea: Amphipoda) on sediments in the northern central Peruvian continental shelf

10:15 **21 Berezina NA**, Maximov AA - Distribution and ecological significance of amphipods in the eastern Gulf of Finland

10:30 **22 Layeghi Y**, Momtazi F - The pattern of Ampithoidae (Crustacea: Amphipoda) distribution along the intertidal area of Qeshm Island

10:45 **Coffee break**

Chairperson: Wim Vader

11:15 **23 Camisa F**, Bellisario B, Lattanzi L, Cimmaruta R - Exploring patterns of amphipod distribution in *Posidonia oceanica* through the metacommunity approach: a proposed framework

11:30 **24 Llaja LI**, Paredes CE, Jiménez A - Characterization of the community of benthic amphipods associated with different habitats generated by Rhizophora mangle in Puerto Pizarro, Tumbes, Peru

11:45 **25 Kobak J**, Rachalewski M, Bącela-Spychalska K - Conquerors or exiles? Impact of interference competition among invasive gammarideans on their dispersal rates

12:00 **26 Fernandez-Gonzalez V**, Sanchez-Jerez P - Dispersal of fouling caprellids around floating aquaculture facilities in the Mediterranean Sea

12:15 **27 Dzierżyńska-Białończyk A**, Jermacz ŁM; Kobak JD - Preferences of the invasive killer shrimp *Dikerogammarus villosus* for substrata of different grain size, macrophytes and zebra mussels

12:30 **Lunch break**

Ecology

Chairperson: Alan Myers

- 14:00 **28** **Martínez-Laiz G**, Ros M, Navarro-Barranco C, Guerra-García JM - Substrate selection of intertidal caprellids of Southern Spain
- 14:15 **29** **Fanini L**, Hughes LE, Springthorpe R, Tosetto L, Lowry JK - Activity patterns of macrofauna on pocket, macrotidal beaches: a field experiment
- 14:30 **30** **Conlan K**, Hendrycks E - An ampeliscid amphipod hotspot provides a Canadian Arctic destination for the Pacific gray whale (*Eschrichtius robustus*)
- 14:45 **31** **Tandberg AHS**, Vader W - Stenothoidae associated with hydroids – does association with other taxa trigger extended parental care?
- 15:00 **32** **Bloor MC** - Tea for Two: The dietary preference of *Gammarus pulex* and *Asellus aquaticus* during laboratory studies
- 15:15 **33** **Jermacz Ł**, Szatkowska B, Kobak J - Density of prey as a factor modifying the anti-predator behaviour of amphipods
- 15:30 **Coffee break**

Chairperson: José Guerra-Garcia

- 16:00 **34** **Jung TW**, Yoon SM - Life history, population dynamics and secondary production of *Grandidierella japonica* Stephenson, 1938 from southern coastal waters of Korea
- 16:15 **35** Jelassi R, Bouslama MF, Khemaissia H, **Nasri-Ammar K** - Life history traits of three sympatric talitrid species in the supralittoral zone of Bizerte lagoon (northern Tunisia)
- 16:30 **36** **Corbari L**, Sorbe JC - First in-situ observations on the behaviour of the deep-sea amphipod *Dulichlopsis* sp. (Senticaudata, Dulichiidae) at the vicinity of the hydrothermal vent site TAG (Mid-Atlantic Ridge)
- 16:45 **37** **Jelassi R**, Khemaissia H, Ayari A, Nasri-Ammar K - Locomotor behavior of *Orchestia gammarellus* over four seasons in the supralittoral zone of Ghar Melh lagoon (North-East of Tunisia)
- 17:00 **38** **Mayer G**, Maas A, Waloszek D - Functional morphology of feeding structures in amphipods inhabiting German inland waters

Conference dinner

Friday, September 11

Keynote talk

- 9:00 **3** **Beermann J**, Dick JTA, Thiel M - Many observations but few specific studies – An overview of social recognition in amphipod crustaceans

Physiology

Chairperson: Oliver Coleman

- 9:45 **39** Axenov-Gribanov D, Vereshchagina K, Lubyaga J, Gurkov A, **Timofeyev MA** - Determination of Lake Baikal endemic and Palearctic amphipods thermal optima limits by changes in its stress markers
- 10:00 **40** **Bedulina DS**, Evgen'ev MB, Gurkov AN, Timofeyev MA, Zatssepina OG - Proteomic thermal stress-responses of two species of Baikal amphipods (*Eulimnogammarus cyaneus* and *E. verrucosus*) with different thermotolerance
- 10:15 **41** **Šidagytė E**, Žilnius M, Lesutienė L, Arbačiauskas K - Oxygen consumption of invasive *Pontogammarus robustoides* and native *Gammarus lacustris* from temperate lakes of contrasting trophy
- 10:30 **42** **Šniaukštaitė V**, Šidagytė E, Lesutienė J, Arbačiauskas K - Allocation of phosphorus into eggs in females of *Pontogammarus robustoides* from environments of different trophy
- 10:45 **Coffee break**

Phylogenetics & phylogeography

Chairperson: Michal Grabowski

- 11:15 **43** **Sket B**, Zhong Hou - Some closed and some open questions regarding the family Gammaridae
- 11:30 **44** **Väinölä R** - Evolution and phylogeography of pallaseid amphipods, within Lake Baikal and beyond
- 11:45 **45** Verheye ML, **d'Udekem d'Acoz C** - Origin and diversification of the amphipod genus *Epimeria* on the Antarctic shelf
- 12:00 **46** **Desiderato A**, Vieira P, Serejo CS, Krapp-Schickel T, Abbiati M, Costa FO, Queiroga H - First insights into phylogenetic relationships among the Atlantic and Mediterranean species of the family Hyalidae
- 12:15 **47** **Wysocka A**, Sworobowicz L, Mamos T, Trajanovski S, Sell J, Grabowski M - Vertical distribution of amphipods in the ancient Lake Ohrid - morphological and molecular perspective
- 12:30 **Lunch break**

Phylogenetics & phylogeography

Chairperson: Cene Fišer

- 14:00 **48** **Copilaş-Ciocianu D**, Petrušek A - The south-western Carpathians as a centre of ancient diversity of freshwater gammarid amphipods: insights from the *Gammarus fossarum* species complex
- 14:15 **49** **Grabowski M**, Mamos T, Rewicz T, Wysocka A, Rachalewski M, Wattier R - Spatial patterns of cryptic diversity within the *Gammarus fossarum* complex: adding an East/West side to the story
- 14:30 **50** **Serejo CS**, Solé-Cava AM,, Rodríguez-Rey GT - The genus *Platorchestia* (Crustacea: Amphipoda) in the supralittoral beaches and lagoons of the tropical and warm temperate Western Atlantic - a molecular approach
- 14:45 **51** **White KN**, Reimer JD, Lorion J - Maybe the Hokey Pokey isn't what it's all about: strong genetic structure revealed in populations of *Leucothoe vulgaris* from Okinawa, Japan
- 15:00 **52** **Bączela-Spychalska K**, Rewicz T, Wattier R, Grabowski M, Mamos T, Ovcharenko M, Rigaud T - Phylogeography and host shift of *Cucumispora dikerogammari* – an intracellular parasite of two Ponto-Caspian gammarids
- 15:15 **53** Davolos D, **De Mattheis E**, Latella L, Vonk R - A new *Cryptorchestia* species (Amphipoda, Talitridae) from the island of Rhodes (Greece) revealed by morphological and phylogenetic analysis
- 15:30 **Coffee break**

Closing session

Chairpersons: Filipe Costa, Marina R Cunha

- 16:00 Brief overview of the Colloquium, presentations of the venues for 17th and 18th ICA, best student presentation award and closing ceremony

Programme of the sessions

Posters

Posters are on display during all week in the entrance hall

Main poster session:

Tuesday, September 8 from 17:00 to 19:00

Biodiversity and biogeography

- 54 **Antunes I**, Ferreira MS, Lobo J, Teixeira M, Borges LMS, Sousa R, Gomes PA, Costa MH, Cunha MR, Costa FO - Contrasting morphological and DNA barcode-based taxonomic units in shallow water marine amphipod fauna from Portugal
- 55 **Baldinger AJ**, Lenihan, JW - The Amphipoda recently collected in Bermuda – preliminary results
- 56 **Beermann J**, Raupach MJ - Hidden gems – an overlooked *Epimeria* species from European seas
- 57 **Chiesa IL** - Tropical/subtropical amphipod genera in the Atlantic Patagonian waters
- 58 **Coleman CO** - Crustacea in the Museum für Naturkunde Berlin
- 59 **Coleman CO** - Mirroring what's on the amphipod literature server with *BitTorrent Sync*
- 60 **Esplana JJ**, Jiménez A, Paredes C - First records of Caprellidae (Crustacea: Amphipoda) in the central coast of Peru
- 61 **Esquete P**, Aldea C - The genus *Leucothoe* in the Magellan Region, with description of a new species from Bernardo O'Higgins National Park
- 62 **Esquete P**, Aldea C - Taxonomic and biogeographic inventory of the benthic Amphipoda in the Magellan Region (Chile)
- 63 **Esquete P**, Sorbe JC, Cunha MR - Diversity and distribution patterns of amphipods in Mercator mud volcano (Gulf of Cadiz, NE Atlantic)
- 64 **Frutos I**, Brandt A - Hadal and abyssal Amphipoda collected during the Vema SO-237 cruise from the Puerto Rico Trench area (Atlantic Ocean)
- 65 **Horton T**; Thurston MH - The World Register of Deep Sea Species - Amphipoda – updating “Thurston, 2000”
- 66 **Hupało K**, Karaouzas I, Olszewska W, Mamos T, Rewicz T, Baćela-Spychalska K, Grabowski M - Diversity and distribution of *Gammarus* on Peloponnese
- 67 **Jazdżewska AM** - New amphipod species from wood-fall
- 68 **Jazdżewska AM**, Jedynek K - Barcoding of deep-sea amphipod fauna – preliminary results
- 69 **Jelassi R**, Khemaissia H, Zimmer M, Garbe-Schönberg D, Nasri-Ammar K - Spatio-temporal distribution of *Talitrus saltator* in the supralittoral zone of Mâamoura beach (North East of Tunisia)
- 70 **Katouzian A-R**, Sari A, Leese F, Weigand AM - Description of a new freshwater species of the genus *Gammarus* from Iran
- 71 Momtazi F, **Layeghi Y** - New report and new species of herbivorous amphipods (Amphipoda: Ampithoidae) from the coasts of the Persian Gulf and the Gulf of Oman, Iran
- 72 **Loerz AN**, Coleman CO - Interactive identification keys for easy online use
- 73 **Mamos T**, Grabowski M, Wattier R - One hundred species in one -

- enormous cryptic diversity of *Gammarus balcanicus* in Europe
- 74 **Piscart C**, Tuekam Kayo R, Lagnika M, Zébazé Togouet SH, Boutin C - First evidence of the presence of the freshwater amphipod genera *Gammarus* and *Pseudoniphargus* in Central and Western Africa
- 75 **Rossano C**, Carlo F, Scapini F - Expansion of the distribution areal of *Dikerogammarus villosus* in the water shed of a recently occupied artificial water body (Florence, Italy)
- 76 **Scipione MB** - *Caprella scaura* Templeton, 1836: new data able to date back its presence in the Mediterranean Sea
- 77 **Seefeldt MA**, Tollrian R, Held C - Lysianassoid amphipods in Potter Cove (King George Island; Antarctica): A first biodiversity inventory in a rapidly changing environment
- 78 **Siqueira SGL**, Serejo CS - New records of Lysianassidae, Pachynidae and Uristidae (Amphipoda: Lysianassoidea) from the southwestern Atlantic Ocean
- 79 **Targusi M**, Lattanzi L, Marusso V, Trabucco B - Taxonomic and ecologic study of taxon Amphipoda (Crustacea): A collection of the benthic macroinvertebrates of the Italian coasts
- 80 **Wongkamhaeng K**, Boonyanusith C, Dumrongrojwattana P - First representatives of the genus *Allorchestes* Dana, 1849 (Amphipoda, Dogielinotidae) from South East Asia
- 81 **Zakhama-Sraieb R**, Sghaier YR, Charfi-Cheikhrouha F - Contribution to the knowledge of the Amphipoda (Crustacea) of the coast of Lebanon
- 82 **Zeina AF**, Guerra-García JM - The diversity and distribution of Red Sea caprellids

Anthropogenic disturbance and global change

- 83 **Berezina NA**, Strode E - Embryonic characteristics in amphipods as a tool for assessment of quality in the eastern Baltic Sea
- 84 Di Donato G, Pierangeli S, Ronci L, Setini A, **De Matthaeis E** - Genotoxicity biomarkers in the sandhopper *Talitrus saltator* and invertebrate community study in the evaluation of coastal ecosystems quality assessment
- 85 Ronci L, Marcoccia M, **De Matthaeis E**, Setini A, Canepari S - Multi-level assessment of particulate matter effects on *Echinogammarus veneris* (Crustacea; Amphipoda)
- 86 **Florido M**, González-Romero P, Navarro-Barranco C, Ros M, Guerra-García JM - The influence of the invasive seaweed *Asparagopsis taxiformis* on the caprellid community
- 87 **Marchini A**, Ferrario J, Nasi E, Occhipinti-Ambrogi A - *Grandidierella japonica* Stephensen, 1938 has appeared in a Mediterranean marina (Tuscany, Italy): first signals of invasion?
- 88 **Rossano C**, Plaiti W, Arvanitidis C, Scapini F - Dominance of *Pseudolirius*

- kroyeri* in a location influenced by freshwater in Cagliari port (Italy)
- 89 **Scipione MB**, Ricevuto E, Gambi MC - Amphipod assemblages in a volcanic CO₂ marine vents system: a study from artificial collectors along a natural pH gradient

Ecology

- 90 **Fernandez-Gonzalez V**, Fernandez-Leborans G, Roura A, Sanchez-Jerez P - First description of the epibiotic associations between apostomid ciliates *Conidophrys* spp. and two amphipods present in fish farms fouling in the western Mediterranean Sea
- 91 **Jazdzewska AM**, Serigstad B, Appoh E - Amphipods of the Gulf of Guinea – diversity distribution patterns
- 92 **Kozlov OV** - Hydrochemical and hydrophysical habitat conditions of *Gammarus lacustris* GO Sars in western Siberia lakes
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Taxonomy in times of the „Taxonomic Impediment“ – a pessimistic provocation

1

Coleman CO

Museum für Naturkunde - Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany
oliver.coleman@mfn-berlin.de

We probably know less than 10% of the species on our planet. Trying to fill these huge gaps in our taxonomic knowledge with a low – and apparently decreasing – number of taxonomists has been referred to as the „taxonomic impediment“; a term that became widely recognized by the Convention on Biological Diversity in Rio de Janeiro in 1992. Looking at the statistics page of the WoRMS Amphipoda section, this taxonomic impediment seems not to be real. In fact there has been a steady increase in the number of known amphipod species, now reaching almost 10,000. Furthermore, many colleagues claim that we taxonomists live in the best of times. Easy access to literature over the internet and new techniques (genetics, digital illustration methods, collection- and character databases) allow us to find and sort information rapidly and thus describe species faster than ever before. This talk tackles the following questions: Is the taxonomic impediment only a misperception? Hasn't the situation for taxonomists always been difficult? Could it be that the situation for taxonomy will rapidly worsen in the future? And what should be the role of museums in maintaining and developing taxonomic expertise?

A new method to study the diet of amphipods

2

Guerra-García JM¹, Tierno de Figueroa JM², Navarro-Barranco C¹, Ros M¹

¹Laboratorio de Biología Marina, Departamento de Zoología, Facultad de Biología, Universidad de Sevilla, Sevilla, Spain; ²Departamento de Zoología, Facultad de Ciencias, Universidad de Granada, Campus Fuentenueva, Granada, Spain
jmguerra@us.es

In spite of the importance of amphipods in marine ecosystems, little is known about the feeding habits of these crustaceans. Traditionally, amphipod feeding strategies have been assessed using *in situ* and laboratory observations, feeding experiments, gut-content analyses and studies of mouthpart appendages. Knowledge of amphipod feeding ecology has recently expanded thanks to the use of biomarkers such as lipids and fatty acids, and stable isotopes. However, these biomarkers' studies require fresh material preventing the use of specimens already fixed in ethanol or formalin, and also depend on abundant material available (especially if the specimens are small) to have enough amounts for chemical analysis. On the other hand, the traditional studies dealing with the direct observation of digestive contents are very scarce, probably due to the difficult task of remove the digestive tract by dissection. Recently, a method used by entomologists for studying the digestive contents of insects was successfully essayed to characterize the diet of more than 200 species of marine amphipods. The method is inexpensive and effective: specimens must be introduced in Hertwig's liquid (consisting on 270 g of chloral hydrate, 19 ml of chloridric acid

1N, 150 ml of distilled water and 60 ml of glycerine) and heated in an oven at 65 °C for 2 to 24 hours depending on the cuticle thickness. After this, they can be mounted on slides for its study under the microscope. The specimens become transparent and the different components (prey, detritus, macroalgae, microalgae, etc) can be observed along the gut. This methodology has been successfully used to explore trophic strategies of exotic caprellids in their native and introduced distribution ranges, to characterise the diet of amphipods from submarine caves and to assess variations in the diet of amphipods according to the substrate, sex and seasonal fluctuations, among others applications.

Many observations but few specific studies – An overview of social recognition in amphipod crustaceans

3

Beermann J¹, Dick JTA², Thiel M³

¹Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Biologische Anstalt Helgoland; Helgoland, Germany; ²Institute for Global Food Security, School of Biological Sciences, Queen's University Belfast; Belfast, N. Ireland, UK; ³Universidad Catolica del Norte, Facultad Ciencias del Mar; Larrondo, Coquimbo, Chile

Jan.Beermann@awi.de

Many amphipod species occur in dense aggregations, cohabit with mating partners for long time periods, or live in family groups. Although this confers ample opportunities for social interactions among conspecifics, little is known about social recognition patterns in these species. Our current review indicates that social recognition in amphipods appears largely limited to mate and female-offspring recognition. In many amphipod species, the males are capable of assessing the reproductive status/quality of females and choose mates accordingly. While females of some species are capable of recognizing their own brood, in other species females seem to be indiscriminate towards their own or unrelated embryos. Some observations, however, suggest kin recognition within family units and even ranking of conspecifics seems to be likely. Central-place foraging has not been reported for amphipod families thus far, and also their potential for fortress defense is very limited. It thus appears that higher level social recognition may not have evolved in amphipods, although we recognize a lack of research in this area. Given their easy maintenance in laboratory cultures and technological advances in video recording and analysis, we believe that selected amphipod species could be ideal model organisms to study the evolution of social behavior.

Biodiversity and biogeography

Diversity of Amphipoda fauna in Bosnia and Herzegovina

4

Karaman GS

Montenegrin Academy of Sciences and Arts, Montenegro
karaman@t-com.me

Thanks to the geological history, geomorphology, climate, water resources, large karstic regions (Dinarids), continuous settlements of the epigeal and subterranean taxa from the Sea, from epigeal and subterranean waters of adjacent regions and ecological conditions, the fauna of Amphipoda in Bosnia and Herzegovina is very rich, consisting of 55+ species and subspecies, 12 genera and 6 families. Among them, nearly 19 endemic taxa are present in this region: subterranean (*Hadzia drinensis* G. Kar. 1984, *Niphargus bosniacus* S. Kar. 1943, *N. cvijici* S. Kar. 1950, *N. factor* G. Kar. & Sket, 1990, *N. zavalanus* S. Kar. 1950, *N. dolichopus* Fiser et al., 2006, etc.) as well as epigeal taxa (*Gammarus bosniacus* Schäferna, 1922; *Echinogammarus acarinatus* (S. Kar. 1931), etc. Various species are endemic for western Dinarids (*Metohia carinata* Abs. 1927, *Typhlogammarus mrazeki* Schaf. 1906, *Accubogammarus algar* G. Kar. 1973, etc. Some marine elements settled the brackish waters near the sea (*Cryptorchestia garbinii* Ruffo et al., 2014, *Rhipidogammarus karamani* Stock, 1971, etc.). Strong relations between Amphipoda fauna of Bosnia and Herzegovina and other adjacent regions were observed.

Taxonomy and distribution of *Gammarus balcanicus*-group in the northern Carpathians

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Jażdżewski K, Mamos T, Grabowski M

Department of Invertebrate Zoology & Hydrobiology, University of Lodz, Lodz, Poland
michalg@biol.uni.lodz.pl

In taxonomic revisions by Karaman & Pinkster (1977a,b; 1987) all European freshwater *Gammarus* species were classified to three following morphogroups *G. balcanicus*-group, *G. pulex*-group and *G. roeselii*-group. According to these authors, the groups were based purely on superficial morphological resemblance and did not aim to reflect the within-genus phylogeny. Recent studies have revealed an enormous molecular diversity within *G. balcanicus*-group, pointing out that the morphospecies *G. balcanicus* itself consists in reality of at least several dozens of species. In consequence, there is a need for another taxonomic revision that may result in re-validation of some species formerly synonymised with *G. balcanicus* Schäferna 1922. In the present study we focused on the northern part of the Carpathian Arch. In result we can state that northern Carpathians are inhabited by at least three species of *G. balcanicus*-group that may be well defined both on molecular and morphological bases. One of the species is *G. leopoliensis* Jażdżewski & Konopacka 1989, attributed formerly to *G. pulex*-group. Two others were formerly recognised as morphological forms (A and B) of *G. balcanicus*. As a matter of fact, form "A" must be attributed to once

synonymised *G. tatrensis* S. Karaman 1931, while form “B” is another species, being described currently as new for science. The “real” *G. balcanicus* does not occur in the Carpathian Mountains and is, in fact, endemic to the Balkan Peninsula. Short phylogeographic history of the three Carpathian species, along with their diagnostic features as well as geographical and altitudinal distribution will be presented.

Distribution of the Ponto-Caspian amphipod species in freshwaters and coastal areas of Turkey

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Özbek M¹, Sezgin M²

¹Department of Hydrobiology, Faculty of Fisheries, Ege University, Bornova- Izmir, Turkey; ²Department of Hydrobiology, Faculty of Fisheries, Sinop University, Sinop, Turkey
ozbekm71@gmail.com

Turkey is one of the countries having long coastal strip to the Black Sea. The length of the coast between Bulgaria and Georgia is almost 1685 km on west-east direction. Black and Caspian seas had turned into lake several times and then back to sea again, during the times. Many invertebrate groups have been radiated in the Ponto-Caspian biogeographic region but endemism in crustaceans (especially amphipods) is higher than in most other groups. Consequently, an autochthonous faunistic complex has been evolved and amphipods have an important role in this unique area. Distributions of Ponto-Caspian Amphipods in Turkey have been reported in a few studies, up to date. In this study, we compiled the previous records of the Ponto-Caspian amphipod species from freshwaters and coastal areas of Turkey. To date, 13 Ponto-Caspian amphipod species were recorded from Turkey. Two of them only are the Ponto-Caspian relicts, namely *Cryptorchestia cavimana* and *Pontogammarus maeoticus* and have been reported also from coastal areas of Turkish Black Sea. Additionally, *Nannonyx propinquus* has been reported as a native species for Black Sea but it has not contemporary records and considered as a Mediterranean species which has penetrated to Black Sea several thousand years ago. In this study, general distribution patterns and likely routes of Ponto-Caspian amphipods were discussed.

Hidden biodiversity and patterns of genetic differentiation in the Mediterranean-Atlantic transition zone: *Dexamine spiniventris* (Costa, 1853) and *Caprella danilevskii* Czerniavskii, 1868 as case studies

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Cabezas MP¹, Santos AM^{1,2}, Branco M¹, Xavier R^{1,3}, Guerra-García JM⁴, Sezgin M⁵

¹CIBIO-InBIO Research Center in Biodiversity and Genetic Resources, Vairão, Portugal; ²Departamento de Biologia, Faculdade de Ciências da Universidade do Porto, Porto, Portugal; ³School of Biological Sciences, Cardiff University, Cardiff, UK; ⁴Dpto. de Zoología, Facultad de Biología, Universidad de Sevilla, Sevilla, Spain; ⁵Hydrobiology Department, Fisheries Faculty, Sinop University, Sinop, Turkey
pilarcabezas@cibio.up.pt

The transition zone between the Mediterranean and Atlantic (MATZ) constitutes one of the best documented biogeographical transitions in the marine environment. However, biases exist towards the analysis of highly dispersive species. Moreover, there is a higher sampling

effort in European coasts compared to North Africa. Amphipods constitute one of the dominant taxa in shallow-water marine ecosystems, and the MATZ is no exception. However, their complicate taxonomy together with the decrease of taxonomic experts, and also the increasing reports of cryptic species in this group, indicate that our knowledge about their diversity is still very incomplete. In the present study, we examined the intra and interspecific genetic diversity, by sequencing mitochondrial and nuclear genes, in the species *Dexamine spiniventris* (Costa, 1853) and *Caprella danilevskii* Czerniavskii, 1868, two marine amphipods distributed throughout the MATZ and adjacent regions. We investigated levels of cryptic divergence and the underlying processes by conducting morphological, phylogeographic and population analysis, to contribute to the knowledge of their distribution in this important region. For *D. spiniventris*, results suggest that it actually consists of a group of four cryptic but sympatric lineages. Three of them correspond roughly to varieties already described by Bellan-Santini et al. (1982), although no information is provided for their geographical distribution. On the other hand, for *C. danilevskii* no intraspecific morphological variation was observed. However, phylogeographical analysis revealed three well supported but previously unrecognized clades: one in the Iberian Atlantic plus the Alboran Sea, one in the island of El Hierro (Canary Islands), and another in the Atlantic coast of Morocco. The strong geographic structure and levels of genetic differentiation found, support that this species is a complex of three cryptic species. The predominant patterns of water circulation typical from this region, together with the existence of refugial areas and/or dispersal barriers could be the main factors shaping phylogeographic patterns, and promoting diversity and consequently speciation in these organisms.

Suprabenthic amphipods from the Capbreton area (SE Bay of Biscay): Faunal recovery after a canyon turbiditic disturbance

Frutos I¹, Sorbe JC²

¹University of Hamburg, Centre of Natural History (CeNak), Zoological Museum, Hamburg, Germany;

²Station Marine, Arcachon, France

inma.frutos@uni-hamburg.de

In the Capbreton area, suprabenthic assemblages were sampled with a multinet sledge towed over the bottom, at different sites located within the upper part of a 'gouf-type' canyon (8 hauls between 642 and 797 m, on the axis of the thalweg or on flat perched flank terraces such as site K), on the northern adjacent open slope (2 hauls between 500 and 567 m) and on the northern adjacent shelf margin (2 hauls between 151 and 158 m). From the whole suprabenthic material collected with the sledge (mainly peracarids), amphipods were represented by 11772 individuals, classified into 35 families and a minimum of 94 species, eight of them putatively new to science (genera *Eusirus*, *Idunella*, *Hippomedon*, *Melphidippa*, *Oediceroides*, *Stilipes*, *Gammaropsis*, *Leptamphopus*). A multivariate analysis carried out on abundance data discriminated different assemblages: a near-canyon shelf assemblage (23 species, mainly Oedicerotidae; 893 ind./100 m², 51% Oedicerotidae; dominant species: *Westwoodilla rectirostris* and *Scopelocheirus hopei*); an open slope assemblage (46 species, mainly Oedicerotidae; 91 ind./100 m², 30% Oedicerotidae; dominant species: *Arrhis mediterraneus* and *Tryphosites alleni*); a canyon E assemblage (61 species, mainly Oedicerotidae; 683 ind./100 m², 13% Melphidipiidae; dominant species: *Melphidippa* sp.B); a canyon E' assemblage (49 species, mainly Eusiridae; 375 ind./100 m², 35% Amathillopsidae;

dominant species: *Cleonardopsis carinata*, *Bonnierella abyssorum* and *Rhachotropis caeca*); and a temporary canyon assemblage at site K (18 species; 772 ind./100 m², 81% Uristidae; dominant species: *Tmetonyx similis*). Site K was sampled only four months after a canyon turbiditic event, triggered by the violent storm which affected the French Atlantic coast on 27 December 1999 (wind up to 200 km/h). The corresponding taxocenose showed evidence of deep structural changes, with the dominance of opportunistic pioneer colonizers such as the scavenger *Tmetonyx similis*. Partial recovery was noticed 18 months later (new site K sample included in canyon climax cluster).

Suprabenthic amphipods along an oligotrophic gradient in the bathyal Mediterranean Sea

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Almeida M¹, Company JB², Lampadariou N³, Cunha MR¹

¹Departamento de Biologia & CESAM, Universidade de Aveiro, Aveiro, Portugal; ²Institut de Ciències del Mar (ICM-CSIC), Barcelona, Spain; ³Hellenic Centre for Marine Research, Heraklion, Greece
mariana@ua.pt

The Mediterranean Sea is characterised by homeothermia and a gradient of increasing oligotrophy from West to East. These two factors have an effect in the quality and quantity of the organic matter reaching the seafloor and therefore in regulating community composition and diversity of deep-sea fauna. Large scale spatial patterns of the suprabenthic assemblages were investigated along a trans-Mediterranean transect in the framework of the project BIOFUN. The fauna was collected with a modified Macer-Giroq sledge, composed with three superimposed nets, at 1200, 2000 and 3000 m depth in three areas of the Mediterranean sea: the Balearic sea (W), central western Ionian (C) and south of Crete (E). Simultaneously, environmental data were collected on surface production, near-bottom physical parameters, sediment grain size and carbon content. The results confirmed the importance of amphipods both in terms of species richness and abundance in suprabenthic assemblages, ascribed to 12 families and 51 species (36 gammarideans and 15 hyperiids). An overall decrease in abundance from shallow- to deep-waters and from West to East was observed but the geographical and bathymetric trends in biodiversity and species turnover were more complex. The results are discussed in relation to the trophic gradient in the Mediterranean Sea.

Biodiversity patterns on Red Sea Amphipods associated with the Intertidal macroalgae

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Zeina AF, Abou Zaid MM

Laboratory of Marine Biology, Marine Biology and Ichthyology Section, Zoology Department, Faculty of Science, Al-Azhar University, Nasr City, Cairo, Egypt
afzeina@gmail.com

Red Sea is considered as one of the most important tropical areas in the world; however; the studies on its fauna still scarce. The aim of this study is to evaluate the status of the associated marine amphipods with the intertidal macroalgae in (Hurghada) Red Sea. Six

stations were studied during 2007-08 to collect most of marine macroalgae from intertidal zone. The collected samples were fixed in 10% formalin until sorting and identification of associated fauna. The results revealed 24 different species of marine macroalgae alternated during the sampling period; 10, 9 and 5 species of brown (Phaeophyceae), red (Rhodophyceae) and green (Chlorophyta) algae. The associated amphipods on the macroalgae fluctuated in density and diversity among the algal types seasonally between different study sites. Twelve amphipod species were found (10 gammarids and 2 caprellids). Gammarid species were belonging to different genera such as *Cymadusa*, *Cyproidea*, *Elasmopus*, *Lembos*, *Leucothoe* and *Quadrimaera* which are well-known from the Red Sea, also *Cerapus* and *Paragrubia* as a new record for the Red Sea Amphipod list. The present study reported 4 species which were not recorded before in the Red Sea, enlarging the number of amphipod in the Red Sea to 82 species.

Systematic study on the selected groups of marine amphipods from Korea

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Shin M-H

Marine Invertebrate II Team, National Marine Biodiversity Institute of Korea, Seocheon, South Korea
speciosusshin@gmail.com

For the systematic study of marine amphipods, three groups of amphipods, the sand-burrowing amphipods, the algae-living amphipods, and the amphipods associated with invertebrates, were selected based on their habitat types. In this study, the three selected groups of amphipods were examined with morphological taxonomic analyses. In addition, a molecular taxonomic study was conducted for the species of three selected groups using mitochondrial COI gene sequences in order to confirm the accuracy of morphological classification. As a result of the taxonomic study of sand-burrowing amphipods, 18 species of 6 genera belonging to four families Dogielinotidae, Haustoriidae, Phoxocephalidae, and Urothoidae were identified. As the algae-living amphipods, 24 species of two genera belonging to the family Ampithoidae were covered. And all species of the genus *Peramphithoe* were reviewed based on the descriptions and illustrations. Three amphipod species, *Melita anmyeonensis*, *Dactylopleustes* sp., and *Metopa groenlandica*, were detected to be associated with other invertebrate. A 658 bp sequence of COI was obtained from a total of 113 individuals of 27 Korean species (excluding a cryptic species of the genus *Urothoe*) belonging to 14 genera under 9 families. A cryptic species of the genus *Urothoe* was detected from the species *U. convexa*. Among the Korean amphipod species, "barcode gap" was observed for the range between 4% and 9%.

The World Amphipoda Database – updating the global species database

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Horton T¹, Lowry J², De Broyer C³, Bellan-Santini D⁴, Coleman CO⁵, Daneliya M⁶, Dauvin J-C⁷, Fiser C⁸, Grabowski M⁹, Gasca R¹⁰, Guerra-García J¹¹, Hendrycks E¹², Holsinger J¹³, Hughes L², Jażdżewski K⁹, Just J¹⁴, Kamaltynov RM¹⁵, Kim Y-H¹⁶, King R¹⁷, Krapp-Schickel T¹⁸, LeCroy S¹⁹, Vonk R²⁰, Senna AR²¹, Serejo C²², Sket B⁸, Thomas J²³, Thurston M¹, Vader W²⁴, Väinölä R²⁵, White K²⁶, Zeidler W¹⁷

¹National Oceanography Centre, Southampton, UK; ²Australian Museum, Sydney, Australia; ³Institut Royal des Sciences Naturelles de Belgique, Bruxelles, Belgium; ⁴IMBE, Université d'Aix-Marseille, Marseille, France; ⁵Museums fuer Naturkunde, Berlin, Germany; ⁶University of Helsinki, Helsinki, Finland; ⁷Université de Caen Basse-Normandie, UMR M2C CNRS, Caen, France; ⁸Univerza v Ljubljani, Ljubljana, Slovenia; ⁹University of Lodz, Lodz, Poland; ¹⁰El Colegio de la Frontera Sur in Chetumal, Quintana Roo, Mexico; ¹¹Laboratorio de Biología Marina, Universidad de Sevilla, Sevilla, Spain; ¹²Canadian Museum of Nature, Ottawa, Canada; ¹³Department of Biological Sciences Old Dominion University, Norfolk, USA; ¹⁴Natural History Museum of Denmark, Copenhagen, Denmark; ¹⁵Limnological Institute of the Siberian Branch of the Russian Academy of Sciences, Irkutsk, Russia; ¹⁶Dankook University, Cheonan, Korea; ¹⁷South Australian Museum, Adelaide, Australia; ¹⁸Zoologisches Forschungsinstitut und Museum Alexander Koenig, Bonn, Germany; ¹⁹University of Southern Mississippi, Mississippi, USA; ²⁰Naturalis Biodiversity Center, Leiden, The Netherlands; ²¹Centro Universitário de Volta Redonda (UNIFOA), Rio de Janeiro, Brasil; ²²Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brasil; ²³Nova Oceanographic Center, Florida, USA; ²⁴University of Tromso, Tromso, Norway; ²⁵Finnish Museum of Natural History, Helsinki, Finland; ²⁶University of Tampa, Tampa FL, USA

tammy.horton@noc.ac.uk

In this presentation I will cover the process of updating and managing the World Amphipoda Database (WAD), a Global Species Database launched in 2013 and hosted by the World Register of Marine Species. I will present the current statistics of additions of new taxa, original descriptions and identification resources, and outline the challenges faced and explain how users can help. Thirty-one amphipod experts are currently on the editorial team helping to update and improve the information held in the database. The ultimate aim is to equip end-users with the tools and information to apply the correct name and classification to their taxon but also to provide a source of information for the identification of amphipod species. Information from the World Amphipoda Database feeds into the World Register of Marine Species (WoRMS), which, as the most comprehensive primary source of quality-assured information on marine species, is the international standard in its field. Beneficiaries of the information – which is often accessed through other databases that are fed by WoRMS – include scientists, consultants, conservationists, journalists, the general public, and many others.

World Amphipoda Database: <http://www.marinespecies.org/amphipoda>

From European Groundwater Crustacean Dataset to public database

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Fišer C¹, Eme D², Galassi D³, Stoch F³, Marmornier P², Zagmajster M¹, Malard F²

¹Department of Biology, Biotechnical Faculty, University of Ljubljana, Ljubljana, Slovenia; ²UMR5023 Ecologie des Hydrosystèmes Naturels et Anthropisés, Université Lyon 1, ENTPE, CNRS, Université de Lyon, Lyon, France; ³Department of Life Health and Environmental Sciences, University of L'Aquila, L'Aquila, Italy

cene.fiser@bf.uni-lj.si

In 1986, Lazare Botosaneanu edited *Stygofauna Mundi*. This impressive book contained a global checklist of all groundwater species on earth and documented their distribution at a

regional scale. In the past 30 years, many changes happened, leaving aside new records of already known species and newly described species. Biodiversity research has been revolutionized by increasing computer power, development of geographic information systems and fast development of statistical methods. Datasets that had been used in traditional biodiversity research have become outdated and inaccurate. In order to address new challenges, a consortium of researchers from the universities of Ljubljana (Slovenia), Lyon (France) and L'Aquila (Italy) compiled a dataset of species occurrence for groundwater crustaceans at European scale. The dataset includes over 21,000 georeferenced records for 1570 crustacean species, making possible ecological analyses at different scales. So far, this dataset grounded two macroecological studies on a continental scale, which showed that i) species range size increases and beta-diversity decreases with latitude, ii) species richness in Europe peaks at mid-latitudes, iii) increase in range size can be explained by long-term climatic variability while iv) species richness pattern is affected by spatially different joint effects of spatial heterogeneity, productive energy and historical climate stability. Currently, the dataset is being updated, revised and transformed into a relational database that may be compatible with existing databases, i.e. Fauna Europaea. The consortium schedules the release of the database in 2016, in honour of the 30th anniversary of *Stygofauna Mundi*. This publicly available database may be upgraded by inclusion of other taxa or geographic regions. We hope it will foster further studies and strengthen international collaboration for the exploration of European groundwater fauna and its conservation.

A BOLD approach to amphipodology

Radulovici AE, Ratnasingham S

Biodiversity Institute of Ontario, University of Guelph, Guelph, Canada
aradulov@uoguelph.ca

Species identification is of paramount importance for biodiversity studies and has practical applications in food traceability, pest control, stock assessment of commercial species and conservation planning. While traditional methods for species diagnosis based on morphological characters require extensive training and are time-consuming, new approaches based on molecular characters have become very popular in the last decade. One such new approach, DNA barcoding, is using COI sequences (in animals) to assign unknown specimens to known species. This method requires the existence of reference libraries for various taxa, which consist of COI sequences from specimens identified by experts based on traditional approaches. Data generated through DNA barcoding are hosted in the Barcode of Life Data Systems (BOLD; www.barcodinglife.org), a workbench used by researchers to store, analyze and publish their data. Specimen data (taxonomy, images, geography, habitat etc.) and molecular data are linked in a dynamic environment, which allows constant updates of the existing information. In April 2015, BOLD was hosting ~80,000 crustacean sequences, including ~17,000 amphipod sequences representing 1150 species plus a large amount of unidentified amphipods. The results reflect the inherent difficulties in barcoding crustaceans, in particular amphipods, compared to other invertebrates (e.g., 3 out of 4 million sequences in BOLD belong to insects), as well as scarce taxonomic resources. Here we discuss the value of using the Barcode Index Number (BIN) system for a DNA-based registry of global amphipods. By clustering COI sequences into putative species, this system provides a fast and accurate tool for documenting

biodiversity. For instance, the amphipod barcodes are clustered into ~2,300 BINs, requiring a rapid initial investigation of morphological characters for ~2,300 specimens as opposed to 17,000 processed. By screening large amounts of data and highlighting those cases that need detailed investigation, BINs may become an essential part of every amphipodologist's toolkit.

Anthropogenic disturbance and global change

Aspects of benthic Environmental Status (ES) of Hellenic Seas (Eastern Mediterranean Sea)

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Plaiti W¹, Naletaki M², Simboura N²

¹Institute of Marine Biology Biotechnology & Aquaculture (IMBBC), Hellenic Centre for Marine Research, Gurnes PEDIADOS, Heraklion, Crete, Greece; ²Institute of Oceanography, Hellenic Centre for Marine Research, Mavro Lithari, Anavissos, Attika, Greece
wanda@hcmr.gr

The composition and structure of amphipod communities were investigated, as part of the evaluation of the ecological status of the Hellenic Seas for the purposes of the Water Framework Directive (WFD), in an attempt to evaluate the condition of the benthic amphipod fauna under the Marine Strategy Framework Directive (MSFD). Quantitative samples from 30 operational stations were collected using a Smith-McIntyre grab during March - April in the years 2012, 2013 and 2014. Among the benthic fauna, Crustacea was third in decreasing order, after Polychaeta and Mollusks, in terms of species richness and abundance. Within Crustacea, amphipods were dominant. A total of 78 species of amphipods were identified. The amphipods community structure was investigated in relation to environmental parameters indicative of the environmental objectives under the framework of the MSFD. The use of sensitive and tolerant amphipod species for the assessment of the Good Environmental Status (GENS) on the Mediterranean sea environment is discussed.

Effects on growth and fatty acid composition of *Monoporeia affinis* from a climate induced food change

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Wiklund A-KE¹, Andersson A²

¹Stockholm University 1, Stockholm, Sweden; ²Umeå University 2, Umeå, Sweden
Ann-Kristin.Eriksson-Wiklund@aces.su.se

We tested how variation in temperature and alteration of the pelagic food web structure affected the productivity and fatty acid composition of a key benthic species, the amphipod *Monoporeia affinis*. This amphipod is a semelparous, stenothermal cold water species that has a life span of 2-3 years in general. In the experiment we used water from the northern Baltic Sea, a mesocosm experiment was performed in which the temperature was altered by 5°C. The structure of the pelagic food web changed from one based on algae to one based on bacteria. The amphipods grew more in the algae based web leading to that amphipod productivity was 3 times higher and FWE was 25 times higher, showing that an altered pelagic food web will have severe effects on benthic productivity. Temperature variation, on the other hand, did not cause any changes in either growth of *M. affinis*. The two food webs and temperature also altered the amphipod response in terms of amount and composition of fatty acids. We found interactions between and fatty acid class and food web but not with temperature. Our data indicate that indirect effects of climate change, leading to structural

changes in the pelagic food web, will have much more severe effects on productivity of the Baltic Sea foundation species *M. affinis* than the direct effect of increased temperature.

Response of Amphipoda assemblages to brine discharge: impact and recovery

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de-la-Ossa-Carretero JA, Del-Pilar-Ruso Y, Loya-Fernández A, Ferrero-Vicente LM, Marco-Méndez C, Martínez-García E, Sánchez-Lizaso JL

Department of Marine Sciences and Applied Biology, University of Alicante, Alicante, Spain
ja.ossa@ua.es

Desalination has become an important and growing industry, whose main impact on marine communities is an effluent of very high salinity. Without proper dilution, effluent from desalination plants remains on the bottom affecting marine benthic communities. Order Amphipoda is considered a sensitive group to pollution but its response to brine discharge has been scarcely studied. This study analysed response of Amphipoda to the impact produced by a brine discharge and its recovery succession when impact is reduced. Amphipoda showed a high sensitivity to increase of salinity produced by this discharge. A decrease in abundance, diversity and indeed disappearance of amphipods was detected at the station closest to the outfall where salinity values reached 53 psu. This increase of salinity was reduced with the inclusion of a diffuser at the end of the pipeline. Six months after implementation of diffuser an increase of amphipod abundance was detected. During the first stage of this recovery, we found species that recovered their abundance, as *Photis longipes* while others as *Microdeutopus versiculatus* deployed certain opportunistic pattern, increasing its abundance just after implementation of diffuser and decreasing during the last period. Other species needed more time for recovery, as *Harpinia pectinata*. These differences in recovery rates could be dependent on the organism's living habits, since domicolous and detritivorous species could have certain advantage to tolerate and recolonize stations affected by brine discharge.

Origin, genetic diversity and secondary introduction patterns of the killer shrimp, *Dikerogammarus villosus*, invading Alpine Lakes

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Rewicz T¹, Wattier R², Grabowski M¹, Rigaud T², Mamos T¹, Bącela-Spychalska K¹

¹University of Lodz, Department of Invertebrate Zoology and Hydrobiology, Łódź, Poland; ²Université de Bourgogne, Equipe Ecologie Evolutive, UMR CNRS 6282 Biogéosciences, Dijon, France
tomek.rewicz@gmail.com

The alien freshwater amphipod *Dikerogammarus villosus*, also known as the killer shrimp, has colonized most of the European main inland water bodies, and is recognized as a major conservation problem. Wide scale survey of Alpine Lakes in 2011 revealed presence of this invader in 12 lakes. Our aims were to reveal: 1) What is the source of the introductions to Alpine Lakes? 2) Were the introductions multiple or single events; 3) Is there a reduction of genetic diversity in these populations? 4) Are there any secondary introductions between the

lakes? Twelve populations were genotyped for mtDNA (COI and 16S) and seven nuclear microsatellites to reveal population structure of *D. villosus*. A wide range of methods was used, including minimum spanning network, Bayesian clustering and demography tests. Our results showed that the Danube-Rhine route is the source from which *D. villosus* entered the Alpine Lakes, occasionally suffering from bottleneck effect. These lacustrine populations have significantly lower genetic diversity compared to the source. Overland transport of the killer shrimp with touristic boats was already pointed out as a major spreading vector to the Alpine Lakes. We observe signs of secondary introductions between lakes, what may be related to boat traffic. Thus implementing of 'check, clean, and dry' procedures may stop or slow down spreading of *Dikerogammarus villosus* in Alpine Lakes.

Ecology

Kuril-Kamchatka deep sea revisited – abyssal amphipods assemblages

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Jażdżewska AM

Laboratory of Polar Biology and Oceanobiology, University of Lodz, Lodz, Poland
ajazdz@biol.uni.lodz.pl

Areas deeper than 4000 m constitute 41% of the Earth surface, making this habitat the biggest ecosystem of the World. However, the knowledge of the diversity of deep-sea communities still remains poorly known. The aim of the study was to characterize North-West Pacific abyssal amphipod assemblages. The series of 21 samples were collected using epibenthic sledge equipped with camera (C-EBS) at the depths from 4830 to 5780 m in the Kuril-Kamchatka abyssal plain. The amphipods were identified to the lowest possible taxonomic level – mainly morphospecies. On this basis the diversity indices were calculated and also the multivariate analysis was conducted. Amphipoda reached almost 6% of abundance among all non-colonial invertebrates collected. They were assigned to more than 60 morphospecies and 21 families. As many as 28 species appeared to be new to science. The amphipod material was dominated by the representatives of the families: Phoxocephalidae, Oedicerotidae, Eusiridae and Synopiidae. The same families together with the family Pardaliscidae were also the most speciose. The cluster analysis clearly separated two stations situated on the western side of the Kuril-Kamchatka Trench. The rest of the stations situated on the abyssal plain on the eastern side of the trench did not show clear pattern of distribution.

Spatial distribution of Ampeliscidae (Crustacea: Amphipoda) on sediments in the northern central Peruvian continental shelf

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Jiménez A^{1,2}, Marquina R², Quipúzcoa L², Paredes C¹, Gutiérrez D²

¹Laboratorio de Biología y Sistemática de Invertebrados Marinos, Universidad Nacional Mayor de San Marcos, Lima, Perú; ²Instituto del Mar del Perú, Esq. Gamarra y Gral. Valle. Chucuito, Callao, Perú
analijim@gmail.com

Ampeliscidae is one of the most diverse families of amphipods which are restricted in certain bottom substrates and bathymetric ranges off Peruvian coast. This study is based on 138 soft bottom samples, which were taken during autumn seasons between 2004 and 2010, at 22 to 372m depth, along the northern central Peruvian continental shelf (3°24' - 9°00' S and 79°30' - 81°30' W). This area is affected by variations of the upper boundary of the Oxygen Minimum Zone (OMZ, $O_2 < 0.5 \text{ ml}\cdot\text{l}^{-1}$), which generates seafloor habitats with permanent hypoxia ($O_2 < 0.2 \text{ ml}\cdot\text{l}^{-1}$). A total of 11 species were identified which belong to *Ampelisca* (10 spp.) and *Byblis* (1 spp.) genus. Bottom-water oxygen concentration tended to increase from south to north latitude of study area; however the organic-matter content on sediment (chlorophyll-*a*) decreased. Describing the distribution of ampeliscids, in low latitude species richness was higher, where the most dominant species were *Ampelisca mexicana* and *Ampelisca araucana*. Between these species, the first were positively correlated with

oxygenated areas, located between 3° to 6°S latitude; however, *A. araucana* was the most tolerant of hypoxic and organic rich conditions within the Peru OMZ, after 6°S. Therefore, spatial distribution suggests that richness and density of amphipods may be related to levels of oxygenation and biogeochemistry variables.

Distribution and ecological significance of amphipods in the eastern Gulf of Finland

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Berezina NA, Maximov AA

Zoological Institute 1, St Petersburg, Russia
Nadezhda.berezina@zin.ru

By the mid-20th century bottom fauna of the eastern Gulf of Finland (Baltic Sea) was little studied and first data are known from S. Segestråle, I. Nikolaev, A. Shurin (1950-70). Over the last decade, we have studied in details the macroinvertebrate community of coastal and deep-water parts of the Russian Gulf of Finland at above 30 sites. Macrozoobenthos was diverse consisting of Hydrozoa, Turbellaria, Aphanoneura, Clitellata (Oligochaeta and Hirudinea), Nemertina, Mollusca, Maxillopoda, Malacostraca (Mysida, Isopoda, Amphipoda, Decapoda) and Insecta. This study presents results on distribution, abundance and significance in trophic chains of amphipods in the eastern Gulf of Finland. The list of confirmed species includes 10 native and 4 alien species. In the Gulf of Finland contribution of amphipod to the total biomass averages 40 % (maximally up to 80 %) in the coastal and only 1-2 % in deep waters. The amphipod biomass was estimated as $5.73 \pm 1.1 \text{ g} \cdot \text{m}^{-2}$ (2014, coastal areas). It was significantly varied between species and sites. The former dominants such as native *Monoporeia affinis* and *Pontoporeia femorata* are scarce species in the gulf due to bottom hypoxia. The important role in food chains of newly established *Gmelinoides fasciatus*, *Gammarus tigrinus*, *Pontogammarus robustoides* were confirmed by the analysis of stable isotopes of carbon and nitrogen in the organism tissue. They classified as omnivores (consumers of second and third orders). The food habits differed considerably between juvenile and adult amphipods, turning during ontogenesis from typically detritivores and plantivorous (trophic level (TL) 2-2.4) to omnivore (TL 2.5-3) with varying percentage of plant and animal food in a diet or carnivore (TL >3) preying upon other invertebrates (chironomids, crustaceans, oligochaetes). The predation impact of adult amphipods on invertebrates (consumption rate of predator/prey production <0.5) was assessed as low being determined high production and abundance of r-strategic species in studied habitats.

The pattern of Ampithoidae (Crustacea: Amphipoda) distribution along the intertidal area of Qeshm Island

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Layeghi Y¹, Momtazi F²

¹Department of Zoology, Faculty of Science, Kharazmi University, Tehran, Iran; ²Iranian National Institute for Oceanography and Atmospheric Science, Tehran, Iran
ylayeghi@gmail.com

The knowledge of the amphipods' distributional pattern in tidal zone is limited. In the present study the vertical pattern of family Ampithoidae distribution was studied in the southern coast of Qeshm Island. The material was collected by quantitative method from high, mid and low tide parts during April 2014. The specimens belong to genera *Ampithoe* and *Cymadusa*. The results of present study show that the highest frequency of family Ampithoidae was recorded in the low tide zone, while the least population was seen in the mid tide zone. The results for genera separately demonstrated that there was ascending trend in *Cymadusa* frequency along the tidal zone; however, there are no similar findings for *Ampithoe*. The least population of *Ampithoe* was seen in the mid zone, and the high tide zone is about as populated as the low tide zone. This study continues to examine whether the time (seasonal changing) affects the found pattern.

Exploring patterns of amphipod distribution in *Posidonia oceanica* through the metacommunity approach: a proposed framework

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Camisa F¹, Bellisario B¹, Lattanzi L², Cimmaruta R¹

¹Department of Ecological and Biological Sciences, Tuscia University, Viterbo, Italy; ²Institute for Environmental Protection and Research (ISPRA), Rome, Italy
federica.camisa@unitus.it

In the Mediterranean, meadows of the endemic seagrass *Posidonia oceanica* represent a key ecosystem supporting local marine biodiversity. Here, the amphipods are one of the most abundant and important groups, playing a relevant role as components of food webs. While many studies have analyzed the influence of biotic (e.g. specific attributes of the seagrass and organisms) and abiotic (e.g. substrates, hydrodynamic conditions) factors on amphipod assemblages, patterns and mechanisms of species distribution within their environment have not been adequately addressed. To this end, the metacommunity approach can represent a useful tool in disentangling the complex mechanisms that determine ecological communities composition, in order to detect if species distribution is the results of local (niche-based) or regional (dispersal-based) mechanisms leading to species substitution in each assemblage. In this work, amphipod assemblages from Central Tyrrhenian Sea have been sampled at different spatial and temporal scales and compared by means of the metacommunity framework to evaluate the spatial extent over which metacommunity patterns emerge. Although this study is limited to a small spatial scale, comparing localities in the range of tens of meters vs. kilometers vs. tens of kilometers, it was able to detect a shift in the distribution patterns of amphipods at increasing distances. The results show how the assemblages are mainly driven by niche processes when distances are in the order of meters/kilometers, while increasing the spatial extent to tens of kilometers enhances the role of species turnover. This study suggests that the metacommunity approach is of help in highlighting the geographic

extent at which regional processes surpass local ones in shaping biodiversity patterns, thus having significant implications for the management and conservation of seagrass systems.

Characterization of the community of benthic amphipods associated with different habitats generated by *Rhizophora mangle* in Puerto Pizarro, Tumbes, Peru

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Llaja LI¹, Paredes CE¹, Jiménez A^{1,2}

¹Laboratory of Biology and Systematics of Marine Invertebrates, Universidad Nacional Mayor de San Marcos, Lima, Perú; ²Instituto del Mar del Perú, Esq. Gamarra y Gral. Valle. Chucuito, Callao, Perú
leslylls.bio@gmail.com

Mangroves are an important ecosystem that is home to species associated with their roots which act as stabilizers substrate and represent a considerable input of organic matter that is decomposed by amphipods as part of the nutrient cycle; these in turn serve as food for fish and crustaceans. The mangrove area in Peru is restricted to the north, in the department of Tumbes, a place of tourist influx. No work on benthic amphipods are recorded in this part of the mangrove therefore the need for this study to characterize the benthic community of amphipods associated with the roots of *Rhizophora mangle* "red mangrove" as the representative species. Benthic amphipods associated to the buried rootlets (RS) and exposed roots (RM) were sampled in November 2011 at low tide and in the dry season in ten stations exposed roots (RM). A total of 100 roots of 25x3cm and 50 samples of rootlets buried were collected, recorded a total of 5 species, distributed in 5 families Aoridae, Corophiidae, Hyalidae, Maeridae, and Talitridae. The most abundant species were *Monocorophium insidiosum* (1890 specimens) and *Parhyale hawaiiensis* (2807 specimens). Both species were found mainly in RM. At the RS the registered families were Maeridae and Aoridae where species with the highest frequency of occurrence was *Grandidierella* sp. From the above, it should be noted that *Monocorophium insidiosum* is a filtering species and feeds on organic matter in the mud, and *R. mangle* provides microhabitats hosting epibenthic and infaunal amphipods allowing bioperturbar the sediment to oxygenate.

Conquerors or exiles? Impact of interference competition among invasive gammarideans on their dispersal rates

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Kobak J¹, Rachalewski M², Bączela-Spychalska K²

¹Department of Invertebrate Zoology, Nicolaus Copernicus University, Toruń, Poland; ²Department of Invertebrate Zoology and Hydrobiology, University of Łódź, Łódź, Poland
jkob73@umk.pl

Several Ponto-Caspian gammarids have successfully invaded European waters, affecting local communities by predation and competition. Their ranges, dispersal rates and introduction times vary across Europe, which may result from their interspecific interactions, accelerating or reducing migrations from communities of different compositions. We checked this hypothesis in laboratory by testing interference competition among three commonly co-occurring invaders: *Dikerogammarus villosus*, *D. haemobaphes* and *Pontogammarus*

robustoides. We conducted experiments in 140-cm long tanks with gravel substratum, divided into seven compartments. We introduced 25 “residents” into the outermost compartment, separated with a barrier. After 1 h, we introduced 25 “intruders”. After the next 1 h, we removed the barrier and the gammarids dispersed in the tank for 4 or 20 h. Finally, we counted the gammarids in the compartments. We tested all pairwise species combinations (N=10) and single species controls (the same species as a resident and intruder). Thus, we could compare gammarid dispersal in the presence of heterospecific residents or intruders with that exhibited in single species situations. Both *Dikerogammarus* species migrated less than *P. robustoides*. *D. villosus* displaced both congeners and reduced its own motility in their presence. *P. robustoides* stimulated migrations of *D. haemobaphes*. The presence of *D. haemobaphes* stimulated the short-time movement of *P. robustoides* but reduced its long-time relocation. In general, the presence of stronger competitors tended to increase gammarid dispersal, whereas the occurrence of weaker congeners reduced the mobility of gammarids, perhaps putting more effort into defending their local shelters. Our results show that competitive interactions, rather than invasive potential, may affect dispersal rates of invasive gammarids and account for the fact that the weakest competitor, *D. haemobaphes* usually appeared first, whereas the strongest species, *D. villosus* was the latest newcomer in many novel areas.

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Dispersal of fouling caprellids around floating aquaculture facilities in the Mediterranean Sea

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Fernandez-Gonzalez V, Sanchez-Jerez P

University of Alicante, Department of Marine Sciences and Applied Biology, Alicante, Spain
victoria.fernandez@ua.es

The absence of a larval stage in amphipods limits dispersal in comparison with taxa with planktonic larvae. However, amphipods have adapted to other means of dispersal, enabling them to increase their habitat colonisation capabilities, being able to reach structures located at off-coast waters. In fact, fish farms are known to support high numbers of amphipods, especially caprellids, associated with the fouling communities. Unfortunately, the factors affecting the colonisation of new habitats by caprellids have not been studied adequately for open waters. In this study, we investigated the effects of distance, current and food availability in the successful colonisation of artificial pelagic structures such as fish farms by caprellids. The experiment was performed utilizing artificial collectors in the form of mesh bags containing lifeless habitat and/or fish pellets. Collectors were placed near (10 m) and far (> 500 m) from the fish farm, up and down to mainstream. Fifteen days later, collectors were covered with plastic bags and retrieved. Three species of caprellids were identified in the artificial collectors: *Caprella dilatata*, *Caprella equilibra* and *Phthysica marina*. Collectors located close to the fish farm were successfully colonised after 15 days regardless the main current. However, caprellids preferably colonised the collectors containing fish pellets when they were located against the main current. Recruitment into far collectors was limited to those placed downstream. Caprellids showed a high dispersion capacity, influenced probably by passive processes (hydrodynamism) and active habitat selection (chemical cues) allowing them to colonise new structures, acting fish farms as source points. The spillover detected in

this study, may contribute to the assemblage homogeneity observed among fish farms and the increase of trophic resources for pelagic predators (i.e. fish).

Preferences of the invasive killer shrimp *Dikerogammarus villosus* for substrata of different grain size, macrophytes and zebra mussels

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Dzierżyńska-Białończyk A, Jermacz ŁM; Kobak JD

Nicolaus Copernicus University, Faculty of Biology and Environmental Protection, Department of Invertebrate Zoology, Toruń, Poland
ann.dzierzynska@wp.pl

Dikerogammarus villosus is one of the most successful freshwater amphipod invaders. It has spread from its native Ponto-Caspian range to many areas in Europe, strongly affecting local communities by predation and competition. We studied its habitat preferences in 24-h pairwise-choice experiments. We tested its affinity for stony substrata of various granulation (2-124 mm), natural and artificial macrophytes (*Myriophyllum spicatum*, *Ceratophyllum demersum*, *Potamogeton perfoliatus*, *Potamogeton nodosus*, *Stuckenia pectinata*) of different structural complexity (expressed as fractal dimension) and zebra mussels. We hypothesized that: (i) gammarids would select substrata offering maximum protection (particles matching their size, more complex plants); (ii) mussels would be the preferred substratum except in high densities, deteriorating water quality and (iii) large gammarids would displace smaller conspecifics to worse substratum. We showed that large (>9 mm) and small (<7 mm) gammarids preferred relatively large stones (≥6 cm) over smaller particles and all types of plants. These dimensions considerably exceeded gammarid sizes, but they could find suitable sites in the angles between neighbouring particles, whereas large spaces among them allowed convenient and fast relocations. Among different types of plants, small gammarids selected complex shapes, whereas large individuals also preferred less complex forms with wide leaves. Compared to large individuals, small gammarids exhibited higher affinity for natural macrophytes over their artificial models, probably using their substratum also as a food source (periphyton overgrowing plant surfaces). Surprisingly, gammarids either did not discriminate between mussel and stone habitats or even avoided dense mussel colonies, probably due to the oxygen depletion caused by bivalves. Thus, gammarids seem to select mussel colonies in the field only when alternative hard substrata are missing. Small individuals switched to the less preferred habitat in the presence of adults, probably avoiding cannibalism and competition. This behaviour explains spatial segregation of gammarid size classes, often observed in the field.

Substrate selection of intertidal caprellids of Southern Spain

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Martínez-Laiz G, Ros M, Navarro-Barranco C, Guerra-García JM

Laboratorio de Biología Marina, Departamento de Zoología, Facultad de Biología, Universidad de Sevilla, Sevilla, Spain
gemmlbio@gmail.com

Habitat selection is a complex process due to the diversity of space and variability of environment conditions, and it is one of the main factors allowing coexistence of species.

Seaweeds are important refuges for mobile epifauna, providing food and protection. In this study, substrate selection experiments were conducted to assess host specificity of two species of caprellids, *Caprella grandimana* and *Caprella takeuchii*, towards two species of macroalgae, *Jania rubens* (dominant during autumn-winter) and *Corallina elongata* (dominant in spring-summer). Amphipods used for the experiments were collected separately from each of those macroalgae in the rocky intertidal in Tarifa Island (Strait of Gibraltar). Specimens of *C. grandimana* were collected during August 2013 and those of *C. takeuchii* were taken during April 2014. The experimental design consisted of four different treatments, two of multiple choice (presented both microhabitats) and two of no choice (presented only one microhabitat). In October *Jania rubens* showed a clear dominance in the intertidal and significantly higher density of caprellids than *C. elongata* in natural conditions. When substrate selection experiments were conducted in the laboratory, *C. grandimana* exhibited a preference for *J. rubens* and there was no effect of the original substrate in this behaviour. Probably, the higher complexity of *J. rubens* compared to *C. elongata* allows greater protection against erosion and refuge against predators. In April, it was *C. elongata* that showed dominance and higher density of caprellids in the field. When the experiments were performed, *C. takeuchii* appeared to be more generalist, as it did not exhibit any preference for any of the macroalgae species. These different strategies may reduce competition between the two species when seasonal fluctuations in the abundance of macroalgae take place. Understanding associations between intertidal epifauna and substrate is important for habitat conservation and serves as a predictive tool for future dispersal of invasive species.

Activity patterns of macrofauna on pocket, macrotidal beaches: a field experiment

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Fanini L^{1,2}, Hughes LE¹, Springthorpe R¹, Tosetto L³, Lowry JK¹

¹Australian Museum Research Institute, Sydney, Australia; ²IMBBC-HCMR, Crete, Greece; ³Macquarie University, Sydney, Australia.

lucia@hcmr.gr

Mobile resident macrofauna on sandy beaches is adapted to consistently move across the littoral in relation to periodical flows of energy and material. We focused this study on surface activity of mobile macrofauna across macrotidal beaches in Pittwater (NSW, Australia). We considered two pocket beaches, both characterised by low exposure but different in human use: Tennis Beach on Scotland Island features artificial structures, is easily accessible and heavily used, while Portuguese Beach, in the Ku-Ring-Gai Chase National Park is only accessible by boat. At each site we placed pitfall traps along two transects across the littoral zone. As a continuous 24-hours study, we emptied the traps every three hours. Replicates for each site were carried out at opposite tidal period, within one month. In both cases the beach-hopper *Platorchestia smithi* was dominant in abundance, although different sex and juvenile ratios recorded between beaches suggested different stress on the sites. We also collected a higher number of species at Portuguese, including the burrowing isopod *Actaeocia bipileura*. We then calculated circular summaries and behavioural models of the activity of dominant species around the 24 hours. Summaries indicated 1) no activity pattern for *A. bipileura* and 2) different activity peaks for age groups in *P. smithi*, with adults active at night and juveniles active in the morning. Behavioural models also highlighted differences in ecological factors affecting the activity of the different groups: while substrate temperature

was significant in all models, wrack presence and tide were only significant for juveniles of *P. smithi*, and for *A. bipleur*a. These results provide information regarding the different vulnerability of resident community and population components from macrotidal beaches and indicate wrack as a relevant feature to the maintenance of critical components (talitrid juveniles and isopods in this case) of beach populations.

An ampeliscid amphipod hotspot provides a Canadian Arctic destination for the Pacific gray whale (*Eschrichtius robustus*)

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Conlan K, Hendrycks E

Canadian Museum of Nature, Ottawa, Canada
kconlan@mus-nature.ca

A dense ampeliscid amphipod bed comprising eight species of *Ampelisca*, *Byblis* and *Haploops* has been recently discovered in the Canadian western Arctic. It is estimated to cover 2545 km² and it has been found to be visited by Pacific gray whales (*Eschrichtius robustus*) which summer in the neighbouring American Arctic. Given that reduced sea ice may give gray whales longer access to the Arctic in summer, this bed may become an increasingly important feeding destination provided that it is sustainable. The characteristics of this bed will be compared with other known beds and mechanisms that are thought to enable these ampeliscids to exist in such high numbers will be presented.

Stenothoidae associated with hydroids – does association with other taxa trigger extended parental care?

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Tandberg AHS¹, Vader W²

University museum of Bergen, Natural History Collections, Bergen, Norway; ²University museum of Tromsø, Tromsø, Norway.
anne.helene.tandberg@um.uib.no

Amphipods are seldom observed in situ to such an extent that it is possible to say anything about their life-histories. Two scuba-performed collections in NW Canada and in S Norway have given photographic and physically sampled material providing insights on amphipods associated with hydroids. The material contains three different species of Stenothoidae, in addition to *Caprella*, Ischyroceridae, Melitidae and Pontogeneiids. All the Stenothoid species seem to perform extended parental care. The juveniles are found on the tentacles of the hydroid, whereas the parents sit either on the stem, or in the centre of the crown, presumably defending the offspring. The number of juveniles within one size-cohort observed with one adult on a hydroid range between six and 71. We will discuss the Stenothoid species associated with the examined hydroids, the modes of potential extended parental care within these taxa seem to perform, and compare with other known Stenothoid parental care.

Tea for Two: The dietary preference of *Gammarus pulex* and *Asellus aquaticus* during laboratory studies

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Bloor MC

School of Earth and Environmental Science, University of Portsmouth, Portsmouth, UK
michelle.bloor@port.ac.uk

What is the food preference of *Gammarus pulex* and *Asellus aquaticus*? For many years scientists have undertaken toxicological research using these two species of detritivore because one is sensitive (*G. pulex*) and the other tolerant (*A. aquaticus*), which allows pollution boundaries to be identified. However, one factor that remains uncertain in these studies is what nutrition (if any) the macro-invertebrates are given during laboratory breeding programmes and bioassays. Over the years, scientists have used a variety of nutritional supplements to feed macro-invertebrates during research studies, including dog food, baby food and fish food. If the macro-invertebrates are being bred for ecotoxicological studies (or as test subjects within bioassays) they need to be representative of wild specimens for any findings to be comparable to the natural environment. It is well documented that a test organism's response can be affected by such things as their past history, diet, life stage and disease, therefore, feeding macro-invertebrates with an unnatural diet, which may not contain the appropriate nutritional requirements, could result in the organisms displaying a false negative/ positive response during a test. The majority of published research has been undertaken with organisms that are fed on detritus (with some studies fasting organisms during the actual bioassays). The food quality of detritus has been defined in terms of chemical (e.g. nitrogen and lignin), physical (e.g. resistance) and biological (e.g. microbial biomass) parameters. High quality food has a low C:N ratio, low lignin content, low resistance and high microbial biomass, therefore, alder (*Alnus glutinosa*) would be described as a high quality food. However, there is still no consensus on the pre-treatment of leaf material to produce simulated detritus for use in laboratory studies. In light of this, an investigation was undertaken to establish if *G. pulex* and *A. aquaticus* preferred a diet of unconditioned, artificially conditioned or naturally conditioned alder leaves (*Alnus glutinosa*). Standardised, 24 hour *ex-situ* feeding assays were undertaken with 300 representatives of both species to determine their food preference. The results showed that *A. aquaticus* ate more leaf material compared to *G. pulex* ($Z = 23.909$, $P = 0.001$) when exposed to all three test variables. Also, both *G. pulex* and *A. aquaticus* demonstrated a preference for naturally conditioned leaves compared to the other two variables, with unconditioned leaves proving the least popular food option for both macro-invertebrates ($Z = 18.803$, $P = < 0.001$). However, both species ate varying amounts of all the leaf treatments ($Z = 136.399$, $P = < 0.001$). Subsequently, the author has developed a feeding methodology and a standardised recipe for natural alder leaf conditioning that could be used during laboratory breeding programmes and bioassays.

Density of prey as a factor modifying the anti-predator behaviour of amphipods

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Jermacz Ł, Szatkowska B, Kobak J

N Copernicus University, Department of Invertebrate Zoology, Toruń, Poland
lukasjermacz@gmail.com

Predators are major elements of ecosystems, controlling prey population sizes and structure of prey communities (consumptive effects). In the presence of predators, prey organisms modify their behaviour, physiology, growth and/or morphology (non-consumptive effects), reducing predator effectiveness. However, such modifications may limit population growth as a result of partitioning energy into defence mechanisms („non-consumptive effects”). We checked how different density affects anti-predator responses of an invasive gammarid *Dikerogammarus villosus*. We tested gammarids at three densities (5, 10 and 15 individuals) on an area of 15x17cm in the presence of predator (*Babka gymnotrachelus*) kairomones and clean water (control) for 2 hours (10 replicates). Gammarid behaviour was recorded and analysed with Noldus Ethovision XT 10 software. We determined: distance moved, occurrence in the open field, meandering, swimming speed and aggregation level. At the lowest density, the predator kairomones caused a significant increase in distance moved and more frequent penetration of the open field by gammarids. At the medium density, the gammarids responded to predator with a higher level of aggregation. At the highest density, kairomones caused a significant reduction in distance moved and increased aggregation. Our results show that the density is a significant factor modifying anti-predator behaviour. Depending on the level of density, *D. villosus* exhibits an adequate defensive reaction to the potential level of risk. At a low density, the probability that a particular individual will be taken by a predator is high, even if its activity is reduced. Therefore, an optimal solution is to leave the area of predator foraging. With an increasing density, this probability decreases (dilution effect), and therefore an activity reduction becomes a more effective strategy to avoid detection.

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Life history, population dynamics and secondary production of *Grandidierella japonica* Stephenson, 1938 from southern coastal waters of Korea

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Jung TW¹, Yoon SM²

¹National Science Museum, Daejeon, Korea; ²Department of Biology, Chosun University, Gwangju, Korea
smyun@chosun.ac.kr

The life history, population dynamics, and secondary production of the gammaridean amphipod, *Grandidierella japonica* Stephensen, 1938, inhabiting euryhaline environment were studied in tidal creek at Sinji Is., southern coast of Korea. The life history pattern was annual and iteroparous, with two dominant recruitments from November to January and from June to August. The population was consisted of four main cohorts during the annual cycle; winter-spring cohorts, short early summer cohorts, summer-autumn cohorts, and over-wintering cohorts. The sex ratio was usually female-biased. The maximum size of males, non-ovigerous, and ovigerous females were 10.20 mm, 11.10 mm, and 9.36 mm,

respectively. There was a positive relationship between the natural logistic value of brood size ($\ln BS$) and the natural logistic value of body length ($\ln BL$) of ovigerous females, and they were significantly different between winter-spring and summer-autumn periods. The egg volume of stage I between two breeding periods also showed significantly different values. However, no significant relationship between the natural logistic value of egg volume ($\ln EV$) and $\ln BL$ was found. The secondary production of *G. japonica* during sampling period was estimated as $9.2 \text{ g}_{\text{DW}} \cdot \text{m}^{-2} \cdot \text{yr}^{-1}$ with a P/B ratio of 9.29 yr^{-1} .

Life history traits of three sympatric talitrid species in the supralittoral zone of Bizerte lagoon (northern Tunisia)

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Jelassi R, Bouslama MF, Khemaissia H, **Nasri-Ammar K**

Unité de Recherche de Bio-écologie et Systématique Evolutive, Faculté des Sciences de Tunis, Campus Universitaire de Tunis El Manar I, Tunis, Tunisie.

knasri@planet.tn

Biology, population dynamics and reproduction of three sympatric species of talitrid amphipods, *Orchestia montagui* Audouin, 1826, *Orchestia mediterranea* Costa, 1853 and *Orchestia gammarellus* (Pallas, 1766) were studied simultaneously in the supralittoral zone of Bizerte lagoon. A total of 10126 specimens was collected during one year from July, 2006 to June, 2007. Our results showed that these species were characterized by a continuous reproduction with the presence of ovigerous females throughout the study period. The average sex-ratio was biased to males in *Orchestia montagui* and to females in *Orchestia gammarellus* and *Orchestia mediterranea*. However, the average number of eggs was estimated at 9 ± 5.1 , 18 ± 7.6 and 15 ± 4.9 respectively. Life span was estimated at 6-7 months, 7-8 months and 5-8 months respectively. Furthermore, this study highlighted that some life history traits of *Orchestia montagui* were different from those of *O. gammarellus* and *O. mediterranea*. These three species were characterized as semiannual species, with iteroparous females producing at least two broods per year and exhibited a bivoltine life cycle.

First in-situ observations on the behaviour of the deep-sea amphipod *Dulichlopsis* sp. (Senticaudata, Dulichiidae) at the vicinity of the hydrothermal vent site TAG (Mid-Atlantic Ridge)

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Corbari L¹, Sorbe JC²

¹Muséum national d'Histoire naturelle, Institut de Systématique, Évolution, Biodiversité ISYEB - UMR 7205 – CNRS, MNHN, UPMC, EPHE, Paris, France ; ²Station marine, Arcachon, France

corbari@mnhn.fr

The oceanographic cruise BICOSE (January/February 2014) was dedicated to multidisciplinary studies at the mid-Atlantic ridge hydrothermal vents, with a special focus on inactive areas as well as on surrounding areas out of hydrothermal influence. During in-situ explorations around the vent site TAG with the ROV Victor (dives PL570 and PL573; 3550-3650 m), we observed for the first time “tiny and mysterious creatures playing on a swing”.

Subsequent examination of high quality pictures revealed that these organisms were amphipods, hung on erected and flexible masts (ca. 7 cm length) fixed on the underlying hard substratum. Finally, two female specimens were opportunely sampled during the last dive of the cruise (PL 575; 3637 m) with the suction sampler of the ROV. Although more or less damaged by this inappropriate sampling method, these specimens were ascribed to genus *Dulichlopsis*, family Dulichiidae (eyes absent; pereopods 3-4 basis not expanded; pereopods 5-7 elongate, with propodal palm; uropods 1-2 normal). Although morphologically close to *D. nordlandica* also reported from the N Atlantic (including S Iceland), the taxonomical status of the collected specimens is not yet fully resolved (ongoing study). No information could be found in literature concerning the benthic behaviour of known *Dulichlopsis* species. However, as observed on video recordings, this species shows a benthic behaviour quite similar to the one described for the shallow water dulichiids *Dyopodos monacanthus* and *D. porrectus*. Apparently, one or two mature individuals can be present on a single mast (no visible smaller progeny), attached to this support by their pereopods 5-7, well adapted for grasping between propodus and dactylus. Due to the sedentary posture of individuals on their mast, with a full deployment of their two pairs of antennae (heavily setose?), this species belongs to the guild of epibenthic suspension-feeding amphipods and is probably severely exposed to predation by abyssal benthic fishes.

Locomotor behavior of *Orchestia gammarellus* over four seasons in the supralittoral zone of Ghar Melh lagoon (North-East of Tunisia)

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Jelassi R, Khemaissia H, Ayari A, Nasri-Ammar K

Unité de Recherche de Bio-écologie et Systématique Evolutive, Faculté des Sciences de Tunis, Campus Universitaire de Tunis El Manar I, Tunis, Tunisie
djelassi.raja@gmail.com

Locomotor rhythm of *Orchestia gammarellus* was investigated, individually over four seasons under two simultaneous experimental conditions; during the first week, animals were kept under light-dark cycle (nLD) in phase with natural diel cycle. During the second week, animals were maintained in constant darkness (DD). Globally, analysis of actograms and waveform curves showed that activity individuals was concentrated during the experimental and subjective nights, respectively during the first and second week. Animals exhibited an endogenous rhythm with a circadian (≈ 24 h) and an ultradian (≈ 12 h) components. Furthermore, circadian period was significantly shorter (τ LD = 23h43m \pm 0h34m) and longer (τ DD = 26h \pm 1h28m) in autumn under light-dark cycle and constant darkness respectively. In addition, the most important stability was observed in summer whatever the regimen. Results showed also a seasonal variation of the mean activity times; the most important activity of individuals was observed during autumn under light-dark cycle (15h30m \pm 3h24m) as well as under constant darkness (14h40m \pm 1h21m).

Functional morphology of feeding structures in amphipods inhabiting German inland waters

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Mayer G, Maas A, Waloszek D

University of Ulm, WG Biosystematic Documentation, Ulm, Germany
gerd.mayer@uni-ulm.de

For long time non-marine gammarideans in Middle and Western Europe were supposed to feed mainly on leaf litter and other plant material. Assignment to the functional feeding group of shredders was reconsidered, when the impact of the very successful Ponto-Caspian species *Dikerogammarus villosus* was recognized. This species has recently started to invade rivers and lakes in Middle and Western Europe, diminishing, or even locally eliminating, the populations of native and established amphipod species. Because of these ecological effects, *D. villosus* and more non-marine amphipods became interesting research objects. Our specific focus was to investigate feeding, predation and behaviour under comparative-morphological aspects. Using scanning electron microscopy we studied the mouthparts – mandibles, maxillulae, maxillae, maxillipeds – and other structures involved in food acquisition, mainly the antennae, gnathopods and the third pair of uropods – of native and non-native amphipod species inhabiting German inland waters. Among the 16 species studied until now, we could identify different morphologies clearly related to different feeding strategies. Some species are feeding specialists, utilizing exclusively detritus and fine-particulate organic matter, with highly adapted structures involved in food acquisition. Another group of species is able to feed on a variety of food, but also possesses morphological specializations, which enable them to use a specific type of food very effectively or to use an additional food resource. The mouthparts of a third group of species do not exhibit any kind of specialization, these species are opportunistic omnivores. Here we give a first summary of our findings, demonstrating that also in non-marine amphipods differences in the morphology of the mouthparts and other structures involved in food acquisition occur, enabling the use of different food resources. Therefore, coexistence of two or more amphipod species – native and non-native – in the same habitat may be possible due to interspecific morphological differences of feeding structures.

Physiology

Determination of Lake Baikal endemic and Palearctic amphipods thermal optima limits by changes in its stress markers

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Axenov-Gribanov D, Vereshchagina K, Lubyaga J, Gurkov A, **Timofeyev MA**

Institute of Biology, Irkutsk State University, Irkutsk, Russia
m.a.timofeyev@gmail.com

Temperature stress provokes energy-demanding responses on a cellular level, which eventually may reduce the organism's competition and reproduction abilities. Hence, temperature stress is a significant physiological and ecological factor. In evolution, those species apparently are more successful that better cope with the physiological effects of stress, i.e. respond with less expense of energy. In the present study metabolic stress markers were comparatively monitored in an endemic amphipods species *Eulimnogammarus verrucosus* (Gerstf., 1858) and *Ommatogammarus flavus* (Dyb., 1874) from Lake Baikal and in the Palearctic amphipod *Gammarus lacustris* (Sars, 1863) (Amphipoda, Crustacea) exposed to a wide range of ambient temperatures. These metabolic data were compared with thermal preferendum data obtained for the same species in behavioral experiments. It was found that exposure of amphipods under increased temperatures resulted in increase of HSP70 content and lactate, activating of antioxidant enzymes (catalase and peroxidase), as well as reduction of lactate dehydrogenase and glutathione S-transferase activities. Exposure of amphipods at low temperatures resulted in decrease of HSP70 content, increase of lactate level, peroxidase and lactate dehydrogenase activation and reduction of glutathione S-transferase activity. It was noted that the most expressed changes of metabolism markers and the area of stability of cellular metabolic markers in all amphipods correlated with a preferred temperature limits obtained in behavioral experiments. Thus, for a first time with Lake Baikal amphipods we showed that the zone of stability of cellular metabolism closely related to their behavioral thermal preference zones and is likely to reflect thermal optima limits of each species.

Proteomic thermal stress-responses of two species of Baikal amphipods (*Eulimnogammarus cyaneus* and *E. verrucosus*) with different thermotolerance

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Bedulina DS¹, Evgen'ev MB², Gurkov AN¹, Timofeyev MA¹, Zatsepina OG²

¹Institute of Biology, Irkutsk State University, Irkutsk, Russia; ²Engelhardt Institute of Molecular Biology, Russian Academy of Sciences, Moscow, Russia
daria.bedulina@gmail.com

Temperature is an important abiotic factor, affecting organisms on all levels of organizations. Recent climate change leads to an increase of water temperature which can have especially deleterious effect for ancient ecosystems, inhabited by narrowly adapted endemics. Lake Baikal is inhabited by a highly diverse endemic amphipod fauna and is considered to be a

hotspot of endemic amphipod speciation. In the present work we aimed to obtain insights how the proteomes of two endemic species from Lake Baikal, thermotolerant *Eulimnogammarus cyaneus* and thermosensitive *E. verrucosus* respond to thermal stress. Using 1D, 2D PAAG-electrophoresis with [³⁵S]-methionine labeled proteins, followed by MALDI-TOF-TOF MS/MS analysis, the thermal stress-proteomes were characterized. In comparison to the more thermosensitive *E. verrucosus* high levels of thermal lability of the proteomes from *E. cyaneus* were observed. All identified thermal stress - responsive proteins could be assigned to four groups according to their functions: proteins of the cytoskeleton, proteins of energy turnover, molecular chaperones and antioxidative stress enzymes. The identified proteins may be useful as candidates for biomarker studies on the thermal stress condition of the studied amphipod species under different temperature regimes.

Oxygen consumption of invasive *Pontogammarus robustoides* and native *Gammarus lacustris* from temperate lakes of contrasting trophy

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Šidagytė E¹, Žilius M², Lesutienė L², Arbačiauskas K¹

¹Laboratory of Evolutionary Ecology of Hydrobionts, Nature Research Centre, Vilnius, Lithuania; ²Coastal Research and Planning Institute, Klaipėda University, Klaipėda, Lithuania
e.sidagyte@gmail.com

During 1960s, a Ponto-Caspian amphipod species, *Pontogammarus robustoides*, was deliberately introduced into numerous Lithuanian lakes in order to improve fish production. However, it managed to establish only in some of them. The species has been recently considered invasive due to its negative impact on native macroinvertebrate communities. High metabolic rate, and thus higher oxygen demand, was considered the main factor restricting successful establishment of *P. robustoides* to lentic waters of lower trophic state or of high turnover, and its ability to eradicate native *Gammarus lacustris*. However, more recently the invader has been noticed to spread into highly eutrophicated waters naturally. In this study, we compared oxygen consumption rates across decreasing oxygen concentrations between *P. robustoides* and *G. lacustris* from Lithuanian lakes of low and high trophy. *P. robustoides* had a higher critical oxyregulation point and lower oxyregulatory capacity than *G. lacustris*, suggesting higher basal metabolism of the invader species. No significant difference in oxyregulation pattern of the invader was found between the contrasting environments. These preliminary results support the predominant classification of the Ponto-Caspian invader as an oxyphilic species and suggest higher metabolism as a basis for invasiveness. However, these particular findings do not provide further proof for our previous hypothesis that *P. robustoides* has adapted to prolonged hypoxia in lentic waters of the northern invasive range by relying more on anaerobic metabolism.

Allocation of phosphorus into eggs in females of *Pontogammarus robustoides* from environments of different trophy**42****Šniaukštaitė V¹, Šidagytė E¹, Lesutienė J², Arbačiauskas K¹**

¹Nature Research Centre, Laboratory of Evolutionary Ecology of Hydrobionts, Vilnius, Lithuania; ²Marine Science and Technology Center, Klaipėda University, Klaipėda, Lithuania.
vikte.sn@gmail.com

Somatic growth, especially fast growth, requires high phosphorus amounts. Therefore larger phosphorus (P) amounts in eggs could ensure faster growth and development of the young. In this study we set to compare allocation of P into eggs in females of the invasive amphipod *Pontogammarus robustoides* from environments of different trophy. The P content was determined in gravid females and their eggs collected from a lagoon, a large river and three lakes of different eutrophication level. Average P percentage in dry matter of females was 0.73%. There was little variation in it and no correlation with the water total P concentration of their habitat, indicating strict homeostasis. Content of P in eggs was higher than that in bodies of their mothers, and exhibited a substantial variation, from 0.64 to 1.51%. The difference in P content between eggs and bodies well correlated with the water total P concentration of investigated water bodies. Our results suggest that amphipod mothers supply their eggs with additional P reserves only if there is a surplus of the element in their environment.

Phylogenetics and phylogeography

Some closed and some open questions regarding the family Gammaridae

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Sket B¹, Zhonge Hou²

¹Biotechnical Faculty, Department of Biology, University of Ljubljana, Slovenia; ²Key Laboratory of Zoological Systematics and Evolution, Institute of Zoology, Chinese Academy of Sciences, Beijing, China
boris.sket@bf.uni-lj.si

Gammaridae encompasses the most numerous freshwater and peri-marine amphipod species of the northern hemisphere. The extent of the family has been changing perpetually. Our molecular phylogenetic analysis encompassed 430 samples of supposed gammarids and samples of 29 supposed outgroup genera, representing 20 supposed families. In the resultant phylogram Gammaridae appears to be sister to Gammaracanthidae, it also excludes e.g. Anisogammaridae. The generally accepted, morphologically very diverse endemic Bajkalian families, like Acanthogammaridae and Macrohectopidae are phylogenetically nested within the morphologically very homogeneous genus *Gammarus*, rendering it paraphyletic. It is possible to cancel the mentioned families to minimize the paraphyly, but it is practically impossible to either divide the genus *Gammarus* or to cancel ca 70 Bajkalian genera in order to obtain only one holophyletic group. Some other families are clearly branches of the gammarid tree. These are Pontogammaridae, and Typhlogammaridae. Some families could have not been molecularly analysed, they remain questionable: Sesonatoridae and Ponto-Caspian Caspicolidae, Behningiellidae. On the other side, the group, named alternately *Echinogammarus* or *Chaetogammarus*, appeared to be a highly polyphyletic clade. Thanks to existence of available names we could attribute its parts to genera *Echinogammarus* s. str., *Homoeogammarus*, *Parhomoeogammarus*, *Marinogammarus*. *Chaetogammarus*, along with a new genus, appeared to be one of diverse genera of the Ponto-Caspian group. Another new genus (for *Marinogammarus stoerensis*) splits from the gammarid tree basally, as a sister to all other gammarids. These groups are very differently distributed. The basally split *Gammarus* aggregates are marine and peri-marine along the North Atlantic coasts and in continental fresh waters of eastern North America. The other *Gammarus* aggregates show different distribution patterns within the Palearctic area – with the exception of *G. lacustris* which is spread beyond the entire rest of the Gammaridae in the Holarctic. The ancient lake Bajkal is inhabited by two clades with some hundreds of species within *Gammarus* and Ohrid with ca 10 species of a monophylum within the *G. balcanicus* aggregate.

Evolution and phylogeography of pallaseid amphipods, within Lake Baikal and beyond

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Väinölä R

Finnish Museum of Natural History, University of Helsinki, Finland
risto.vainola@helsinki.fi

Pallasea cancellus (as *Oniscus cancellus* Pallas, 1772) was the first species of the hyperdiverse Lake Baikal amphipod assemblage to be scientifically described. *Pallaseopsis quadrispinosa* is the single species derived from the hyperdiverse Lake Baikal amphipod assemblage that has naturally dispersed from the immediate Siberian neighborhood of the ancient lake to Northern Europe across the continent. Currently Pallaseidae, with eight genera and some 20 species, is one of the ten suggested endemic Baikalian gammaroid families. We have addressed the evolution of pallaseid diversity at various temporal and spatial scales and levels of systematic organization, principally using mitochondrial COI gene sequencing. These data bear on the composition and validity of the family Pallaseidae, the systematic relationships of conventional taxa within it, the presence and nature of cryptic taxa within the genus *Pallaseopsis*, the further organization of “intra-specific” variation within the lake into deep phylogeographic lineages, the relationship of the European “escapee” *P. quadrispinosa* to the Baikalian diversity and the identity of its “ancestor”; and as a contrast to the Baikalian data, on the late or post-glacial variation among populations in North European lakes and springs, where the ancient-lake amphipods ultimately have ended up.

Origin and diversification of the amphipod genus *Epimeria* on the Antarctic shelf

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Verheye ML^{1,2}, d'Udekem d'Acoz C³

¹Royal Belgian Institute of Natural Sciences, OD Taxonomy and phylogeny, Brussels, Belgium; ²Catholic University of Louvain-la-Neuve, ELIB - Croix du Sud, Louvain-la-Neuve, Belgium; ³Royal Belgian Institute of Natural Sciences, Scientific Service of Heritage, Brussels, Belgium
mverheye@naturalsciences.be

Southern Ocean biodiversity reflects major tectonic, oceanographic and climatic changes that occurred in this region during the last 55 million years. Within the amphipod family Epimeriidae, the genus *Epimeria* contains 50 known species. It is distributed worldwide, although its diversity is much higher on the Antarctic shelf. Mitochondrial (COI) and nuclear (H3, 28S) markers are used to reconstruct a general phylogeny of the genus. The study aims to (1) test the monophyly of the family by including a variety of related taxa. (2) evaluate the extent of genetic structuration of widely distributed *Epimeria* species in the Southern Ocean and (3) determine the origin and diversification of *Epimeria* species on the Antarctic shelf, by including extralimital species into the phylogenetic analysis. The results show that the genus would be polyphyletic, with two stilipedid genera (*Bathypanoploea* and *Alexandrella*) nested within the epimeriids. The Antarctic and non-Antarctic *Epimeria* form two distinct clades on the trees. Within Antarctic epimeriids, many formerly recognized species appear as genetically strongly heterogeneous, consisting of morphologically distinct clades, often separated by considerable COI distances. Some species are widely distributed around the continent (Peninsula, Eastern Weddell Sea and Terre Adélie), while others have a more

restricted distribution. A calibration of the phylogenetic tree in time with external rates of COI evolution shows that the Antarctic *Epimeria* clade would have originated before the complete isolation of Antarctica. Its isolation from the remaining epimeriids and early diversification could coincide with the onset of the continental cooling.

First insights into phylogenetic relationships among the Atlantic and Mediterranean species of the family Hyalidae

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Desiderato A^{1,2}, **Vieira P**¹, **Serejo CS**³, **Krapp-Schickel T**⁴, **Abbiati M**², **Costa FO**⁵, **Queiroga H**¹

¹Departamento de Biologia & CESAM, Universidade de Aveiro, Aveiro, Portugal; ²Dipartimento di Scienze Biologiche, Geologiche ed Ambientali (BiGeA) and Centro Interdipartimentale di Ricerca per le Scienze Ambientali (CIRSA), University of Bologna, Ravenna, Italy; ³Departamento de Invertebrados - Museu Nacional, Universidade Federal do Rio de Janeiro, Rio de Janeiro, Brazil; ⁴Forschungsmuseum A. Koenig, Bonn, Germany; ⁵CBMA - Centro de Biologia Molecular e Ambiental, Departamento de Biologia, Universidade do Minho, Braga, Portugal

andrea.desiderato@studio.unibo.it

Understanding the spatial patterns of species and genetic diversity has been one of the main focuses in ecology. It is important to explore the evolutionary processes related to the origin of a species, and the factors influencing its genetic structure. The use of a standard system, like the DNA barcode, can assist in the identification and discrimination of different species, and help in recognising phylogenetic patterns when complemented with other loci. The members of the family Hyalidae are common and abundant in the littoral and shallow sublittoral habitats. It comprises more than one hundred species, distributed worldwide. Most studies about this family were dealing with taxonomy, while very little is known about phylogenetic relationship between genera and species. In the present study, we aim to do the first approach of the phylogenetic patterns of this family in Atlantic Ocean and Mediterranean Sea. In order to do that, twelve species belonging to the genera *Serejohyale*, *Apothyale*, *Hyale*, *Protohyale*, *Parhyale* were investigated using the DNA barcode region. Specimens were collected along European and Moroccan Atlantic rocky shores, including Iceland, the British Isles and Macaronesia, in the Mediterranean Sea, between Spain and Turkey and in SW Atlantic Ocean in Brazil. Data available from the NW Atlantic Ocean in GenBank and BOLD were used. As expected, phylogenetic analyses showed highly-divergent clades, clearly discriminating between different species clusters, confirming their morphology-based identifications. Moreover, within some species, high genetic diversity was found among populations from different locations. This is the first attempt using molecular data to determine phylogenetic relationships of the family Hyalidae at large geographical scale. In the future, we aim to use other loci to fully comprehend the phylogenetic relationship within this family and to complete and support our results. These findings provide new insight about patterns of evolution of the Hyalidae species.

Vertical distribution of amphipods in the ancient Lake Ohrid - morphological and molecular perspective

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Wysocka A¹, Sworobowicz L¹, Mamos T², Trajanovski S³, Sell J¹, Grabowski M²

¹Department of Genetics, University of Gdansk, Gdansk, Poland; ²Department of Invertebrate Zoology & Hydrobiology, University of Lodz, Lodz, Poland; ³Hydrobiological Institute – Ohrid, Ohrid, Republic of Macedonia

anna.wysocka@biol.ug.edu.pl

The Balkan Lake Ohrid of tentatively dated Plio-/Pleistocene origin is the oldest ancient lake in Europe, characterized by very high endemism rate. Sixteen species and subspecies of amphipods were described from the Lake Ohrid and its shore springs, including one endemic species of *Synurella* (Crangonyctidae), five endemic species and subspecies of *Niphargus* (Niphargidae) and ten species of *Gammarus* (Gammaridae), of which eight are endemic. Very recently two new endemic, still undescribed species of *Gammarus* were discovered. Our previous studies have shown that endemic *Gammarus* species comprise an ancient species flock. We suggested that their diversification could be promoted by colonization of vacant ecological niches along a depth gradient and/or by historical water level fluctuations. Now, including new large material collected from depth profiles all over the lake, we present in details spatial and vertical distribution of all the local amphipod species. Particularly we focused on the endemic *Gammarus* species flock. Using a portion of mtDNA genome (COI), we scanned its molecular diversity, compared to results of morphological identification and analysed its structure along the depth gradient. Concerning vertical distribution two species groups may be defined. First includes two species widely distributed in various habitats along a depth gradient and showing no or very little haplotype diversity. The species seem to have different evolutionary background. One is probably an old deep-water species, while the other one is a recent colonizer from shallow waters. Second group comprises of remaining species with distribution limited to particular habitats and/or depth zones, mainly in the shallower parts of the lake above the thermocline. Also in this group a very dynamic and complex diversification process may be observed. Distribution of the species will be interpreted in the context of the lake history combined with habitat heterogeneity and presence of possible vertical dispersal barriers.

The south-western Carpathians as a centre of ancient diversity of freshwater gammarid amphipods: insights from the *Gammarus fossarum* species complex

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Copilaş-Ciocianu D, Petrušek A

Charles University in Prague, Faculty of Science, Department of Ecology, Prague, Czech Republic
denis.copilas@yahoo.com

Gammarus fossarum represents one of the most diverse species complexes of epigeal freshwater amphipods throughout Europe. Due to their poor dispersal capabilities and ubiquity, these crustaceans may serve as a model for investigating the influence of historical factors on contemporary distribution and diversity patterns of freshwater macrozoobenthos. Here, we investigate the fine-scale phylogeographic structure of this complex throughout its range in the southwest Carpathian Mountains which comprises two areas that are

geographically isolated from its main European distribution area. Given the Tertiary age of many freshwater *Gammarus* species, we hypothesize that the southwest Carpathian populations reflect a relict distribution pattern. We used two mitochondrial and three nuclear markers from 32 localities to reconstruct phylogenetic relationships and estimate timings of divergence among southwest Carpathian and non-Carpathian lineages. Cryptic diversity was evaluated from mitochondrial markers by employing phylogenetic and distance-based methods. We distinguished at least 16 highly divergent cryptic lineages distributed in a mosaic-like pattern with small geographic ranges that do not exceed 80 km along the longest diagonal. In two cases, we observed syntopic co-occurrence of two lineages and in another four instances we identified up to three lineages coexisting in the same drainage. These clades form a monophyletic group together with several additional lineages from southeast Europe. Estimated divergence times indicate a Middle Miocene origin of this group with many deep splits dating back to more than 10 Ma. This time frame corresponds with a period of intense geological subsidence in the region that gave birth to the Pannonian Basin and was caused by the uplift of the Outer Carpathians. We conclude that subsidence could have been an important driver of diversification for freshwater *Gammarus* and that the southwest Carpathians represent an ancient centre of diversity for these crustaceans.

Spatial patterns of cryptic diversity within the *Gammarus fossarum* complex: adding an East/West side to the story

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Grabowski M¹, Mamos T¹, Rewicz T¹, Wysocka A², Rachalewski M¹, Wattier R³

¹Department of Invertebrate Zoology & Hydrobiology, University of Lodz, Lodz, Poland; ²Department of Genetics, University of Gdansk, Gdansk, Poland; ³Ecologie Evolutive, UMR CNRS 5561 Biogéosciences, Université de Bourgogne, Dijon, France
michalg@biol.uni.lodz.pl

Due to its wide distribution in Europe, the morphospecies *Gammarus fossarum* is an obvious candidate for a cryptic species complex. So far, a number of putative cryptic species within *G. fossarum* in part of its range (e.g. Germany) has been identified with molecular methods of cryptic species based on the mitochondrial markers (COI, 16S). The story told in several papers involved very complex speciation and colonisation pattern leading to sympatric distribution of several lineages. However, still there is a deficiency of knowledge upon cryptic diversity within *G. fossarum* both in the western and eastern part of its range in Europe, namely: France, the Balkans, Carpathians, Pannonian Basin and the Baltic Plains. Little studied was also its cryptic diversity in the Alps, particularly in Alpine lakes. In the present study we aim to integrate the already published data with our large new material from the previously unstudied parts of Europe in order to reveal the level of cryptic diversity and number of putative cryptic species within *G. fossarum* on a continental scale as well as to illustrate spatial patterns of this diversity. That is particularly important, taking into account that the species is commonly used as bio-indicator and subject for ecotoxicology tests. Additionally we will present some preliminary ideas for the glacial refugia and possible post-glacial colonisation routes for the species in Europe.

The genus *Platorchestia* (Crustacea: Amphipoda) in the supralittoral beaches and lagoons of the tropical and warm temperate Western Atlantic - a molecular approach

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Serejo CS¹, Solé-Cava AM², Rodríguez-Rey GT²

¹Museu Nacional, Departamento de Invertebrados, Universidade Federal do Rio de Janeiro, Brazil; ²Departamento de Genética, Instituto de Biologia, Universidade Federal do Rio de Janeiro, Ilha do Fundão, Brazil.

csserejo@acd.ufrj.br

The genus *Platorchestia* comprehends 17 species that colonized supralittoral of beaches, estuaries and also the litter of forests. The locality of the type-species *P. platensis* is in Mar del Plata, Uruguay, but the species has been considered to have a wide distribution. However, recent studies showed that *P. platensis* is part of a species complex and more studies are needed to elucidate the group. In Brazil, two species of *Platorchestia* have been registered: *P. platensis* and *P. monodi* but both identifications are doubtful. To better understand the *P. platensis* complex, DNA sequences from specimens from Costa Rica, from Brazil (Bahia, BA and Rio de Janeiro, RJ) and from Uruguay were performed. The Folmer fragment of the mitochondrial cytochrome c oxidase subunit 1 (COI) was used to construct phylogenetic trees using the maximum likelihood (ML) and Bayesian inference (BI) methods. Additionally, two methods for species delimitation were implemented: the Automatic Barcode Gap Discovery (ABGD) and the Poisson Tree Process (PTP). Sequences available in the GenBank from other nine *Platorchestia* species (*P. japonica*, *P. joi*, *P. monodi*, *P. munmui*, *P. pachypus*, *P. pacifica*, *P. paludosus*, *P. parapacifica*, *P. platensis*) were compared with the study material. Intraspecific K2P distances varied from 0.2% to 9% and interspecific K2P varied from 14% to 48%. The molecular analyses show that at least five *Platorchestia* species can be found in the Western Atlantic: two putative new species from Costa Rica; a third species that includes samples from Rio de Janeiro, Uruguay and sequences of *P. parapacifica* and *P. pacifica*; a fourth species that includes samples from BA, RJ as well as sequences of *P. platensis* from the Mediterranean and of *P. pacifica*; and a fifth species that includes samples from Uruguay and *P. platensis* from Canada. Sequence of another mitochondrial marker (16S ribosomal gene) and a nuclear marker (Histone 3 gene) were also analyzed, and, even though were used on a smaller dataset, corroborated the results obtained from the COI analyses.

Maybe the Hokey Pokey isn't what it's all about: strong genetic structure revealed in populations of *Leucothoe vulgaris* from Okinawa, Japan

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White KN¹, Reimer JD², Lorion J^{2,3}

¹The University of Tampa, Tampa, FL, USA; ²University of the Ryukyus, Okinawa, Japan; ³Palau International Coral Reef Center, Koror, Republic of Palau

white.kristinen@gmail.com

Preliminary phylogenetic analyses of specimens of *Leucothoe vulgaris*, collected from sponges, ascidians, and coral rubble from Okinawa, Japan, were completed using mitochondrial COI and nuclear 18S ribosomal DNA sequences. Analyses of sequences from 83 specimens demonstrate that populations of *L. vulgaris* likely entail at least two cryptic

species, which are reciprocally monophyletic and reproductively isolated. These two potentially cryptic species live in sympatry but are apparently morphologically identical, suggesting a geographically-driven divergence process and secondary contact. Within each clade, two major subclades corresponding to the east and west coast of Okinawa Island were present, with divergence times of approximately 1.61-1.83 mya. This last result suggests a role of Pleistocene sea level changes in the current patterns of intra-specific genetic structure and highlights the need for a more comprehensive sampling of *L. vulgaris* throughout the Indo-west Pacific.

Phylogeography and host shift of *Cucumispora dikerogammari* – an intracellular parasite of two Ponto-Caspian gammarids

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Bączela-Spychalska K¹, Rewicz T¹, Wattier R², Grabowski M¹, Mamos T¹, Ovcharenko M³, Rigaud T²

¹University of Lodz, Department of Invertebrate Zoology and Hydrobiology, Łódź, Poland;

²Université de Bourgogne, Equipe Ecologie Evolutive, UMR CNRS 6282 Biogéosciences, Dijon, France ; ³Laboratory of Unicellular Parasite, Polish Academy of Science, Warsaw, Poland

karolina@biol.uni.lodz.pl

Dikerogammarus villosus, nicknamed “killer shrimp” is one of the most successful freshwater invaders of European waters. The species spreads rapidly from the Ponto-Caspian region to all the main inland waters of Europe. This successful invasive species is known to be infected by five species of microsporidian parasites, including the most successful *Cucumispora dikerogammari*. In some populations the prevalence of this horizontally-transmitted parasite reaches 70%. It is highly virulent, has density dependent transmission and decreases the predatory behavior of its host. This microsporidian infects also *Dikerogammarus haemobaphes*, but with much lower prevalence (mostly 2% and not higher than 19%). The goal of our study was to reveal: (1) phylogenetic relationships between *C. dikerogammari* found in *D. villosus* and in *D. haemobaphes*, (2) distribution of particular lineages of this parasite, (3) potential effects of host invasion dynamics on demography of the parasite. Based on molecular analysis of 378 bp-long fragment of ITS and LSU sequences, we detected separate lineages of *C. dikerogammari* infecting each host species. Apparently, the ancestral host of the parasite was *D. haemobaphes* from which it shifted *D. villosus*. The spread and demographic expansion of this parasite has only been possible after it infected the latter species. *Cucumispora dikerogammari* could therefore be a case of an emerging disease that took advantage of the invasive potential of its new host.

A new *Cryptorchestia* species (Amphipoda, Talitridae) from the island of Rhodes (Greece) revealed by morphological and phylogenetic analysis

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Davolos D^{1,2}, De Matthaeis E², Latella L³, Vonk R^{4,5}

¹INAIL, Research, Certification, Verification Area, Department of Technological Innovations and Safety of Plants, Products and Anthropic Settlements (DIT), Rome, Italy; ²Department of Biology and Biotechnology "Charles Darwin", Sapienza University of Rome, Rome, Italy; ³Museo Civico di Storia Naturale di Verona, Verona, Italy; ⁴Naturalis Biodiversity Center, Department of Marine Zoology, Leiden, The Netherlands; ⁵Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, Amsterdam, The Netherlands

d.davolos@inail.it

A new *Cryptorchestia* species from the island of Rhodes in southeastern Greece can be distinguished on the basis of morphological and phylogenetic data. Our DNA sequencing analysis of mitochondrial and nuclear protein-coding genes indicated that this novel taxon is related to *C. cavimana* (Cyprus island) and *C. garbinii* (Mediterranean regions, and with apparently a recent northward expansion). All the species in the recently proposed new genus *Cryptorchestia* (split off from *Orchestia*) are terrestrial species associated with freshwater-soaked leaf litter, including *C. kosswigi* (Turkish coast), and those from the northeast Atlantic islands: *C. canariensis* (Canary islands), *C. chevreuxi* (the Azores), *C. gomeri* (Canary islands), *C. guanacha* (Canary islands), *C. mateusi* (the Azores), *C. monticola* (Madeira), *C. stocki* (Canary islands). The new *Cryptorchestia* species (Rhodes), *C. cavimana*, *C. garbinii*, and *C. kosswigi* from the east Mediterranean regions have a small lobe (probably used in rasping or scrubbing) on the male gnathopod 1 (Gn1) merus as well as on the carpus and propodus. This character has been proposed to be the main diagnostic difference between *Cryptorchestia* (the type species being *O. cavimana*) and *Orchestia* (in the latter there is a palmate lobe only on male carpus and propodus of Gn1). However, among the northeast Atlantic island terrestrial *Cryptorchestia* species apparently only *C. stocki* has a small lobe on the merus of Gn1. This is in line with our DNA sequencing findings that did not support that *C. canariensis*, *C. gomeri*, *C. guanacha*, and *C. stocki* examined in this study belong to *Cryptorchestia*. An alternative hypothesis that includes reduction or losses of the small posterior palmate lobe cannot be ruled out, however, our preliminary analysis identified similarity in this small structure present on the male Gn1 merus as independently convergent within the east Mediterranean *Cryptorchestia* and *C. stocki*.

Abstracts Posters

Biodiversity and biogeography

Contrasting morphological and DNA barcode-based taxonomic units in shallow water marine amphipod fauna from Portugal

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Antunes I¹, Ferreira MS¹, Lobo J^{1,2}, Teixeira M¹, Borges LMS^{1,3}, Sousa R^{1,4}, Gomes PA¹, Costa MH², Cunha MR⁵, Costa FO¹

¹CBMA-Centre of Molecular and Environmental Biology, Biology Department, University of Minho, Braga, Portugal; ²IMAR-Institute of the Sea, Department of Science and Environmental Engineer, Faculty of Science and Technology, Lisbon New University, Monte de Caparica, Portugal; ³Helmholtz-Zentrum Geesthacht, Centre for Material and Coastal Research, Germany, ⁴CIIMAR/CIMAR, Interdisciplinary Centre of Marine and Environmental Research, University of Porto, Porto, Portugal, ⁵Departamento de Biologia & CESAM, Universidade de Aveiro, Aveiro, Portugal
fcosta@bio.uminho.pt

In this study we used DNA barcodes to test currently known species boundaries against molecular discontinuities, in shallow water marine amphipod fauna from Portugal. COI-5P sequences were obtained from 197 specimens collected along the coast and estuaries of continental Portugal, which were then assigned to 41 morphospecies and 21 families. To this dataset, we added publicly available COI-5P sequences of the same or taxonomically close species, coming to a total of 60 species and 273 sequences. The Barcode Index Numbers (BINs) implemented in the Barcode of Life Data Systems (BOLD), were used as method for assigning COI-5P sequences to molecular operational taxonomic units (MOTUs). Sequences from this dataset were assigned to 68 BINs, of which 38 were concordant (i.e. 1 BIN = 1 species), 11 taxonomically discordant BINs and 19 singletons. A detailed examination of the discordant BINs revealed that in most cases discordances likely result from misidentifications. Rigorously identified specimens of *Corophium multisetosum* Stock, 1952 were split into two BINs, which diverged 18%. Albeit fairly divergent, these BINs correspond to two geographically close populations (≈ 115 km), lacking any apparent geographic barrier between them. These results suggest that specimens of *C. multisetosum* here analyzed comprise two overlooked cryptic species. By comparing species assignments and DNA barcode-derived taxonomic units we detected relevant discordances in data deposited in public databases and highlighted cases of possible undiagnosed diversity. The availability of a dedicated COI-5P sequences database (BOLD) enables straightforward comparison of the taxonomic consistency of records obtained independently from different studies and regions. Thus, the completion of a global reference library of DNA barcodes for amphipods would be of great utility to assist taxonomic revisions and inventories, flagging potential new species and providing a tool for routine species identifications, thus contributing to improve our collective knowledge on amphipod diversity.

The Amphipoda recently collected in Bermuda – preliminary results

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Baldinger AJ, Lenihan, JW

Department of Invertebrate Zoology, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA
abaldinger@oeb.harvard.edu

B.W. Kunkel's (1910) monograph on "The Amphipoda of Bermuda" listed, described and illustrated 45 species, including 17 new species. Kunkel's work was based in part from two collecting expeditions to Bermuda that were led by Addison E. Verrill (1839-1926) whom at the time was Curator of Invertebrate Zoology at the Peabody Museum of Natural History (Yale University). Since 1985 other expeditions to Bermuda specifically to collect amphipods have been carried out by the first author and colleagues. These specimens have led to many publications including a review of Kunkel's types, descriptions of several new species and diversity reports. Gable et al. (2010) summarizes many of these publications and reported 81 species that were currently known from Bermuda. In May 2013 additional amphipods were collected in Bermuda to augment ongoing morphological studies by the current authors and colleagues and to also preserve amphipods for future molecular analyses. Specimens from this expedition were accessioned into the collections within the Department of Invertebrate Zoology at the Museum of Comparative Zoology (Harvard University). Collection data and some images for these specimens are searchable through our online database at <http://mczbase.mcz.harvard.edu/SpecimenSearch.cfm>. This poster presents the preliminary results of the amphipods collected in Bermuda during this May 2013 expedition.

Hidden gems – an overlooked *Epimeria* species from European seas

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Beermann J¹, Raupach MJ²

¹Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Biologische Anstalt Helgoland, Helgoland, Germany; ² Senckenberg am Meer, German Center for Marine Biodiversity Research (DZMB), Wilhelmshaven, Germany
Jan.Beermann@awi.de

Species of the genus *Epimeria* Costa, 1851 are among the most beautiful and photogenic amphipods, as they usually feature prominent morphological characteristics and conspicuous colouration. Four species of this genus have frequently been recorded from the NE Atlantic and the Mediterranean Sea in the past. Based on morphological criteria, however, there has been only little or no reason to doubt the validity of the species' statuses. In a standardized DNA barcoding approach on North Sea Amphipoda, we found a distinct divergence within an *Epimeria* species. This finding was verified by nuclear 18S rDNA sequence data as well as extensive morphological analysis of collected North Sea material and of vouchers from the Natural History Museums of London (UK) and Verona (Italy). In the current poster, a detailed description of the new species is provided. Furthermore, its differentiation from other European *Epimeria* species is discussed, using both molecular and morphological data, and respective geographical distributions are presented.

Tropical/subtropical amphipod genera in the Atlantic Patagonian waters

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Chiesa IL

Museo Argentino de Ciencias Naturales "Bernardino Rivadavia" & Departamento de Biodiversidad y Biología Experimental, FCEyN, UBA, Buenos Aires, Argentina
ichiesa@macn.gov.ar

The genera *Hartmanodes* (Oedicerotidae) and *Garosyrrhoë* (Synopiidae) have been recorded from temperate and tropical waters. *Hartmanodes* includes three species: *H. hartmanae* (JL Barnard, 1962) and *H. murrius* (JL Barnard, 1962), both species reported from south of California, and *H. nyei* (Shoemaker, 1933) reported from the Gulf of California, Gulf of Mexico, Belize and Brazil. The genus *Garosyrrhoë*, also comprises three species: *G. bigarra* (JL Barnard, 1962) recorded from south of California, Gulf of Mexico and the Caribbean sea, *G. disjuncta* (JL Barnard, 1969) recorded from the northwestern Gulf of California, and *G. luquei* Ortiz & Veledo, 1988 only found in Cuba, Caribbean Sea. In January of 2005 nineteen samples were taken off Piedras Coloradas (40° 53.081' S, 65° 07.5920' W), in San Matías Gulf, Río Negro, Argentina, between 12 - 20 m depths, using a van Veen grab and a Rauschert sledge. Thirty-five amphipod species were recognized, including specimens belonging to *Hartmanodes* and *Garosyrrhoë*. These specimens represent not only the first report of both genera for Argentine waters, but also the southeast records of distribution. The finding of extant genera distributed from tropical waters to northern Atlantic Patagonia has already been mentioned for other benthic invertebrates groups. The presence of this "tropical fauna" could be explained by historical causes and the actual oceanographic conditions. During the Late Miocene times -after the opening of the Drake passage- the fauna of the Southwest Atlantic Ocean contained "paratropical" components that probably became extinct or retreated northward, when the cold Malvinas current was fully operating. Besides, at present, the waters from the northeast San Matías Gulf are the warmest of the entire Patagonian coast. On the basis of this oceanographic scenario, it is possible to speculate that part of the amphipod fauna of the northeast San Matías Gulf could include relictual tropical genera and species.

Crustacea in the Museum für Naturkunde Berlin

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Coleman CO

Museum für Naturkunde - Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany
oliver.coleman@mfn-berlin.de

The Crustacea collection of the Museum für Naturkunde Berlin encompasses 27,000 catalogued lots of specimens collected world-wide from all crustacean groups. The predominant taxa in the collection reflect the research interests of former curators, e.g. Vanhöffen and Gruner (Isopoda), Hilgendorf (Decapoda) and Schellenberg (Amphipoda). Material from important German marine expeditions, e.g. the Gazelle-Expedition, the German Deep Sea Expedition and the German Southpolar Expedition was also deposited in Berlin. Besides the wet collection, there are 1,500 dry crustaceans and we have about 1,400 types and more than 5,000 microscope slides. The collection has been completely databased during the GBIF programme using the SESAM collection database. All collection catalogues were scanned and the reference collection of more than 20,000 books and reprints in the

crustacean library was databased in Endnote (<http://download.naturkundemuseum-berlin.de/oliver.coleman/>). There is a focus on literature on amphipods. Currently there are 8,000 scanned books and reprints in pdf-format, fully searchable, most of them on amphipod systematics. We support the scientific community with scanned papers from our reprint collection on demand. Guests are very welcome in the collection. Those who cannot visit us in person can borrow material for six months. We also provide digital images of specimens, e.g. dry material, which is not available for loan. In recent years we worked extensively on the improvement of the physical state of the collection and replaced thousands of leaking museum jars and old labels. Research in the crustacean department is focused on the taxonomy and functional morphology of amphipods, especially species from the Antarctic, Australia and New Zealand.

Mirroring what's on the amphipod literature server with *BitTorrent Sync*

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Coleman CO

Museum für Naturkunde - Leibniz Institute for Evolution and Biodiversity Science, Berlin, Germany
oliver.coleman@mfn-berlin.de

The amphipod-server is a repository of amphipod literature. It can be accessed via ftp (<ftp://amphipod.dnsalias.net>, user: amphipod; password: amphipods). Currently there are more than 8000 pdfs from all fields of amphipod research available. If you are interested in a complete copy of what is on the server, there is a very elegant alternative way to receive the downloads: *BitTorrent Sync* (downloadable here: www.getsync.com) is a free of charge small driver-like tool, which, once running, mirrors the literature held on the amphipod-server directly onto your local hard disk. This is done by interconnecting a keyphrase and a folder on your computer using a simple interface running in a web browser. When this is done, all the pdfs will be copied into this folder on your computer. Make sure that you have enough space on your hard disk. Currently you would need at least 35 GB of free disk space. The great advantage of this mirroring is that whenever I put new files on the server they will automatically be copied onto your computer in the connected literature folder.

Fist records of Caprellidae (Crustacea: Amphipoda) in the central coast of Peru

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Esplana JJ¹, Jiménez A^{1,2}, Paredes C¹

¹Laboratorio de Biología y Sistemática de Invertebrados Marinos, Universidad Nacional Mayor de San Marcos, Lima, Perú; ²Instituto del Mar del Perú, Esq. Gamarra y Gral. Valle. Chucuito, Callao, Perú
Joub.esplanq@gmail.com

The Family Caprellidae (Amphipoda: Caprelloidea) was studied in some localities in the central coast of Peru sea. This is the first study that describes two common species in the central coast of Peru. There are not studies about these kind of amphipods, especially about species richness and diversity, also, spatial variations are not known. Collections at 7 stations located between the area of Pisco, Ica and the Bahía of Ancon, Lima, as follows: San Francisco, Agua Dulce, Chorrillos, Punta Hermosa, Athenas, Santo Domingo, Sequión

beaches. Two species live among epiphytic algae *Chondracanthus chamissoi* and invasive algae *Caulerpa* sp, where the greatest amount of material analyzed was found to determine species. In addition, fouling was collected too. *Caprella Scaura* was found in algae and fouling, while *Caprella penantis* cf. *gibbous* only found in fouling.

The genus *Leucothoe* in the Magellan Region, with description of a new species from Bernardo O'Higgins National Park

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Esquete P¹, Aldea C²

¹Departamento de Biología & CESAM, Universidade de Aveiro, Aveiro, Portugal; ²Laboratorio de Ecología y Medio Ambiente, Instituto de la Patagonia, Universidad de Magallanes y Programa GAIA-Antártica, Universidad de Magallanes.
pesquete@ua.pt

Although the genus *Leucothoe* has been reported repeatedly in the Magellan Region, the citations in the channels and fjords were either unidentified or attributed to the previously considered cosmopolitan *L. spinicarpa*. The new species was one of the dominant species of amphipod found in unvegetated hard substrates in the southernmost sampling site, where the amphipods *Polycheria antarctica* (Stebbing, 1875) and *Orchestria* spp., were also abundant. Towards the north of PNBO, it was found in substrates with macroalgae dominated by *Macrocystis pyrifera*, where *Andaniopsis integripes* was dominant (Bellan-Santini & Ledoyer, 1986) and it also co-occurred with the tanaid *Zeuxoides troncosoi* Esquete & Bamber, 2012 and juveniles of the isopod family *Janiridae*. The two species currently described for the Magellan region have a well separated geographical distribution: While the new species was found in the channels and fjords, *L. weddelsensis* was found off shore, south of Tierra de Fuego and is distributed throughout the Antarctic seas.

Taxonomic and biogeographic inventory of the benthic Amphipoda in the Magellan Region (Chile)

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Esquete P¹, Aldea C²

¹Departamento de Biología & CESAM, Universidade de Aveiro, Aveiro, Portugal; ²Laboratorio de Ecología y Medio Ambiente, Instituto de la Patagonia, Universidad de Magallanes y Programa GAIA-Antártica, Universidad de Magallanes
pesquete@ua.pt

Magellan Region coast extends along the south of Chile from 41°S to 56°S. It comprises an intricate network of channel and fjords that result in a coastline of 32000 km with an ample range of environments and substrates. In the context of the project SIBMAGALLANES (FIC-R 2012) all available data and bibliography have been compiled with the objective of creating a complete taxonomic and biogeographic database that includes all the species of Amphipoda recorded in the region, as well as geographic location of the records and the associated bibliographic reference. A total of 146 species belonging to 44 families have been listed. A few species, such as *Aora anomala*, *Liljeborgia octodentata*, *Tryphosites chevreuxi* o *Crassikorophium bonelli* are recorded throughout the region, nevertheless, the vast

majority of the species have a restricted geographic distribution. A number of species found toward the south extend their distribution range to the Antarctica. The vast majority of the records come from the Magellan Strait, Beagle Channel and the islands around the southern tip, whereas in the northern channels and fjords the records are scarce. As an overall, the scarcity of benthic studies in the region remains a bias error in the knowledge of the distribution range of the species.

Diversity and distribution patterns of amphipods in Mercator Mud Volcano (Gulf of Cadiz, NE Atlantic)

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Esquete P, Sorbe JC, Cunha MR

Departamento de Biologia & CESAM, Universidade de Aveiro, Aveiro, Portugal
pesquete@ua.pt

The Gulf of Cadiz is an extensive methane seep area in the South Iberian Margin (NE Atlantic), which has been extensively sampled for geological and biological studies. Mud volcanoes are cold seepage structures with a positive topographic expression occurring both in passive and active margins. Mercator Mud Volcano is located at El Arraiche field in the Moroccan margin, and lies between 350 and 500 m depth. It has a maximum height of 140 m, a diameter of 2.5 km at the base and 1.1 km at the top; the crater is 2 m deep. Active fluid venting, as well as evidence of past event episodes such as mud flows covered by hemipelagic sediments have been verified on its surface. During research cruises carried out between 2002 and 2006, Mercator has been sampled using both quantitative and qualitative methods. In this work, sampling sites have been divided in three groups: sites inside the crater, in the flank, and outside, in the vicinity of the volcano. A total of 479 specimens belonging to 53 species was found. All samples with more than 3 specimens included widely distributed species of the Northeast Atlantic but also undescribed species. 30 species were found exclusively in samples from the crater, while only the melitid *Carangoliopsis spinulosa* was found exclusively out of the volcano. Quantitative data analyses reveal higher diversity and abundance in samples from the crater (up to 18 species per sample, 90 ind·0.25 m²) than in samples taken in the flank (up to 12 species per sample, 28 ind·0.25 m²) and off the mud volcano (9 species per sample, 22 ind·0.25m²). The heterogeneity, and thus variety of microhabitats on the crater, decreasing through the flanks and the adjacent seafloor is likely to drive the observed gradient of diversity and abundance.

Hadal and abyssal Amphipoda collected during the Vema SO-237 cruise from the Puerto Rico Trench area (Atlantic Ocean)

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Frutos I, Brandt A

University of Hamburg, Centre of Natural History (CeNak), Zoological Museum, Hamburg, Germany
inma.frutos@uni-hamburg.de

Within the framework of the German multidisciplinary Vema-TRANSIT project on board of the new RV *Sonne*, the suprabenthic fauna of the Puerto Rico Trench area (northwestern

Atlantic Ocean) was sampled using a multinet camera-epibenthic sled. This gear is equipped with two superimposed nets (0.5 mm mesh size, 0.3 mm at the cod end) and samples the motile fauna in the 25–60 and 77–112 cm water layers above the sea floor. Sled samplings were carried out in January 2015 at 6 stations located between 4552 and 8340 m depth. In the material sorted up to now, 93 individuals belonging to the families Eusiridae, Hirondellidae, Hyperiopsideae, Lysianassidae and Pandaliscidae were identified from the 4 hadal stations (8042–8340 m depth). Lysianassidae were the dominant group (49.5% of the total abundance) where *Lepiduristes lepidus* (Barnard, 1964) showed the higher number of animals recorded (46 specimens) followed by Hirondellidae (25.8%) with a non yet identified *Hirondellea* sp. (24 specimens), Hyperiopsideae (6.5%), Eusiridae (4.3%) and Pandaliscidae (4.3%) (damaged Gammaridea specimens: 9.6%). This hadal fauna will be compared with the ongoing study of abyssal amphipods sampled in the same area from two stations located between 4552 and 4930 m depth. Amphipods from the abyssal area seem to be more speciose and abundant than in the hadal area.

The World Register of Deep Sea Species - Amphipoda – updating “Thurston, 2000”

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Horton T; Thurston MH

National Oceanography Centre, Southampton, UK
tammy.horton@noc.ac.uk

At the Xth International Colloquium on Amphipoda in Crete in 2000 a compilation of the bathymetric and geographic data for 4342 species of benthic Amphipoda Gammaridea described prior to 1990 was presented by Mike Thurston. In December 2012 the World Register of Deep-Sea Species (WoRDSS) was launched; a taxonomic database of deep-sea species based on the World Register of Marine Species (WoRMS). This site was launched as a project of the International Network for Scientific Investigation of Deep-sea Ecosystems (INDEEP). As part of this project we have updated the information in Thurston (2000), incorporated taxa described subsequent to that compilation, and present a reanalysis of this dataset.

WoRMS: <http://www.marinespecies.org/>

INDEEP: <http://www.indeep-project.org/>

Diversity and distribution of *Gammarus* on Peloponnese

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Hupała H¹, Karaouzas I², Olszewska W¹, Mamos T¹, Rewicz T¹, Bączela-Spychalska K¹, Grabowski M¹

¹Department of Invertebrate Zoology and Hydrobiology, University of Lodz, Lodz, Poland; ²Institute of Marine Biological Resources and Inland Waters, Hellenic Centre for Marine Research, Athens, Greece
michalg@biol.uni.lodz.pl

Balkan Region is known for its high amphipod biodiversity. However, little is known about the real level of diversity and distribution of freshwater gammarids in that area. Peloponnese is a large mountainous peninsula at the southernmost end of the Balkans. So far, only four

species of the genus *Gammarus* Fabricius, 1775, namely *Gammarus arduus*, *G. roeseli*, *G. rambouseki* and *G. pulex*, have been reported from the peninsula. Given the numerous species of *Gammarus* recorded in freshwaters from other parts of the Balkans, we expect that the real number of species living on Peloponnese should be much higher. Thus, in summer 2011 we performed a survey of the Peloponnese inland waters in order to achieve at least rough estimation of the local diversity within the genus. The samples were collected in a qualitative way, with use of a standard hand-net from a variety of habitats in rivers, streams and springs. The material was sorted *in situ* and directly preserved in 96% ethanol to allow further morphological, ultrastructural (SEM) and molecular studies. Preliminarily we revealed presence of at least eight freshwater species of *Gammarus*. Interestingly, leaving out one species identified as *G. cf. pulex*, we could not confirm presence of any other species formerly reported from the peninsula. The remaining eight species could not be assigned to any species known from the Balkan Region. Molecular species delimitation methods based on mitochondrial markers (COI and 16S) as well as SEM supported their distinctness. Distribution of the species along with its interpretation will be presented on the poster.

New amphipod species from wood-fall

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Jażdżewska AM

Laboratory of Polar Biology and Oceanobiology, Department of Invertebrate Zoology and Hydrobiology, University of Lodz, Lodz, Poland
ajazdz@biol.uni.lodz.pl

Abyssal areas are recognized to be deficient in low energy supply. Dead wood is one of very few organic matter sources in the deep sea. The fauna associated with this type of substrate is known to be specific and includes 10 already known amphipod species from five families. Three of them belong to the genus *Bathyceradocus*. The aim of the study was to characterize a new species of *Bathyceradocus* from the piece of dead wood fall collected at Kuril-Kamchatka abyssal plain. The material consisted of several individuals including mature females, males and juveniles. From the three known species of this genus, the present species differs among others, in the shape of propodus of gnathopod 1 and 2, shape of basis of pereopods 5-7 and armature of mandibular palp. The COI barcode for the species, representing one haplotype, was also obtained. The present record is the first evidence of this genus from North-West Pacific.

Barcoding of deep-sea amphipod fauna – preliminary results

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Jażdżewska AM, Jedynak K

Laboratory of Polar Biology and Oceanobiology, University of Lodz, Lodz, Poland
ajazdz@biol.uni.lodz.pl

Barcoding can be a useful tool in species recognition and description. Using DNA barcode can be particularly helpful when working with damaged material. This is often the case of deep-sea invertebrates, especially some fragile crustaceans that can be destroyed already during sampling. Additionally, molecular markers can be favorable when sexual or age dimorphism

is strong within the species studied. The aim of the present study is to survey the molecular diversity of deep-sea amphipods from Kuril-Kamchatka abyssal plain. The material was collected using epibenthic sledge at 12 stations at the depth range 4830-5730 m. The most remote stations are separated by the distance of ca. 1000 km. Total DNA was extracted using standard phenol-chloroform method and the COI gene was amplified with the use of HCO2198/LCO1490 primers. Until now the barcodes for the representatives of the families Phoxocephalidae, Oedicerotidae, Maeridae, Synopiidae and Pandaliscidae were obtained. The inter and intraspecies variation of selected species will be presented.

Spatio-temporal distribution of *Talitrus saltator* in the supralittoral zone of Mâamoura beach (North East of Tunisia)

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Jelassi R¹, Khemaissia H¹, Zimmer M², Garbe-Schönberg D³, Nasri-Ammar K¹

¹Unité de Recherche de Bio-écologie et Systématique Evolutive, Faculté des Sciences de Tunis, Campus Universitaire de Tunis El Manar I, Tunis, Tunisie ; ²Paris-Lodron-Universität FB Organismische Biologie AG Oekologie, Biodiversität & Evolution der Tiere Salzburg, Austria; ³Institut für Geowissenschaften, ICP-MS Labor, Universität zu Kiel, Kiel, Germany
djelassi.raja@gmail.com

In Tunisia, sandy beaches were the most studied wetlands. In order to better understand the spatio-temporal structure of talitrid communities, the present work was carried out along transects, whose length varied between 48m (winter) and 77.5m (autumn) during four seasons in the supralittoral zone of Mâamoura beach. Our results showed that whatever the seasons, the sandhopper *Talitrus saltator* was the only identified species with a total number of individual equal to 882 and a mean density equal to $27.20 \pm 25.20 \text{ ind}\cdot\text{m}^{-2}$. Furthermore, principal component analysis (PCA) showed that the distribution of this species was positively related to soil temperature and to the cobalt and copper contents.

Description of a new freshwater species of the Genus *Gammarus* from Iran

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Katouzian A-R^{1,2}, Sari A¹, Leese F², Weigand AM²

¹School of Biology and Center of Excellence in Phylogeny of Living Organisms, College of Science, University of Tehran, Tehran, Iran; ²Ruhr University Bochum; Department of Animal Ecology, Evolution and Biodiversity; Bochum, Germany
Ahmad.Katouzian@ruhr-uni-bochum.de

Gammarus Fabricius, 1775, is one of the most diverse and widely distributed genera of epigeal freshwater amphipods in the northern hemisphere with 18 freshwater species known from Iran. Here, we describe a new species from Golestan National Park (GNP) in northern Iran along the Alborz mountain range at the locality of Cheshmeh Shoor. So far, only *Gammarus komareki* Schafferna, 1922 is known to be widely distributed in this region. Our preliminary morphological and molecular data indicate that this species may consist of several cryptic lineages, i.e. comprises a species complex. One species - *Gammarus shoorcheshmensis* sp. nov. – is presented in more detail. The species shows morphological similarities to *G. komareki* but differs e.g. in the shape of the telson and in having a less

setose peduncle of the second antenna. We analysed the 658 bp Folmer-fragment of the mitochondrial cytochrome c oxidase subunit I, which is one of the most widely applied genetic marker for species delimitation. Our molecular data confirm the differentiation of this species from other '*G. komareki*-like' species in the Alborz mountains as well as from other *Gammarus* species. Interestingly, the new species occurs in brackish inland water which is an obvious difference to the presumed ecology of *G. komareki*.

New report and new species of herbivorous amphipods (Amphipoda: Ampithoidae) from the coasts of the Persian Gulf and the Gulf of Oman, Iran

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Momtazi F¹, Layeghi Y²

¹Iranian National Institute for Oceanography and Atmospheric Science, Tehran, Iran; ²Department of Zoology, Faculty of Science, Kharazmi University, Tehran, Iran
ylayeghi@gmail.com

The herbivorous amphipods, because of its position at the base of the food chain, have an important ecological role in marine ecosystems. Little is known about the diversity of herbivorous amphipod fauna of Iran's Southern shores. In the present study, Ampithoidae fauna of 51 localities along the intertidal zones of the coasts of the Persian Gulf and the Gulf of Oman were investigated. The specimens are described by morphological characters, and compared with the descriptions of other species of the family Ampithoidae. The results of the present study show that the species belong to 3 Genera and 6 species including; *Ampithoe* sp1; *Ampithoe* sp2; *Cymadusa filosa* Savigny, 1816; *C. setosa* Haswell, 1879; *Cymadusa* sp. and *Plumithoe* sp.. In current study 4 new species in this area are described.

Interactive identification keys for easy online use

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Loerz AN^{1,2}, Coleman CO³

¹NIWA, Wellington, New Zealand; ²CeNak, Hamburg, Germany; ³Naturkundemuseum, Berlin, Germany
Anne-Nina.Loerz@t-online.de

Creating interactive keys for internet use, with illustrations of the key characters, profoundly improves the identification process of amphipods by making it much faster and easier - and (for the first time) possible for non-taxonomists to correctly identify amphipod samples (<http://amphipod.dnsalias.net>). **What are we doing?** Morphological characters of selected amphipods are stored in a DELTA database, and the digital illustrations and information exported to Intkey, which produces interactive identification systems for web use. Interactive keys enable the end user of taxonomic knowledge (e.g. ecologists) to identify species with the help of character state illustrations (see figure); hence there is no need for the use of the sometimes difficult terminology. **How the results are used?** Intkey is an 'eliminative' key- it can be made as an image based key, one click can take you from 100 taxa to 5 to 1- this is completely different from dichotomous keys that have no shortcuts. Intkey is easy and fast to use, also suitable for non experts, because the characters are illustrated. Illustrated interactive keys from the internet are the most modern and efficient delivery system of taxonomic knowledge imaginable. The selected marine Amphipoda families Synopiidae and

Epimeriidae are our priority groups because they proved to be abundant and diverse in many samples.

One hundred species in one - enormous cryptic diversity of *Gammarus balcanicus* in Europe

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Mamos T¹, Grabowski M¹, Wattier R²

¹Department of Invertebrate Zoology and Hydrobiology, University of Lodz, Lodz, Poland; ²Equipe Ecologie Evolutive, UMR CNRS 5561 Biogéosciences, Université de Bourgogne, Dijon, France
tmamos@biol.uni.lodz.pl

Previous studies of the morphospecies *Gammarus balcanicus*, pointed out high level of genetic diversity highly structured in space, and long history of diversification associated with Alpine orogeny and continentalisation of Europe. Given wide geographical distribution of the morphospecies, associated with highly fragmented habitats (mountain springs and streams) we can expect that it comprises at least several cryptic species. Thus, our aim was to assess the level of this cryptic diversity with several methods of species delimitation based on molecular markers i.e. a portion of mtDNA genome. The study included samples from 112 locations all over European range of the morphospecies. Two different methodological approaches were used. First, we used the distance-based barcode-gap approach using the Automatic Barcode Gap Discovery (ABGD) software. Second, we applied the tree-based, phylogenetic approach using the General Mixed Yule Coalescent (GMYC) model based method and Bayesian Implementation of the Poison Tree Processor (bPTP). Depending on the method, from 60 to over 100 putative molecular species was detected within the analyzed material. The highest number of putative species was discriminated in large mountain chains: Carpathians (22-25 species), Dinarides (15-20 species) and Hellenides (14-20 species). It is not surprising as the mountainous areas of Southern and South-Central Europe have already been recognized as hot-spots of biodiversity. However, so far *G. balcanicus* is the only example of such high level and long history of cryptic diversity. Our results point out a need for new taxonomic revision of European freshwater *Gammarus*, combining both the molecular and morphological studies. Most probably this will result in resurrection of numerous local species synonymised in previous revisions based exclusively on the morphological traits. Only such combined approach can reflect the true level of biodiversity, which is apparently way higher than ever expected.

First evidence of the presence of the freshwater amphipod genera *Gammarus* and *Pseudoniphargus* in Central and Western Africa

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Piscart C¹, Tuekam Kayo R², Lagnika M³, Zébazé Togouet SH², Boutin C⁴

¹Université de Rennes 1, UMR CNRS 6553 Laboratoire écosystèmes, biodiversité, évolution (ECOBIO), Rennes, France; ²Université de Yaoundé 1, ³Université d'Abomey-Calavi, Faculté des Sciences et Techniques, Département de Zoologie, Cotonou, Benin; ⁴Université Paul Sabatier, ENSAT, UMR CNRS 5245 Laboratoire écologie fonctionnelle et environnement (ECOLAB), Toulouse, France
Christophe.piscart@univ-rennes1.fr

The continental Africa, which represents 10% of the total amount of world's freshwater, is also one of the least-studied regions of the world with regard to crustaceans. Moreover, studies of freshwater fauna in Africa focused mainly on arid and semi areas in Northern, Eastern, and Southern Africa whereas Western and Central Africa, that concentrate around 50% of the African freshwater resource, were much less explored. Between 2012 and 2014, samplings were realized in dozens of streams and wells in Benin and in Cameroun. Among the samples collected in wells, new species of the freshwater genera *Gammarus* (forthcoming description of *Gammarus camerounensis*) in Cameroun and *Pseudoniphargus* (forthcoming description of *Pseudoniphargus beninensis*) in Benin were found. The discovery of these species strongly enlarged the known distribution of these genera in continental Africa, since they were previously known only in Morocco and Algeria. These preliminary studies revealed also many new groundwater species (at least 14 species and two genera) belongings to other Orders (Ostracoda Candoninae, Isopoda Cirolanidae and Decapoda Atyidae) and, probably a new family of epigeal Amphipod that remains to be confirmed because only one incomplete female was found in a well in Cameroun. Our results highlighted the high potential of Africa in terms of crustacean diversity. Further investigations on the distribution of the Crustacea in this part of Africa are currently realized and the molecular relationships should be determined to establish the relationship among species to clearly define their origin.

Expansion of the distribution areal of *Dikerogammarus villosus* in the water shed of a recently occupied artificial water body (Florence, Italy)

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Rossano C, Carlo F, Scapini F

Department of Biology, University of Florence, Florence, Italy
claudia.rossano@unifi.it

The ability in colonization of new niches is the most typical feature that characterizes invasive species. Some amphipods are well known for their adaptability that allows them to enlarge their areal, frequently with the detriment of autochthonous species. *Dikerogammarus villosus* is an invasive species that in recent years has become popular for its fast spreading in the centre and south of Europe. Mainly favorite by the capillary connection of the water sheds of the Danube and Rhine Rivers, its diffusion from the Ponto Caspian Region was and is still being facilitated by human actions. It is perhaps due to animal and/or human passive transport that *D. villosus* colonized the artificial water body of Bilancino Lake (Barberino di Mugello, Florence) in the centre of Italy. This happened before 2008, the year when a well established population was found, about 10 years after the dam that produced the water

body had been activated and a few years after touristic activities had been started at the lake. In 2008 no specimens of *D. villosus* were found in the watershed except than in the lake itself. During October 2014 an inspective survey was performed to check the diffusion of the species in the tributaries and effluents of the lake and well established populations were found downstream, but not upstream of Bilancino Lake. Any autochthonous species was found in sympatry with *D. villosus*, but some isolated autochthonous populations of *Echinogammarus veneris* were found in a river upstream the main effluent of the lake. At the moment it seems that in this area *D. villosus* is following the simplest way to disperse, along the main effluent downstream the comfortable niche of Bilancino Lake.

***Caprella scaura* Templeton, 1836: new data able to date back its presence in the Mediterranean Sea**

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Scipione MB

Stazione Zoologica Anton Dohrn, Department of Integrative Marine Ecology, Center of Villa Dohrn Ischia – Benthic Ecology, Ischia Porto (Napoli), Italy.
beatrice.scipione@szn.it

Recent studies focused on the role of marine alien and invasive species and the nature of their impact on native assemblages. *Caprella scaura* Templeton, 1836 was recorded for the first time in the Mediterranean Sea in 1994 (Venice lagoon, Italy). Since then many studies showed its spread, and the possible introduction pathways were recently described. Further records will allow to learn more about its biology and ecology, giving new insights on patterns of invasion and colonization. The amphipod material, object of this paper, was obtained from studies on mobile fauna associated to drifting algae, conducted in the Mar Piccolo di Taranto (Ionian Sea, Italy) from February 1989 to January 1990. Monthly samplings were performed collecting the whole algae on 0.25m², at 20 stations located in 4 different areas of the outer (A, B) and inner (C, D) inlets, at two depth-ranges (0-2.5m and 2.5-5m), totalling 240 samples. Overall, 1,141 individuals of *Caprella scaura*, accounting for 12.6% of the whole amphipod assemblages identified (14 taxa), were found in 73 samples. The species was mainly present from February to July, reaching the highest mean abundances in May, at the shallower depth-range in area B, close to the shipyards and subject to urban impacts. The males were dominant except in February and March, when the sex ratio was almost close to 1:1 and ovigerous females were present. Thus in February 1989 rich populations of *Caprella scaura* (the only species highly dominant after *Gammarus insensibilis*) were already well established, and therefore its introduction in the Mediterranean Sea may be dating back positively. More recent records of the species in the Mar Piccolo di Taranto (2007-2009) show its persistence and invasive success in this sheltered and transitional environment, which is considered a true hotspot of non-indigenous species.

Lysianassoid amphipods in Potter Cove (King George Island; Antarctica): A first biodiversity inventory in a rapidly changing environment

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Seefeldt MA^{1,2}, Tollrian R¹, Held C²

¹Ruhr University Bochum, Faculty of Biology and Biotechnology, Department of Animal Ecology, Evolution & Biodiversity, Bochum, Germany; ²Alfred Wegener Institute for Polar and Marine Research, Department of Functional Ecology, Bremerhaven, Germany
Meike.Seefeldt@rub.de; Meike.Seefeldt@awi.de

Although the abundant lysianassoid scavenging guild plays a key role in Antarctic food webs, the lysianassoid species composition in Potter Cove (King George Island, Western Antarctic Region) is almost unknown due to the challenging morphological differentiation of species. However, baseline information such as species diversity is crucial to monitor the effect of environmental changes on local food webs of vulnerable regions like the Western Antarctic Peninsula region. Potter Cove (PC) is exposed to rapid increases in temperature, melt and retreat of the Fourcade Glacier resulting among others in freshwater inflow, sedimentary run-off and increase of sea surface temperature. The aim of this study was to record the taxonomical diversity of scavenging amphipods in the PC. For this inventory more than 30 baited traps were deployed in the Antarctic spring/summer season 2014/2015, collecting thousands of lysianassoids at depth between 10 and 50m at sample sites with distances to the Fourcade Glacier between approx. 50m and 1400m. Our study gives first information on the species composition and abundances of lysianassoid amphipods in PC and simultaneously complement species catalogues from previous studies of adjacent bays (Marian Cove/Maxwell Bay, Admiralty Bay). The most dominant lysianassoid species found are *Cheirimedon femoratus*, *Waldeckia obesa*, *Orchomenella rotundifrons*, *Hippomedon kergueleni*, whereby in the latter species two different colour morphs could be detected. Our results suggest a moderate species richness and an abundance of lysianassoids decreasing with an increasingly proximity to the Fourcade Glacier.

New records of Lysianassidae, Pachynidae and Uristidae (Amphipoda: Lysianassoidea) from the southwestern Atlantic Ocean

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Siqueira SGL^{1,2}, Serejo CS¹

¹Museu Nacional/UFRJ, Departamento de Invertebrados, Setor de Carcinologia, Rio de Janeiro, Brazil; ²Departamento de Biologia Animal, Instituto de Biologia, Universidade Estadual de Campinas, Campinas, Brazil
silvsbio@yahoo.com.br

The superfamily Lysianassoidea comprehends 22 families and is an important component of the marine benthic community. These amphipods have a wide bathymetric distribution, occurring from shallow to deep sea depths around the world. In Brazil, there are 19 species of Lysianassoidea registered mainly as part of efforts in the last decade of projects that aimed to characterize the Brazilian Marine Exclusive Economic Zone, such as the REVIZEE program (Evaluation of the Sustainable Potential of Living Resources in Marine Exclusive Economic Zone); OCEANPROF project (Campos Basin Deep Sea Environmental Project) and HABITATS project (Evaluation of Environmental Heterogeneity in Deep Sea Campos Basin). Results of the present study are based in the AMBES project (Environmental Characterization of Espírito Santo Basin and Northern Campos Basin). Samples were carried

out with the vessel *R/V Gyre* using a box-core gear between December 2011 and July 2013 in depths varying from 20 to 3000m. In 23 samples analyzed, six species of three different families were found in different depths: *Cheirimedon foscae* Siqueira & Serejo, 2014 (955-1887m), *Hippomedon* sp. (45-1897m), *Lepidepecreum* sp. (34, 142m), *Lepidepecreoides* sp. (430, 1288 m), (Lysianassidae); *Eclecticus* cf. *eclecticus* Lowry & Stoddart, 2002 (36-46m) (Uristidae); and *Figorella* sp. (955m) (Pachynidae). Apart from *C. foscae* that was recently described from the Campos Basin, all other genera and corresponding species are new records for the southeastern Brazilian coast. The present study provides new information about the distribution and diversity of the superfamily Lysianassoidea along the southwestern Atlantic Ocean, an area that seems to be still poorly known for the group.

Taxonomic and ecologic study of taxon Amphipoda (Crustacea): A collection of the benthic macroinvertebrates of the Italian coasts

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Targusi M, Lattanzi L, Marusso V, Trabucco B

¹ISPRA Institute for the Protection and Environmental Research, Rome, Italy
monica.targusi@isprambiente.it

Since 2000 Researchers of the Benthic Ecology Laboratory (LEB) of the Institute for the Protection and Environmental Research (ISPRA) have been studying taxonomic and ecological characteristics of benthic organisms, sampled during different research projects of the Italian marine and transitional ecosystems, at different spatial and temporal scales. In 2014 a taxonomic revision work of all the samples taken over the years has begun, in order to create a reference collection of marine benthic organisms, with particular attention to Polychaeta, Crustacea, Mollusca and Echinodermata taxa. Amphipoda (Crustacea Peracarida), sampled on soft bottoms along the Italian coasts (the Adriatic and the Tyrrhenian), in the marine and transitional ecosystems at different depths (from 5m to 100m), are part of this collection. The work of taxonomic revision of Amphipoda species firstly showed the high diversity characterizing amphipods assemblages of Italian seas, both from a quantitative and a qualitative point of view. Furthermore, this activity has revealed important morphological differences among individuals of the same species, related to the stage of development; finally, it has allowed us to collect new information on the biogeographic distribution of species as well as to get an update on their ecological characteristics/preferences. All amphipods reviewed up to now are preserved at the LEB and the species complete updated list will be soon available online. Also a database will be available online, with major ecological and biogeographic information regarding each specimens, plus photos of each species with their main diagnostic characters. This collection is one the several results gained from the different surveys performed by ISPRA Researchers, representing an invaluable asset for the development of taxonomic, morphological, ecological and biogeographic research, and even for the advancement of basic research on biodiversity. Furthermore, investigations based on biological collections may be a reference for land management, environmental protection and sustainable development.

First representatives of the genus *Allorchestes* Dana, 1849 (Amphipoda, Dogielinotidae) from South East Asia

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Wongkamhaeng K¹, Boonyanusith C², Dumrongrojwattana P³

¹ Marine and Coastal Resources Institute (MACORIN), Prince of Songkla University, Thailand; ²Biology Program, Faculty of Science and Technology, Nakhon Ratchasima Rajabhat University, Nakhon Ratchasima, Thailand; ³ Department of Biology, Faculty of Science, Burapha University, Bangsaen, Chonburi Thailand
koraon@gmail.com

During the BioBlitz, 24 hour rapid biodiversity survey in Bangkajao Urban Oasis, Samutprakarn province on the 1st- 2nd November 2014, altogether 637 species were record. In the material collected during this survey an amphipod belonging to Family Dogielinotidae was identified as new to science. *Allorchestes rosea* n.sp. which is also the first record of this genus in Southeast Asia can be distinguished from other congeners by its red colour; pappose setae on antennae 1–2, gnathopods 1–2, pereopods 5–7, and uropods 1–2; male gnathopod 1 dactylus not exceeding regular palm. This combination of characters has not been recorded previously in the *Allochestes*.

Contribution to the knowledge of the Amphipoda (Crustacea) of the coast of Lebanon

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Zakhama-Sraieb R, Sghaier YR, Charfi-Cheikhrouha F

Université Tunis El Manar, Faculté des Sciences de Tunis, Département de Biologie Animale, S11UR11 Bio-Ecologie et Systématique Evolutive 2092 Manar II, Tunisia
zakhamarym@yahoo.fr

Despite the amphipod fauna of the Mediterranean Sea being considered one of the best known in the world, the Lebanon coasts (eastern Mediterranean) remains nearly unexplored. The present work is a contribution to the study of Amphipoda collected in September 2013 from four locations along the Lebanon coasts: Saida, Naqoura, Tyr and Bayatha. Different algal habitats were sampled (*Codium arabicum*, *Corallina mediterranea*, *Cystosera* sp ...) at depth ranged from 3 to 17m. A total of 187 amphipod specimens were collected and 14 species were identified. Information about the distribution and habitats preference of each species were provided.

The diversity and distribution of Red Sea caprellids

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Zeina AF¹, Guerra-García JM²

¹Laboratory of Marine Biology, Marine Biology and Ichthyology Section, Zoology Department, Faculty of Science, Al-Azhar University, Nasr City, Cairo, Egypt; ²Laboratorio de Biología Marina, Departamento de Fisiología y Zoología, Facultad de Biología, Universidad de Sevilla, Sevilla, Spain
afzeina@gmail.com

Since the nineteenth century most of amphipod research on the Red Sea was focused on the study of gammarids. Only few of Red Sea caprellid species had been recorded during that

period of research. In the present study, the Caprellidae from the Red Sea are reviewed based on the literature data and new collections from the Hurghada coasts. So far, only six valid species has been reported from the Red Sea: *Caprella equilibra* Say, 1818, *Hemiaegina minuta* Mayer, 1890, *Metaprotella africana* Mayer, 1903, *Paracaprella pusilla* Mayer, 1890 and *Paradeutella multispinosa* Schellenberg, 1928, *Pseudocaprellina pambanensis* Sundara Raj, 1927. The type material of *M. africana* (deposited in the Muséum national d'Histoire naturelle, Paris) and *Paradeutella multispinosa* (deposited in the Museum für Naturkunde, Berlin) are redescribed and illustrated in detail. *P. pambanensis* and *H. minuta* were the most abundant species in the collections along the Egyptian northern coast of the Red Sea. *P. pambanensis* occurred on all types of macroalgae, but *H. minuta* was recorded only on some species of brown algae. The highest densities of both species were measured during the months April and June. Most of the sampling effort has been focused on algae from shallow waters; additional substrates such as sediments, hydroids and coral rubble, especially from areas deeper than 15 meters should be explored. The number of caprellid species in the Red Sea is low compared to adjacent waters, as the Mediterranean Sea. However, further research and more extensive caprellid collections should be conducted along the coasts of Saudi Arabia, Yemen, Sudan and Eritrea, which are still unexplored.

Anthropogenic disturbance and global change

Embryonic characteristics in amphipods as a tool for assessment of quality in the eastern Baltic Sea

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Berezina NA¹, Strode E²

¹Zoological Institute1, St Petersburg, Russia; ²Department of Experimental Hydrobiology, Latvian Institute of Aquatic Ecology, Riga, Latvia
Nadezhda.berezina@zin.ru

Amphipods have great potential for the sediment toxicity tests in coastal areas of the Baltic Sea. The malformation rate in amphipods can be evaluated as frequency of occurrence for females with malformed embryos or ratio of aberrant to the total number of embryos in marsupium. It was recommended as general indicators of contaminants effect in the Baltic Sea by HELCOM (2010, 2013). This study presents results of comparative assessment for environmental state using amphipod embryos in the Gulf of Finland and the Gulf of Riga. We sampled females of four amphipod species in 2013-14. The native Baltic amphipod *M. affinis* is rare species in the Gulf of Finland due to hypoxic sediments presented in deep water areas and was collected only in the Gulf of Riga. The *G. fasciatus*, *P. robustoides* and *G. tigrinus* belong to so-called alien species but they are important components (30-40% of the total biomass) in the benthos of coastal areas of eastern Baltic Sea and are a main item in the diet of local fish and birds. Earlier they are used as test indicators (10 days mortality test) for sediment toxicity (Berezina et al. 2011, Strode, Balode, 2011). All of last three species have a life span lasting for 1.5 year; and their mating begins in April-May; embryogenesis proceeds through 2-3 weeks, and juveniles are released several times per season (2-3 generations). The embryos malformation rates were measured as mean frequency proportion of malformed, enlarged, undifferentiated and dead embryos per female using at least 50 females per site. The good environmental status (GES) is reached if the rate is <8 % of embryos are malformed and the very bad status is given if it >40% of embryos are malformed. The proportion of females with >1 malformed embryos reached >20 % testifies increased level of contaminants in area.

Genotoxicity biomarkers in the sandhopper *Talitrus saltator* and invertebrate community study in the evaluation of coastal ecosystems quality assessment

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Di Donato G, Pierangeli S, Ronci L, Setini A, **De Matthaeis E**

Department of Biology and Biotechnology "Charles Darwin", University of Rome "La Sapienza", Rome, Italy
giovanna.didonato@uniroma1.it

Ecosystems are under the pressure of complex mixtures of contaminants whose effects are not always simple to assess. In the last decades, the increasing contamination of water bodies, especially in coastal areas, has required a better understanding of how these substances spread in the environment. Biomarkers, acting as early warning signals of the presence of potentially toxic xenobiotics, are useful tools for assessing either exposure to, or the effects of these compounds providing information about the toxicant bioavailability. Shore

and sub-shore beaches and sand dunes environments are among the most vulnerable and seriously endangered ecosystems in the world. The complex nature of these environments has led to the development of ecosystems characterized by specialized and highly adapted communities often exclusively present in these habitats. In this context, our work foresees investigations at different levels; we indeed aim at applying ecological, eco-toxicological and molecular approaches to unravel the biotic effects associated with different types of environmental perturbations on sandy beaches, with particular attention to the role played by rivers as carriers of pollutants. We hence focus on sandy beaches close to the Albegna and Tiber river mouth (Central Italy), along these beaches were carried out chemical analyses of organic and inorganic pollutants on sand samples jointly with an ecological study on structure and diversity of invertebrate community. Furthermore, to better understand the cause-effect relationship determining the ecological quality of the chosen locations, we are firstly applied a biomarker of genotoxicity (Single cell gel electrophoresis) in the amphipod species, *Talitrus saltator* to monitor the effects of pollution at a low level of biological organization and to relate them to both biotic and abiotic indicators. Talitrid amphipods constitute the main animal biomass in sandy beach ecosystems and play an important role in the energy flow among different trophic levels.

Multi-level assessment of particulate matter effects on *Echinogammarus veneris* (Crustacea; Amphipoda)

Ronci L¹, Marcoccia M², De Matthaeis E¹, Setini A¹, Canepari S²

¹Department of Biology and Biotechnology "Charles Darwin", University of Rome "La Sapienza", Rome, Italy; ²Department of Chemistry, University of Rome "La Sapienza", Rome, Italy

Monitoring of atmospheric Particulate Matter is required in order to assess the air quality in urban areas. Particulate Matter includes and absorbs several toxic and/or carcinogenic compounds such as polycyclic aromatic compounds, heavy metals and nanoparticles, characterized by different bio-accessibility properties. We used the freshwater amphipod species *Echinogammarus veneris* (Heller, 1865), as bioindicator, to evaluate the genotoxic potential and oxidative stress, as biomarkers, of the certified material NIST 1648a, by Comet assay, with FPG modified protocol, and estimation of cellular Glutathione (GSH) concentration, in the haemocytes cells. Furthermore, the concentration of soluble and insoluble fractions of elements in the exposure water and their bioaccumulation in the gammarids tissues were followed during the whole exposition period. In the first step we considered different exposure concentration of NIST 1648a to perfect the different methods. Therefore, total elements content in NIST 1648a was fractionated into two contributions – soluble species and insoluble particles – to assess their toxic and genotoxic potential. The combined results, of the different biomarkers, show a relevant damage (genotoxic and oxidative stress) in the haemocytes and bioaccumulation, in the amphipod tissues, induced by insoluble fraction, probably due to the nanoparticles and PAHs presences.

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The influence of the invasive seaweed *Asparagopsis taxiformis* on the caprellid community

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Florido M, González-Romero P, Navarro-Barranco C, Ros M, Guerra-García JM

Laboratorio de Biología Marina, Departamento de Zoología, Facultad de Biología, Universidad de Sevilla, Sevilla, Spain
marflocap@alum.us.es

A comparison between caprellid assemblages inhabiting the invasive *Asparagopsis taxiformis* and the native *Halopteris scoparia* was conducted along the Andalusian Mediterranean coast. Four factors were considered: (1) 'Substrate', a fixed factor, with two levels (*A. taxiformis* vs *H. scoparia*), (2) 'Habitat', a fixed factor, orthogonal with 'substrate' with two levels (habitat dominated by *A. taxiformis* vs habitat dominated of *H. scoparia*), (3) 'Locality' (localities separated tens of kilometers), a random factor nested with 'habitat', with three localities for each habitat, and (4) 'Site' (sites separated tens of meters), a random factor nested with 'habitat' and 'locality', with three random sites for each locality. Four replicates of each alga were collected in each site. Six species were found: *Caprella acanthifera* 'sensu lato', *C. hirsuta*, *C. liparotensis*, *C. mitis*, *Phtisica marina* and *Pseudoprotella phasma* f. *quadrispinis*. *C. acanthifera* and *P. marina* were present in all the localities. There were no significant differences between substrates and habitats in number of caprellid species, Shannon diversity and total abundance. However, we found differences among localities mainly due to the high abundances of *C. mitis* or *C. hirsuta* in particular places. *Caprella mitis* and *P. marina* was more abundant in *H. scoparia*, while *C. acanthifera*, *C. hirsuta* and *C. liparotensis* were more abundant in *A. taxiformis*. *Pseudoprotella phasma* was only found in the habitat dominated by *A. taxiformis*. According to the multivariate analysis, the presence of the invasive seaweed did not involve important changes in the structure of the community. However, abundance of some species showed significant differences between the native and invasive seaweed. Hence, special attention should be paid also at species level and not only at community level. These results should be taken into consideration in management and monitoring programmes to evaluate the potential impact of this invasive alga on its associated invertebrate community.

Grandidierella japonica Stephensen, 1938 has appeared in a Mediterranean marina (Tuscany, Italy): first signals of invasion?

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Marchini A, Ferrario J, Nasi E, Occhipinti-Ambrogi A

Department of Earth and Environmental Sciences, University of Pavia, Italy
agnese.marchini@unipv.it

The aorid amphipod *Grandidierella japonica* is native to the Western Pacific region (Japanese archipelago) and known since the 1970's as introduced to the Pacific coasts of America; more recently, it appeared in the Atlantic coasts of Europe, with isolated records from England, Sweden and France. The present work reports the first record of *G. japonica* in the Mediterranean Sea, where no other species of the genus *Grandidierella* are known. More than 200 specimens of *G. japonica* were collected from the docks of the marina of Viareggio (Tuscany, Tyrrhenian Sea) in July 2013. *G. japonica* was present in seven out of nine sampling sites, 6 of which in the innermost part of the marina, characterized by brackish

water conditions (water salinity ranged from 15.8 to 20.9 psu). Although previous introduction events of this species have been polyvectoric (oyster trade and shipping), in the case of Viareggio, lacking any aquaculture facilities nearby, recreational boating is the only possible vector of introduction. In Europe, *G. japonica* is currently confined in few localities, mainly estuaries, enclosed bays and brackish water areas, but its successful history of invasion in the Pacific coasts of North America suggests that a further spread can be expected in the Mediterranean Sea as well.

Dominance of *Pseudolirius kroyeri* in a location influenced by freshwater in Cagliari port (Italy)

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Rossano C¹, Plaiti W², Arvanitidis C², Scapini F¹

¹Department of Biology, University of Florence, Florence, Italy; ² Hellenic Centre for Marine Research, Heraklion, Crete, Greece

claudia.rossano@unifi.it

A survey on the Mediterranean port of Cagliari (Italy) was performed in 2012 within the framework of the MAPMED project, aiming at providing good practices to the Port Authorities for the improvement of the environmental quality. Three sampling campaigns were performed in relation to the touristic season in February (winter), May (beginning of the touristic season) and September (end of the touristic season). Five sampling stations were chosen in relation to the uses of the port area to identify possible relationships between the benthic communities and the abiotic variables: leisure boats, intermediate station, passengers ships, cargo ships, and a station near the entrance of the port as control station, are the main sectors considered. Benthic samples were collected and the main physico-chemical variables were measured to describe the ecological status of the port sectors. Amphipods were the main component of the crustacean subphylum in the macrobenthic samples, as expected, with their abundances unequally distributed both among the stations and seasons. *Pseudolirius kroyeri* was the dominant species, representing 93% of the total amphipod abundance. However, its presence was concentrated in a single station (intermediate station) in February and May. Possible explanations are reported linked to the autoecology of the species and the port characteristics, namely the hydrodynamics and the freshwater inputs into the port.

The project "MANagement of Port areas in the MEDiterranean Sea Basin (MAPMED)" has been funded by ENPI CBC MED Cross-Border Cooperation.

Amphipod assemblages in a volcanic CO₂ marine vents system: a study from artificial collectors along a natural pH gradient

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Scipione MB, Ricevuto E, Gambi MC

Stazione Zoologica Anton Dohrn, Department of Integrative Marine Ecology, Center of Villa Dohrn Ischia – Benthic Ecology, Ischia Porto (Napoli), Italy
beatrice.scipione@szn.it

Ocean acidification, one of the most serious threats facing marine life, is likely to cause a decrease in biodiversity which may lead to shifts in ecosystem structure. Amphipods have become important in assessing biodiversity, and have long been known as sensitive environmental indicators. The present study was framed within a wider research programme, aimed at investigating the effect of low pH values on benthic assemblages. It was conducted at the Castello Aragonese, an area off the Island of Ischia (Gulf of Naples, Italy), characterized by a natural pH gradient due to CO₂ volcanic vents. In this 'natural laboratory', amphipods were sampled by means of artificial collectors settled for one month in the water column at approx. 2m depth. Three stations (control: 8.1 mean pH; low pH: 7.7; extreme low pH: 7.3) at each side of the Castello (North and South) were studied in May 2008, September 2009, March and May 2010, totalling 77 samples. Overall, 3,257 individuals belonging to 40 species were identified. The assemblage parameters did not show evident differences along the pH gradient, with a significant increase of species richness and Shannon diversity at acidified stations only in May 2010 at the south side. The nMDS ordinations coupled with cluster analyses showed significant disjunctions between control and acidified sites only in September and May 2010, and interactions between time, side and pH were found. The peculiar substratum favours the settlement of less mobile or domicolous forms: dominant species are *Caprella acanthifera*, *Ampithoe ramondi*, *Microdeutopus sporadhi* (low-extreme low) and *Jassa cadetta*, *Lembos websteri* (control). On the whole, the Castello volcanic CO₂ vents do not affect negatively amphipod colonization; the assemblages appear to be tolerant and well adapted to the low and extreme low pH values recorded, and the differences found might be due to the biological features and the ecological requirements of individual species.

Ecology

First description of the epibiotic associations between apostomid ciliates *Conidophrys* spp. and two amphipods present in fish farms fouling in the western Mediterranean Sea

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Fernandez-Gonzalez V¹, Fernandez-Leborans G², Roura A³, and Sanchez-Jerez P¹

¹University of Alicante, Department of Marine Sciences and Applied Biology, Alicante, Spain; ²Complutense University, Department of Zoology, Madrid, Spain; ³La Trobe University, Department of Ecology, Environment and Evolution, Melbourne, Australia
victoria.fernandez@ua.es

Fish farms commonly support high abundances of invertebrates, especially amphipods, associated with fouling communities developed over nets, ropes and buoys. Protozoan epibiont ciliates of the genus *Conidophrys* were observed on two of the most abundant amphipod species collected from ropes of a fish farm in the western Mediterranean Sea. The amphipod species were *Erichthonius punctatus*, which presented the epibiont *Conidophrys pitelkae*, and *Jassa marmorata*, with the epibiont *C. pilisuctor*. The epibionts were found in numbers fluctuating between 1 and 119 individuals in *J. marmorata* (median value = 8), higher than the number of epibionts found on *E. punctatus* that varied between 1 and 39 individuals (median value = 3). The epibiosis on *J. marmorata* also showed prevalence values (34.33%) superior to those of *Erichthonius punctatus* (24%). Differential distribution of the epibiont species on the surface of basibionts has been detected: *Conidophrys pilisuctor* were more frequently found on the head and gnathopods of *J. marmorata*, while *C. pitelkae* were mainly counted on the head of *E. punctatus*. This is the first time that *Conidophrys* were found on these amphipod species.

Amphipods of the Gulf of Guinea – diversity and distribution patterns

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Jazdzewska AM¹, Serigstad B², Appoh E³

¹Laboratory of Polar Biology and Oceanobiology, University of Lodz, Lodz, Poland; ²Institute of Marine Research, Bergen, Norway; ³Ghana Environmental Protection Agency, Accra, Ghana
ajazdz@biol.uni.lodz.pl

The Gulf of Guinea is a large marine system in the West Africa where rapid increase of industrial activity can be observed. The material was collected in the framework of the program "Marine environmental monitoring in Ghana", involving the Norwegian Agency for Development Cooperation (NORAD) under the Oil for Development program (OfU) and Food and Agriculture Organization of the United Nations (FAO). The study aims to assess the diversity and distribution patterns of Amphipoda, along the depth range of 25–1300 m. Over 270 Van Veen grab samples (0.2 m²) from nine transects (three to six replicates at 42 stations) were collected in 2012 along the coast of Ghana. Data on sediment type and organic matter content were also gathered at each station. Each sample was washed on 0.3 mm sieve. Amphipods were present in 232 out of 277 samples and constituted 10% of all non-colonial invertebrates being the second most abundant group after Polychaeta. The dominant and the most frequent family was Ampeliscidae which reached almost 40% of the dominance and 75% of the frequency, followed by Melitidae, Phoxocephalidae and

representatives of the suborder Corophioidea. The highest mean density and the maximum number of taxa were observed at 25 m. Deeper both the density and diversity decreased. The shelf samples (down to 250 m) were dominated by representatives of the family Ampeliscidae and suborder Corophioidea whereas in lower depths amphipods from the families Oedicerotidae and Phoxocephalidae played a more important role.

Hydrochemical and hydrophysical habitat conditions of *Gammarus lacustris* GO Sars in western Siberia lakes

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Kozlov OV

Kurgan State University, Kurgan, & State Scientific and Production Centre for Fisheries, Tyumen, Russia
kozloff@kgsu.ru

Gammarus lacustris may be considered in lakes of Western Siberia forest-steppe zone as ordinary boreal-arctic species. The reason for this is a high temperature tolerance of this species (from 0°C to + 30°C) and the dissolved oxygen concentration in the water. It can exist in the range from 0.2 mg·l⁻¹ to the maximum possible value, as in the lakes with a sufficient concentration of dissolved oxygen in waters well as hypoxic type lakes. These lakes are typical for the forest-steppe zone of Western Siberia. Gammaridae population southwest part of West Siberian plain found in small (1.0-2.0 km²) hypoxic type lakes with an average depth of 2.0-2.5 m, in which the dissolved oxygen concentration is 0.5-1.5 mg·l⁻¹ before opening lakes in the March-April. By decreasing of the dissolved oxygen concentration in the water during the winter season take place the oxyphilous migration of individuals to the ice surface and their transition from benthic to nektonic lifestyle. Combined effect of temperature and dissolved oxygen concentration is important for *G.lacustris* populations. Gammarus has a capable to resisting of short-time freezing in ice and restore function of organism by increasing of water temperatures. Silt is the main habitat of Gammarus when the lake freezes to the bottom. *G.lacustris* has an internal mechanism of homeostasis regulation (maintained by osmoregulation), stabilizing metabolism during an annual cycle and does not depend on the temperature optimum (from +11°C to +24°C). This allows the species to exist when the salinity increase up to 30 grams per liter. Interval natural salinity for *G.lacustris* is the concentration of salts from 0.3 to 10.0 g·l⁻¹. This species can live in lakes of the West Siberian Plain south part at a salinity of 20 grams per liter (average population biomass 118.3 g·m⁻²). Most likely, the *G.lacustris* may be classified as a brackish water organism with a high degree of adaptation to salinity. Lakes water, in which inhabits this species of *Gammaridae*, can be attributed to the chloride-bicarbonate-sodium type according to the chemical composition of water.

Relationship between amphipod assemblages and organic enrichment in a marine fish farm: a case study

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Lattanzi L, Targusi M, Tomassetti P

ISPRA - Italian National Institute for Environmental Protection and Research, Rome, Italy
 loretta.lattanzi@isprambiente.it

In the present study the relationship between the distribution patterns of amphipod assemblages and organic enrichment resulting from fish production in a marine fish farm located in Follonica (Tyrrhenian Sea, Italy) was assessed. Amphipods were collected in two different years (April and October 2011 and April and October 2012), by mean of a Van Veen grab in selected stations grouped based on their distance from the sea cages: 0 m, station located just beneath the sea cages or in the center of net pen, 25 and 50 m from the sea cages and control station located at enough distance from sea cages. At each station sediment samplings were collected and granulometric and biochemical analyses were performed. Data analysis of the amphipod assemblages were performed with statistical methods and biotic indexes were calculated. The assignment of ecological group for the amphipod assemblages was in according to the list of species, for AMBI calculation, available in the AZTIs web (<http://www.azti.es>). The taxonomic analysis of the amphipods collected in 16 stations led to the identification of 3071 individuals belonging to 42 different species. The results showed higher values in abundance and species at October 2011, in particular at 25m stations, where instead lower values of organic matter were found. In particular three deposit feeders species *Elasmopus rapax* Costa, 1853, *Gammarella fucicola* (Leach, 1814), both species classified as tollerant species to organic enrichment (group III) and *Maera grossimana* (Montagu, 1808) classified as sensible species to organic enrichment (group I) dominated. *E. rapax* and *G. fucicola* resulted, based on their ecological behaviour towards organic enrichment found in the present study, as sensitive species rather than tolerant as reported in the literature.

Long-terms dynamics in a soft-bottom amphipod community and the influence of the pelagic environment

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Navarro-Barranco C¹, McNeill CL², Widdicombe CE², Guerra-García JM¹, Widdicombe S²

¹Laboratorio de Biología Marina, Departamento de Zoología, Facultad de Biología, Universidad de Sevilla, Sevilla, Spain; ²Plymouth Marine Laboratory, West Hoe, Plymouth, UK
 carlosnavarro@us.es

In the context of the Western Channel Observatory (Plymouth, UK), the amphipod species found at a reference station and their abundance patterns have been tracked during 7 years (2008-2014). In order to explore the importance of the benthic-pelagic coupling in this coastal community, it has been also characterized the annual changes in phytoplankton biomass, water temperature, salinity and chlorophyll a concentration. According to our results, there are not major changes among seasons and years in the main species characterizing the community. Comparisons with previous studies (there are data available since the beginning of the last century) pointed out that these dominant species are well established in the area for a long time. In spite of this, statistical analyses showed that both season and year have a significant effect in the structure of the community. In contrast to expectations, our analyses

did not detect a significant influence of the phytoplankton biomass on benthic amphipod dynamics. Although phytoplankton blooms started at spring, peak in amphipod abundance was not detected until the beginning of autumn. On the other hand, there is a clear and constant synchronization between annual temperature fluctuations in the sea bottom and amphipod abundance. Thus, the main limitation to benthic amphipod abundance seems to be temperature rather than phytodetritus supply. This pattern is different from that observed in other detritivorous species at L4, highlighting the complexity of benthic-pelagic coupling and the high variability both in nature and timing of the response to pelagic conditions among different groups. Because of its biogeographic position, the influence of temperature on amphipod populations, as well as the solid baseline provided here and in previous studies, the monitoring of long-term amphipod dynamics in the English Channel could be a valuable tool to evaluate the biological effect of climate change over marine benthic communities.

Amphipods as food sources for some fishes in the Turkish Aegean Sea: A synthesis

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Bayhan B, Sever TM, **Özbek M**, Kaya M, Kurtul I

Ege University, Faculty of Fisheries Department of Hydrobiology, Izmir, Turkey
bahar.bayhan@ege.edu.tr; baharbayhann@gmail.com

Aegean Sea is the richest sea in Turkey that hosts approximately 449 fish species, in other words, 88% percent of Turkey's sea fish. Turkish Aegean Sea is the feeding, breeding and growth area of many economically important fish species. Nowadays, trophic levels are used in order to develop ecosystem based fisheries management strategies. Depending on the trophic controls forming upwards from the lowest level and downwards from the highest level of the food chain, long-term changes in fish stocks and leaps between low and high stock regimes can be identified. Changes in the number, size or composition of species that make up a ring of the food chain due to any reason will affect all of the marine life and also the biosphere which it interacts with. Therefore, it is necessary to adopt rational and scientific approaches for sustainable use of marine resources. For this purpose, the feeding regime of the fish species was studied by several researchers and we searched diet composition of many fish species distributing in the Aegean Sea. Also according to our previous findings about stomach content analyses showed that many species mainly fed on crustaceans in the Turkish Aegean Sea. Despite their importance in terms of biodiversity, very few is known about the role of amphipods in the Turkish Aegean Sea trophodynamics. Based on an exhaustive literature survey, we tried to delineate their importance as potential prey for fishes. So it is the purpose of our study to identify the Amphipoda prey groups of the some fish species distributing in the Turkish Aegean Sea. The present paper is the first attempt to summarize the available information about Amphipoda as preys.

Environmental factors modulating the extent of competitive interactions between newcomer and established caprellids along the Iberian Peninsula

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Ros M¹, Vázquez-Luis M², Guerra-García JM¹

¹Laboratorio de Biología Marina, Dpto. Zoología, Facultad de Biología, Universidad de Sevilla, Sevilla, Spain; ²IEO, Centre Oceanogràfic de les Balears, Palma de Mallorca, Spain
mros@us.es

Understanding the respective roles of environment and interspecific interactions in shaping species' distributions is a critical aspect to determine the potential impacts of newcomer species on occupied habitats. The invasive caprellid amphipod *Caprella scaura* has successfully spread along the western Mediterranean coast in a short time period, coinciding with a decline in the population of an ecologically similar congener, *Caprella equilibra*. To understand the mechanisms underlying the establishment success of *C. scaura* and its potential role in shaping *C. equilibra*'s distribution, we analyze the factors involved in the patterns of distribution and co-occurrence of both species at 42 marinas along the Iberian Peninsula and northern Africa. Results reveal that the two species are strongly spatially segregated, with a limited spatial overlap, where *C. scaura* dominates in the Mediterranean coast of the Iberian Peninsula while *C. equilibra* dominates in the Atlantic coast. Our analyses provide statistical evidence for a competitive displacement of *C. equilibra* by *C. scaura* along the Mediterranean coast of Spain, and point out the critical role of salinity in modulating this interaction and limiting the invasive success of *C. scaura* in the Iberian Atlantic coast.

Amphipod functional groups distribution and environmental variables at the southern Brazilian continental shelf

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Almeida TCM¹, Serejo C²

¹Laboratório de Ecologia de Comunidades - UNIVALI, Rio de Janeiro, Brazil; ²Museu Nacional/UFRJ, Rio de Janeiro, Brazil
tito@univali.br

This study presents a comprehensive approach on the distribution of amphipod functional groups and their relation with sediment variables as: pigments, organic carbon, mean grain size, sorting, skewness, as well as temperature and salinity of the bottom water at the southern Brazilian continental shelf. A total of 54 sites were sampled in triplicate during two surveys (March/2009, rainy period and July/2009, dry period) using a 0.1 m² Van-Veen grab at depths ranging from 15 to 100 m. A total of 14.860 specimens were collected distributed in 43 identified species and 146 morphotypes. The most abundant species were *Chevalia convexa*, *Puelche* sp.1, *Chevalia setosa*, *Phtisica marina* and *Chevalia anomala*, which together represented 50% of the total amount of specimens. The faunal similarity between sample stations were done by Bray-Curtis coefficients and MDS showed two assemblages related to depth: 1) the inner shelf assemblage (15 - 50 m) dominated by *Metharpinia* sp. *Puelche* sp. 1 and *Puelche* sp. 3; and 2) the outer shelf assemblage (75-100 m) dominated by *Phtisica marina*, *Carangolioides castellatus* and *Ampelisca youngi*. The PERMANOVA analysis indicated interaction between depth and time, represented by rainy and dry periods. The canonical correspondence analysis (CCA) showed significant correlation (R>0.8) among

amphipods and sediment granulometric composition, organic matter, pigments (chlorophyll and pheophytin) and the bottom water temperature. The inner shelf assemblage was dominated by burrowers, which are potentially carnivorous, while the deepest assemblage was dominated by tubicolous from the epifauna and endofauna.

Phylogenetics and phylogeography

Further insights into hidden diversity among Mediterranean marine *Gammarus* (Amphipoda: Gammaridae) as indicated by mitochondrial and nuclear loci

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Antunes I¹, Ferreira MS¹, Sezgin M², Iannilli V³, Karaman GS⁴, Costa FO¹

¹Centre of Molecular and Environmental Biology (CBMA), Department of Biology, University of Minho, Braga, Portugal; ²Sinop University Fisheries Faculty, Marine Biology and Ecology Department, Sinop, Turkey; ³Unità Tecnica AGRIC-ECO, ENEA CR Casaccia, Roma, Italy; ⁴Montegrin Academy of Sciences and Arts, Riste Stijovica Podgorica Crna Gora, Montenegro
fcosta@bio.uminho.pt

In earlier studies we examined the sequence variability of a 658 bp fragment of the cytochrome oxidase I (COI) gene among dominant *Gammarus* of the Mediterranean Sea. We have found deeply divergent lineages within the morphospecies *Gammarus aequicauda* and *Gammarus insensibilis*. Both species displayed a similar geographic arrangement of their lineages: Black Sea and Mediterranean populations completely sorted in distinct monophyletic clusters. In the present study we examined additional specimens from the same populations, reviewed some morphological identifications, examined specimens from other locations (e.g. Marmara Sea), and obtained partial sequences of the small subunit of the 18S rRNA nuclear gene for selected specimens. Examination of the COI fragment of additional specimens further supported our earlier findings. Populations of *G. aequicauda* and *G. insensibilis* from the Black Sea displayed an average genetic distance of 13 and 14% (Kimura-2-parameter) from their conspecifics collected respectively in Italy and Spain (Mediterranean coast). These levels of divergence in COI are well beyond what is usually found within species of *Gammarus*. Specimens of *G. insensibilis* from Marmara Sea had an exclusive set of COI haplotypes, but they were very close (1% average distance) to their conspecifics from the Black Sea (Bulgary and Turkey). When comparing specimens of *G. insensibilis* from Spain (Mediterranean coast) and from the Black Sea, the large differences observed with COI nearly disappear in the case of 18s sequences. However, it has been observed in numerous taxa that sequence variability observed in the 18s rRNA is typically much smaller than in COI, and frequently unable to discriminate even among established species. Hence, globally these results confirm the probable occurrence of hidden (possibly cryptic) species among the Mediterranean and Black Sea populations of *G. aequicauda* and *G. insensibilis*.

Molecular markers show genetic structuring in *Ampelisca* species from the Central Mediterranean Sea

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Cimmaruta R¹, Cecchetti S¹, Marusso V², Trabucco B²

¹Department of Ecological and Biological Sciences, Tuscia University, Viterbo, Italy; ²Institute for Environmental Protection and Research (ISPRA), Rome, Italy
cimmaruta@unitus.it

Marine amphipods are known as poor disperser, being brooding species, so that high levels of intraspecific genetic structuring are expected, and frequently found, both between and within sea basins. Nevertheless, some established discontinuities do not produce genetic breaks in all the species, thus making this group a good candidate for studies aimed at investigating the consistency between biogeographic and phylogeographic breaks. The Central Mediterranean Sea is a target area for such studies, since it hosts different biogeographic regions separated by well-known discontinuities. In this preliminary study, samples of three species of *Ampelisca* (*A. tenuicornis*, *A. ledoyeri*, *A. typica*) from Tyrrhenian and Adriatic Sea have been investigated by means of molecular markers, both mitochondrial (COI) and nuclear (H3, 28S), to look for possible genetic structuring between the two basins. The results obtained show that *A. tenuicornis* and *A. ledoyeri* overall share the same haplotypes and exhibit very low divergence levels, so suggesting a possible need of taxonomic rearrangement. As to the genetic structure, both *A. typica* and *A. tenuicornis* + *ledoyeri* group show genetically differentiated lineages in the two sea basins, as supported by both markers. This suggests that the multiple barriers between the studied basins are effective for these species.

Which way to the island? Diversity and origin of freshwater gammarids from Crete – preliminary results

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Hupało K¹, Mamos T¹, Wysocka A², Olszewska W¹, Rewicz T¹, Plaiti W³, Grabowski M¹

¹Department of Invertebrate Zoology and Hydrobiology, University of Lodz, Lodz, Poland; ²Department of Genetics, University of Gdansk, Gdansk, Poland; ³Institute of Marine Biology, Biotechnology and Aquaculture, Hellenic Centre for Marine Research, Heraklion, Crete, Greece
hrupeq@gazeta.pl

Islands are natural laboratories of evolution and places with extremely high level of endemism, and the Mediterranean Region is known to be among the most precious biodiversity hotspots in the world. However majority of studies upon Gammaridae of the Mediterranean Region focused mostly on marine species, leaving aside the freshwater fauna. So far, around 120 freshwater species of two genera, *Gammarus* Fabricius, 1775 and *Echinogammarus* Stebbing, 1899, have been reported from the region, with only 15 known from its islands. Given the very high cryptic diversity discovered recently in European gammarids and relative scarcity of studies upon insular species, we conclude that number of species already reported from the Mediterranean Islands is definitely underestimated. Our main goal is to reveal the diversity, phylogenetic relationships and origin of freshwater gammarids inhabiting Crete – a large Mediterranean island of continental origin. Based on the materials collected during our expedition in 2011, we have revealed presence of at least five freshwater species on the island. Based on morphology four of them could be identified

as the members of *Echinogammarus* already known from Crete. However, results of molecular species delimitation based on mitochondrial markers (COI and 16S) show different pattern, suggesting high phenotypic plasticity and cryptic diversity. Also, based both on morphology and molecular data, we have revealed presence of one species new for science and belonging to *Gammarus*, genus that has not been reported from Cretan freshwaters so far. Interestingly the species has disjunctive distribution, inhabiting two quite remote regions of the island. Preliminary time-calibrated reconstruction of phylogeny suggests that the insular *Gammarus* lineage is an ancient continental relic of the pre-Messinian land connection with mainland Greece. Origin and evolution of the Cretan *Echinogammarus* seem to adhere to a different, yet obscure scenario, likely to involve several colonisations from the Tethys waters.

Morphology

Antarctic *Epimeria*: a systematic Pandora box revealed by DNA analysis and illustrated by stacking photography

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d'Udekem d'Acoz C¹, Verheye ML^{2,3}

¹Royal Belgian Institute of Natural Sciences, Scientific Service of Heritage, Brussels, Belgium; ²Royal Belgian Institute of Natural Sciences, OD Taxonomy and phylogeny, Brussels, Belgium; ³Catholic University of Louvain-la-Neuve, ELIB, 1348 Louvain-la-Neuve, Belgium
cdudekem@naturalsciences.be

Analyses of DNA sequences of *Epimeria* from the Antarctic Peninsula, East Weddell Sea and Terre Adélie reveal an unexpected genetic diversity in this species flock. Many formerly recognized species appear as genetically strongly heterogeneous, consisting of clades separated by K2P distances between 2 and 30% for COI. Careful examination of the specimens confirms that the different clades are morphologically distinct and should be considered as separate species. Some are separated by previously overlooked clear-cut differences, others by subtle details. Some closely related species are allopatric; others are sympatric. As a whole, the material examined comprises about 25 undescribed species, which increases by twofold the number of Antarctic *Epimeria* species. They are used as case study for testing stacking photography as an alternative to line drawings in amphipod taxonomy. It appears that these large and often very geometric amphipods can indeed be adequately and quickly illustrated by this new technique. For species presenting subtle differences in body relief like the species of the *angelikae/georgiana/inermis* complex, stacking photographs even proves to be superior to line drawings.

A new species of the rarely collected deep-sea genus *Vemana* (Amphipoda: Vitjazianidae) from the DIVA-2 cruise in the southeast Atlantic

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Hendrycks EA

Canadian Museum of Nature, Research and Collections, Station D, Ottawa, Canada
ehendrycks@mus-nature.ca

During the DIVA-2 expedition (Diversity of the Abyssal Atlantic benthos), various gears were deployed from the German ship *R/V Meteor* to sample the benthos at depths > 5000m in three abyssal basins. Targeted basins were the Cape Basin, northern Angola Basin and the Guinea Basin in the southeast Atlantic off the west coast of Africa. Benthic samples were collected using four gears, namely giant box corer, MUC (multicorer), epibenthic sledge and 3.5 m modified Agassiz trawl. During sorting of material from box core station # 69 (0°26.7'S, 2°20.5'W, 17 March 2005, 5060 m depth) in the Guinea Basin, a single, peculiar amphipod was found. Upon morphological examination, it was determined to be a new species of the genus *Vemana* Barnard, 1964. This is the 5th recorded *Vemana* species, the deepest record and the first from the south Atlantic. The single specimen of the new species now brings the total number of recorded specimens of *Vemana* to only 9. The new species can be differentiated from the other 4 species, *Vemana compressa* Barnard, 1964 (type species), *V. geysereensis* Ledoyer, 1986, *V. lemuresa* Barnard, 1967 and *V. lizata* Barnard, 1964 in the

possession of a strong posterodistal tooth on peduncular article 2 of antenna 1 and a broad, non-narrowed telson, which has broadly rounded lobes and a shallow, widely gaping cleft. The inclusion of *Vemana* into the family Vitjazianidae by JL Barnard (1964) has been questioned by Ledoyer (1986) and will be briefly discussed.

A new species and new record of the rare genera *Tripotella* Arimoto, 1970 and *Protogeton* Mayer, 1903 (Amphipoda, Caprellidae) from Korean Waters

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Heo J-H, Hong S-S, Kim Y-H

Department of Life Science, Dankook University, Cheonan, Korea
yhhkim@dankook.ac.kr

A new species of genus *Tripotella* and newly recorded species *Protogeton incertus* Mayer, 1903 were collected from Korean waters. Worldwide, only one species, *Tripotella amica* Arimoto, 1970 has been reported in the monotypic genus *Tripotella* from the Arabian Sea and Indian Ocean. *Tripotella* n. sp. differs from *T. amica* by the following characters: 1) gnathopod 1 subrectangular; 2) pereonites 2–3 with acute triangular processes anterolaterally; 3) mandibular palp 3-articulate, terminal article with 4 setae. The genus *Protogeton* is characterized by having the 1) triarticulate flagellum in antenna 2; 2) mandible lacking molar, with uni- or biarticulate palp; 3) pereonites 3–4 with gills; 4) pereopods 3–5 well developed, consist of 6-articulate; 5) lacking appendages on abdomen. Up to now, *Protogeton* composed of only 2 species worldwide; *P. incertus* from Thailand, East China Sea, Japan and *P. inflatus* Mayer, 1903 from Indonesia, Japan, Philippines, Papua New-Guinea and Australia. Our specimens are congruent with *P. incertus* with biarticulate mandibular palp.

***Platorchestia* from Bermuda – results from morphological and molecular studies**

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Lenihan JW¹, Baldinger AJ¹, Lazo-Wasem EA², Kvist S³

¹Department of Invertebrate Zoology, Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, USA; ²Division of Invertebrate Zoology, Peabody Museum of Natural History, Yale University, New Haven, Connecticut, USA; ³Department of Natural History, The Royal Ontario Museum, Toronto, ON, Canada

lenihan@fas.harvard.edu

The cosmopolitan genus *Platorchestia* currently includes 20 species. However morphologically it is very difficult to differentiate these species. In May 2013 specimens of *Platorchestia* were collected from Bermuda by the first two authors. Morphological specimens were collected into 70% ethanol or, for molecular study, into RNAlater. Select individuals were photographed whole prior to color loss. Additional *Platorchestia* specimens were dissected and mounted on permanent slides, for illustrations via slide scanning techniques. In addition to morphological differences found in *Platorchestia* from Bermuda, we compare it to neighboring North American areas around New England, and as far south as the British Virgin Islands. These preliminary results show that *Platorchestia* in Bermuda is

morphologically different from specimens identified as *Platorchestia platensis* from New England. In addition to our morphological data, the results from CO1 sequencing of 95 of these specimens were compared to what has been reported in GenBank.

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