

Deep-Sea Life

Issue 10, November 2017

Here we are at Issue 10 of Deep-Sea Life, and gone are the days of having to chase around for articles to include! The life of a Deep-Sea Life editor is far easier these days and for that I thank you all!

For those readers new to this publication, DSL is an informal and somewhat traditional way of connecting the world of deep-sea biology and related issues – best read with a cup or glass of something soothing, feet up.

Traditional yes, but we still like to embrace change! There are plans afoot for Deep-Sea Life issue 11 and we hereby give you a heads-up. [INDEEP](#), [DOSI](#) and the [Deep-Sea Biology Society](#) (DSBS), although very distinct groups and complimentary in many ways, have one clear overlapping activity – that of communication. Whilst it is clear that each entity warrants its own website, and (perhaps - TBD) social media outlets, the INDEEP newsletter (Deep-Sea Life) and email lists that have been established firstly during the Census of Marine Life and built upon during INDEEP, DOSI and subsequently DSBS are a highly valuable form of communication for well over 1000 members and to interest groups beyond. Currently, DSL is distributed



Above: *Bathymodoilus childressi*, *Alvinocaris* c.f. *muricola*, *Pachycara caribbaeum* and *Gastropod Sp.1* found at deep methane seeps off Trinidad and Tobago. Credit: Ocean Exploration Trust.

via website link to a printable PDF. With additional production support from DSBS Trustees, DSL could be enhanced in terms of its production to embrace additional formats. For example, a content-rich email linking to the DSBS website, where blog versions, pictures and other media elements are maintained will make DSL more widely-available beyond the current readership. To that end, we are delighted to inform you that DSL will, from this day forth, become a joint INDEEP, DOSI and DSBS enterprise – maintaining an official newsletter for the entire deep-sea biology community.

So, back to this issue and we have a wonderful image for our front page, submitted to us by Dr Diva Amon. This image was taken during exploration of deep methane seep communities of Trinidad and Tobago. A paper relating to this work which explored the little-known biodiversity of the region contains further stunning imagery and is found on page 60.

Contributions to DSL issue 10 have been abundant and once again of great interest. Thank you for all the submissions. Thanks again to Dr Abigail Pattenden (University of Limerick, Ireland) and Dr Eva Ramirez-Llodra (NIVA, Norway) for their dedication to this publication, one that I hope many of you enjoy to read as much as we do.

Dr Maria Baker (Editor) INDEEP/DOSI Co-Lead, University of Southampton

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Cruise News

Sensitive Ecosystem Assessment and ROV Exploration of Reef: SEAROVER

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¹Marine Institute of Ireland; ²University of Plymouth, UK; ³Geological Survey of Ireland; ⁴INFOMAR;

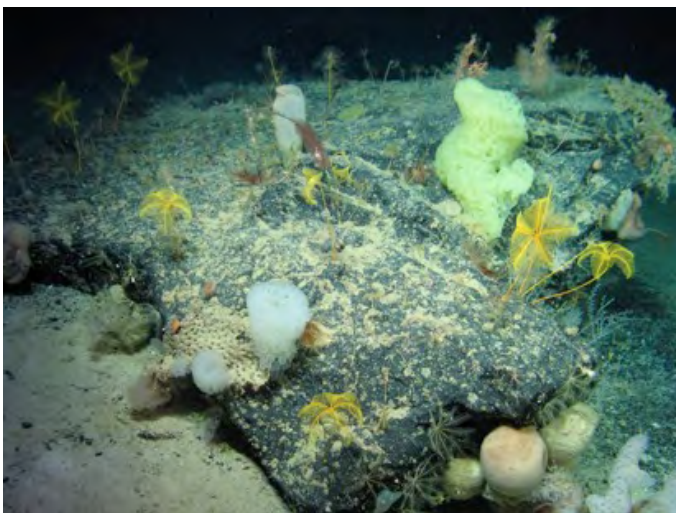
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Reef habitats are widespread in Irish offshore waters but there is a paucity of data concerning their exact distribution and abundance. Ireland's Department of Culture, Heritage and the Gaeltacht assessed the Annex I Reef habitat as Unfavourable/Bad-with-an on-going-decline, and identified significant data gaps relating to their area, range, structure and function, and potential pressure components. Under the European Union Habitats Directive Ireland is obliged to protect and monitor these sensitive ecosystems.

An exploratory reef survey was commissioned and an international team of multidisciplinary scientists assembled to pick the most alluring acronym for the survey - the SeaRovers were born. The Sensitive Ecosystem Assessment and ROV Exploration of Reef habitat survey departed Galway on Ireland's stunning west coast on the 3rd July for 21 days.

The primary objective was to map the distribution and extent of vulnerable reef habitat along Ireland's continental margin using the Marine Institute's ROV *Holland I*. Target features comprised mounds, steep slopes, canyons and escarpments and areas of low fishing effort to monitor the health of these sensitive ecosystems. The survey also revisited the northwest Porcupine Bank Special Area of Conservation (SAC) originally surveyed in 2009 to assess any change over time.



Above left: Stalked crinoids, *Anachalypsicrinus nefertiti*, with multiple sponge species and corals; above right: *Solenosmilia variabilis* reef with zoanthids and some colourful *Brisingsids*.

In the northeast Atlantic there are two familiar types of cold water coral reef, *Lophelia pertusa* and *Madrepora oculata*, that can form extensive reefs in Irish waters, the Porcupine Seabight, Porcupine Bank and on the Rockall Bank. The SeaRovers encountered these species throughout the survey and observed reef habitat in-situ along the shelf-edge. We also discovered cold water coral reef composed of *Solenosmilia variabilis* at >1600m. Because reefs composed of this species may be rare, with only three known occurrences in the region west of Ireland and the UK, we think this



Above left: The SeaRovers. Top Row from Left: Helen McCormack, Yvonne Leahy, David O'Sullivan, Zara Cleere, Louise Healy. Bottom Row: Felim O'Toole, Kerry Howell, Rebecca Ross; above right: A beautiful anemone (*Bolocera tuediae*) appears from the gloom.

is the deepest known coral reef in Irish and UK waters, and possibly in the world!

The SeaRovers ultimately completed 50 dives, recorded 127 hours HD footage, traversed 135 vertical kilometres, and collected 200 samples. The survey identified biologically sensitive reef-forming coral at numerous locations. We discovered previously unknown submerged canyons, tracked an escarpment feature for 100 miles, and provided biological samples to the biodiscovery programmes at NUI Galway, University of Plymouth and the DeepLinks project to study the connectivity of populations in the north Atlantic. We also took sediment samples for analysis of micro-plastics in the deep sea.

The SeaRovers survey successfully contributed to conservation objectives for the offshore SAC and mapped vulnerable fisheries resources for the Department of Agriculture, Food and Marine that will encourage sustainable management of Ireland's marine resources. Furthermore, it has established a need to build on the data collected to date to produce comprehensive biological baseline datasets critical to the formulation of future policy on the management and conservation of Ireland's deep-water resource.

This extensive offshore reef survey of Ireland's Northwest continental shelf edge was commissioned by the National Parks and Wildlife Service (NPWS), funded by the European

Maritime Fisheries Fund (EMFF), and coordinated and led by INFOMAR (Integrated Mapping for the Sustainable Development of Ireland's Marine Resources) and Ireland's Marine Institute.

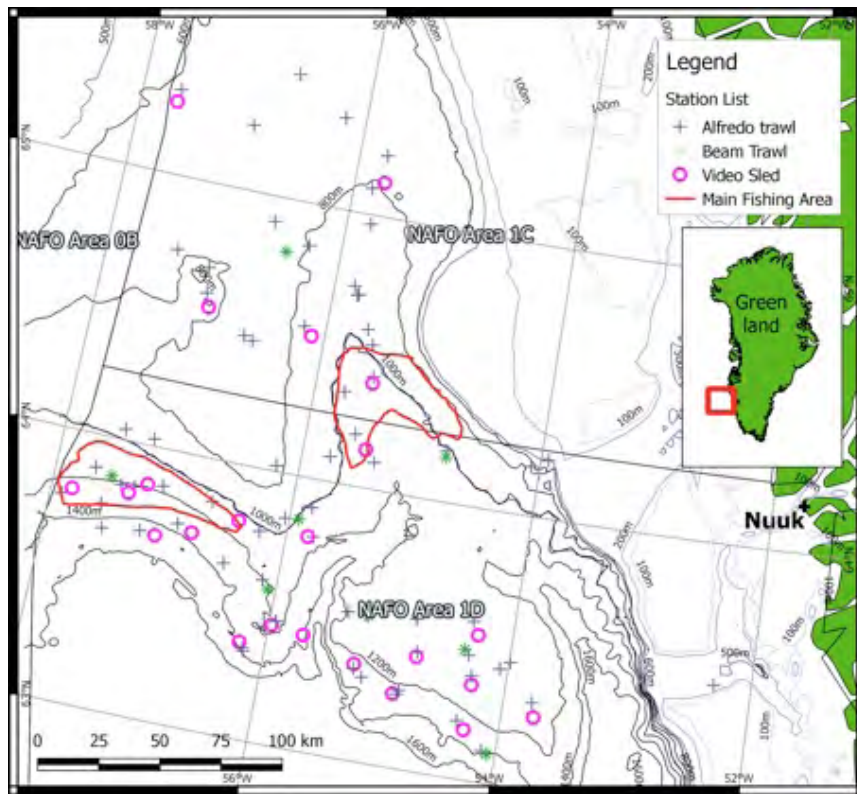
The SeaRovers hope to sail again in 2018. Watch this space...

Benthic communities off the West Greenland shelf: combining video imagery with benthic sampling and bycatch during a cruise onboard the *RV Paamiut*

Mona M. Fuhrmann¹, Stephen Long^{1,2}, Igor Manushin³, Martin Blicher⁴ & Chris Yesson¹

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We joined the annual stock assessment cruise of the Greenland halibut (*Reinhardtius hippoglossoides*) conducted by the Greenland Institute of Natural Resources, 10-14 October, 2017. The objective was to investigate the benthic fauna in and around the halibut fishery in the Davis Strait. The fishery recently attained Marine Stewardship Council certification, a sustainable eco-labelling scheme for wild-capture seafood. As part of the certification assessment, our research team coupled up with the industry representatives (Sustainable Fisheries Greenland), to tackle the scarcity of data on benthic communities in fishing grounds and assess the impact of trawling. Benthic fauna off the shelf,



Above: Map of survey stations (+), video observations (o) and beam trawls (*) in the Davis Strait, West Greenland. Depths are indicated by contour lines. Approximate area of intensive halibut fishery is indicated by red outlines.

within the fishery and adjacent areas, is largely unexplored. Therefore data collected during this cruise provides new knowledge for fishery and conservation stakeholders.

We used a towed camera and a beam trawl to sample predominantly epifaunal organisms. In addition, benthic bycatch from halibut stock assessment using an Alfredo trawl was recorded. In total, we sampled 31 benthic stations between 63°6.54'N and 65°15.92'N at depths of 647 to 1476 m along a gradient of fishing effort (obtained from logbooks of participating vessels between 2012 and 2016).

Bottom substrata were mostly muddy, with occasional drop stones. Bycatch in Alfredo trawls was typically low; both in terms of diversity and abundance: a greater range of taxa were seen in videos and beam trawls. To date we have recorded 151 taxa of which 99 have been identified to the species level. Soft-bottom communities were typically dominated by the scleractinian cup coral *Flabellum alabastrum*, often occurring in assemblages with the brittle star *Ophiomusium lymani*. Our initial impression was that stations with obvious impact of trawling activity, evident by marks on the seafloor, were low in biodiversity and appeared rather flat and homogenous, with less infaunal burrowing activity. The flat sea urchin *Phormosoma placenta* was common, even in obviously trawled areas. Large sea pens (mostly *Halipteris finmarchica* and *Anthoptilum grandiflorum*), sponges (e.g. *Asconema foliatum*), bamboo corals (*Acanella arbuscula*) and black corals (*Stauropathes* spp.) were seen in videos and beam samples, and were found

entangled in trawl gear, suggesting they are vulnerable to trawling. Further analysis of video footage and effort data will quantify the effect of trawling this area.



Top: Grenadier fish, *Flabellum alabastrum*, *Ophiomusium lymani* and unidentified gastropod at 1000 m, observed with the towed video camera; Middle: Trawl marks were frequently seen on the seafloor in areas of high fishing effort. Here at a depth of 1250 m, next to the abundant sea urchin *Phormosoma placenta*; Bottom: stones offer attachment to a variety of species, i.e. black corals (*Stauropathes* spp.) and an unidentified sponge at 1336 m.



Far left: Benthic bycatch from Alfredo trawls. Left: large seapens (*Halipteris finmarchica*) caught at 628 m. Right: Sponges (e.g. *Geodia* sp.) caught at a deep southern station at 1353 m.

Live ship-to-shore broadcast outreach events from the *JOIDES resolution* International Ocean Discovery Program

Stephanie Sharuga

The International Ocean Discovery Program (IODP) is an international research collaboration that coordinates seagoing expeditions to explore the Earth's history by studying sediments and rocks beneath the seafloor. The scientific drillship, *JOIDES Resolution*, is part of this program and hosts international, collaborative research expeditions throughout the year. Important components of the *JOIDES Resolution's* expeditions include education and outreach designed to engage communities around the world in the activities of the IODP, *JOIDES Resolution*, and each individual expedition's research.

A key aspect of this outreach are live ship-to-shore broadcast events hosted by each expedition's Education and Outreach Officer(s) aboard the *JOIDES Resolution*. These events are open to anyone - students, the general public, and other groups - around the world, and are customized for each group depending on needs, interests, and education level. The live events are a great opportunity to engage your students and community in international scientific exploration and inspire future generations to pursue STEM careers!

Live broadcast events can be scheduled during active expeditions throughout the year. I am currently writing specifically to introduce Expedition 372, for which I will be serving as an Education and Outreach Officer aboard the *JOIDES Resolution*. Expedition 372 will run from November 27, 2017-January 4, 2018, and we cordially invite you to sign up for a live broadcast event with us! For more information and instructions on signing up for a live broadcast: <http://joidesresolution.org/live-video-events-with-the-joides-resolution/>.

The main expedition page for Expedition 372 can be found here: <http://joidesresolution.org/expedition/372/>. This will be the go-to website for links and more information on the expedition, as well as where you can find expedition updates, blogs, and more. Additional, more detailed information on Expedition 372, including the Expedition Summary & Scientific Objectives and Scientific Prospectus, can be found here: http://iodp.tamu.edu/scienceops/expeditions/hikurangi_gas_hydrate_slides.html.

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Sampling the abyss: latitudinal biodiversity patterns along the base of Australia's eastern continental margin

INDEEP Biogeography Awardee Reports

1) Dr. Annekatrien Enge, University of Vienna, Austria

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In May 2017 I was able to join the deep-sea cruise IN2017_V03 ("Sampling the Australian Abyss"), made possible and sponsored by the INDEEP network. I applied for the training opportunity because I am very interested in deep-sea

biota, particularly in deep-sea foraminifera (ubiquitous protists). I was also very interested to obtain more experience in the use and application of deep-sea sampling equipment and collection methods.

The expedition on board Australia's newest research vessel "*Investigator*" was led by Tim O'Hara (Museum Victoria) who had invited 27 scientists from different museums and research institutions in Australia, Europe and Asia. The aim was to survey the eastern continental margin of Australia to describe the abyssal community for the first time and to obtain specimens for museum collections, genetic and species composition analyses. On 15 May we started in Launceston (Tasmania) and moored in Brisbane (Queensland) 31 days later.



What I found most remarkable from the samples we collected was the variety of forms, size and adaptations with the different groups of deep-sea animals. Over the weeks I became more and more acquainted with the different species and groups, profiting from the different expertise of the other scientists on board. A very great addition were the presentations given by the scientists where I learned a great deal more such as bioluminescence in the deep sea or how to prepare a shark for a museum exhibition - just to name a few.

Over the duration of the cruise it was possible to see all the different sampling gears in action (beam trawl, Brenke sled, demersal trawl, deep-two camera, box corer) and to get a clear picture on the potential and applicability of each device. During processing of samples obtained with the Brenke sled I was able to roughly examine and document the community of benthic foraminifera. In comparison to other smaller organisms groups, foraminifera proved to be very abundant. A bit striking for me was the large size, which I have not observed in other deep-sea habitats before. The possibility to take sediment samples during the journey and bring them to Vienna will allow me to further identify species and perform distribution and diversity analyses.

Besides getting samples to work on and learning more about the processing and handling of samples and data, I had to opportunity get to know other scientists from the deep-sea community and to exchange knowledge, experiences and stories.

I really enjoyed the time and I gained a lot of experience and knowledge. I would like to sincerely thank the INDEEP network, Maria, and Tim for the opportunity to participate in the cruise and my peers and the crew for the good time.

2) *Dr. Izwandy Idris, Universiti Malaysia Terengganu*

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Introduction

The deep-sea expedition 'Sampling the abyss: latitudinal biodiversity patterns along the base of Australia's eastern continental' was conducted from 15th May to 16th June 2017. The voyage covered the deep-sea area of east Australian continental shelf for 33 days, visited seven Commonwealth Marine Reserve (CMR) and 136 deployments of scientific gears. The voyagers were mostly Australian with some of scientists from different countries including Belgium, Britain, France, Germany, Malaysia, Russia and Mexico. Dr. Izwandy Idris (Universiti Malaysia Terengganu) and Dr. Annkaterin Enge from the University of Vienna are the two early career scientists who were chosen to participate as part of networking expansion and interest by INDEEP. Interestingly, this is the first deep-sea biology cruise participated by a scientist (Dr. Izwandy Idris) from Malaysia, a country that has a deep-water area north of Borneo.

Objectives

The main objective of the cruise is to collect samples from deep-sea (organisms, sediment and microplastics) of bathyal and abyssal depth (2500-4000m). Other objectives are to construct a bathymetric map of deep-water ecosystem from each seven CMRs, identifying bioluminescence species and training for early career scientists in deep-sea research. The overarching hypothesis in the voyage is that the species composition in the deep-sea area exhibits latitudinal change as its go northward.

Sampling activity

Collections of abyssal specimens were separated into several categories including fish (vertebrates), invertebrates (meiofauna, polychaete, Echinodermata, Cnidaria, Porifera, Crustacea, Mollusca and Pycnogonida), sediments, microplastics and bioluminescence. The specimens were collected using a number of gears, i.e. beam trawl, Brenke sled, box corer and demersal trawl. Images of abyssal organisms and environment were also recorded using a deep-water towed camera.

Similar to other ocean going research cruise, samplings were done in 24 hours to maximise the ship time and cost invested. Scientists were divided into two groups with 12 hours rotation in every shift. The selection for each group was made intentionally with all major phyla organisms were represented by specialists on board.

As for the sole participants from the shallow tropic, the author (Izwandy Idris) found that sampling and post sampling process is very interesting. It took about 6-7 hours for the sampling gear to complete the deployment, as opposed less than one hour that he used to. Moreover, prior to deployment, various variables such as current (surface and bottom), ship and wind speed and direction, bathymetry and sediment type were recorded and considered in choosing the suitable sampling area. Luckily in this voyage, the weather except for three days was conducive for the deployment of sampling gears. However, the demersal trawl novel attempt for abyssal sampling was short-lived because of damage and sensor lost occurred on the second day of the cruise. The accident occurred because the demersal trawl was blocked with rocks that were undetectable by the multibeam sonar.

Skills and knowledge gained from the expedition

The deep-sea expedition demands specific skills, techniques and knowledge from the voyagers in achieving its objectives. The deep abyssal zone in eastern Australia receives no light energy from the sun. Thus, the zone is in complete darkness with a temperature close to 0°C, due to deep-water current from the Antarctica. Hence, the organisms need to be processed as soon as possible once they are out of the water to slow down the deterioration.



Polychaete workers onboard RV *Investigator* during the expedition. Left to right: Dr. Magdalena Giergova (NHM, UK), Above left: Offloading specimens caught using beam trawl (center). All major deep-sea sampling gears can be seen on the deck. Left: Brenke (lower), Sherman sled (upper); Right: Biological box corer. Photo by Izwandy Idris. Above middle: Picking small invertebrates among the sediments collected by the Brenke sled was quite challenging. The water in the petri dish kept sloshing following the ship's movement. Photo by Rob Zugaro. Above right: Participating scientists on board RV *Investigator*. Photo by Asher Platt.

The changes of pressure and light are difficult to be dealt with and not the major variables that can accelerate the deterioration of specimens. However, temperature can be controlled to maintain the quality of the specimens prior to preservation. The organisms brought back from the deep were sorted in the lower temperature as soon as possible in chilled seawater. Apart of normal preservation solution, selected specimens were frozen in the step freezer for molecular works. A number of organisms with bioluminescence potential were selected for specific tests by Dr. Jerome Mallafet from the University of Louvain, Belgium.

Processing the specimens collected using the beam trawl was a fun event. The hype for getting interesting organisms (e.g. faceless fish, *Typhlonus nasus*) superseded everything. However, picking invertebrates among the benthic sediment collected by Brenke sled and box corer was quite challenging, particularly when the ship rolled following the waves. After a few days, the process (sorting, preservation) became a routine for most of us.

Life on Board

The life onboard RV *Investigator* during the voyage was centralised on the collection and processing of deep-sea specimens. Nevertheless, there were side activities to avoid the boredom. During the stand down period due to bad weather, some of us played ping-pong (yes, the ship's rolling added the thrill!), board games or simply reading. Other times in between the shift, movie session was the favourite activity. On most days, short presentations by the voyager on a topic related to their science were conducted before the morning shift ended. The evening shift team has even made a daily 'supper time club' session around 11.00 pm to keep up the spirit within the group.

Conclusion

The expedition has benefitted the early career scientists in two ways. First, the equipment and techniques for collecting, sorting and preservation of deep-sea specimens were well exposed, used and practised. Second, the management and operation of the deep-sea expedition can be observed and understood. This is the first experience in international, deep-sea scientific expedition, thus it may be too exaggerated to say the attended cruise is the best. However, decisions and actions made the voyage leader and manager were well justified and agreed by other voyagers and ship's crews. Hence, the voyage was an excellent exposure for a newcomer in deep sea research.

Acknowledgement

The author would like to express the greatest gratitude for the INDEEP Biogeography Award to participate in the expedition. Sincere appreciation goes to the INDEEP/DOSI coordinator (Dr. Maria Baker), the expedition leader (Dr. Tim O'Hara) and another member of selection committee for the opportunity given. The knowledge, experience and welcoming atmosphere from other voyagers and RV *Investigator* crews are unforgettable. Looking forward to another deep-sea expedition in the future.

Project Focus

The final stage of the Vema-TRANSIT project

Torben Riehl¹ and Angelika Brandt²

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The lack of knowledge about the deep sea is reflected in the numbers of undescribed taxa frequently discovered and in how little we know about the evolutionary processes that led to the present-day biodiversity on the deep seafloor. Despite the fact that most research has been conducted in the north Atlantic, even there these knowledge gaps still prevail.

In winter 2014–2015, the Vema-TRANSIT campaign was conducted with the German research vessel *SONNE*. The goal of the expedition was to sample along the entire extent of one of the major offsets of the Mid-Atlantic Ridge (MAR), the Vema Fracture Zone (VFZ), as well as the deepest trench in the Atlantic. During this interdisciplinary cruise, the benthic fauna, especially variations in benthic communities and populations, were investigated along a ~4600 km long transect. The project aimed to discover if large bathymetric features, represented by the MAR and the depth transition between hadal Puerto Rico Trench (PRT) and adjacent abyss, act as isolation barriers to communities, species, and populations, influencing exchange and thus contributing to diversification and ultimately speciation.

The project is now in its final phase. Government funding has expired, but data analyses are ongoing. A DSRII special issue is about to be published. Here, we provide a short summary of results from this project – more will follow soon:

- Nematode distribution patterns were highly variable but generally did not follow the separation of the North Atlantic by the MAR.
- Meiofaunal communities east and west of the MAR showed no significant differences between stations or regions.
- Macrobenthos was dominated by Crustacea, Annelida and Mollusca (in decreasing order).
- Macrofauna abundances were generally higher on the eastern side than in the west.
- Community composition differed between east and west but there was an overlap.
- Majority of macrobenthic invertebrate species was restricted to either east or west of the VFZ
- Isopod distributions were more locally restricted to one side of the MAR or one depth zone. Species ranged over 2000 km in some cases.
- Macrofauna species (Crustacea, Polychaeta, Mollusca) were often rare in the samples or singletons, and occurred at one station or site.
- Polychaete (Polynoidae and Spionidae) species showed restricted distributions but some species exhibited a trans-MAR distribution.
- Mollusc and polychaete abundances were higher in the east compared to the west.
- Despite permeability for some species, the MAR has negative effect on exchange between eastern and western populations.
- Depth gradients, geographic distance, and the MAR were correlated to genetic differentiation in Macrostylidae

- New species were described for Nemertea, Isopoda, Cumacea, and Amphipoda.

Keep updated on our project at <https://www.researchgate.net/project/Vema-TRANSIT-Bathymetry-of-the-Vema-Fracture-Zone-and-Puerto-Rico-Trench-and-Abyssal-Atlantic-Biodiversity-Study>.



The Vema-TRANSIT logo will soon be featured on the cover of the journal *Deep-Sea Research II* as a special issue from this project is in the final stage of preparation.

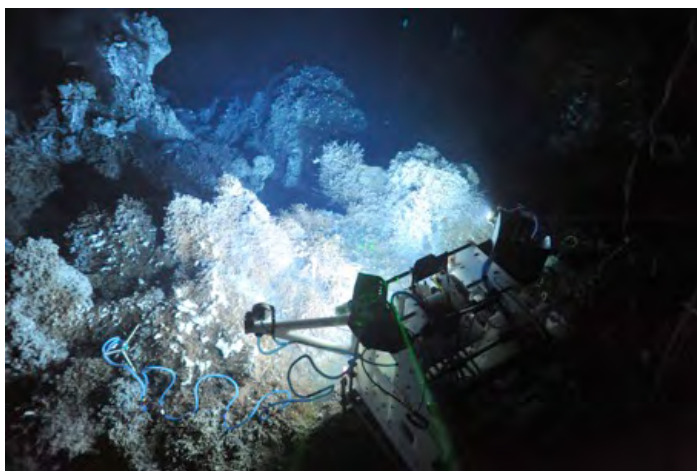
Deep Sea Spy:

A crowdsourcing project for the annotation of deep-sea vent images

Marjolaine Matabos, Julie Tourolle, Catherine Borremans, Patrick Bossard, Carole Decker, Jozée Sarrazin

Ifremer, Brest, France

Deep Sea Spy is a citizen science project that was developed to help annotate the thousands of images recorded in hydrothermal vents using EMSO-Azores and Ocean Networks Canada deep-sea observatories. Since 2010, the ecological modules TEMPO and TEMPO-mini have recorded more than 5000 hours of video sequences of vent communities from the Mid-Atlantic and Juan de Fuca ridges.



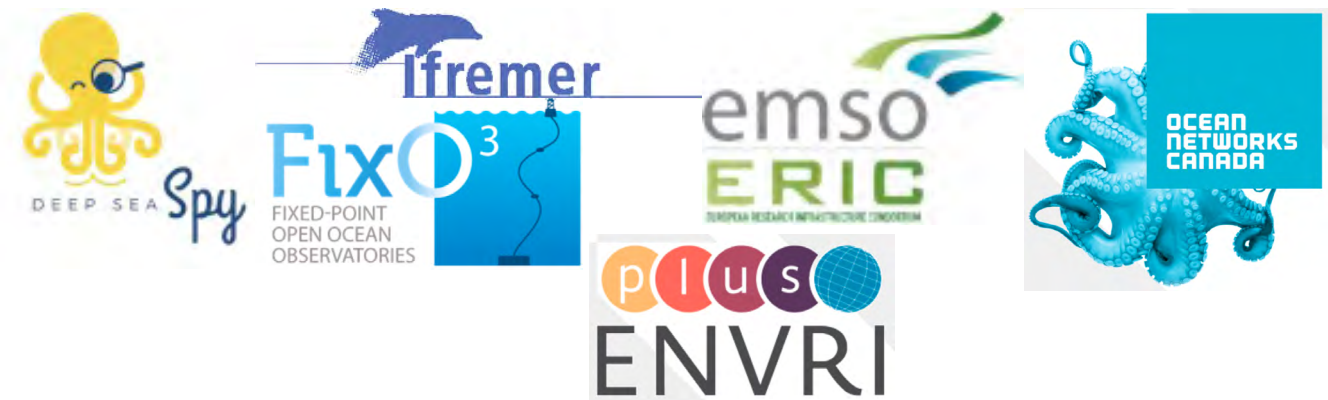
This crowdsourcing project invites all citizens to contribute to vent ecology research by performing simple tasks (find and annotate visible species) in order to help our team to process our huge image archive. Our ultimate goal is to better understand vent communities' temporal dynamics, including variations in faunal abundances and species behaviour. This online tool also provides an opportunity to raise awareness among the general public on deep-sea ecosystems biodiversity. Teachers around Brittany brought the programme into their classes through an official collaboration with the regional school academy. Please spread the word widely around, to your family,

friends, students, and any other network!

For more information visit the project website: www.deepseaspy.com/en/

This project was funded by the EU H2020 project ENVRIPLUS (<http://www.envriplus.eu/>) and FP7 project FixO3 (<http://www.fixo3.eu/>).

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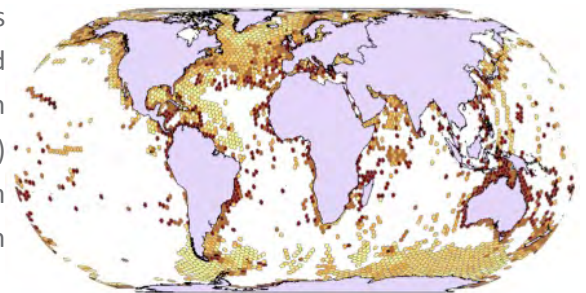


Species richness decreases with depth in the ocean

Chhaya Chaudhary and Mark J. Costello

Institute of Marine Science, University of Auckland, New Zealand

On global scale data we found four measures of species richness declined with depth (Costello and Chaudhary 2017). We calculated species richness for 51,659 species with known depth of occurrence in 50,000 km² hexagons in the depth range 0 – 500 m (at 100 m intervals) and 500 – 9,000 m (at 500 m intervals). Data were obtained from the Ocean Biogeographic Information System (OBIS) as described in Chaudhary et al. (2017).

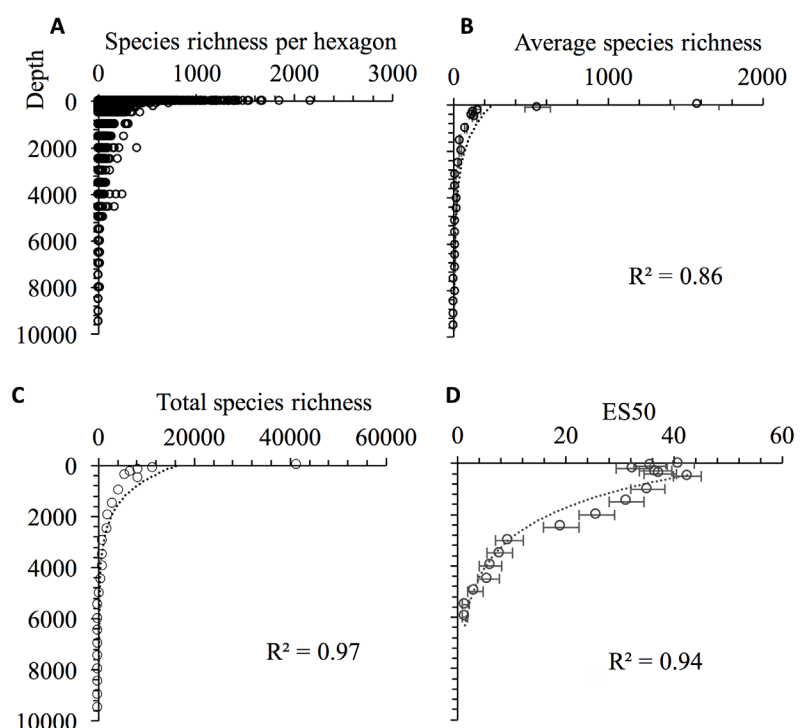


Above: The distribution of hexagons used in the present analysis. Darker hexagons had higher species richness.

Deep-sea species tend to have larger depth and geographic ranges

than coastal species, probably because the deep-sea environment is relatively more homogenous and has lower endemism than continental shelves (Costello and Chaudhary 2017, Costello et al. 2017). Thus, although the deep-sea is relatively less well-sampled than shallow depths, we do not expect the global pattern of species richness to significantly change with more data. However, the fact that ES50 richness increased at 400 – 500 m (Figure 2D) and then declined with depth, merits further research.

Right: Depth gradients in (A) number of species recorded per hexagrid, (B) average (\pm 95% CI) number of species (alpha diversity), (C) total number of species (gamma diversity), and (D) ES50 (\pm 95% CI) which accounts for sampling effort.



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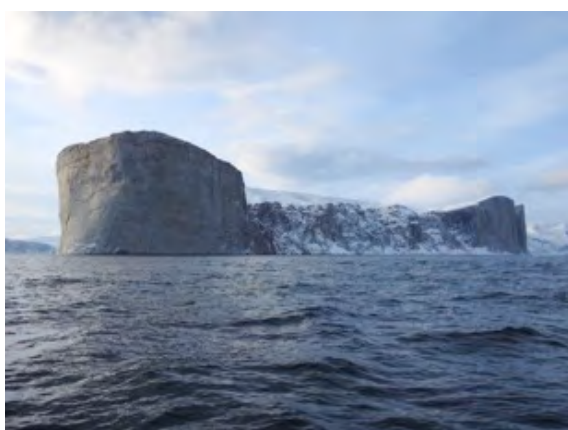
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Greenland halibut management in Arctic Canada

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Ocean Tracking Network



Top: Scott Island (Nunavut), Canada (Photo: Jena Edwards); Above: University of Windsor and Nigel Hussey Lab Ph.D. candidate, Amanda Barkley, preparing to tag a Greenland halibut during the team's 2017 field work expedition to Baffin Island, Nunavut (Photo: Jena Edwards)

Greenland halibut are a deep-sea flatfish distributed throughout the Arctic, North Atlantic and Pacific Oceans, that are highly valuable as a commercial species for many northern countries. In Canada, there is particular interest in developing coastal Inuit community fisheries targeting this species, given the success of an established seasonal ice fishery by the community of Pangnirtung in Cumberland Sound on the east coast of Baffin Island. Working with communities, commercial fishing vessels, and the government of Nunavut, our research team has been focused on the sustainable development and management of these Greenland halibut fisheries. Notably for the Cumberland Sound fishery, the management line for the traditional winter fishery was recently moved to the mouth of the Sound placing the entire area under the management of the local community. This was achieved through electronic tags inserted in fish and fixed receivers (supplied by the Ocean Tracking Network) on the seabed. Through passive monitoring, we observed a seasonal migration of Greenland halibut within the Sound that crossed the original management boundary, identifying that it did not appropriately delineate the stock (see Hussey et al. 2017). Nearby to the community of Clyde River, in Scott Inlet, we then determined through telemetry tracking that Greenland halibut present in the coastal region are highly transient, suggesting that any developing fishery would have to share a quota with the offshore (Barkley et al. *in press*). In working with the various communities along the Baffin Island coast (Pond Inlet, Clyde River, Qikiqtarjuaq, and Pangnirtung), we are using deep-sea acoustic telemetry to monitor the movements of Greenland halibut to develop sustainable spatial management practices that

recently expanded to include the offshore. By including the offshore fishing vessels of Baffin Bay and the expansion of the array, we can begin to address questions regarding long-distance migrations and connectivity throughout much of the Canadian Arctic. We can ask the ultimate question – do fish live in boxes defined by management units?

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Deep-sea research has no boundaries: Building capacity in South Africa

Zoleka Filander^{1,2}

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Offshore scientist and PhD candidate, Zoleka Filander, recently visited four research institutions in the United States of America. This mini-sabbatical was part of the WWF: GreenMatter Leadership program, which aims to promote excellence in the biodiversity sector. Zoleka was one of the ten fellows to be awarded such a Professional Development grant in the 2016/2017 fiscal year. With the assistance of her primary host (Dr Sandra Brooke), three other scientists (Dr Stephen Cairns, Dr Cheryl Morrison, and Dr Daniel Wagner) were approached to finalize the five-week schedule, which aimed to enhance Zoleka's existing knowledge in deep-sea research.

Research activities undertaken included exposure to the fundamentals of cold-water coral histology under the supervision of Dr Sandra Brooke at Florida State University (FSU). In addition to laboratory techniques, Dr Brooke also arranged a meeting with Ms Holy Binn from the PEW Charitable Trust, who shared her experience on stakeholder engagements. A vital component in conservation planning particularly relevant to South Africa's recent Marine Spatial Planning Bill of Rights. Apart from the week in Florida, Zoleka spent another week at the Smithsonian Institution: National Museum of Natural History (SI: NMNH), with Dr Stephen Cairns. Here she spent most of her time analyzing type and non-type specimens of azooxanthellate scleractinian corals. Through this visit, she refined her PhD proposal and acquired invaluable advice on deep-water coral taxonomy and different approaches applied to understand the evolutionary history of deep-sea scleractinian coral species.



Above: Zoleka Filander with new colleagues.

With two more weeks left, Zoleka visited Dr Cheryl Morrison at the United States Geological Survey (USGS) to acquire practical training on molecular techniques. In this time, Zoleka learnt the different protocols followed in deep-sea

coral molecular applications. These transferable skills have provided guidance on her current research interest and compliment the taxonomic expertise she wishes to advance in South Africa. Zoleka's trip was wrapped up with her participation on the National Oceanic Atmospheric Administration (NOAA) five-day cruise onboard the *Nancy Foster*, as part of the Deep Sea Coral Program. This second leg of the cruise was dedicated to mapping priority areas identified by the South Atlantic Fisheries Management Council. In this time, Zoleka gained insight on the importance of outreach, science communication, and data management through the various interactions with the students and experts onboard.

Research skills acquired on this trip will undoubtedly contribute to building capacity in the field of deep-water coral research in South Africa. Zoleka, would therefore like to extend her gratitude to the Department of Environmental Affairs and WWF: GreenMatter Fellowship program for funding the visit. A heartfelt thank you to Dr Sandra Brooke (FSU), Dr Stephen Cairns (SI: NMNH), Dr Cheryl Morrison (USGS), and Dr Daniel Wagner (NOAA) for hosting her at their respective institutions.

Southeast Deep Coral Initiative: successful second year of deep-sea coral explorations off the Southeast United States

National Oceanic and Atmospheric Administration (NOAA)

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In 2016, the National Oceanic and Atmospheric Administration (NOAA) launched the [Southeast Deep Coral Initiative \(SEDCI\)](#), a four-year effort that aims to study deep-sea coral and sponge ecosystems across the Southeast U.S., a region including U.S. waters of the South Atlantic Bight, Gulf of Mexico, and Caribbean Sea. The initiative is the latest regional research effort supported by NOAA's [Deep Sea Coral Research and Technology Program](#). It is led by a multidisciplinary science team from multiple NOAA offices, and works in close collaboration with federal partners and academic institutions.

Guided by the [SEDCI science plan](#), the initiative supports multiple research expeditions each year, which aim to map, survey and sample deep-sea coral ecosystems, focusing on areas where information is needed to support

management decisions. In 2017, SEDCI expeditions surveyed (1) deep-water banks in the northwestern Gulf of Mexico, (2) deep-sea habitats on the West Florida Slope, and (3) submarine canyons off North Carolina.

Led by Emma Hickerson, surveys in the northwestern Gulf of Mexico were conducted using ROV *Mohawk* during missions aboard the R/V *Manta*. These surveys targeted seven deep-water banks, all of which are being considered for expansion of the Flower Garden Banks National Marine Sanctuary. A total of 49 ROV dives were conducted to depths of 50-210 m, yielding a bottom time of over 48 hours.

Seafloor surveys on the West Florida Slope were conducted using ROV *Odyssey* during an expedition aboard NOAA Ship *Nancy Foster*. Led by Peter Etnoyer, the expedition focused on four areas that are being considered by the Gulf of Mexico Fishery Management Council for the establishment of new habitat areas of particular concern off West



Above: Map showing seafloor areas surveyed during SEDCI expeditions in 2017. These areas include (1) seven deep-water banks in the northwestern Gulf of Mexico surveyed using ROV *Mohawk* during an expedition aboard FGBNMS R/V *Manta*; (2) five areas on the West Florida Slope surveyed by ROV *Odyssey* during an expedition aboard NOAA Ship *Nancy Foster*; and (3) five submarine canyons off North Carolina surveyed using AUV *Sentry* during an expedition aboard NOAA Ship *Pisces*.

Florida. A total of thirteen ROV dives were conducted to depths of 390-710 m, yielding a bottom time of over 51 hours. Additionally, the expedition included CTD casts and multibeam mapping operations.



Above: Deep-sea coral habitats surveyed during SEDCI expeditions in 2017 including (left) aggregation of black corals and crinoids at 122 m depth on Elvers Bank in the northwestern Gulf of Mexico (credit: NOAA-FGBNMS /UNCW-UVP); (middle) aggregation on *Lophelia pertusa* stony corals and the thorny tinsselfish *Grammicolepis brachiusculus* on the West Florida Slope at 496 m depth (credit: NOAA-Pelagic Research Services); and (right) corals on Pamlico Canyon wall at 1300m depth (credit: NOAA-OER-NMFS/WHOI).

The North Carolina canyon surveys were conducted using AUV Sentry during a 12-day expedition aboard NOAA Ship *Pisces*. Led by Martha Nizinski, the expedition included seven AUV dives to depths of 700-2000 m, for a total of 150 hours of bottom time covering a distance of 210 km. Additionally, CTD casts, monocoore sample collections, and multibeam mapping operations were conducted in order to further characterize these deep-sea canyon habitats. This research complements submarine canyon surveys off the northeast U.S. conducted between 2012-2015.

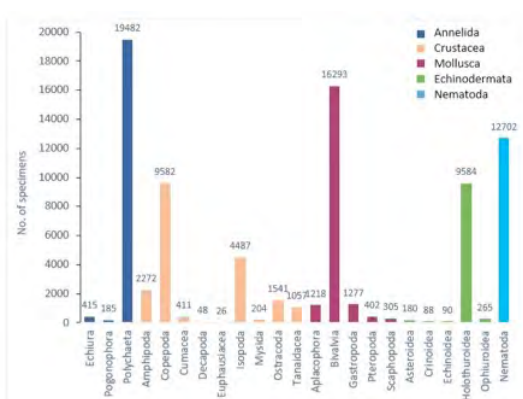
The 2017 SEDCI expeditions provided a great amount of new data on deep-sea coral ecosystems in the Southeast U.S. Region. While most of these data will take many months to process, some important findings are beginning to emerge. The surveys in the northwestern Gulf of Mexico indicate that many, but not all, deep-water banks host very dense communities of corals and sponges. Similarly, large aggregations of *Lophelia pertusa* and various species of black corals were documented during dives on the West Florida Slope. Finally, coral diversity and abundance varied widely in each surveyed canyon off North Carolina. Collectively, these surveys highlight the importance of surveying deep-sea habitats to support decision-making with the best possible science.

Updates on the project KuramBio II: Kuril Kamchatka Biodiversity Studies

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Senckenberg Research Institute and Natural History Museum | Goethe University Frankfurt am Main, Institute for Ecology, Evolution, and Diversity

One year has passed since the expedition SO250 with RV *Sonne* in the framework of the Kurambio II project. As reported in Deep-Sea Life last year (Issue 8, Nov 2016), this project follows the course of three preceding German-Russian collaborations investigating the diversity and distribution of organisms in the northwest Pacific deep sea. We have now a huge amount of new records (more than 82,000 specimens) and new species described from various taxonomic groups, from meiofauna to megafauna. These records are soon going to be uploaded to the OBIS database through the Beneficial Project (also introduced in this issue). We took samples from the abyss down to hadal depths of up to 9581m. We sampled transects across the trench to compare the composition



Above: Numbers of specimens from the most abundant taxonomic groups of the KuramBio II expedition (sorting state Nov 2017).



Above: Species of Macrostyliidae and Haploniscidae occurring across several stations of KuramBio II. A) *Macrostyliis n. sp. "sabinae"* juvenile female with tantulocarid parasite. A') *M. n. sp. "sabinae"* adult male with tantulocarid parasite. B) *Macrostyliis grandis* adult female. B') *Macrostyliis grandis* juvenile (probably = *M. ovata*). C) *Macrostyliis curticornis*. D) *Haploniscus cf. hydroniscoides*. E) *Haploniscus n. sp. #3*. Scales = 1 mm, except B and B' = 3 mm. © T. Riehl, N. Heitland (originally published in Cruise Report (<https://repository.publisso.de/resource/frl:6401131>)).

and abundance of species across depth and geographical distance. The main goal of this project is to test the potential barrier effect of the Kuril-Kamchatka-Trench (KKT) to the benthic fauna. This hypothesis will be tested by studying different species across areas using a wide array of methods: morphological taxonomy, systematics, ecology, and population genetics. On top of that, we also want to investigate trophic relations between organisms and life stages, across areas, and depths. Are there differences in feeding strategies with increasing depth? Do organisms feed selectively? Are there differences in feeding mode between larval stages and adults?

We are currently in the middle of sorting, identifying, and quantifying the samples of deep-sea organisms from the KKT and surrounding abyssal area. A large group of postdocs, PhD students, masters, and internship students are all working together to process the 106 stations that were sampled. Until now, polychaetes were the most abundant group, with almost 20,000 specimens, followed by bivalves, nematodes, and holothurians. Amongst the crustaceans, copepods were the most abundant group with more than 9500 specimens, followed by isopods.

The database is growing and samples are being sent to taxonomic specialists for identification. Interestingly, although we recovered several species from the historic Vitjaz expeditions in that area, numerous species are new to science and some of them are already being described.

Keep updated on our project at <https://www.researchgate.net/project/KuramBio-II-Kuril-Kamchatka-Biodiversity-Studies-II>.

Twenty years of deep-sea research in the Colombian Caribbean

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Colombia has taken the leadership in deep-sea exploration in the southern Caribbean region during the past two decades. Despite the challenges of scientific capacity and significant financial and logistic constraints, biodiversity inventories have been carried out in soft-bottom areas of the continental shelf break and bathyal inferior (200 to 3800 m) and in the mesopelagic zone (200 to 1000 m). The deep sea has captured the attention of the country not only for biodiversity and science, but also in terms of resources for multiple industrial sectors. The gas and oil industry is the main actor looking into the potential of fossil fuel reserves in the deep sea. The boom of hydrocarbon exploration

demands a better understanding of the biodiversity, ecology, and biogeography of species that live in these poorly known environments to guarantee an adequate conservation and management of their resources. The [Taxonomy, Systematics and Marine Ecology Team \(GTSEM\)](#) of the Instituto de Investigaciones Marinas y Costeras (Invemar) have carried out more than fourteen expeditions (274 stations) to study the Colombian deep-sea biodiversity. Surveys were initially intended to characterize the marine benthic biodiversity (1995-2006) and subsequently to provide a solid baseline of knowledge for the hydrocarbon exploration (2007-2017). Different methods have been used to achieve our goals, first (1998-2010) the slope was explored using benthic trawls in soft bottom areas, and lately (2011-2017) our main tools to reach deeper bottoms are box core sampling for benthic areas and plankton hauls for the mesopelagic zone. All samples collected in those expeditions are stored in the Museo de Historia Natural Marina de Colombia “MAKURIWA” from Invemar and most of the data are publicly available through the [Marine Biodiversity Information System \(SIBM\)](#).



Above: Methods, organisms and geographic coverage. Figure 1 (top left) Plankton net with open/close system; Figure 2 (top Right) Trawling net; Figure 3 (bottom left) Southern Caribbean hydrocarbon block map; Figure 4 (bottom right) Some of the new species described; Figure 5 (middle row) Some benthonic and planktonic organisms collected. Images Invemar BEM archives.

Associated publications of the results can be found listed in the in the GTSEM Scienti platform. Nowadays, more than 1645 species have been identified, representing ten phyla (Foraminifera, Porifera, Cnidaria, Annelida, Arthropoda, Bryozoa, Mollusca, Chaetognatha, Echinodermata, Chordata). About 466 species were new records for Colombian waters and 21 new species have been described, but a big amount of samples are still in process. It is remarkable the discovery of new ecosystems such as deep-sea coral habitats and methane cold-seep communities. The occurrence of abundant branching azooxanthellate corals and its associated high diversity of invertebrates and fish were the first evidence of the presence of deep-sea

coral communities in three different localities. One of these localities was the subject of additional research and in 2013 acquired relevance at national environmental policies with the declaration of the first marine protected area in the deep-sea, namely “Parque Nacional Natural Corales de Profundidad”. The main challenges identified to continue with this important field of research include: investment on the development of human resources and training of scientists, improvement of research facilities, securing funding for research and the acquisition of new technologies (Driftcam, ROV, research vessels) that allow non-destructive exploration and reaching greater depths.

Say «Hello» to OCTO (Open Communications for The Ocean)

John B. Davis, President, OCTO, Woodinville, USA

The parent organization of OpenChannels.org, MPA News, and other marine knowledge-sharing services has reorganized to become [OCTO](#), or Open Communications for The Ocean (formerly MARE). OCTO has a lot of tentacles, so to speak,

some of which you may already know:

- OpenChannels.org - the knowledge hub for sustainable ocean management and conservation (e.g., jobs, grants, webinars, scientific literature, reports, conferences, news, blogs, and more)
- MPA News - providing news, analysis, and guidance on marine protected areas since 1999
- MEAM (Marine Ecosystems and Management) - covering marine ecosystem-based management and ocean planning since 2007
- EBM Tools Network - providing webinars, tools training, and discussion on tools and methods for improving coastal-marine management and conservation, and co-coordinated with NatureServe
- MarineDebris.info - the global online community for sharing knowledge on research, management, and prevention of ocean plastics
- And, launched in November 2017, MarXiv (rhymes with archive) - a free repository for marine conservation science and marine climate change science. The site invites researchers to start uploading their preprints, open access papers, reports, and other eligible content - making the science freely available for ocean managers and conservationists to access and apply more easily.

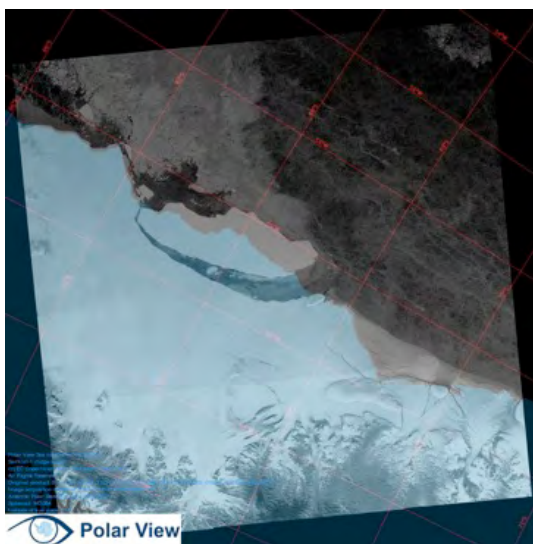
Altogether, OCTO's role is to speed the spread of best practices, build robust communities of practice, and lower barriers to knowledge-sharing for the global marine management and conservation community. In the past year 80,000 ocean professionals from over 120 countries used OCTO's services.

Larsen-C Benthos: Benthic biodiversity under Antarctic ice-shelves – baseline assessment of the seabed exposed by the 2017 calving of the Larsen-C Ice Shelf

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Above: Sentinel-1 Image from Polarview.aq on 14.10.2017

On 12 July 2017, the Larsen-C Ice Shelf calved the largest iceberg originating from the Antarctic Peninsula ever recorded (Fig. 1). As iceberg A68 moves north, it will leave an area of 5,800 km² of seabed newly exposed to open marine conditions. The calving of A68 offers a unique scientific opportunity for fundamental research to address questions around the mobility and colonisation capacity of benthic marine species.

Under-ice-shelf continental shelf areas provide unique benthic environments, restricted to the Antarctic and characterised by biodiversity that is largely unknown; occasional glimpses of these environments stem from very infrequent robotic surveys, or through holes drilled from above. The Antarctic shelf ecosystems that form following ice-shelf loss will be susceptible to colonisation by species

and their larval stages from immediately adjacent areas. When studying benthic responses to events such as ice-shelf collapse, considerable uncertainty remains about how biodiversity is affected, and what the resultant ecological responses are likely to be.

In October 2017 UK's Natural Environmental Research Council funded a multi-institute urgency proposal to take RRS James Clark Ross into the Larsen-C area in February to March 2018. We will have an international and multidisciplinary team of scientists on board to study biology, biogeochemistry and geology from the surface via the water column to the seafloor and beyond. Our governing hypothesis is "Until the calving of the Larsen-C iceberg, A68, the benthic fauna on the seabed beneath ice shelf has likely comprised oligotrophic assemblages resembling deep-sea Weddell Sea assemblages. The calving of A68, and the exposure of the seabed it covered to open-marine and sea-ice conditions will initiate a rapid colonisation by new species that will transform the benthic ecosystem significantly within 3-5 years." We will test the hypothesis by examining the biological communities formerly under the iceberg A68 in the western Weddell Sea, and sampling the benthic biological communities in the first austral summer after this major calving to provide a unique baseline for undisturbed under-ice-shelf communities. Using a holistic approach based on the sampling of benthos, plankton, sediments, and water, we will investigate the biodiversity, assemblage and food-web structure of the in-, epi-, and suprabenthic meio-, macro-, and megafauna, gaining the first insights into under-ice-shelf ecosystem functioning. Our results will set a starting point to help answer questions relating to the biological sustainability of polar continental shelves under climate change, the processes by which benthic populations survive and migrate, and the degree to which the distribution of marine benthos can be used to interpret past responses to climate change.

We aim to sample stations outside the pre-calving ice front and inside the pre-calving ice front, under the former ice shelf (former position of A68) (Fig. 2) and will deploy trawls (epibenthic sledge (EBS), Agassiz trawl (AGT), bongo net (BN)), mega-corer (MUC), gravity corer (GC), towed camera systems (SUCS & DWCS), CTD, and single and multi-beam echosounders at each station. As the seabed under A68 is uncharted, areas around the proposed stations will be surveyed by swath bathymetry to map seafloor topography.



Above: Location of proposed stations in Larsen-C



Seabed mining in international waters – whose liability is it anyway?

Hannah Lily

Commonwealth Secretariat, London, UK

Since 2001, the International Seabed Authority (ISA) has approved 29 contracts for seabed mineral exploration in international waters. Applications for mining can be expected in the next few years, and so the ISA has committed to



Above: Participants of the Commonwealth Secretariat, ISA and CIGI meeting in London.

developing rules to govern this ('the Mining Code') by 2020. This is a challenging task, given the number of unknowns around the future industry. Concerns about potential environmental and economic impacts are often at the forefront of the debate. Less reported, but equally crucial, are some of the legal uncertainties.

This was the issue at the heart of the meeting hosted by the Commonwealth Secretariat in London on 28-29 September 2017, in partnership with the ISA, and the Centre for International Governance Innovation (CIGI). The three co-convenors were delighted to bring together 14 ocean lawyers from around the world (including Argentina, Canada, China, Malta, Singapore, South Africa, Trinidad and Tobago, UK and US), to launch a 'Legal Working Group on Liability for Environmental Harm from Activities in the Area Beyond National Jurisdiction', funded by CIGI.

Lively debate took place over two days in Commonwealth Secretariat's Marlborough House, as these experts explored key legal issues that need to be addressed in the Mining Code. The main focus of the workshop was liability. The group asked: if something goes wrong, who is legally answerable? A simple-sounding question ... but with no easy answer. A mining operation run from ships in international waters will involve a multiplicity of actors, regulators, and legal regimes – giving rise to grey areas about who is responsible for what, in certain circumstances. The Working Group agreed that the legal position is far from clear, and identified six areas to research further, in order to assist the ISA and States develop the relevant legal regimes.

The September meeting was a fruitful starting point. The Working Group now will work to delve further into these complex legal questions, in order to report back with research papers, before the next ISA meeting in March 2018.

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95% of the ocean remains unexplored.

Are you ready to #getkraken?

Matthew Mulrennan

Co-Founder, CEO Kolossal



At KOLOSSAL we're ready to GO BIG to explore and protect our oceans. As a new nonprofit based in Venice Beach, we want to captivate the public imagination by launching expeditions into uncharted waters with cutting-edge technology to turn rare and amazing ocean creatures into worldwide celebrities. Not only to raise awareness about the wonders

of our ocean, but also to anchor ambitious conservation campaigns centered around these unique animals.

Our first mission is to find and film the colossal squid, better known in pop culture as the legendary Kraken. The largest invertebrate with the largest eye in the animal kingdom, the colossal squid is one of the most mysterious creatures in the ocean. It has never been filmed in its natural habitat. Even though this bad boy is believed to glow in the dark, we know it will take an entire community to find it and protect it, which includes our efforts to protect and conserve one of its main prey: the «Chilean sea bass» (not actually Chilean NOR a sea bass).

- With a capable crew in place, we need your help to go to the next level.
- You have to be bold to succeed where no one else has, and we're looking for people who share our vision. By becoming a part of the KOLOSSAL team, you're doing more than just supporting some wild ambitions:
- You're embarking on incredible journeys to the unexplored recesses of our planet.
- You're transforming the way people think about the oceans.
- And you're protecting these valuable creatures and their habitats for generations to come.

The decision is yours, but we hope you choose to go with us. There's more than enough room on the boat.

Sign up for the newsletter on our website to stay in the loop about upcoming events, promotions, and campaigns. And prepare yourself to...

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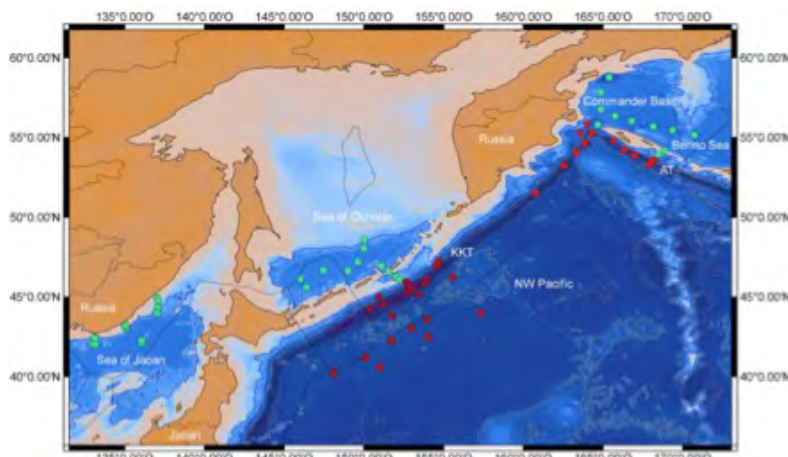
<https://www.kolossal.org>

Biogeography of the NW Pacific deep-sea fauna and their possible future invasions to the Arctic Ocean (Beneficial Project)

Hanieh Saeedi, Angelika Brandt

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Above: Joint Russian-German and German-Russian expeditions performed between 2010 and 2016 from board of RVs Akademik M.A. Lavrentjev and Sonne.

Our ongoing current project is about **biogeography** of the **northwest Pacific fauna**, a benchmark study for **estimations of alien invasions** into the Arctic Ocean in times of rapid climate change (**beneficial**). This project will deliver a sound biogeographic baseline study of the deep NW Pacific Ocean including our last expeditions data since 2010 from the Sea of Japan (SoJaBio project), Sea of Okhotsk (SokhoBio project), Kuril-Kamchatka Trench (KKT) (Kurambio I and II), Aleutian Trench (AT), SW Bering Sea, and the NW Pacific open abyssal plain (Fig. 1). The main objectives of our project are 1)

data mobilization of the NW Pacific deep-sea fauna to Ocean Biogeographic Information System (OBIS), 2) compiling a novel book on the biogeography of the NW Pacific deep-sea faunas, 3) and also to provide information on highly abundant key species which might potentially invade the Arctic Ocean in future under decreasing sea-ice conditions.

Since June 2017 we started data mining from all of our published papers from the last four expeditions aiming at submitting the data into OBIS through the deep-sea node (described in Deep-Sea Life Issue xx). OBIS deep-sea node has just been connected to Global Biodiversity Information Facility (GBIF) since October 2017. We plan to submit all the distribution records to OBIS by mid next year. So far, we extracted

6,000 unique distribution records out of 24 papers published in Deep Sea Research I and II. Considering a few available abyssal plain and oceanic trench distribution records of NW Pacific fauna in OBIS at this time (less than 2,000 records), we believe that our data mobilization attempt will significantly benefit the deep-sea community for any future deep-sea faunal biodiversity and biogeography studies specifically in the NW Pacific.

To encourage more deep-sea scientists to submit their data into OBIS, we held a workshop on “deep-sea data mobilization and biogeography of the NW Pacific” in Vladivostok from 19 - 21 September, 2017 with about 25 participants (Fig. 2). The aim of our workshop was encouraging our Russian colleagues to mine, extract, and submit their unique deep-sea data to OBIS. The outcome of our workshop led to a consistent data mining plan lead by German and Russian colleagues who were all involved in our last deep-sea expeditions. To assess the data quality control before submitting the data to OBIS, we will hold a follow up workshop in Frankfurt, Germany in 2018 when German and Russian scientists will finalize their data submission to OBIS and will plan their future collaboration plans. After submitting the upcoming data from both Germany and Russia to OBIS, the dataset will then be used to publish joint papers on the biodiversity and biogeography of the key deep-sea species in the NW Pacific and finally to publish the biogeography of the NW Pacific deep-sea fauna book.



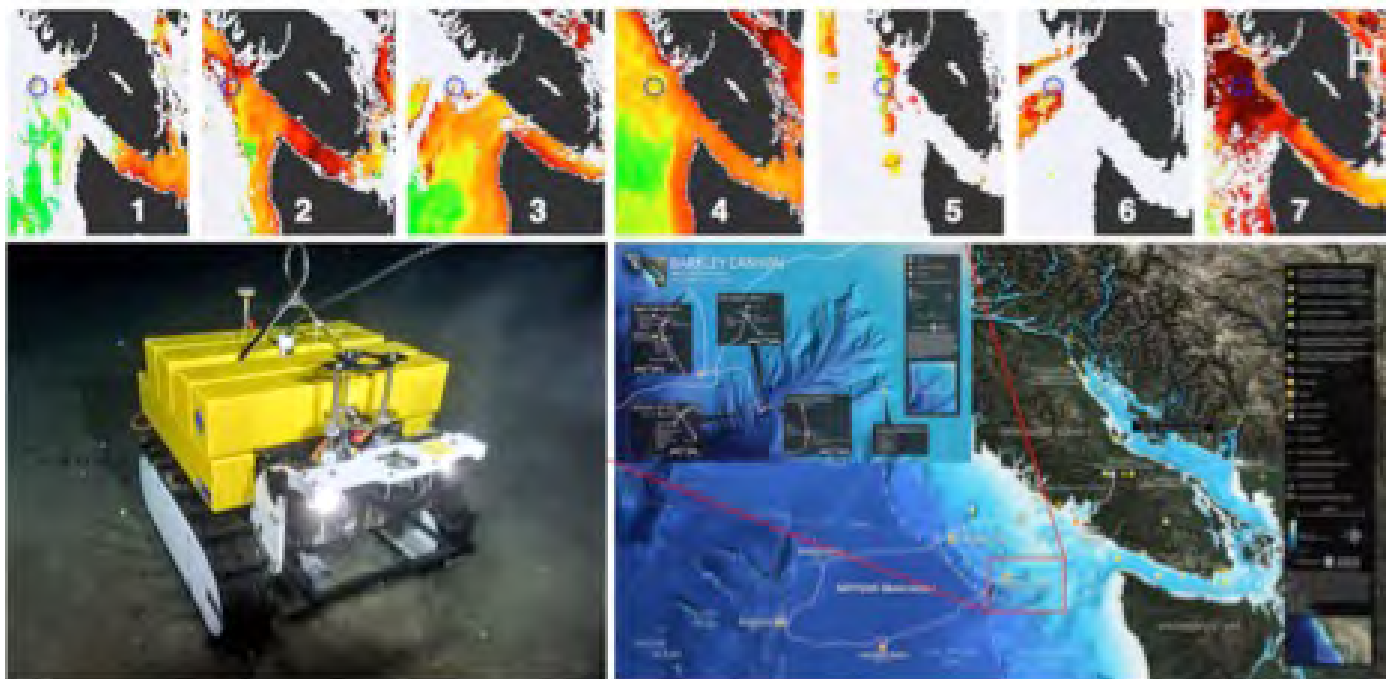
Above: The group photo of the Vladivostok workshop, 21 September, 2017, Vladivostok, Russia.

Deep-sea and outer space technology helps understanding of submarine canyons, carbon sequestration and pelagic-benthic coupling

Fabio De Leo^{1,2}, Laurenz Thomsen², Jacopo Aguzzi³, Corrado Costa⁴, Andrea Ogston⁵, Autun Purser⁶

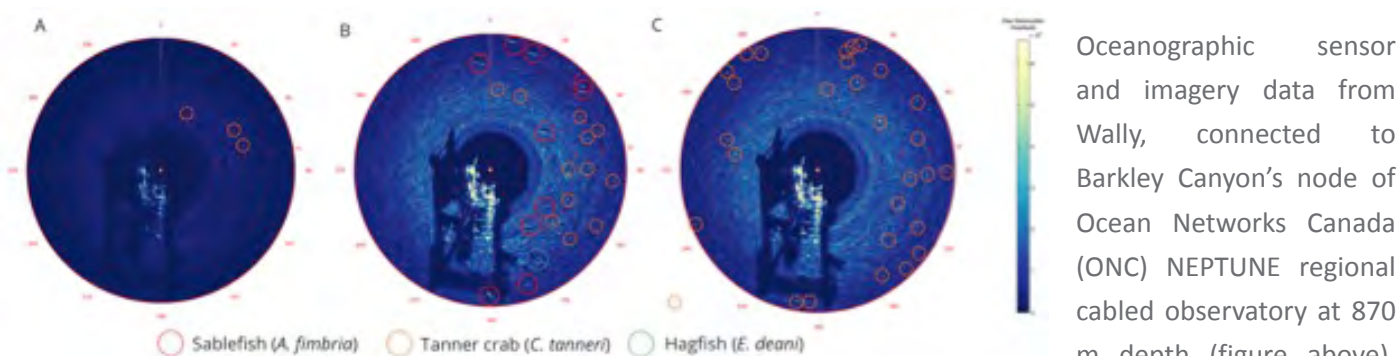
¹Ocean Networks Canada and Department of Biology, University of Victoria, BC, Canada; ²Jacobs University, Bremen, Germany; ³Instituto de Ciencias del Mar (ICM-CSIC), Barcelona, Spain; ⁴Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria, Italy; ⁵School of Oceanography, University of Washington, Seattle, USA; ⁶Alfred Wegener Institute for Polar Research, Bremerhaven, Germany

Technology from undersea and outer space has helped us to better understand the role of submarine canyons in aiding carbon sequestration along continental margins. In the recently published paper, “[The oceanic biological pump: rapid carbon transfer to depth at continental margins during winter](#),” published in Scientific Reports earlier in September, we have further described how canyons play a fundamental role in ocean’s biological pump, i.e., a mechanism that



Above: Figure highlighting MODIS satellite data offshore Vancouver Island, Canada (top); the Internet operated vehicle (crawler Wally) installed in Barkley Canyon (bottom left); and a map showing the study area and the NEPTUNE cabled observatory infrastructure (bottom right).

promotes the drawdown of carbon dioxide from the atmosphere and its trapping into deep-sea sediments. In this truly international and collaborative study, co-authored by colleagues from universities and institutes in Germany, Spain, Canada, Italy and the U.S., we used synchronized real-time data from an internet operated deep-sea crawler (aka: [Wally](#)) and NASA’s MODIS satellite to investigate for the first time the importance of carbon transport by wintertime downwelling events enhanced by canyon topographically-induced eddies off the coast of British Columbia, Canada.



Above: Backscatter images generated by seafloor rotary sonars installed in Barkley Canyon’s node of NEPTUNE cabled observatory. Sonar works in a duty cycle scanning the seafloor for 5-10 minutes at each UTC hour. A, Nov 2010, prior to surface winter blooms; B, 3 days following intense winter bloom, Feb. 2011; C, early spring bloom conditions, April 2011.

Oceanographic sensor and imagery data from Wally, connected to Barkley Canyon’s node of Ocean Networks Canada (ONC) NEPTUNE regional cabled observatory at 870 m depth (figure above), combined with MODIS ocean color data supports that submarine canyons

play an important role in rapidly transferring carbon into the deep sea during winter downwelling events. POC flux derived from short-lived but intense phytoplankton blooms tracked at the sea surface with MODIS reached the seafloor in Barkley Canyon within 1.5-3 day time lags. The arrival of fresh microalgae phytodetritus on the seafloor was identified by optical-fluorescence sensors and a video camera installed in Wally. Additional fixed seafloor cameras and single-beam rotary sonars also plugged into the NEPTUNE observatory documented an increase in benthic megafauna abundance and activity, mainly by detritivore tanner crabs (*Callinectes tanneri*), sablefish (*Anoplopoma fimbria*) and the scavenger hagfish (*Heptatretus deani*), demonstrating a tight pelagic benthic-coupling following the phytodetritus deposition events.

If we consider that there are approximately 10,000 submarine canyons in continental margins worldwide, roughly half of which are shelf-incising canyons, i.e., with canyon heads directly connected to the shelf-edge, we predict that the role of canyons in actively transporting POC to the deep-sea will be far more significant than previously thought. Many questions remain to be addressed as far as how much carbon, and how intrinsic heterogeneity in submarine

canyon geomorphological attributes, such as overall size, wall steepness, significance in sediment transport, etc, will affect single canyon downward transport in POC. If proven to be significant globally, new carbon budget models should include canyons as potential channels for atmospheric CO₂ sink into the ocean.

[ONC](#) monitors Canada's three coasts to continuously deliver real-time data for scientific research that helps communities; government and industry make informed decisions about our future. Using cabled ocean observatories, remote control systems, interactive sensors and big-data management, ONC enables evidence-based decision-making on ocean management, disaster mitigation and environmental protection.

Meetings & Workshops

Workshop report: Evolution of chemosynthesis-based ecosystems

Hiromi Kayama Watanabe¹, Chong Chen¹, Robert G Jenkins², Takami Nobuhara³

¹Japan Agency for Marine-Earth Science and Technology; ²Kanazawa University, Japan; ³Shizuoka University, Japan

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A workshop entitled «Evolution of chemosynthesis-based ecosystems» took place between 18 - 20 March, 2017 at the Misaki Marine Biological Station, University of Tokyo. The workshop aimed to connect geologists, geophysicists, paleontologists, and biologists to form a multi-disciplinary research network to collaborate and share knowledge of chemosynthesis-based ecosystems, and was well-attended with 29 participants (including 13 graduate students).



Above: Field observation of serpentine outcrops in Day 1.



Above: Brain-storming session in Day 3.

Day 1 was a field trip to observe chemosynthetic fossil communities and serpentine-hosted outcrop in the Miocene Hayama Group, Miura Peninsula, guided by one of the authors (RGJ). Twelve talks were given by participants during days two and three, followed up by a brain-storming session to identify major knowledge gaps led by postdoctoral researchers and graduate students before the end of the workshop.

From the workshop, we were able to identify the following key focus areas to fill key knowledge gaps in chemosynthetic ecosystems: 1) 4D mapping of the fauna and their energy sources (both gradient of reducing chemicals and input of organic materials), 2) Determine robust criteria to accurately identify chemosynthesis-based ecosystems, especially in fossil environments and serpentine-hosted systems, and 3) Construction of model chemosynthetic ecosystems (shallow water or laboratory-based) for observation of fine-scale temporal and spatial changes, 4) Elucidate useful traits for determining ecology (energy source, etc.) in fossil species by analyzing living species to reconstruct energy flow in fossil systems.

As a first attempt the workshop was limited to participants from within Japan, but we hope to extend this project to an international audiences and participants. To this end, we have proposed an English session with the same

title as the workshop in the upcoming Japan Geoscience Union (JpGU) meeting in 2018, which has been accepted in collaboration with another session focusing on mud volcanoes. We invite all scientists working on (or are interested in) chemosynthetic ecosystems to attend our session to discuss and form collaborations to better our understanding of the evolution of chemosynthesis-based ecosystems.



June 2018 // Washington D.C. // 4th International Symposium on The Effects of Climate Change on The World's Oceans

The 4th International Symposium will bring together experts from around the world to better understand climate impacts on ocean ecosystems – and how to respond.

Session 6 - The deep ocean under climate change

<http://meetings.pices.int/meetings/international/2018/climate-change/program#S6>

In this session, we invite presentations that describe how climate stressors may alter deep-ocean ecosystems, as well as their combination with other occurring anthropogenic stressors (e.g., fishing, mineral mining), and what the possible societal implications may be. Current initiatives and observing programs, scientific and policy advances and technological developments that will contribute to this effort are also welcome.

The Symposium will:

- Highlight the latest information on how oceans are changing, what is at risk and how to respond;
- Identify key knowledge gaps;
- Promote collaborations; and
- Stimulate the next generation of science and actions

The Symposium will include:

- Great sessions, presentations, and posters
- Opportunities for pre- or post-meeting workshops
- Special events for early career scientists
- Sponsorship and Exhibit Opportunities

Key Topic Areas:

The Symposium is a great opportunity to share information, highlight activities, build partnerships and shape the future of this important field.

One objective for this Symposium is to present current research results and to facilitate the uptake of these new results in other analyses, including (but not restricted to) the 6th Assessment Report (AR6) of the Intergovernmental Panel on Climate Change (IPCC). We plan a Special Volume of the ICES Journal of Marine Science and we expect that additional Special Volumes in peer-reviewed journals may emerging from this Symposium.

Deep-Sea Science for Sustainable Development: DOSI at the Ocean Conference, United Nations

Harriet Harden-Davies

5-9 June 2017

Deep ocean science-policy engagement was championed by the Deep Ocean Stewardship Initiative (DOSI) at the Ocean Conference, held at the United Nations in New York, 5-9 June 2017. This historic conference convened thousands of participants, from governments, businesses and civil society to advance progress to achieve the Sustainable Development Goal 14 (*conserve and sustainably use the oceans, seas and marine resources for sustainable development*). In February 2017 DOSI, IUCN, CNRS and IOC (led by Lisa Levin) held a side-event entitled “Sustaining Integrity of Ecosystems in the Deep Half of the Planet” at the Preparatory Meeting in New York, to raise awareness of the importance of the deep ocean and its biodiversity and to set the stage for the June meeting. Subsequently, in June 2017, DOSI, having secured UN Observer Status, hosted a side-event, delivered a statement during a major partnership dialogue, and convened a group with cross-disciplinary expertise to engage with a range of stakeholders to highlight deep ocean issues.



Above: DOSI Side Event (5 June 2017, United Nations, New York). Clockwise from top: Harriet Harden-Davies, Judith Gobin (University of the West Indies), Nadine LeBris (Université Pierre et Marie Curie); The Hon. Semisi Fakahau (Minister for Agriculture and Food, Forestry, and Fisheries, Kingdom of Tonga); Harriet Harden-Davies (University of Wollongong); Albert Fischer (IOC).

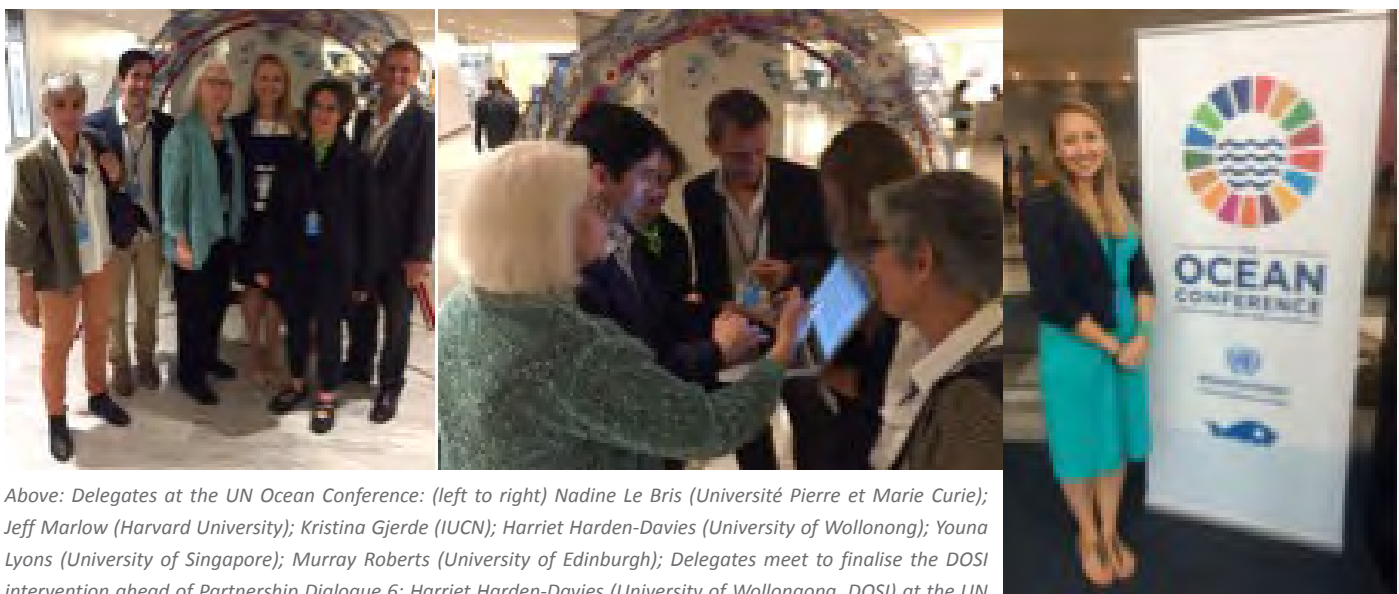
Opportunities for international collaboration and technology development to increase knowledge of the deep-ocean and lift research capacity for sustainable development were discussed at the DOSI side event, “Deep-Sea Science for Sustainable Development”. More than 60 participants attended the event, which DOSI organised in partnership with IUCN, Intergovernmental Oceanographic Commission of UNESCO, and the Permanent Mission of the Kingdom of Tonga to the United Nations, on Monday 5 June, 09.00-10.30. The event was opened by the Hon. Semisi Fakahau (Minister for Agriculture and Food, Forestry, and Fisheries, Kingdom of Tonga) and featured presentations on: challenges for improving resilience of deep-sea impacts (Professor Nadine le Bris, Université Pierre et Marie Curie, Paris); enhancing ecosystem-based management and avoiding significant adverse impacts, including from mining (Kristina Gjerde, IUCN); sustainable management of North Atlantic Ecosystems (Professor Murray Roberts, ATLAS Project, University of Edinburgh), capacity development opportunities for small island developing states (Dr Judi Gobin, University of

West Indies), and science, technology and innovation opportunities (Harriet Harden-Davies, University of Wollongong). Participants engaged in a lively discussion) moderated by Albert Fischer (IOC).



Above: The DOSI, INDEEP, DOOS Voluntary Commitment () being presented to the Partnership Dialogue 6 by Harriet Harden-Davies, 8 June United Nations, New York.

The deep sea was recognised as the next exploration frontier during Partnership Dialogue 6 (“Increasing scientific knowledge, and developing research capacity and transfer of marine technology”) on Thursday 8 June. In a statement delivered during this dialogue, DOSI highlighted the role of international and interdisciplinary collaboration is crucial to conserve and sustainably use the global ocean in the face of growing threats from human activities. The Voluntary Commitment from DOSI, the International Network for Scientific Investigation of Deep-Sea Ecosystems (INDEEP) and the Deep Ocean Observing Strategy (DOOS) (#OceanAction15238 <https://oceanconference.un.org/commitments/?id=15238>) was presented, highlighting how the growing global network of more than 1000 deep-sea scientific experts from 45 countries can help in three areas. Firstly, to champion and engage in the development of a deep ocean observing system (as part of the Global Ocean Observing System) that is integrated, coordinated and sustained. Secondly, to encourage scientific inquiry into the cumulative effects of climate change and other human-induced stressors in the deep ocean and promote accessibility of deep-ocean data. Thirdly, to offer deep-sea science input to legal and policy developments (related to biodiversity beyond national jurisdiction, deep sea-bed mining, oil and gas, fisheries, climate change, and other issues) at national and international levels.



Above: Delegates at the UN Ocean Conference: (left to right) Nadine Le Bris (Université Pierre et Marie Curie);

Jeff Marlow (Harvard University); Kristina Gjerde (IUCN); Harriet Harden-Davies (University of Wollongong); Youna Lyons (University of Singapore); Murray Roberts (University of Edinburgh); Delegates meet to finalise the DOSI intervention ahead of Partnership Dialogue 6; Harriet Harden-Davies (University of Wollongong, DOSI) at the UN Ocean Conference, 8 June 2017.

Achieving SDG14 will require ongoing engagement and collaboration to: advance deep ocean knowledge by strengthening global research alliances and cross-disciplinary integration; develop and transfer technology by facilitating information sharing; and strengthen scientific capacity by sharing skills and expertise with scientists from all

disciplines and all countries. The DOSI delegation, led by Harriet Harden-Davies (University of Wollongong, Australia), comprised eight deep ocean scientists and ocean governance experts: Daniel Dunn (Duke University); Quentin Hanich (University of Wollongong); Nadine Le Bris (Université Pierre et Marie Curie); Youna Lyons (University of Singapore); Jeff Marlow (Harvard University); Claire Nouvian (Bloom); Murray Roberts (University of Edinburgh). The DOSI side event was supported by the J M Kaplan Foundation.

<https://oceanconference.un.org/>



“Canyons to Coast” Conference

Deep-sea canyons intercepting the shelf are increasingly recognised for their importance in driving oceanographic processes, productivity, and feeding aggregations of marine mammals. Exchange processes and connectivity between abyssal plains, canyons, seamounts, ridges, shelf and across to the coast are, however, less well known. The relevance of topographic features and their associated habitat types in mediating biodiversity patterns is also just emerging. Exploration and investigation have advanced with technology, yet challenges persist for deep-sea discoveries to advance basic and applied science. For a long time, the ‘Catchment to Coast’ concept has influenced the research and management agenda. This conference seeks to progress our scientific understanding by shifting the perspective deeper to the interconnectedness between the coast and deep sea.

The need to understand patterns and processes of the geology, oceanography, and biodiversity in this interconnected ocean sphere has intensified with rising resource uses and conservation efforts in a growing Blue Economy. Furthermore, climate change affects productivity and biogenic carbonate producers on both temperate and tropical shelf’s, and it changes communities through increased tropicalisation of temperate waters. Marine protected areas are also expanding within territorial seas, the exclusive economic zones and in areas beyond national jurisdictions.

This conference is inviting presentations of research addressing the deep sea, canyons, seamounts and ridges, high seas, shelf ecosystems, coastal ecosystems, and oceanographic and ecological processes in between. Our aspiration is to promote synergies through interdisciplinary plenary sessions. General session themes are offered and several workshops are envisaged before and after the conference. We are also seeking an accompanying exhibition to showcase the latest technological advancements and methodologies to survey and explore deep sea and shelf habitats.

As deep-sea research thrives on international collaboration, we are reaching out to the global marine science community to contribute to this conference with an aim to derive commonalities for processes between canyons and coast, or to identify idiosyncrasies that are habitat specific. This overview will advance our understanding of the marine realm and raise the perspective for canyon to coast connectivity.

[Click here for symposia and general session themes and information.](#)

UK Deep-Sea Researchers head North for their annual meeting

Bhavani Narayanaswamy

SAMS, UK



Members of the UK's Challenger Deep-Sea Special Interest Group headed to SAMS, Oban for their annual meeting (September 2017). About 30 people attended ranging from undergraduate students through to senior researchers as well as industry representatives and policy makers which added a good dynamic to the discussions held. A number of different talks were given including highlights from different research groups to more detailed research talks. For example, PhD students Noëlie Benoist (University of Southampton) gave a talk on "Testing the metabolic theory of ecology predictions against the body size distribution...", whilst Winnie Courtene-Jones (SAMS-UHI) presented her research on microplastic pollution in the deep waters of the NE Atlantic. Kerry Howell led an interesting session on funding deep-sea research in the UK. This is not just a UK or deep-seas problem, but it was interesting to hear the views on the perception of how easy/difficult/impossible it is to find funding. For

the UK community there was really useful advice given both on the submission of grants, and guidance (useful for all) on what to write (or not) when you are a reviewer. So, if you receive a grant to review and you think it is great and should be funded, don't just say "it's great", you need to give reasons as to why the work should be funded! No deep-sea meeting is complete without a group dinner, which I am delighted to report that everyone was able to attend. For those of you interested, the next UK DS SIG meeting will be held in Glasgow in November 2018. Look forward to seeing some of you there.

15th Deep-Sea Biology Symposium

9-14 September 2018

Monterey, California

The Symposium is the main event for the Deep-Sea Biology Society, and takes place every three years. It brings together leaders from the fields of research, exploration, marine operations, conservation, and management for the deep ocean environment, including benthic, vents and seeps, and water-column biology and oceanography.

Returning to the United States for the first time since 2003, the 15th Deep-Sea Biology Symposium will be held September 9-14, 2018 in Monterey, California. This 5-day conference will feature plenary speakers and two daily concurrent sessions. There will be an opening reception, a poster session on Tuesday night, and a concluding symposium dinner on Friday night at the world renowned Monterey Bay Aquarium. Meeting registration includes a membership in the Deep-Sea Biology Society and all are invited to the Society meeting held during the week (time and location to be determined).

The 15th Deep-Sea Biology Symposium is supported by the Deep-Sea Biology Society and co-hosted by the Monterey Bay Aquarium Research Institute and the Monterey Bay Aquarium.

Abstract Registration opens 18 December 2017 and closes 30 March 2018.

See website for all further details: <https://dsbs2018.org>



The **4th World Conference on Marine Biodiversity** will bring together scientists, practitioners, and policy makers to discuss and advance our understanding of the importance and current state of biodiversity in the marine environment. Through a mix of keynote sessions, contributed talks and posters, the conference program will address marine biodiversity across a deliberately wide range of relevant sectors.

For more information, please visit <http://www.wcmb2018.org/>

Scientist Profiles

Lidia Lins Pereira

Postdoctoral Researcher

Senckenberg Research Institute and Natural History Museum | Goethe University Frankfurt, Germany

<https://www.lidia-lins.com> | https://twitter.com/lidia_lins | https://www.researchgate.net/profile/Lidia_Lins



I cannot express in words my surprise and excitement after I got an email from Mister Hans Rombaut from the Royal Flemish Academy of Belgium for Science and Arts to inform me that I was the laureate for the Paul van Oye prize. This prize is given to scientists who performed innovative research in general biology either of invertebrates or protists from aquatic ecosystems. I was nominated for the Paul van Oye prize based on the results from my PhD thesis: “the importance of benthic-pelagic coupling and spatial variability for deep-sea meiofauna” under the supervision of Prof. Dr. Ann Vanreusel from Ghent University. In general, my research consisted of an interdisciplinary work using different ecological, molecular, and biochemical methods to try to understand patterns and processes occurring in the deep-sea environment. For my PhD work I was motivated by the questions: is the deep-sea diversity at a local scale and turnover limited? Is there a link between primary productivity and diversity and standing stocks? Are there links between water depth and benthic community composition? Do changes in patch-mosaic dynamics shape diversity? Do benthic organisms feed selectively according to the quality of organic matter present in their

environment? Currently in my PostDoc position at the Senckenberg Museum in Frankfurt under the lead of Prof. Dr. Angelika Brandt, I am expanding the last question to other deep-sea organisms and other deep-sea areas exhibiting different hydrodynamics regime. In this regard, my research involves the investigation of trophic relationships in abyssal and hadal areas covering various organisms from the macrofauna (e.g. amphipods, isopods, polychaetes). Do these organisms feed selectively? Are there differences in feeding strategies between the different taxonomical groups? Are there differences in feeding mode between larval and adult stages? These questions still lack an answer at the moment and it is exciting for me to try to unravel this black box.

Georgios Kazanidis

Postdoctoral research associate in Deep-Sea Biodiversity (ATLAS project)

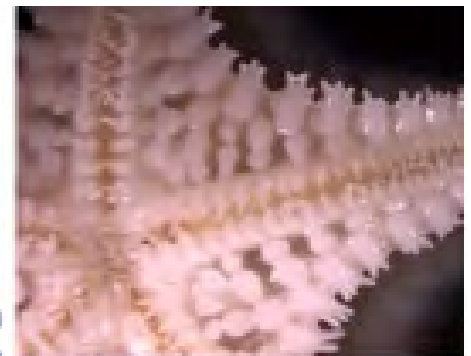
Changing Oceans Group, School of Geosciences, University of Edinburgh

Contact: georgios.kazanidis@ed.ac.uk



Hello there...please let me introduce myself. My name is Georgios Kazanidis and I got the baptism of fire as a deep-sea biologist at the National Oceanography Centre (UK) working on sea cucumbers from the North Atlantic abyss. Being fascinated by the deep sea and its creatures, I continued my studies at the University of Aberdeen working on the biology and ecology of sponges from cold-water coral reefs, perhaps the most spectacular ecosystem in the deep-sea realm. Currently I have been appointed as a postdoctoral research associate at a large Horizon 2020 project– ATLAS (www.eu-atlas.org). My role in this multidisciplinary trans-Atlantic collaboration is to develop new explanatory models of environmental drivers of biodiversity trends in the deep North Atlantic Ocean, and assess Good Environmental Status in cold-water coral reefs and deep-sea sponge grounds. If you would like to learn more about sea

cucumbers, sponges & cold-water coral reefs, please get in contact!



Above: Fauna from Mingulay Reef Complex (Outer Hebrides Sea, Scotland). Image credit: Georgios Kazanidis – ATLAS project.

Opportunities



YOUNG OCEAN LEADERS WANTED!

The World Oceans Day Youth Advisory Council is expanding for 2018 by adding 10 new young ocean leaders from around the world! [Applications are due by 1 December 2017.](#)

The World Oceans Day Youth Advisory Council helps to expand the reach and impact of World Oceans Day, on 8 June, and year-round. Council members are instrumental in helping shape the development of World Oceans Day as it grows, providing new and unique perspectives, ideas, and recommendations. Launched in 2016, the inaugural Council had 11 members. For 2018, we will double the size of the Council and seek out youth in a wider range of countries.

To apply you must be between the ages of 16 and 22, able to make at least a two-year commitment, including approximately 5-10 hours per month to Council activities and have a passion for the ocean! Read the [Youth Advisory Council Handbook](#) for more information about the Council and requirements.

Submit your application!

Advance notice of an opportunity to contribute to a forthcoming special issue on marine benthic biodiversity:

Special issue theme: Marine Benthic Biodiversity

Journal: Diversity (<http://www.mdpi.com/journal/diversity>)

Guest Editor: Martin Solan (m.solan@soton.ac.uk)

Deadline: February, 2018

If you wish to commit to writing a paper, please send a working title and most likely authorship to Martin Solan for consideration after checking the suitability of your contribution at the journal website 'about' pages (<http://www.mdpi.com/journal/diversity/about>).

Post-Doctoral Position in Marine and Coastal Ecosystem Services Saudi Arabia

Position Summary

The Saudi Aramco-KAUST center for Marine Environmental Observations (SAKMEO) is seeking a Post-Doctoral position in the area of marine and coastal Ecosystem Services (ES). The candidate should have a strong research and publication background in the development of biophysical quantification of ecosystem services, mapping and spatial prediction of ecosystem services and the development of ecological (rather than economic) perspectives to ES. Ideally, the candidate will have expertise in the measurement of regulating and supporting ecosystem services in highly dynamic marine environments or how stressors impact on ES delivery. The candidate should have excellent writing skills and a good publication record.

We are seeking individuals who have strong interdisciplinary interests and are capable of working collaboratively within an international, interdisciplinary group. All applicants are required to have a Ph.D. with demonstrated expertise in their respective areas.

For more information visit: <https://iop.kaust.edu.sa/Pages/post%20doc%20ecosystem%20services.aspx>

Higher degree positions and Hong Kong PhD Fellowships at The Swire Institute of Marine Science

Are you passionate about marine science and want to work in a vibrant research community? If so this may be the right opportunity for you....

Applications for MPhil or PhD degree positions are invited for students wanting to work at The Swire Institute of Marine Science, The University of Hong Kong. Applications are especially encouraged to apply for the Hong Kong PhD Fellowship scheme (see <https://www.gradsch.hku.hk/gradsch/>). Interested students should contact staff members to discuss applications.

CLOSING DATE 1st December 2017

Staff and research interests:

David Baker (dmbaker@hku.hk): Coral reef ecology & restoration; ecology & evolution of mutualism; marine biodiversity

Stefano Cannicci (cannicci@hku.hk): Mangrove ecology; crab behavioural ecology; evolutionary biology; animal-plant interactions (in mangroves); bioaccumulation

Juan D. Gaitan-Espitia (juadiegaitan@gmail.com): Evolutionary ecology; phenotypic plasticity; functional & comparative genomics; environmental variation & climate change

Kenneth Leung (kmyleung@hku.hk): Marine pollution & ecotoxicology; eco-shoreline & ecosystem restoration; biodiversity conservation; fisheries & mariculture

Christelle Not (cnot@hku.hk): Microplastic pollution; Paleoclimate; Paleoceanography; Trace element geochemistry

Bayden Russell (brussell@hku.hk): Subtidal ecology; grazer-algae interactions; climate change & trophic ecology; oyster restoration

V. ThiyagaRAJAN (rajan@hku.hk): Oyster larval biology & aquaculture; Ocean Acidification & biomineralization; environmental epigenetics & proteomics

Benoit Thibodeau (bthib@hku.hk): Biogeochemistry; paleoceanography; global change; Nitrogen cycle; stable isotopes

Gray A Williams (hwsbwga@hku.hk): Rocky shores; behavioural ecology; thermal biology, biogeography & climate change

Moriaki Yausuhara (moriakiyasuhara@gmail.com): Marine ostracod paleoecology; macroecology; (paleo)biogeography



PhD Opportunity “Deep-sea hydrothermal vents under different disturbance regimes” at NIOZ

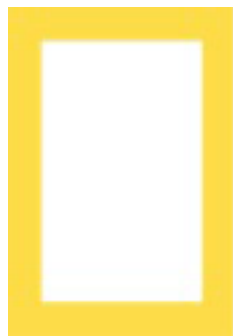
Dr. Sabine Gollner

NIOZ Royal Netherlands Institute for Sea Research

I am pleased to announce that a PhD position on “Community dynamics at deep-sea hydrothermal vents under different disturbance regimes” was opened at the NIOZ Royal Netherlands Institute for Sea Research. A detailed description of the position and application instructions can be found [here](#).

Interested applicants can contact me under sabine.gollner@nioz.nl for additional information.

CLOSING DATE: JANUARY 14TH, 2018



NATIONAL GEOGRAPHIC

National Geographic Application Call for Early Stage Researchers

Claire McNulty and Siebo Heinken

The National Geographic Society, in partnership with Sky, is calling for applications from early stage researchers, or other individuals working in marine research, technology or conservation. Project grants of up to US \$10,000 will be awarded to successful applicants from the UK, Republic of Ireland, Italy, Germany or Austria, and they will have the chance to be selected to receive additional support and exposure through the Sky Ocean Rescue project. The deadline is 1st January 2018. For more information on this call visit: <https://www.nationalgeographic.org/grants/global/sky-ocean-rescue/>

See also: [nationalgeographic.org/grants](https://www.nationalgeographic.org/grants) or contact: cmcnulty@ngs.org



National Oceanography Centre

NATURAL ENVIRONMENT RESEARCH COUNCIL

PhD Opportunity “Assessment of temporal patterns in deep-sea communities” at National Oceanography Centre, Southampton, UK

The DeepSeas Group at NOCS are looking for a PhD candidate to carry out a project assessing temporal patterns in deep-sea communities. The project includes the opportunity to collect and analyse ecological data from the UK long-term abyssal time-series site at the Porcupine Abyssal Plain (PAP) Sustained Observatory, which has been running since 1989. The student will focus on using these data to evaluate climate-driven changes in benthic communities over time. Biological changes will be interpreted with reference to a wide range of physical, chemical and biological information collected regularly at PAP, including essential climate variables measured from the atmosphere and surface ocean to the seafloor. Changes will be assessed using statistical approaches and interpreted using ecological theory. Patterns in community structure, standing stock, size, biomass and biodiversity can be assessed across a range of faunal groups. This project will evaluate the latest changes in the time-series as well as applying novel analytical approaches to evaluate change in the context of established ecological theory.

More details can be found here: <http://noc.ac.uk/gsnocs/project/assessment-temporal-changes-benthos-atlantic-abyss>



Research Faculty Position: Marine/Coastal Scientist

Florida State University
Coastal and Marine Lab, USA

The Florida State University Coastal and Marine Laboratory (FSUCML) invites applications for a RESEARCH FACULTY position in Marine/Coastal Science (12-month renewable appointment). We seek a highly motivated scientist with notable research achievements aligned with FSUCML's mission *to conduct pioneering, interdisciplinary research on coastal and marine ecosystems, to mentor the next generation of problem solvers, and to leverage scientific outcomes and expertise through engagement with stakeholders to optimize marine management and conservation*. The FSUCML is embedded in an area of rich terrestrial and marine biodiversity with an abundance of complex and interconnected estuarine and marine habitats including tidal salt marshes and flats, seagrass meadows, oyster reefs, and hardbottom reefs dominated by soft coral and sponge communities. It is expected that the successful candidate will focus on processes related to these local habitats and environments.

Applicants must have a Ph.D. with significant postdoctoral experience. The successful applicant will be expected to make a commitment to excellence in scholarship, student mentoring and outreach and to develop a well-funded, independent research program. Salary will be provided at 100% for the first two years and 75% from the 3rd year forward, with the expectation that the remaining 25% of salary will be met through external funding. A competitive start-up package will be offered.

Application Content: Applicants are asked to provide a single document in PDF format containing a letter of application, a curriculum vita, a two-page narrative describing their research interests and plans, a brief graduate student mentoring statement, and the contact information for three references. Applicants are encouraged to present their research in a way that is complementary to and can form a basis for integrative collaboration with faculty at the FSUCML and on the FSU main campus.

Applications must be sent electronically to Tianna Forbes: fmsforbes@fsu.edu. Review of applications will begin on December 18, 2017 and will continue until the position is filled. Questions about the position should be directed to Dr. Sophie McCoy: smccoy@fsu.edu.



CALL FOR NOMINATIONS: SECRETARY-GENERAL AWARD FOR EXCELLENCE IN DEEP SEA RESEARCH

Secretary-General Michael Lodge issued a Call on 13 November for Nominations for the Secretary-General Award for Excellence in Deep Sea Research.

The Award is a first for the International Seabed Authority and is one of seven voluntary commitments made by the Authority at the 2017 UN Ocean Conference. The annual Award is intended to recognize and encourage the achievements of young researchers (under 35 years of age) from developing countries who have made outstanding contributions to the advancement of scientific knowledge of the deep sea environment or to the development of environmentally sustainable regulatory frameworks.

A five-member Advisory Committee recognized for their expertise in the field of deep-sea science (natural and/or applied); social sciences and humanities with experience in the law of the sea; international law and management of marine resources has been appointed by the Secretary-General to consider and evaluate all nominations. These members are: Annick de Marffy Mantuano, President of the Scientific Board of the Economic Law of the Sea Institute (INDEMER, Monaco); Chunhui Tao, Researcher/Deputy Director of China Deep-Sea Exploration Tech and Geoscience R&D Centre, Second Institute of Oceanography; Biliana Cicin-Sain; Professor/Director/President, Global Ocean Forum; David Billet, Director, Deep Seas Environmental Solutions Ltd; and Lawrence Folajimi Awosika, Vice Chairman of the Commission on the Limits of the Continental Shelf (CLCS).

For further information on the Award guidelines and eligibility criteria, visit the Authority's website on <http://bit.ly/2iO7Yzr>

The deadline for nominations is 15 April 2018. All nominations should be emailed to sgaward@isa.org.jm



Mary Derrickson McCurdy Visiting Scholar

The [Nicholas School of the Environment](#) at [Duke University](#) invites applications for the Mary Derrickson McCurdy Visiting Scholar, based at the [Duke Marine Laboratory](#) on the North Carolina coast. We seek an early-career scholar who will benefit from support that allows her/him to pursue self-directed research, while engaging in the intellectual life of the Marine Laboratory. The PhD must be complete for the fellowship to commence.

We value diverse ways of knowing, understanding and learning, and encourage applicants from all areas across the spectrum of Marine Science and Conservation, broadly construed (e.g., oceanography, biogeochemistry, marine technology, remote sensing, coastal geomorphology, ocean energy, deep-sea science, environmental toxicology, natural hazards, microbial ecology, marine biology and ecology, fisheries, conservation science, and human-environmental interactions at various scales and from different perspectives, e.g., political ecology, theories of collective-action and governance, economics, livelihoods and well-being). Individual qualifications, academic excellence appropriate to career stage and home discipline, and collegiality, rather than specific research area will be the primary criteria in selecting the successful candidate.

To see full description or to apply, visit Academic Jobs Online: <https://academicjobsonline.org/ajo> See Job # 10163

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Scenarios of biodiversity and ecosystem services

The Belmont Forum and BiodivERSA are pleased to announce the 2017-2018 international call for research proposals on "Scenarios of Biodiversity and Ecosystem Services"

The Call will address the two following major (non-exclusive) priorities:

- Development and application of scenarios of biodiversity and ecosystem services across spatial scales of relevance to multiple types of decisions
- Consideration of multiple dimensions of biodiversity and ecosystem services in biodiversity scenarios

The call aims at supporting proposals that **explicitly address a scenario dimension**, taking into account the following definition of scenarios: "Scenarios of biodiversity and ecosystem services are the outputs of the combination of scenarios of indirect drivers and direct drivers - such as land use change, invasive alien species, overexploitation, climate change or pollution - and models of impacts of these drivers on biodiversity and ecosystem services."

Twenty-five funding organisations from 23 countries are joining this call:

Argentina, Austria, Belgium#, Brazil (State of Sao Paulo only), Bulgaria, Canada, Estonia, Finland, France, Germany, Ireland, Ivory Coast, Lithuania, The Netherlands, Norway, Poland, Romania, Slovakia, Spain, Sweden, Switzerland,

Turkey, United States of America.

confirmed for the Wallonia-Brussels Federation; decision for the federal level still pending

Some Funding organisations may also define specific funding rules allowing the funding of teams from low-income and lower-middle income countries. This information is detailed in the Funding organisations' rules. If you would like to use this opportunity, please make sure to contact your Funding Organisation Contact Point.

The Belmont Forum and BiodivERsA partners together with the European Commission (EC)* have provisionally reserved more than 25 million Euros for this call.

*(*EC contribution is still tentative, pending on the signature of the Grant Agreement of the BiodivScen project)*

Scientific teams are invited to form international consortia comprising research groups from **at least three countries** participating in the call. Consortia are highly encouraged to involve at least two teams from two different EU Member States or H2020 Associated Countries to be eligible for EC funding (here: Austria, Belgium, Bulgaria, Estonia, Finland, France, Germany, Ireland, Lithuania, The Netherlands, Norway, Poland, Romania, Slovakia, Spain, Sweden, Switzerland and Turkey).

Proposals should also clearly demonstrate the **added value linked to the international nature of the projects** and to the level of collaboration between teams from different countries. Proposals will be evaluated according to criteria of **(i) scientific excellence, (ii) policy relevance and societal impact (which includes stakeholder engagement), and (iii) quality and efficiency of the project implementation**. For more information on the objectives and possible approaches for stakeholder engagement in research projects, please check the [BiodivERsA Stakeholder Engagement Handbook](#).

A two-step process will apply, with a mandatory pre-registration of projects at the first step and submission of full proposals at the second step. Pre-registrations and full proposals (to be written in English) must be submitted electronically with the Electronic Proposal Submission System (EPSS). The link to the EPSS will be available on the Belmont Forum and BiodivERsA websites.

Each research Partner in a project must comply with the eligibility criteria and rules of its funding organisation.

SCHEDULE OF THE CALL

Release date of the call: Monday 02 October 2017

Deadline for pre-registration (mandatory): Friday 01 December 2017, 17:00 CET (local time in Brussels)

Deadline for submission of full-proposals: Friday 09 March 2018, 17:00 CET (local time in Brussels)

MORE INFORMATION

For more information on the call, please consult the complete announcement of opportunity (including research priorities, pre-registration and submission forms, and rules and procedures including assessment criteria) either on the [BiodivERsA website](#) or [Belmont Forum website](#). Please also make sure to consult your Funding organisations' rules and to contact your Funding organisation Contact Points (FCPs).

If you are looking for a Research Partner for your Project or for a Project to join, please do not hesitate to use the BiodivERsA/Belmont Forum [Partner Search Tool](#).

For specific questions related to the budget, criteria and rules of your funding organisation, please consult your Funding organisation's rules. Each research team is encouraged to contact its FCP before submitting a proposal.

For general information on the call, please contact the Theme Programme Office (TPO): Sophie GERMANN, Scientific project manager, sophie.germann@agencerecherche.fr

For technical questions regarding the submission, please contact the TPO or the EPSS technical helpdesk: Taavi Tiirik, biodivscen@etag.ee.



Ambassador Awards up for grabs!

MarXiv, the free research repository for the ocean and climate sciences, is now accepting applications for Ambassadors to help train researchers on how to legally make academic literature freely-available for everyone to access. To help cover time spent advocating on MarXiv's behalf, we are awarding US \$1,000 each to 10 MarXiv Ambassadors who will serve a one-year tenure beginning January 1st, 2018.

The MarXiv Ambassadors will serve as preprint-sharing experts for the local institutions, helping their fellow researchers determine which documents can (and cannot) be legally shared in MarXiv.

Applications are due by 17 December 2017. Preference will be given to Ambassadors based at institutions in Chile, China, Japan, Indonesia, Mexico, and the United States of America.

For more information, please visit <https://www.marxiv.org/apply-marxiv-ambassador>.

More about MarXiv (rhymes with "archive")

Ocean managers, policymakers, and NGOs routinely face barriers to scientific knowledge: they simply can't afford costly subscriptions to traditional academic journals. Studies have found that these financial barriers result in less primary science being used in on-the-ground environmental management plans.

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But MarXiv isn't just for preprints. You can deposit your group's technical reports and Open Access publications, as well. Deposit your report in MarXiv to get a unique DOI number, a long-term storage solution, and ensure your work is indexed in Google Scholar.

Documentation for MarXiv is available at <https://www.marxiv.org/> and new papers may be added to the repository at <https://osf.io/preprints/marxiv/>.

Please share this announcement with your networks! Any questions may be directed to Nick Wehner at nick@octogroup.org or via Twitter at @MarXivPapers.

Hot off the Press

A comparative experimental approach to ecotoxicology in shallow-water and deep-sea holothurians suggests similar behavioural responses

Alastair Brown, Roseanna Wright, Lisa Mevenkamp, Chris Hauton (2017)

Aquatic Toxicology, 191: 10-16

Exploration of deep-sea mineral resources is burgeoning, raising concerns regarding ecotoxicological impacts on deep-sea fauna. Assessing toxicity in deep-sea species is technologically challenging, which promotes interest in establishing shallow-water ecotoxicological proxy species. However, the effects of temperature and hydrostatic pressure on toxicity, and how adaptation to deep-sea environmental conditions might moderate these effects, are unknown. To address these uncertainties we assessed behavioural and physiological (antioxidant enzyme activity) responses to exposure to copper-spiked artificial sediments in a laboratory experiment using a shallow-water holothurian (*Holothuria forskali*), and in an in situ experiment using a deep-sea holothurian (*Amperima* sp.). Both species demonstrated sustained avoidance behaviour, evading contact with contaminated artificial sediment. However, *Amperima* sp. demonstrated sustained avoidance of 5 mg l⁻¹ copper contaminated artificial sediment whereas *H. forskali* demonstrated only temporary avoidance of 5 mg l⁻¹ copper-contaminated artificial sediment, suggesting that *H. forskali* may be more tolerant of metal exposure over 96 h. Nonetheless, the acute behavioural response appears consistent between the shallow-water species and the deep-sea species, suggesting that *H. forskali* may be a suitable ecotoxicological proxy for *Amperima* sp. in acute (≤24 h) exposures, which may be representative of deep-sea mining impacts. No antioxidant response was observed in either species, which was interpreted to be the consequence of avoiding copper exposure. Although these data suggest that shallow-water taxa may be suitable ecotoxicological proxies for deep-sea taxa, differences in methodological and analytical approaches, and in sex and reproductive stage of experimental subjects, require caution in assessing the suitability of *H. forskali* as an ecotoxicological proxy for *Amperima* sp. Nonetheless, avoidance behaviour may have bioenergetics consequences that affect growth and/or reproductive output, potentially impacting fecundity and/or offspring fitness, and thus influencing source-sink dynamics and persistence of wider deep-sea populations.

Link to paper: <https://doi.org/10.1016/j.aquatox.2017.06.028>

Hydrostatic pressure and temperature affect the tolerance of the free-living marine nematode *Halomonhystera disjuncta* to acute copper exposure

L. Mevenkamp, A. Brown, C. Hauton, A. Kordas, S. Thatje, A. Vanreusel (2017)

Aquatic Toxicology, 192: 178-183.

Potential deep-sea mineral extraction poses new challenges for ecotoxicological research since little is known about effects of abiotic conditions present in the deep sea on the toxicity of heavy metals. Due to the difficulty of collecting and maintaining deep-sea organisms alive, a first step would be to understand the effects of high hydrostatic pressure and low temperatures on heavy metal toxicity using shallow-water relatives of deep-sea species. Here, we present the results of acute copper toxicity tests on the free-living shallow-water marine nematode *Halomonhystera disjuncta*,

which has close phylogenetic and ecological links to the bathyal species *Halomonhystera hermesii*. Copper toxicity was assessed using a semi-liquid gellan gum medium at two levels of hydrostatic pressure (0.1 MPa and 10 MPa) and temperature (10 °C and 20 °C) in a fully crossed design. Mortality of nematodes in each treatment was assessed at 4 time intervals (24 and 48 h for all experiments and additionally 72 and 96 h for experiments run at 10 °C). LC50 values ranged between 0.561 and 1.864 mg Cu²⁺ L⁻¹ and showed a decreasing trend with incubation time. Exposure to high hydrostatic pressure significantly increased sensitivity of nematodes to copper, whereas lower temperature resulted in an apparently increased copper tolerance, possibly as a result of a slower metabolism under low temperatures. These results indicate that hydrostatic pressure and temperature significantly affect metal toxicity and therefore need to be considered in toxicity assessments for deep-sea species. Any application of pollution limits derived from studies of shallow-water species to the deep-sea mining context must be done cautiously, with consideration of the effects of both stressors.

Link to paper: <https://doi.org/10.1016/j.aquatox.2017.09.016>

Identifying toxic impacts of metals potentially released during deep-sea mining — a synthesis of the challenges to quantifying risk

C. Hauton, A. Brown, S. Thatje, N.C. Mestre, M.J. Bebianno, I. Martins, R. Bettencourt, M. Canals, A. Sanchez-Vidal, B. Shillito, J. Ravaux, M. Zbinden, S. Duperron, L. Mevenkamp, A. Vanreusel, C. Gambi, A. Dell'Anno, R. Danovaro, V. Gunn, P. Weaver (2017)

Frontiers in Marine Science, 4: 368.

In January 2017, the International Seabed Authority released a discussion paper on the development of Environmental Regulations for deep-sea mining (DSM) within the Area Beyond National Jurisdiction (the “Area”). With the release of this paper, the prospect for commercial mining in the Area within the next decade has become very real. Moreover, within nations’ Exclusive Economic Zones, the exploitation of deep-sea mineral ore resources could take place on very much shorter time scales and, indeed, may have already started. However, potentially toxic metal mixtures may be released at sea during different stages of the mining process and in different physical phases (dissolved or particulate). As toxicants, metals can disrupt organism physiology and performance, and therefore may impact whole populations, leading to ecosystem scale effects. A challenge to the prediction of toxicity is that deep-sea ore deposits include complex mixtures of minerals, including potentially toxic metals such as copper, cadmium, zinc, and lead, as well as rare earth elements. Whereas the individual toxicity of some of these dissolved metals has been established in laboratory studies, the complex and variable mineral composition of seabed resources makes the a priori prediction of the toxic risk of DSM extremely challenging. Furthermore, although extensive data quantify the toxicity of metals in solution in shallow-water organisms, these may not be representative of the toxicity in deep-sea organisms, which may differ biochemically and physiologically and which will experience those toxicants under conditions of low temperature, high hydrostatic pressure, and potentially altered pH. In this synthesis, we present a summation of recent advances in our understanding of the potential toxic impacts of metal exposure to deep-sea meio- to megafauna at low temperature and high pressure, and consider the limitation of deriving lethal limits based on the paradigm of exposure to single metals in solution. We consider the potential for long-term and farfield impacts to key benthic invertebrates, including the very real prospect of sub-lethal impacts and behavioral perturbation of exposed species. In conclusion, we advocate the adoption of an existing practical framework for characterizing bulk resource toxicity in advance of exploitation.

Link to paper: <https://doi.org/10.3389/fmars.2017.00368>

The effects of temperature and hydrostatic pressure on metal toxicity: Insights into toxicity in the deep sea

Alastair Brown, Sven Thatje, Chris Hauton (2017)

Environmental Science & Technology, 51.

Mineral prospecting in the deep sea is increasing, promoting concern regarding potential ecotoxicological impacts on deep-sea fauna. Technological difficulties in assessing toxicity in deep-sea species has promoted interest in developing shallow water ecotoxicological proxy species. However, it is unclear how the low temperature and high hydrostatic pressure prevalent in the deep sea affect toxicity, and whether adaptation to deep-sea environmental conditions moderates any effects of these factors. To address these uncertainties we assessed the effects of temperature and hydrostatic pressure on lethal and sublethal (respiration rate, antioxidant enzyme activity) toxicity in acute (96 h) copper and cadmium exposures, using the shallow-water ecophysiological model organism *Palaemon varians*. Low temperature reduced toxicity in both metals, but reduced cadmium toxicity significantly more. In contrast, elevated hydrostatic pressure increased copper toxicity, but did not affect cadmium toxicity. The synergistic interaction between copper and cadmium was not affected by low temperature, but high hydrostatic pressure significantly enhanced the synergism. Differential environmental effects on toxicity suggest different mechanisms of action for copper and cadmium, and highlight that mechanistic understanding of toxicity is fundamental to predicting environmental effects on toxicity. Although results infer that sensitivity to toxicants differs across biogeographic ranges, shallow water species may be suitable ecotoxicological proxies for deep-sea species, dependent on adaptation to habitats with similar environmental variability.

Link to paper: <http://pubs.acs.org/doi/pdf/10.1021/acs.est.7b02988>

Metabolic costs imposed by hydrostatic pressure constrain bathymetric range in the lithodid crab *Lithodes maja*

A. Brown, S. Thatje, J.P. Morris, A. Oliphant, E.A. Morgan, C. Hauton, D. Jones, D.W. Pond (2017)

Journal of Experimental Biology, 220: 3916-3926.

The changing climate is shifting the distributions of marine species, yet the potential for shifts in depth distributions is virtually unexplored. Hydrostatic pressure is proposed to contribute to a physiological bottleneck constraining depth range extension in shallow-water taxa. However, bathymetric limitation by hydrostatic pressure remains undemonstrated, and the mechanism limiting hyperbaric tolerance remains hypothetical. Here, we assess the effects of hydrostatic pressure in the lithodid crab *Lithodes maja* (bathymetric range 4–790 m depth, approximately equivalent to 0.1 to 7.9 MPa hydrostatic pressure). Heart rate decreased with increasing hydrostatic pressure, and was significantly lower at ≥ 10.0 MPa than at 0.1 MPa. Oxygen consumption increased with increasing hydrostatic pressure to 12.5 MPa, before decreasing as hydrostatic pressure increased to 20.0 MPa; oxygen consumption was significantly higher at 7.5–17.5 MPa than at 0.1 MPa. Increases in expression of genes associated with neurotransmission, metabolism and stress were observed between 7.5 and 12.5 MPa. We suggest that hyperbaric tolerance in *L. maja* may be oxygen-limited by hyperbaric effects on heart rate and metabolic rate, but that *L. maja*'s bathymetric range is limited by metabolic costs imposed by the effects of high hydrostatic pressure. These results advocate including hydrostatic pressure in a complex model of environmental tolerance, where energy limitation constrains biogeographic range, and facilitate the incorporation of hydrostatic pressure into the broader metabolic framework for ecology and evolution. Such an

approach is crucial for accurately projecting biogeographic responses to changing climate, and for understanding the ecology and evolution of life at depth.

Link to paper: <http://jeb.biologists.org/content/220/21/3916>

Heterogeneity of methane seep biomes in the Northeast Pacific

Sarah Seabrook, Fabio C. De Leo, Tamara Baumberger, Nicole Raineault, Andrew R. Thurber

Deep Sea Research II (in press)

Methane seeps habitats are now known to occur and are important centers of greenhouse gas regulation and food production in the food-limited deep-sea. Most research efforts have focused on single-seep habitats, with paradigms developed based on the dynamics within these epicenters, such as Hydrate Ridge off the Oregon Coast. Recent cruises have discovered over 1,000 individual bubble streams over a range of depths (150m-2660m) off the Cascadia Margin, the region that spans the coast of Northwest America from 48°N to 40°N in latitude.



Images from the E/V Nautilus 2016 expedition along the Cascadia Margin. From top left to bottom right: bushes of Siboglinidae tubeworms off of Heceta Banks, a methane hydrate found at Astoria Canyon, bubbles coming out from under a carbonate platform associated with methane seepage at Klamath Knoll, and a sulfide oxidizing microbial mat with a juvenile rockfish and fly catcher anemone nearby. Photos copyright: Ocean Exploration

In this study, we give the first report of the microbial and animal communities at eight newly-discovered methane seeps, explored by the E/V *Nautilus* along the Cascadia Margin. We compare these new seep sites with two known seeps, and two non-seep (reference) environments within the Ocean Networks Canada NEPTUNE cabled observatory. We report animal communities not previously known from the region (specifically vestimentiferan siboglinids and gooseneck barnacles). We highlight interesting differences in microbial communities both between and within

the seep sites studied, revealing both large and small-scale heterogeneity in the seep microbial community. Potentially most exciting, we observed an unexpected latitudinal trend in the species richness of the microbial community that counters trends observed previously in single-seep habitats. This broad survey highlights the variability that exists both within and among seep communities in the NE Pacific. Further, it exemplifies the power of cross-margin studies to increase our understanding of seep dynamics, and the interactions of seep habitats with the surrounding environment.

Link to article: <http://www.sciencedirect.com/science/article/pii/S0967064517301881>

Synchronous, year-long captures of “swimmers” from near- bottom sediment traps in a submarine canyon and its adjacent open slope

C. Romano, M.M. Flexas, M. Segura, S. Romàn, N. Bahamon, J.M. Gili, A. Sanchez- Vida, D. Martin

Deep Sea Research I: 129 (99-115)

Together with sediments, numerous organisms, including both passive sinkers and active migrators (the “swimmers”), are captured in deep-sea sediment traps. For this reason, they become an extraordinary tool to gather relevant information on the biodiversity and dynamics of deep-sea organisms.

We analyzed the near-bottom swimmers collected continuously during one year, and synchronously from 300 to 1800 m depth in Blanes Canyon and its adjacent slope (NW Mediterranean). We revealed the mean annual swimmer fluxes to be almost one order of magnitude higher inside the canyon, as well as to show higher seasonal variability in the canyon than at the slope. In parallel, we also reported a much higher abundance of infaunal organisms (particularly polychaetes) inside the canyon.

The overall combination of different events (e.g. strong bottom currents, resuspension events and lateral transport of matter) appeared to be responsible for bringing benthic taxa to the pelagic environment in the canyon during late autumn-early winter, while we attributed the spring increase of swimmer fluxes inside the canyon to lateral transport events linked to the resuspension of bottom sediments caused by the recurrent, daily trawling activities in the nearby canyon flanks.

Moreover we showed that Blanes Canyon hosts unique and novel deep-sea fauna, including hydromedusae (e.g. *Teclaiia recincolae*, *Parateclaiia euromarge*, *Earleria araiiae*) and other interesting organisms such as rare echinoderms and polychaetes, which support the postulated biodiversity hot spot character attributed to submarine canyons.

Link to article: <https://doi.org/10.1016/j.dsr.2017.10.002>



Above: Illustration of *Earleria araiiae*. Image: Jordi Corbera.



Above: Illustration of *Teclaiia recincolae*. Image: Jordi Corbera.

Dispersal Barriers and Genetic Differentiation in the Abyss

Torben Riehl

Deep Sea Research Part II: Topical Studies in Oceanography

“Endless”, “homogeneous”, and “barrier-free” are attributes often associated with abyssal basins, the seafloor habitat encountered between 3,500 m and 6,500 m depth. How can a habitat that is apparently free of barriers and poor in heterogeneity host a rich biodiversity? And does diversification, and ultimately speciation, occur in the abyss, or do the organisms that we encounter there originate from the slope?



Above: Artistic illustration of an undescribed species of Macrostylidae (Isopoda) from the eastern and western Vema Fracture Zone. A genetic study revealed, that genetic differentiation in this taxon is linked to physical barriers like Mid-Ocean Ridges, depth gradients, as well as geographic distance. This adult male is characterized by several highly modified body parts, such as the long appendages and bushy antennae, which the do not share with the conspecific females (sexual dimorphism). With permission from Nele Heitland.

During the Vema-TRANSIT project (see Project focus), a transect along the Vema Fracture Zone, crossing the Mid-Atlantic Ridge, was sampled, also including the Puerto Rico Trench. Together with Lidia Lins and Angelika Brandt, I used a molecular genetic approach to study differentiation in the isopod crustacean group Macrostylidae (Fig. 1). Macrostylids have an endobenthic lifestyle digging through the sediment or building tubes. Moreover, being peracarids, they do not have free larvae but care for their offspring developing in a brood pouch. Both lifestyle and reproductive mode render species belonging to this taxon poor dispersers but great study taxa for phylogeographic questions.

We discovered that three factors play a role in genetic differentiation: 1) Oceanic ridges, 2) depth gradients, and 3) the vast size of the abyss, have negative effects on exchange between populations. All three factors represent barriers and thus contribute to independent evolutionary fates of populations that are divided by them. The abyss seems not to be free of barriers after all! Enjoy reading!

Link to article: [doi: 10.1016/j.dsr2.2017.10.005](https://doi.org/10.1016/j.dsr2.2017.10.005)

Deep-sea mega-epibenthic assemblages from the SW Portuguese margin (NE Atlantic) subjected to bottom-trawling fisheries

Ramalho SP, Lins L, Bueno-Pardo J, Cordova EA, Amisi JM, Lampadariou N, Vanreusel A and Cunha MR

Frontiers in Marine Sciences 4:350

Bottom-trawling fisheries are a common threat to the health of continental margins worldwide. Together with numerous environmental and biological processes, physical disturbance induced by trawlers can largely shape the benthic habitats and their associated assemblages. At the SW Portuguese Margin, crustacean bottom trawlers have exploited deep-sea habitats for a few decades, but its effects on the benthic biodiversity are practically unknown. During the spring-summer of 2013 and 2014, several Remotely Operated Vehicle (ROV) video transects were used to investigate mega-epibenthic abundance, composition, and diversity in soft-sediment areas subjected to varying trawling pressures off Sines and Setúbal (200–800 m). Differences in mega-epibenthic assemblages were linked with environmental changes (depth, grain size, primary productivity) and trawling disturbance. The effect of trawling was assessed between segments with similar habitat characteristics, i.e., muddy-sand bottoms between 300 and 500 m. Areas subjected to intensive trawling pressure showed a generally flattened seabed, with abundant recent trawl marks (up to 3 scars.100 m⁻¹), indicating that the seabed physical integrity was compromised. Significant negative correlations were detected between various mega-epibenthic diversity indices [S, H', and ET(20)] and trawling pressure (h.cell⁻¹.y⁻¹). Furthermore, the distinct mega-epibenthic assemblages and absence of several sessile erect morphospecies at

both low and highly disturbed locations by trawling off Sines, namely all seapen morphospecies found in non-trawled areas, demonstrates the negative influence of trawling fisheries on the benthic component of the study area. Also, low dissimilarity between assemblages from the main fishing grounds and the adjacent low-disturbance locations, suggests that the potentially negative influence of trawling can extend beyond the targeted areas (e.g., by the plumes of re-suspended sediments). The observed deleterious effects of trawling on mega-epibenthic fauna together with the intensification of trawling pressure in the study area, stress the need for adequate monitoring programs and regulatory measures to halt the long-term loss of biodiversity and allow the sustainability of fisheries at the SW Portuguese Margin.

Link to article: <https://www.frontiersin.org/articles/10.3389/fmars.2017.00350/full>

Sexually dimorphic dietary differences in common demersal elasmobranchs of the Northwestern Pacific

Orlov, A.M. (2017)

Advances in Medicine and Biology, Vol. 104, Hauppague, New York, Nova Science Publishers, Inc., P. 131-149.

Among demersal elasmobranch species of the Northwestern Pacific, two sharks (North Pacific spiny dogfish *Squalus suckleyi*, Pacific sleeper shark *Somniosus pacificus*) and several skates (Alaska skate *Bathyraja parmifera*, Aleutian skate *B. aleutica*, whiteblotched skate *B. maculata*, Matsubara skate *B. matsubarai*, Okhotsk skate *B. violacea*, mud skate *B. taranetzi*, and whitebrow skate *B. minispinosa*) are most common. This paper reviews male and female diet compositions of above-mentioned elasmobranch species. In case of skates, dietary differences between males and females might be attributed to well-known distinctions in dentition. Partly dietary differences in male and female skates and sharks might be associated with size differences.

Link to paper: https://www.novapublishers.com/catalog/product_info.php?products_id=59321&osCsid=c30e312f31a6e47cacf3a201e8c0395c

The Pacific sleeper shark *Somniosus pacificus*: A deterrence for existing fisheries or a promising target?

Orlov, A.M. (2017)

Advances in Medicine and Biology, Vol. 119, Hauppague, New York, Nova Science Publishers, Inc., P. 277-289.

The Pacific sleeper shark *Somniosus pacificus* is a large shark (up to 7 m long) widely distributed in the North Pacific Ocean from Taiwan and Mexico in the south to the Chukchi Sea in the north. The abundance of this species increased dramatically during recent years in the most parts of the species' range that resulted in disturbance for many existent bottom trawl and longline fisheries. This paper reviews past and current state of Pacific sleeper shark abundance in the North Pacific, discusses its disturbance to fisheries and proposes some ways of commercial exploitation of the stocks of this shark.

Link to paper: https://www.novapublishers.com/catalog/product_info.php?products_id=61351&osCsid=c30e312f31a6e47cacf3a201e8c0395c

Fishes of the Northern Mid-Atlantic Ridge collected during the MAR-ECO cruise in June-July 2004: an annotated checklist

Porteiro, F.M., Sutton, T.T., Byrkjedal, I., Orlov, A.M., Heino, M., Menezes, G., Bergstad, O.A. (2017)

Arquipelago. Life and Marine Sciences, Supplement 10: iii +126 p.

Records of the fishes from the northern Mid-Atlantic Ridge (MAR) (41°N - 60°N) sampled during two research cruises conducted in summer 2004 on the R/V G.O. Sars and M/S Loran are presented. The cruises were major sampling efforts carried out for the MAR-ECO project, i.e. the Census of Marine Life field project entitled "Patterns and Processes of the Ecosystems of the Northern Mid-Atlantic". The investigation included sampling with several midwater nets, bottom trawl and longlines from surface waters to about 4000 m. The list comprises around 300 species of fishes from 82 families. Many records were new to the northern mid-Atlantic area, and the list also comprises three recently described species and some additional specimens to date only identified to genus.

Link to paper: http://nsuworks.nova.edu/occ_facreports/102/

Spatial Distribution, Size Composition, and Dynamics of Catches of the Okhotsk Skate *Bathyraja violacea* in the North Pacific Ocean

Grigorov, I.V., Baitalyuk, A.A., Orlov, A.M. (2017)

Journal of ichthyology 57 (5): 706-720

The results of the long-term (1963–2015) studies of spatial and vertical distributions, dynamics of abundance and size composition of the Okhotsk skate *Bathyraja violacea* in the North Pacific Ocean are presented. This species is the most abundant at depths of 100–400 m; in the cold season, it migrates to the larger depths for wintering, while it migrates to shallower depths in the warm season. Specimens of the length 12 to 132 cm with prevalence of skates of 50 to 80 cm long were recorded in catches. The difference between males and females in body weight and length was not considerable. Condition factor of specimens decreases from January to August and begins to increase in September. Males dominate among the skates up to 30 cm long, females dominate in the size groups of 30–60 cm and >70 cm, while an almost equal sex ratio is observed in the size group of 60–70 cm. The dynamics of the catches of the Okhotsk skate vary in different regions: in the western Bering Sea and in the Sea of Okhotsk, the catches consistently increased during the study period, the catches increased to the mid-1980s–early 1990s in the Kuril and Kamchatka waters of the Pacific Ocean, and then a decrease has been observed; in the eastern Bering Sea, the peak of catches occurred in the mid-1970s, and then they decreased subsequently.

Link to paper: <https://link.springer.com/article/10.1134/S0032945217050071>

Population Status of Greenland Halibut *Reinhardtius hippoglossoides* (Walbaum, 1793) of the Laptev Sea

Orlova, S.Yu., Volkov, A.A., Maznikova, O.A., Chernova, N.V., Glebov, I.I., Orlov, A.M. (2017)

Doklady Biochemistry and Biophysics 477 (1): 101-105

This is the first study to perform a comparative genetic analysis of Greenland halibut in the samples from the Atlantic (waters of west and east of Greenland), Arctic (Laptev Sea), and Pacific (the western part of the Bering Sea) ocean basins using seven microsatellite loci. The obtained data clearly demonstrate that the Greenland halibut population in the Laptev Sea belongs to the groups of the Atlantic Ocean basin. Apparently, the Greenland halibut of the Laptev Sea is represented by a dependent population, which is replenished due to the drift of immatures from the spawning grounds in the Barents Sea with the transformed Atlantic water flow along the continental slope. In addition, the Arctic population can be partially replenished due to the breeding of the halibut in local spawning grounds.

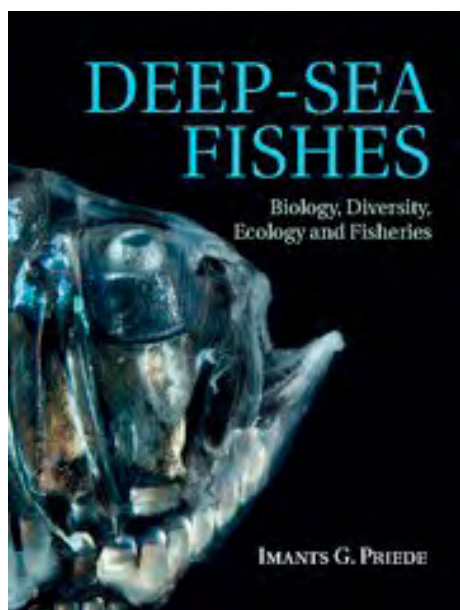
Link to paper:

https://www.researchgate.net/publication/320372682_POPULACIONNAI_PRINADLEZNOST_CERNOGO_PALTUSA_Reinhardtius_hippoglossoides_WALBAUM_1793_MORA_LAPTEVYH

Deep-Sea Fishes: Biology, Diversity, Ecology and Fisheries.

Priede I.G. (2017)

Cambridge University Press | ISBN 9781107083820



The technological advances of the last twenty years have brought huge advances in our understanding of the deep sea and of the species inhabiting this elusive and fascinating environment. Synthesising the very latest research and discoveries, this is a comprehensive and much-needed account of deep-sea fishes. Priede examines all aspects of this incredibly diverse group of animals, reviewing almost 3,500 species and covering deep-sea fish evolution, physiology and ecology as well as charting the history of their discovery from the eighteenth century to the present day. Providing a global account of both pelagic and demersal species, the book ultimately considers the effect of the growing deep-sea fishing industry on sustainability. Copiously illustrated with explanations of the deep-sea environment, drawings of fishes and information on how they adapt to the deep, this is an essential resource for biologists, conservationists, fishery managers and anyone interested in marine evolution and natural history.

Summary of Contents: Chapter 1. Introduction. What are deep-sea fishes? The deep-sea environment, geological history, structure, circulation food supply. History of the discovery of deep-sea fishes. Sampling methods. Chapter 2. Colonisation of the Deep Sea by Fishes. Present-day depth distribution of fishes. Evolution and origins of the modern deep-sea fish fauna. Were there deep-sea fishes in the Palaeozoic? Chapter 3. Adaptations to the Deep Sea Energy metabolism, effects of pressure, buoyancy, swimming, feeding, growth, life history strategies, Sensory systems. The maximum depth limits of fishes. Chapter 4. Systematic Description of Deep-Sea Fishes Review of 222 families with deep-sea representatives with illustrations. Chapter 5. The Deep-Sea Fish Faunas. Mesopelagic and Bathypelagic, Bathyal Demersal Fishes, Abyssal Demersal Species, The Hadal Zone, Hydrothermal Vents, Cold Seeps Chapter 6. Deep-Sea Fisheries and Conservation. Review of global trends and data for 276 species of exploited deep-sea fish species. The impacts of deep-sea fishing.

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For a 20% discount on the advertised price, go to the following link to order the book: www.cambridge.org/9781107083820 and enter the code **PRIEDE2017** at the checkout. Discount price £59.99 or \$ 71.99 (offer expires 9 July 2018).

First HOV Alvin study of the pelagic environment at Hydrographer Canyon (NW Atlantic)

Amanda N. Netburn, Joanna D. Kinsey, Stephanie L. Bush, Anni Djurhuus, Julianne Fernandez, Colleen L. Hoffman, Doreen McVeigh, Katrina I. Twing, Laura Baggei

Deep Sea Research Part II: (In Press)

In August 2016, a group of 24 early career scientists participated in the Early Career Scientist Deep Submergence Training program. This NSF and ONR-funded program provided the opportunity to train with 6 mentors to learn how to work with HOV Alvin and AUV Sentry from the proposal-writing stage through cruise planning and mission execution. The two-leg cruise took place offshore of Woods Hole Oceanographic Institute in the northwest Atlantic Ocean, and involved a significant water column component. This study reports the findings of the water column exploration conducted by Alvin on this expedition.

Continental slope canyons off the United States Atlantic coast remain poorly studied, and in particular, the distributions of pelagic organisms in waters overlying these unique environments are not well documented. During the Early Career Scientist Deep Submergence Training cruise, AT36-EAGER, the distribution of organisms in the water column overlying Hydrographer Canyon, which cuts through the northwestern Atlantic continental margin, was investigated through daytime midwater observations using HOV Alvin (AD4831) at three depths. Mixed swarms of krill and *Themisto* sp. amphipods were observed at all depths surveyed. Observations centered at 250 m were also dominated by chaetognaths, copepods, and *Phronima* sp. amphipods, while at 500 and 750 m, the assemblages were dominated by the fishes in the families Paralepididae, Nemichthyidae, and Mytophidae. Additionally, measurements of methane, nitrous oxide, optical properties (absorbance and fluorescence), dissolved organic carbon, and base-extracted particulate organic carbon were made to better characterize the hydrography and biogeochemistry over Hydrographer Canyon. This study was aided by the use of telepresence to communicate between ship and shore-based researchers, and the expedition marks the first use of SMS messaging to communicate between the submersible and the ship. This study demonstrates the capabilities and utility of using Alvin for conducting water column science.

Link to article: <http://www.sciencedirect.com/science/article/pii/S096706451730098X?via%3Dihub>

Sharing and Preserving the Resources in the Deep Sea: Challenges for the International Seabed Authority

Michael W. Lodge, Kathleen Segerson, and Dale Squires

The International Journal of Marine and Coastal Law 32 (2017) 427–457

The development of mineral resources in the deep sea can potentially generate significant economic returns, but also raises governance challenges. The International Seabed Authority (ISA) wrestles with a wide range of issues and

complex interactions that may affect not only how the industry develops over time, but also how development will benefit mankind. Two key issues they face are the means for sharing the payments from deep-sea mining (DSM), and protecting environmental resources in the deep sea from harmful effects. This article provides an overview of issues for deciding among alternative means of distributing the ISA's share of monetary returns that will be realized as deep-sea mineral resources, how they are converted from natural assets into financial assets, and alternative approaches to ensure that exploitation of these resources does not come at the expense of mankind also benefiting from the environmental resources provided by the deep sea.

Link to article: <http://booksandjournals.brillonline.com/content/journals/10.1163/15718085-12323047>

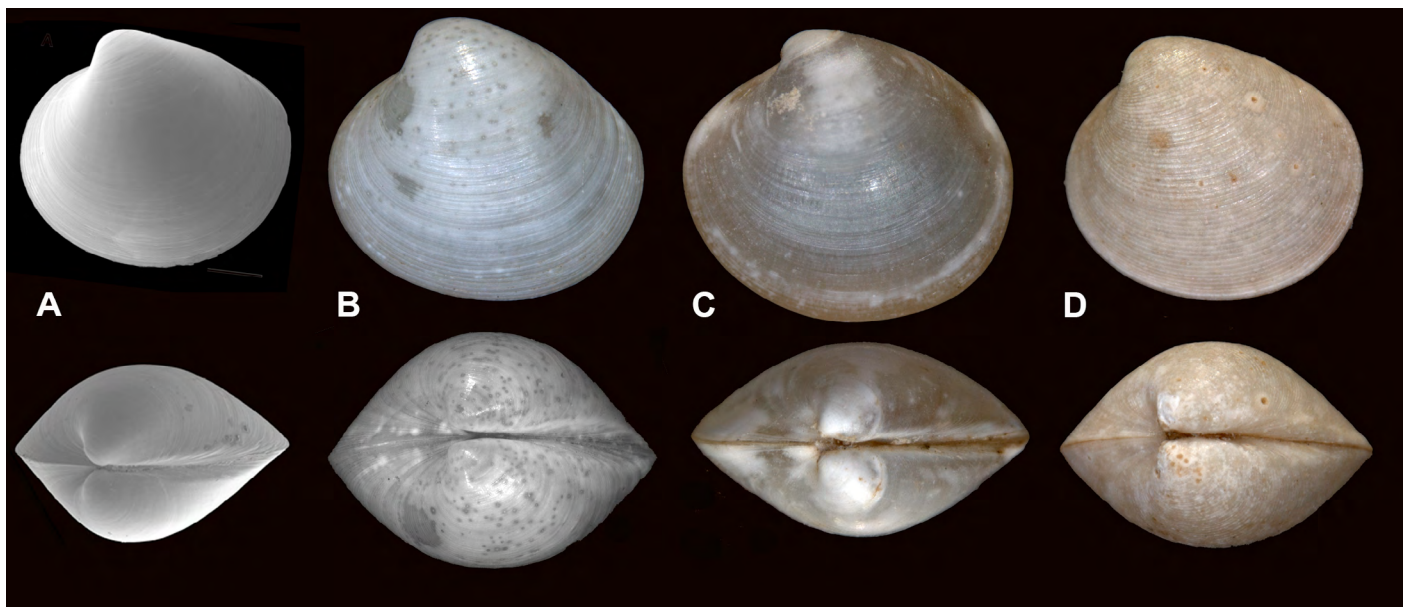
A tale of tiny clams

E. Krylova, H. Sahling & C. Borowski

Journal of Molluscan Studies (in press)

The minute bead-shaped clams are apparently familiar to everybody who ever collected samples of abyssal and ultra-abyssal benthos. They are among the most common and abundant deep-sea bivalves distributed all over the World Ocean at 400–10730 m depths. Thousands of specimens of these clams were recovered in single trawl hauls from the Kuril-Kamchatka and Orkney trenches. Despite they are obviously an important component of deep-sea communities, their taxonomy, even at the family level, remained ambiguous.

The story began when Smith (1885) described the first three species of tiny bivalves on the material collected by the “Challenger” expedition. Soon after that, Dall (1886) erected a new subgenus for them, *Vesicomya*, attributed to their very specific swollen shell shape (“vesica” means “bubble” in Latin). Later on, Smith (1900) elevated *Vesicomya* to the generic level and included some additional large-sized conspicuous clams (e.g. one well-known now as *Archivesica gigas*) on the basis of similarity of the hinge margins. Further on, Dall took turns again and placed *Vesicomya* in a new family Vesicomycidae (= Vesicomycidae) (Dall & Simpson, 1901). As time passed, the hydrothermal vent and cold seep communities were discovered, and many big clams assigned to vesicomycids were recorded from these habitats. Eventually, the giant prominent bivalves nearly have “stolen” the name “*Vesicomya*” from the tiny deep-sea clams, the



Above: Exterior of right valve and dorsal view of different species of *Vesicomya*: A. *V. atlantica* (Smith, 1885), RV Jean Charcot, Stn OS07, MNHN, Scanning microscopy, L=1.6 mm. B. *Vesicomya pacifica* (Smith, 1885), RV Sonne, KuramBio, St. 11, IORAN RAS, L=6.6 mm. C. *Vesicomya sergeevi* Filatova, 1971, R/V Vityaz, St.5627, ZMMU, Ld 2915, L=4.3 mm. D. *Vesicomya profundus* Filatova, 1971, R/V Vityaz, St.5632, ZMMU, Ld 2939, L=3.4 mm. (B, C, D – images made by G. Kamenev).

latter commonly referred to the mainly shallow-water genus *Kelliella*.

Trying to clear up the relationship between genuine small *Vesicomya* and *Kelliella* we for the first time used not only morphological characters but also genetic divergence based on the mitochondrial cytochrome-c-oxidase subunit I (COI) gene. The molecular data indicate that the genus *Vesicomya* is distinct from *Kelliella*. At the same time we provide further evidence for the relationship of vesicomynes, including *Vesicomya* s.s., and pliocardines, comprising chemosymbiotic clams. We consider these two subfamilies in frame of the family Vesicomylidae and discuss an evolutionary scenario which might be realized in the family. First data on stable carbon and nitrogen isotopic composition of soft tissues of *Vesicomya* do not suggest involvement of chemosynthetically fixed carbon in the nutrition of *Vesicomya*.

Details are in Resolving the status of the families Vesicomylidae and Kelliellidae (*Bivalvia*, *Venerida*) with a note on the ecology of the genera *Vesicomya* and *Kelliella*.

Reviewing the EBSA process: Improving on success

David E. Johnson, Christopher Barrio Froján, Phillip J. Turner, Philip Weaver, Vikki Gunn, Daniel C. Dunn,
Patrick Halpin, Nicholas J. Bax, Piers K. Dunstan

Marine Policy, Volume 88, Pages 75-85

This paper reviews key aspects of the implementation of the Convention on Biological Diversity's Ecologically or Biologically Significant Area (EBSA) process to date, anticipating global marine coverage of that process in so far as is possible by the end of 2018. EBSAs merge marine and coastal physical, biological and biogeographical information held by States, diverse scientific institutions and individual experts to identify inherent value of marine biodiversity, as well as providing a focus for either States or international organisations with sectoral competences to apply potential management measures to protect and sustainably manage biodiversity. In assessing information made available at dedicated EBSA Regional Workshops, several common patterns emerged, both in the data made available and in the gaps in information. The latter include missing information, representation of taxa and features of interest, and specialist expertise. The review exercise detailed here has highlighted the value and efficacy of the EBSA process and the information it has generated, despite some recognised shortcomings. It further suggests that there is potential to strengthen the EBSA portfolio by (i) adding some selected new areas yet to be described, (ii) revisiting existing EBSAs to add both new and existing information, and (iii) reconsidering some areas previously deemed to not meet the EBSA criteria by incorporating both new and existing information. Improving the systematic assessment of areas against the EBSA criteria could be achieved using a combination of (i) spatially precise systematic conservation approaches, supported by (ii) predictive modelling and biogeographic multi-criteria approaches based on expert judgement.

Link to article: <https://www.sciencedirect.com/science/article/pii/S0308597X1730711X>

The next wave of science diplomacy: marine biodiversity beyond national jurisdiction

Harriet Harden-Davies, Handling editor: Andrew Serdy

ICES Journal of Marine Science, fsx165

Science diplomacy is lauded as a catalyst for cooperation in international spaces. International science cooperation is

a duty under international law and a necessity in reality. With the international community poised to begin historic negotiations to develop a new international legally binding instrument for the conservation and sustainable use of biodiversity in areas beyond national jurisdiction, it is timely to consider what role science diplomacy could play in advancing governance of this vast international space encompassing 64% of the ocean's surface. In this article, three forms of science diplomacy are examined: how international science collaboration could provide a unifying focus in the development of the new instrument (science for diplomacy), what opportunities and challenges this could pose for global ocean science (diplomacy for science), and how scientists, as stakeholders, could help to identify and overcome obstacles (science in diplomacy). Learning from past examples of science diplomacy in international spaces and engaging a diverse group of scientific stakeholders to look to the future would enable ocean science to be a unifying focus for this new agreement.

Link to article: <https://doi.org/10.1093/icesjms/fsx165>

New species of the xenophyophore genus *Aschemonella* (Rhizaria: Foraminifera) from areas of the abyssal eastern Pacific licensed for polymetallic nodule exploration

Andrew J Gooday, Maria Holzmann, Clemence Caille, Aurélie Goineau, Daniel O B Jones, Olga Kamenskaya, Erik Simon-Lledó, Alexandra A -T Weber, Jan Pawlowski

Zoological Journal of the Linnean Society, zlx052

We describe *Aschemonella monile* Gooday and *Holzmann* sp. nov. from the Clarion–Clipperton Zone (CCZ, abyssal eastern equatorial Pacific), a region characterized by commercially significant concentrations of polymetallic nodules. The new species is the most abundant xenophyophore (giant agglutinated foraminifera) in our main sampling area (12–14°N; 116°30'–117°26'W). Additional specimens originate from the central CCZ, and from a third area, ~900 km NW of the main area, where *A. monile* numerically dominates the megabenthos in photographic surveys of the seafloor (average densities 1.54 individuals/m²; peak densities > 3 individuals/m²). *Aschemonella monile* is much larger (≥ 7cm in length) than previously described species of the genus, with a test comprising an irregular sequence of self-contained, partly overlapping 'segments', creating a multichambered structure. A similar, much rarer species from the main study area, described here as *Aschemonella aspera* Gooday and *Holzmann* sp. nov., has an unsegmented test with a very rough, coarsely agglutinated wall. Genetic data suggest that *A. monile* is distinct from *A. aspera* and most closely related to a group comprising *Rhizammina algaeformis* and *Aschemonella ramuliformis*. Both new species have delicate tests that are often attached to nodule surfaces, making them particularly vulnerable to seafloor disturbances.

Link to article: <https://doi.org/10.1093/zoolinnean/zlx052>

Leaching of Metals and Metalloids from Hydrothermal Ore Particulates and Their Effects on Marine Phytoplankton

Shigeshi Fuchida, Akiko Yokoyama, Rina Fukuchi, Jun-ichiro Ishibashi, Shinsuke Kawagucci, Masanobu Kawachi, and Hiroshi Koshikawa

ACS Omega 2017 2 (7), 3175-3182

Seafloor massive sulfide deposits have attracted much interest as mineral resources. Therefore, the potential environmental impacts of full-scale mining should be considered. In this study, we focused on metal and metalloid contamination that could be triggered by accidental leakage and dispersion of hydrothermal ore particulates from mining vessels into surface seawater. We determined the leaching potential of metals and metalloids from four hydrothermal ores collected from the Okinawa Trough into aerobic seawater and then evaluated the toxic effects of ore leachates on a phytoplankton species, *Skeletonema marinoi*–*dohrnii* complex, which is present ubiquitously in the ocean. Large amounts of metals and metalloids were released from the ground hydrothermal ores into seawater within 5 min under aerobic conditions. The main components of leachates were Zn + Pb, As + Sb, and Zn + Cu, which were obtained from the Fe–Zn–Pb-rich and Zn–Pb-rich zero-age, Ba-rich, and Fe-rich ores, respectively. The leachates had different chemical compositions from those of the ore. The rapid release and difference in chemical compositions between the leachates and the ores indicated that substances were not directly dissolved from the sulfide-binding mineral phase but from labile phases mainly on the adsorption–desorption interface of the ores under these conditions. All ore leachates inhibited the growth of *S. marinoi*–*dohrnii* complex but with different magnitudes of toxic effects. These results indicate that the fine particulate matter of hydrothermal ores is a potential source of toxic contamination that may damage primary production in the ocean. Therefore, we insist on the necessity for the prior evaluation of toxic element leachability from mineral ores into seawater to minimize mining impacts on the surface environment.

Link to article: <http://pubs.acs.org/doi/full/10.1021/acsomega.7b00081>

A procedural framework for robust environmental management of deep-sea mining projects using a conceptual model

J.M. Durden, K. Murphy, A. Jaeckel, C.L. Van Dover, S. Christensen, A. Ortega, D.O.B. Jones

Marine Policy 84 (2017) 193–201.

Robust environmental management of deep-sea mining projects must be integrated into the planning and execution of mining operations, and developed concurrently. It should follow a framework indicating the environmental management-related activities necessary at each project phase, and their interrelationships. An environmental management framework with this purpose is presented in this paper; it facilitates the development of environmental information and decision-making throughout the phases of a mining project. It is based environmental management frameworks used in allied industries, but adjusted for unique characteristics of deep-sea mining. It defines the gathering and synthesis of information and its use in decision-making, and employs a conceptual model as a growing repository of claim-specific information. The environmental management activities at each phase have been designed to enable the implementation of the precautionary approach in decision making, while facilitating review of adaptive management measures to improve environmental management as the quantity and quality of data increases and technologies are honed. This framework will ensure fairness and uniformity in the application of environmental standards, assist the regulator in its requirements to protect the environment, and benefit contractors and financiers by reducing uncertainty in the process.

Link to article: <http://www.sciencedirect.com/science/article/pii/S0308597X17300465>

Preparation of Environmental Impact Assessments: General guidelines for offshore

Clark, M.R., Rouse, H.L., Lamarche, G., Ellis, J.I., Hickey, C.

NIWA Science and Technology Series No. 81. 110pp. , 2017

Contact: malcolm.clark@niwa.co.nz

Interest in offshore hydrocarbon and minerals exploration is growing rapidly as investors identify the potential economic returns from New Zealand's rich marine resources. The challenge for management agencies is how to facilitate development of these natural resources while ensuring environmental sustainability is not compromised. In 2012 the Ministry for Business, Innovation and Employment funded NIWA to lead a research project entitled "Enabling management of offshore mining through improved understanding of environmental impacts". This research programme aimed to develop, validate and implement science-based guidelines for effective environmental management of offshore mineral and hydrocarbon extraction, as well as address some critical gaps in our understanding of the environmental impacts of mining operations on New Zealand's marine estate.

The first research aim of the project included the development of a generic template for Environmental Impact Assessment (EIA), and guidelines for its use that could be used by any offshore mining or drilling company to guide the preparation of an assessment of the environmental impacts of the proposed operation. These were initially produced in 2014, but have been revised and updated for this guidance document that accompanies the generic EIA template for offshore mining and drilling activities. It is important to note that the template and guidance have been prepared in the joint context of New Zealand's Exclusive Economic Zone and Continental Shelf (Environmental Effects) Act 2012 (the EEZ Act) and the broader Pacific context where activities in 'The Area' are managed. An international need for a consistent approach to assessment of environmental impacts has been identified and addressed by the International Seabed Authority (ISA) and the Pacific Community (SPC) in their own developing EIA templates. The template and guidance presented here draws lessons from that international best practice but provides direct reference to New Zealand's own legislation.

The guidance is not intended to be exhaustive or prescriptive. Each resource and each location will have its own set of circumstances that are best described and assessed in a particular way. However, the document covers aspects that should be in every EIA, and provides general guidance to the content in each section of the template. It includes a background to the project and the purpose of this guidance document; outlines (and appends in full) the EIA template; provides general advice on how to prepare an EIA; and then details specific guidance on template sections. The report also contains a list of references cited in various sections to help the reader access important sources of information, a glossary of key terms and abbreviations, and a table containing useful websites for further information.

The document focusses on guidance for environmental and ecological assessment of impacts. The template includes sections and subsections on social, economic, and cultural issues, and in doing so follows the recent production of an EIA template by the ISA. These issues are often treated separately, and how that is addressed can be evaluated for each specific case. Their inclusion here attempts to progress the concept of a more integrated impacts assessment, even though provision of advice on them was beyond the scope of the existing study.

A related report covering the scientific research requirements for baseline surveys and monitoring programmes has been developed between NIWA and the SPC, and provides more specific detail than given in this higher-level document.

Link to article: <https://www.niwa.co.nz/coasts-and-oceans/research-projects/enabling-management-of-offshore-mining>

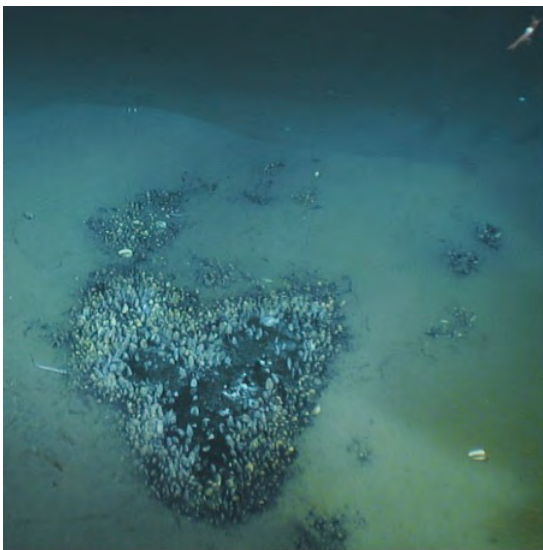
Organic carbon transfer and ecosystem functioning in the terminal lobes of the Congo deep-sea fan: the Congolobe multidisciplinary study

C. Rabouille, K. Olu, F. Baudin, B. Dennielou, A. Khripounoff

Deep-Sea Research II, vol. 142 (Special Issue)

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The terminal lobe complex of the Congo deep-sea fan is a fascinating environment. It is located at 5000 meters depth and 750 km offshore Africa. It is currently connected with the Congo River by a canyon and deep-sea channel system starting in the estuary and still fed by turbidity currents. It thus displays most of the characteristics of a subaquatic delta: large sedimentation rates, high concentration of organic carbon, active diagenesis. In addition, this peculiar zone of the deep ocean hosts unexpected biological assemblages resembling those of cold seeps: chemosynthetic vesicomyid bivalves, microbial mats and reduced sediments in metric size discrete habitats (see picture).



Above: The heart: vesicomyid bivalves bed in a bacterial mat with reducing sediments in the terminal lobes of the Congo deep-sea fan

A project was recently achieved and a special issue in *Deep-Sea Research II* was published this summer (DSRII, Vol. 142) which features the interdisciplinary survey and research conducted by a group of biologists, geologists and geochemists both organic and inorganic from various institutes in France (IFREMER, Université Pierre et Marie Curie, Laboratoire des Sciences du Climat et de l'Environnement, ...) and abroad (Georgia Institute of Technology-USA, Hellenic Center for Marine Research in Greece). The results show that, in the complex geological setting of the Congo deep-sea fan, the enormous amount of organic material originating mostly from the African continent generates reducing conditions in sediments with large dissolved sulphide concentrations in surface pore waters. These favourable conditions allow the colonization of sediments by bacteria and chemosynthetic bivalves in patchy colonies of decimetres to one meter in size. Furthermore, we show that the sediments of the terminal lobes of the Congo deep-sea fan are an unexpectedly large repository of

organic matter from continental origin which sustains a very dense and diverse macrofaunal community everywhere in lobe sediments. It also constitutes a mega-burial centre located in the abyssal plain far from the coast. Our calculations show that 20% of the river particulate organic material could be preserved in terminal lobe sediments.

Link to article: <http://www.sciencedirect.com/science/article/pii/S0967064517302795>

Rethinking the importance of food quality in marine benthic food webs

Neus Campanyà-Llovet, Paul V.R. Snelgrove, Christopher C. Parrish

Progress in Oceanography, Volume 156, 2017, Pages 240-251

Current knowledge on the role of food for benthic communities and associated food webs focuses on quantity of available organic matter; however, the few studies that specifically address food quality show significant potential influences on food web and community structure. We examine current understanding of food quality and consider its contribution to regulating benthic ecosystems. By assembling data from the literature we found that, whereas food

quantity increases benthic stocks (i.e., abundances), various trophic groups respond differently to quality parameters, suggesting that food quality can alter benthic trophic structure substantially. Moreover, contrasting ecosystems respond differently to food quantity and quality inputs. Based on our literature review we find that, for many highly productive coastal marine ecosystems (coral reefs, seagrass meadows, kelp forests), the detrital compartment represents the most important primary food source because low nutritional value (i.e., hard skeleton, lignin, deterrent substances, etc.) often characterizes this high productivity. Strong seasonality in the flux of organic matter, such as in polar ecosystems, results in food webs based on relatively consistent but often poorer quality food sources (i.e., “food banks”). Benthic community structure may shift dramatically in food-poor deep-sea ecosystems where otherwise rare species become dominant in response to food pulses. These ecosystems appear to respond more strongly than other benthic ecosystems to quantity and quality of food input. In deep-sea chemosynthetic environments, high food quantity and quality fuel benthic communities through resource partitioning of specialized chemosynthesis-based food sources. Lastly, we argue that food quality may have significant implications for benthic ecosystem functioning and services (e.g., bioturbation, nutrient fluxes, organic carbon preservation), particularly in the context of global warming. These implications point to several key gaps and opportunities that future food web studies should consider by applying knowledge gained in aquaculture to field studies, understanding the mechanisms for particle selection within the detrital compartment, and better understanding how rising temperatures and ocean acidification impact ecosystem functioning through changes in food quality.

Link to article: <https://doi.org/10.1016/j.pocean.2017.07.006>

First observations of the structure and megafaunal community of a large *Lophelia* reef on the Ghanaian shelf (the Gulf of Guinea)

L. Buhl-Mortensen, B. Serigstad, P. Buhl-Mortensen, M.N. Olsen, M. Ostrowski,
M. Błażewicz-Paszkowycz, E. Appoh

Deep Sea Research Part II: Topical Studies in Oceanography, Volume 137, 2017, Pages 148-156

The distribution of cold-water coral reefs is relatively well known in the North-east Atlantic as compared to the Central-east Atlantic, where only a few documentations exist from low latitudes. In 2012 an initial survey was conducted on a reef situated at 400 m depth on the continental shelf off Ghana. The reef corals and fauna were visually documented using a Video Assisted Multi Sampler (VAMS) coupled with an ROV. Here we present the results from three dives on the 1400 m long and 70 m high reef with ambient temperatures between 9 and 10°C. The banana shaped reef was oriented perpendicular to the main current, the convex side facing the current and there was no sign of human impact. The great height of the reef is probably a result of undisturbed growth for more than 20,000 years. On the Norwegian continental shelf, the largest reefs are around 30 m high and have been aged to ~9000 years. The reef morphology resembles that of Northeast Atlantic *Lophelia* reefs. The main reef building coral was *Lophelia pertusa* with contribution from *Madrepora oculata*, *Solenosmilia variabilis*, and occasional occurrences of *Dendrophyllia cf. alternata*. The skeleton of *Aphrocallistes beatrix* (Hexactinellidae) contributed to the reef framework and the reef consisted of 46% coral blocks 22% sediment, 13% coral rubble, 11% sponge skeleton and 8% live corals. A rich megafauna of 31 taxa was recorded and most frequent was *Acesta excavata* (bivalve), *Aphrocallistes beatrix* (with an associated Zooanthida on 39% of the colonies), squat lobsters, hydroids and bryozoans. Six fish species were recorded of which the Sebastidae *Helicolenus dactylopterus* and *Nettastoma melanurum* were found amongst coral blocks. The reef community showed several similarities with the northern reefs with sponges, *Sebastes* spp., squat lobsters, and *Acesta excavata* being common megafauna associates. In contrast the gorgonian corals that are characteristic of the northern reefs seemed to be lacking and Hexactinellidae rather than Demospongia were common on the reef and contributed to the reef framework. Crabs

that are uncommon on northern reefs were frequently encountered.

Link to article: <https://doi.org/10.1016/j.dsr2.2016.06.007>

Deep risks from offshore development

Angelo F. Bernardino and Paulo Yukio Gomes Sumida

Science 358(6361):312

Brazil's government is now reopening bidding rounds for deep-sea Oil & Gas exploration after four years of economic and political turmoil. Economic expectations with licenses and production royalties are high, but strategic management and conservation priorities for deep-sea ecosystems continue to be disregarded. Hundreds of offshore blocks being offered will overlap deep-sea corals, seamounts and submarine canyons on a continental scale. In order to offset offshore threats and increase protection to deep-sea ecosystems, there is a need to adopt strategic basin-wide management for offshore basins in the South Atlantic. Here we call for adoption of international management strategies for sustainable use of natural resources in the deep sea to be widely applied within Brazil's environmental legal framework.

Link to article: <http://science.sciencemag.org/content/358/6361/312.1>

High Quantities of Microplastic in Arctic Deep-Sea Sediments from the HAUSGARTEN Observatory

Bergmann M, Wirzberger V, Krumpfen T, Lorenz C, Primpke S, Tekman MB, Gerdt G

Environ. Sci. Technol., 2017, 51 (19), pp 11000–11010

Although mounting evidence suggests the ubiquity of microplastic in aquatic ecosystems worldwide, our knowledge of its distribution in remote environments such as Polar Regions and the deep sea is scarce. Here, we analyzed nine sediment samples taken at the HAUSGARTEN observatory in the Arctic at 2340–5570 m depth. Density separation by MicroPlastic Sediment Separator and treatment with Fenton's reagent enabled analysis via Attenuated Total Reflection FTIR and μ FTIR spectroscopy. Our analyses indicate the wide spread of high numbers of microplastics (42–6595 microplastics kg⁻¹). The northernmost stations harbored the highest quantities, indicating sea ice as a possible transport vehicle. A positive correlation between microplastic abundance and chlorophyll a content suggests vertical export via incorporation in sinking (ice-) algal aggregates. Overall, 18 different polymers were detected. Chlorinated polyethylene accounted for the largest proportion (38%), followed by polyamide (22%) and polypropylene (16%). Almost 80% of the microplastics were $\leq 25 \mu\text{m}$. The microplastic quantities are among the highest recorded from benthic sediments. This corroborates the deep sea as a major sink for microplastics and the presence of accumulation areas in this remote part of the world, fed by plastics transported to the North via the Thermohaline Circulation.

Link to article: <http://pubs.acs.org/doi/pdf/10.1021/acs.est.7b03331>

Characterization of Methane-Seep Communities in a Deep-Sea Area Designated for Oil and Natural Gas Exploitation Off Trinidad and Tobago

Diva J. Amon, Judith Gobin, Cindy L. Van Dover, Lisa A. Levin, Leigh Marsh and Nicole A Raineault

Front. Mar. Sci., 30 October 2017

Exploration of the deep ocean (>200 m) is taking on added importance as human development encroaches. Despite increasing oil and natural gas exploration and exploitation, the deep ocean of Trinidad and Tobago is almost entirely unknown. The only scientific team to image the deep seafloor within the Trinidad and Tobago Exclusive Economic Zone was from IFREMER in the 1980s. That exploration led to the discovery of the El Pilar methane seeps and associated chemosynthetic communities on the accretionary prism to the east of Trinidad and Tobago. In 2014, the E/V Nautilus, in collaboration with local scientists, visited two previously sampled as well as two unexplored areas of the El Pilar site between 998 and 1,629 m depth using remotely operated vehicles. Eighty-three megafaunal morphospecies from extensive chemosynthetic communities surrounding active methane seepage were observed at four sites. These communities were dominated by megafaunal invertebrates including mussels (*Bathymodiolus childressi*), shrimp (*Alvinocaris cf. muricola*), *Lamellibrachia* sp. 2 tubeworms, and *Pachycara caribbaeum*. Adjacent to areas of active seepage was an ecotone of suspension feeders including Haplosclerida sponges, stylasterids and Neovermilia serpulids on authigenic carbonates. Beyond this were large *Bathymodiolus* shell middens. Finally, there was either a zone of sparse octocorals and other non-chemosynthetic species likely benefiting from the carbonate substratum and enriched production within the seep habitat, or sedimented inactive areas. This paper highlights these ecologically significant areas and increases the knowledge of the biodiversity of the Trinidad and Tobago deep ocean. Because methane seepage and chemosynthetic communities are related to the presence of extractable oil and gas resources, development of best practices for the conservation of biodiversity in Trinidad and Tobago waters within the context of energy extraction is critical. Potential impacts on benthic communities during oil and gas activities will likely be long lasting and include physical disturbance during drilling among others. Recommendations for the stewardship of these widespread habitats include: (1) seeking international cooperation; (2) holding wider stakeholder discussions; (3) adopting stringent environmental regulations; and (4) increasing deep-sea research to gather crucial baseline data in order to conduct appropriate marine spatial planning with the creation of marine protected areas.

Link to article: <https://doi.org/10.3389/fmars.2017.00342>

Environmental Impact Assessment process for deep-sea mining in ‘the Area’

Durden, JM, Lallier, LE, Murphy, K, Jaeckel, A, Gjerde, K, Jones, DOB

Marine Policy, 87:194-202

Environmental Impact Assessment (EIA) is key to the robust environmental management of industrial projects; it is used to anticipate, assess and reduce environmental and social risks of a project. It is instrumental in project planning and execution, and often required for financing and regulatory approval to be granted. The International Seabed Authority currently requires an EIA for deep-sea mining (DSM) in areas beyond national jurisdiction (the Area), but the existing regulations present only a portion of a robust EIA process. This article presents an ideal EIA process for DSM, drawing upon the application of EIA from allied industries. It contains screening, scoping and assessment phases, along with the development of an environmental management plan. It also includes external review by experts, stakeholder consultation, and regulatory review. Lessons learned from application of EIA elsewhere are discussed in relation to DSM, including the integration of EIA into UK domestic law, and the reception of EIAs prepared for seabed ore extraction in

the Exclusive Economic Zones of New Zealand and Papua New Guinea. Finally, four main challenges of implementing the EIA process to DSM in the Area are presented: 1) EIA process for DSM needs to incorporate mechanisms to address uncertainty; 2) detailed requirements for the EIA process phases should be made clear; 3) mechanisms are needed to ensure that the EIA influences decision making; and, 4) the EIA process requires substantial input and involvement from the regulator.

Link to article: <http://www.sciencedirect.com/science/article/pii/S0308597X17305316>



Many of us were among the 15,364 scientists who signed this article, which was published earlier this month in BioScience (open access).

The main authors urge us to provide the scientists' warning article to the leaders of our organizations, states, provinces, or countries and any others that should know about this second warning to humanity.

Any scientist that did not sign the article before the BioScience publication deadline, is invited to endorse it now after publication by visiting : scientists.forestry.oregonstate.edu

The voice of world scientists is essential in driving forward progress on dealing with climate change and other critical environmental trends. Working together, we can make great progress in preserving the biosphere for the sake of humanity. (William Ripple, Distinguished Professor of Ecology, Oregon State University, USA)

Links to news articles about this scientists' warning project:

CNN: <http://www.cnn.com/2017/11/14/health/scientists-warn-humanity/>

INDEPENDENT: <http://www.independent.co.uk/environment/letter-to-humanity-warning-climate-change-global-warming-scientists-union-concerned-a8052481.html>

Boston Globe: <http://www.bostonglobe.com/metro/2017/11/13/why-dozens-massachusetts-scientists-signed->

warning-humanity-letter/iAJiCOAxhhGGFlozoL0dyH/story.html

The Washington Post: https://www.washingtonpost.com/news/speaking-of-science/wp/2017/11/13/thousands-of-scientists-issue-bleak-second-notice-to-humanity/?utm_term=.aff3abecd190

Link to article: <https://doi.org/10.1093/biosci/bix125>

Academia Obscura

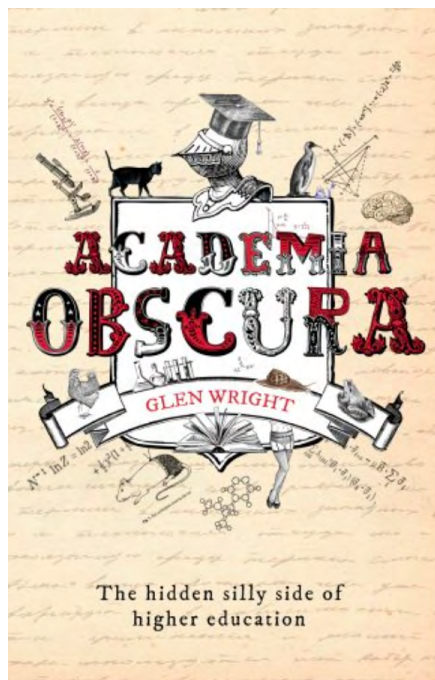
Glen Wright

If you’ve ever been bored to tears at a conference or meeting, driven to the brink of insanity by your co-authors, or wanted to see a rat in underpants, I think you will love the book!

Academia Obscura is an irreverent glimpse inside the ivory tower, exposing the eccentric and slightly unhinged world of university life. Take a trip through the spectrum of academic oddities and unearth the Easter eggs buried in peer-reviewed papers, the weird and wonderful world of scholarly social media, and rats in underpants.

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The title of the paper ‘Remains of Holocene Giant Pandas from Jiangdong Mountain (Yunnan, China) and their Relevance to the Evolution of Quaternary Environments in south-western China’ scarcely prepares the reader for the storyboard depiction of a poor panda falling off a cliff and slowly rotting into bones.²⁶

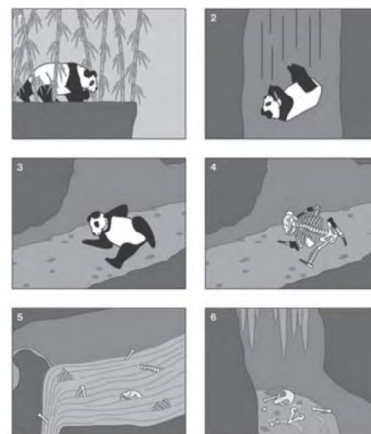


Figure 4: Possible taphonomic scenario resulting in the accumulation of giant panda bones in the lower chamber

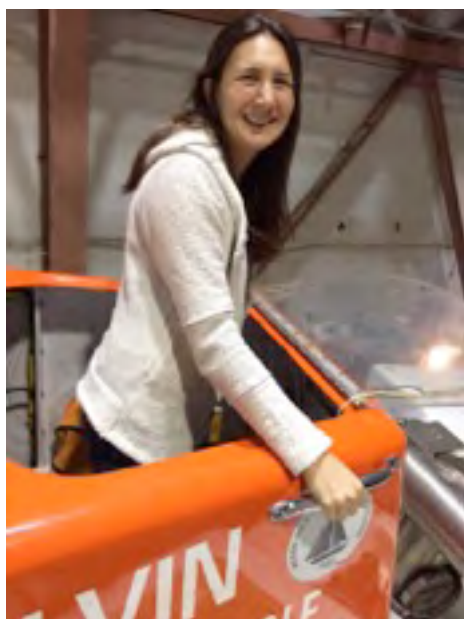
Obituaries

In Memoriam: Diane Poehls Adams

Sadly, our deep-sea community has lost another star - Diane Poehls Adams, Rutgers University (Assistant Professor) and Woods Hole Oceanographic Institution (Guest Investigator).

Diane's work in the deep-sea focused on the influence of hydrodynamics on the larval supply at hydrothermal vents.

In Memorandum from WHOI (22 June 2017)



Above: Diane Poehls Adams. Photo courtesy of Jennifer B Glass, Georgia Institute of Technology.

Excerpt: "The breadth of her (Diane's) approach to the complex interdisciplinary problem of larval transport was truly extraordinary, and her success inspiring to those who had the blessing of knowing her".

The Woods Hole Oceanographic Institution announces with great sorrow the death of former Joint Program student Diane Poehls Adams after an illness. Diane was an assistant scientist at Rutgers University. She came to WHOI in 1999 as a summer fellow with Rob Olson and returned in 2001 as a Joint Program student with Lauren Mullineaux and was awarded her doctoral degree in June 2007. She also had a current appointment at WHOI as a Guest Investigator. Diane's thesis was titled "Influence of Hydrodynamics on the Larval Supply to Hydrothermal Vents on the East Pacific Rise."

Diane approached her science the same way she approached life - with exuberance and joy.

She did groundbreaking work at deep-sea hydrothermal vents, including discovery of a novel potential mechanism for larval dispersal, driven by surface winds.

She was never daunted by difficult problems, and in fact was drawn to them. She did the equivalent of two thesis projects - one deep sea and one coastal. She started a coastal mussel project as backup in case the deep-sea cruises didn't come through. They did, but she continued with the mussels because she wanted to learn culture techniques and molecular genetics.

Diane was fearless and determined in her research. Her curiosity demanded answers, and her incredible intellect sought them by whatever means necessary -- be it deep-sea observations, numerical models, or satellite remote sensing. The breadth of her approach to the complex interdisciplinary problem of larval transport was truly extraordinary, and her success inspiring to those who had the blessing of knowing her.

She was always game for adventure. When the eruption at the East Pacific Rise occurred in 2006, she was the one who dropped everything else and said "I'll go!" When James Cameron was looking for a student to star in a documentary on the mid-Atlantic Ridge, Diane said 'count me in'. When she came back from the cruise, one of the other students had pasted a large star on the back of her seat. She loved it and it stayed there for her full graduate career and many years after.

She was truly a star.

A celebration of life was held at the Rutgers University Marine and Coastal Sciences Building on Friday, July 14, at 10:00 a.m. In lieu of flowers, donations may be made in Diane's name to the [Diane Poehls Adams Graduate Student Support in Marine and Coastal Sciences Endowed Fund](#).