Deep-Sea Life

Issue 11, June 2018

Welcome to Issue 11 of Deep-Sea Life, your friendly connection to the world of deep-sea biology.

As I alluded to in the DSL10 editorial, this and future issues of DSL will not only encompass news from community members from INDEEP (deep-sea research network) and DOSI (advancing deep-sea science in policy), but will also now be a platform for news from the Deep-Sea Biology Society (DSBS, scientific society). The DSBS Trustees will lend additional production support to DSL and enhancement in the form of web-based media elements in order make DSL more widely-available beyond the current readership. This integration will, we hope, improve clarity and communication to the general deep-sea biology community.

Deep-Sea Life photo of issue 11 is a beautiful yellow crinoid, spotted on the Florida Escarpment Canyon ridge, and comes from Amy Bowman of NOAA (see below).

Thank you for all the submissions for DSL11 and thanks as always to Dr Abigail Pattenden (University of Limerick, Ireland) and Dr Eva Ramirez-Llodra (NIVA, Norway) for their dedication to this publication. Thanks too to our new editoral team members, Dr Paris Stefanoudis (Nekton Foundation, Oxford, UK) and Dr Adrian Glover (NHM, London) from DSBS.

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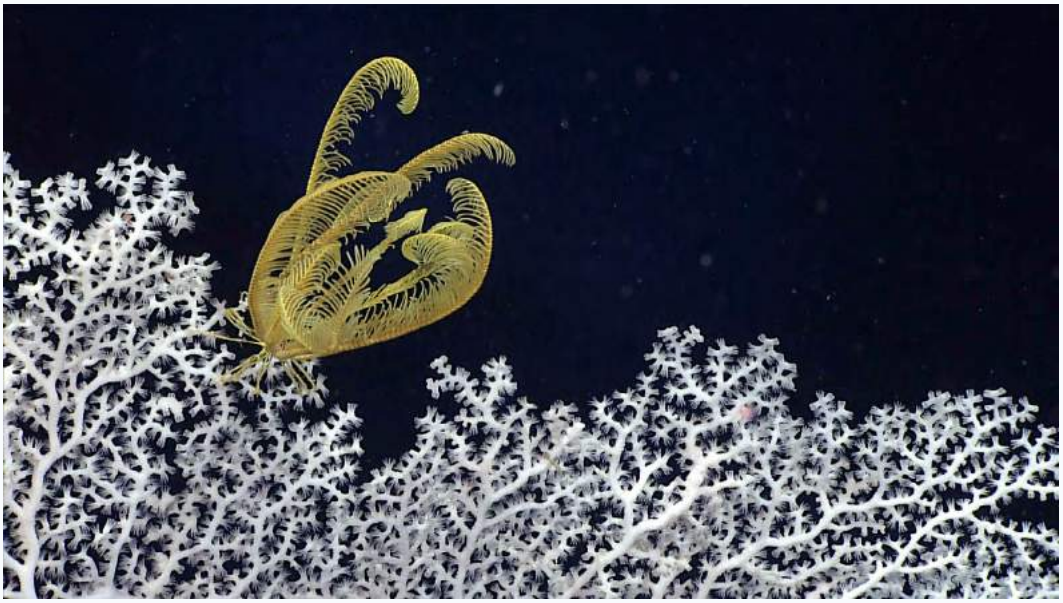

Above: A yellow crinoid perched on a precious coral (*Corallium niobe*) that was attached on a topographic high at a depth of 2,273 meters (7,457 feet) on the Florida Escarpment canyon ridge during Dive 14 of the Gulf of Mexico 2018 expedition. There was an abundance of bryozoans at the base of this colony. *Image courtesy of the NOAA Office of Ocean Exploration and Research, Gulf of Mexico 2018.*

Issue Contents

Cruise News

Deep-sea Exploration of the U.S. Gulf of Mexico with NOAA Ship *Okeanos Explorer*

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Written by: Amy Bowman, Communications and Public Relations, CollabraLink Technologies, in support of NOAA's Office of Ocean Exploration and Research

Between November 2017 and May 2018, the U.S. National Oceanic and Atmospheric Administration (NOAA) conducted three expeditions to explore unknown and poorly known deep-sea areas in the U.S. Gulf of Mexico (Figure 1). Expeditions aboard NOAA Ship *Okeanos Explorer* are live-streamed through telepresence technology. The ship's ROV *Deep Discoverer* and camera sled *Seirios* work in tandem to provide high-resolution imagery, allowing shore-based scientists and managers to participate in the dives, communicate directly with the ship-based team, and help direct operations. The collaborative on-ship and on-shore team determines the location and purpose of ROV dives, which samples should be considered for collection, and the choice of imagery needed to maximize observations. However, the expeditions are not just for scientists. Educators, students and people with an interest in exploration also have extensive opportunities to connect to the missions via the live video feeds in near real-time through the Internet. This provides a front row seat to exploration activities and discoveries as they are made. In addition, the ship conducts live telepresence interactions with various groups, including aquaria, academic institutions, museums, and more. The Gulf of Mexico expeditions provided 22 of these opportunities, reaching hundreds of people in the U.S. and beyond.

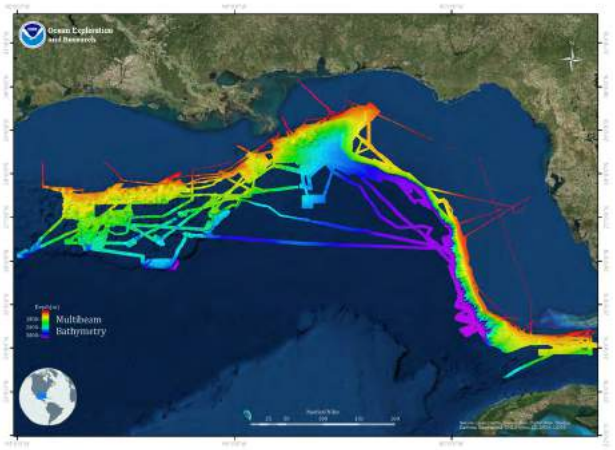

Figure 1. Map of the Gulf of Mexico showing cumulative color-coded multibeam sonar bathymetry collected during all NOAA Ship *Okeanos Explorer* expeditions, including the three most recent expeditions. Map courtesy of NOAA's Office of Ocean Exploration and Research.

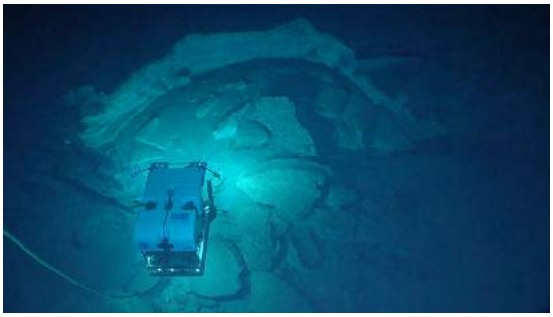

Figure 2. Remotely operated vehicle *Deep Discoverer* investigates some of the striking geology seen at "Okeanos Ridge" during Dive 03 of the Gulf of Mexico 2017 expedition. Image courtesy of NOAA's Office of Ocean Exploration and Research.

Using NOAA Ship *Okeanos Explorer*, the only U.S. federal vessel dedicated to exploring our largely unknown ocean, the three Gulf of Mexico expeditions conducted (1) exploratory investigations using remotely operated vehicles (ROVs) of deep-sea habitats (Figure 2), including areas of biological, geological, and archaeological significance, (2) seafloor and water column mapping operations, and (3) testing of three emerging technologies at sea. Collectively, these three expeditions acquired data in priority areas identified by resource management and scientific communities. Specifically, the expeditions explored deep-sea coral and sponge communities;

Figure 3. One of the goals of the Gulf of Mexico 2017 expedition was to search for corals in deep waters of the Gulf, as these corals provide habitat for a diversity of organisms such as squat lobsters, ophiuroids, and more. Image from dive 09 of the expedition at "Henderson Ridge Mid South". By locating deep-sea coral communities, we are in a better position to understand and thus manage marine resources in the Gulf of Mexico. Watch the video. Image courtesy of NOAA's Office of Ocean Exploration and Research.

midwater communities; canyons; a variety of chemosynthetic habitats, including cold seeps, mud volcanoes, and brine pools; and shipwrecks. Information obtained during these expeditions will help inform the management and conservation of deep-sea habitats in the Gulf of Mexico. Additionally, the expeditions also increased the public's knowledge and awareness of the deep sea.

The first expedition, Gulf of Mexico 2017, conducted 17 ROV dives at depths ranging from 300 to 2,321 meters and included midwater exploration in depths ranging from 300 to 1,000 meters. Hundreds of different species were observed, including several potentially undescribed species and several significant range extensions. Some organisms were being observed alive for the first time. Throughout the expedition, 105 biological samples were collected (32 primary and 73 associated and commensal taxa), some of which may be undescribed species. At least nine high-density and high-diversity coral (Figure 3) and sponge communities were documented and at least 20 previously unknown chemosynthetic habitats were discovered. Eight rock samples and one sediment sample were collected for geochemical composition analysis and age dating. One ROV dive surveyed the wreck of an early 19th-century copper-clad merchant vessel. More than 26,000 km^2 of seafloor were mapped during the course of the expedition. A total of 82 scientists from 42 institutions in four countries participated in this expedition via telepresence technology.

The second expedition, Gulf of Mexico Technology Demonstration, conducted three emerging technology demonstrations, something that *Okeanos Explorer* had not done before. The first, working in partnership with the Cooperative Institute for Ocean Exploration, Research & Technology, used a new midwater profiler system to study the midwater communities in low-light environments (Figure 4). The second, in partnership with the Naval Undersea Warfare Center, deployed an Instrumented Tow Cable with novel temperature profiling capability to collect temperature and acoustic data throughout the water column. The third, in partnership with the Center for Coastal and Ocean Mapping at the University of New Hampshire, tested two new Simrad EK80 split beam sonars for their ability to detect seeps in conjunction with the *Okeanos Explorer*'s multibeam and EK60 sonars.

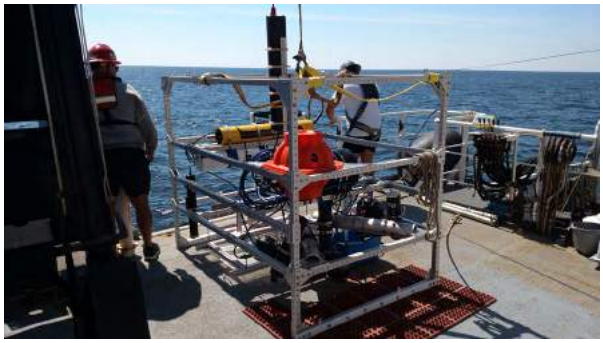

Figure 4. A suite of sensors on the new midwater profiling system permits researchers to map distributions of individual returns from organisms at finer scales while at depth. In addition, a prototype time-gated laser imaging system enables imaging the hemisphere below the sensor cage in 3D at ranges of up to 10 meters (33 feet) while remaining eye-safe and invisible to marine life. Image courtesy of Florida Atlantic University and NOAA's Office of Ocean Exploration and Research.

The third expedition, Gulf of Mexico 2018, conducted 15 ROV dives that ranged in depth from 305 to 3,010 m, and included midwater exploration ranging in depth from 300 to 2,100 m. As on the previous ROV-expedition, hundreds of species were observed, including first-time *in situ* observations of some species and previously unseen behaviors of others (Figure 5); several significant range extensions were also documented. Sixty-seven biological samples were collected during the expedition (22 primary and 45 associated and commensal taxa), some of which may be undescribed species. At least five high-density communities of deep-sea corals were documented, including one at ~2,600 m, the deepest known from the Gulf of Mexico, and two previously unknown chemosynthetic habitats were discovered. Twelve rock samples were collected for geochemical composition analysis and age dating. The expedition surveyed two previously unexplored shipwrecks (Figure 6), producing 3D photogrammetry of both sites. Over 21,100 km^2 of seafloor were mapped and 85 scientists from 35 institutions in six countries participated remotely in this expedition via telepresence technology.

Figure 5. This squid, observed on an unnamed mound in EB1009 during Dive 04 of the Gulf of Mexico 2018 expedition, had many researchers stumped. It was in a strange posture and was damaged; its long tentacles were missing and the ventral arms were mostly gone. The current best guess is that it belongs to the species *Discoteuthis discus* in the family Cycloteuthidae. However, that species has never previously been observed alive, and therefore it is unknown if this contorted posture is a common behavior in this species. Watch the video. Image courtesy of NOAA's Office of Ocean Exploration and Research.

Figure 6. Two *Muusoctopus* sp. appear to wrestle for space inside a previously unsurveyed shipwreck during Dive 02 of the Gulf of Mexico 2018 expedition. Watch a video of this interaction. Image courtesy of NOAA's Office of Ocean Exploration and Research.

Altogether, the three expeditions collected more than 24 terabytes of data, including video and still imagery, multibeam sonar and single beam echosounder measurements, subbottom profiles, current profiles, CTD and dissolved oxygen measurements, and surface oceanographic and meteorological information. All data and samples will be made publicly available through national archives.

NOAA works with partners to identify priority areas for exploration, support innovations in exploration tools and capabilities, and encourage the next generation of ocean explorers, scientists, and engineers to pursue careers in ocean exploration and related fields. The data and information collected during these expeditions, along with other research funded by NOAA, give resource managers, the academic community, and the private sector the information they need to identify, understand, and manage ocean resources for this and future generations. The next ROV expedition, Windows to the Deep 2018: Exploration of the Southeast U.S. Continental Margin, begins on June 11, 2018, and we invite you to join us. Please visit our website for more information.

BioMount Project: unveiling deep biodiversity of Mediterranean seamounts

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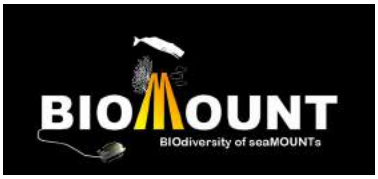

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Among deep-marine environments, seamounts represent crucial habitats for conservation, due to their importance in offshore ecosystem functioning and to their high degree of vulnerability. Seamounts are widespread in Mediterranean offshore waters and account for approximately 230 structures, many of which are located in the Ligurian and Tyrrhenian seas by virtue of the complex geologic history of these basins.

Figure 1. Forest of the black coral *Leiopathes glaberrima* on the summit of the Santa Lucia seamount, 150m.

Figure 2. The crab *Paromola cuvieri* within a gorgonian field on the top of the Ulisse Seamount, 500m.

Figure 3. The hexactinellid *Farrea* sp. on the top of the Janua seamount, 850m.

All these structures are known to represent important feeding areas for cetaceans and are recognized as productive fishing grounds supporting the occurrence of highly productive ecosystems. Unlike paleo-geological studies, however, biological explorations of these mounts are extremely limited and virtually nothing is known on the benthic ecosystems.

The first large-scale ROV exploratory survey of the Ligurian and Tyrrhenian seamounts (BioMount) carried on board of the oceanographic catamaran *Daedalus* departed La Spezia (Italy) in summer 2017, targeting 5 of the 11 summits foreseen in the project. The primary objective was to conduct a biocoenotic characterization of the megabenthic communities thriving on the top of the Ligurian seamounts (Ulisse, Penelope, Janua, Santa Lucia and Occhiali), using the GayMarine's ROV *Multipluto*. At the same time, the explorations aimed at assessing the vulnerability of the communities by quantifying the degree of fishing impact on each summit.

Figure 4. Freshly collected samples in the grabber of the *Multipluto* ROV

Rich cold-water coral and sponge ecosystems were encountered on all seamounts whose peaks are located in different bathymetric intervals, including large black coral forests on the shallower peak (Santa Lucia, 150 m), and small-sized gorgonians, soft corals and hexactinellids assemblages on the deepest peaks (450-800 m). Remarkable biological discoveries included a new species of black coral and the first Mediterranean record of a new isidid coral. Extensive traces of fishing impact in the form of lost long lines and entangled colonies were found at all depths and were mainly related to recreational fishing vessels.

The first BioMount survey ultimately completed 19 dives, recorded 18 hours HD footage, and collected 30 samples. Biological samples of the black coral *Antipathella subpinnata* were provided from seamount locations to the University of Bologna, who are leading a study on the connectivity of populations at large scale and investigating the degree of isolation of the summits.

Figure 5. Marzia Bo, Guido Gay and Martina Coppari on the vessel deck together with *Multipluto* ROV.

The BioMount survey successfully contributed to shedding light on the composition and biogeographic origin of vulnerable ecosystems dominated by rare or extremely longevous species on previously unexplored seamounts subjected to fishing pressure. This information, included in a comprehensive WEBGIS biological baseline dataset, will be of crucial importance to fulfil future requirements of EU Marine Strategy Standards on deep marine habitat protection in the Mediterranean Sea.

This project was financed by the Italian Ministry of University and research under the Scientific Independence of young Researchers (SIR) programme.

The second BioMount survey will start again in just a couple of weeks, destination Spinola Spur in the Ligurian Sea and five summits located in the North Tyrrhenian Sea … stay tuned!

Voyage to the White Shark Café

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The R/V *Falkor* made port in San Diego on May 19 after a month-long expedition to explore the White Shark Café (WSC), a region the size of New Mexico roughly halfway between Hawaii and the Baja peninsula. Biologging devices have demonstrated that white sharks migrate from coastal California and Mexico to the subtropical gyre where they spend up to six months of the year. Males and females both come to this region and display diverse diving behaviors. Females have a diel pattern and males do rapid oscillatory diving from the surface to over 500 m many times an hour. Far from land, there has been little investigation of the WSC, and on April 20 a multidisciplinary team aboard the R/V *Falkor* set out to understand why the white sharks migrate to this apparent oceanic desert. In the fall prior to the expedition, a record number of white sharks had been tagged with pop-up satellite archival tags (PAT), programmed to pop up during the expedition. Nearly all the PAT tagged sharks transited into the WSC, leading the science team to this intriguing pelagic hotspot. To date, no one knows why the white sharks come to the Café. One hypothesis to explain this behavior is that it is related to reproduction. A second compelling hypothesis is that the sharks are feeding on organisms associated with the deep scattering layer, occurring at the mesopelagic (>200 m) depths to which the sharks repeatedly dive. In order to learn more about the oceanography in the WSC, we conducted a comparative series of oceanographic observations that spanned from video surveys, net tows, hydrography, acoustics, and molecular ecology.

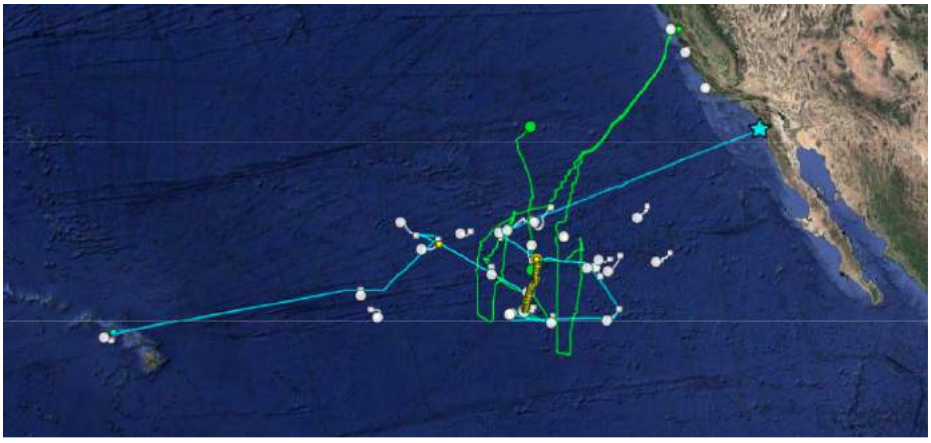

Figure 1. Map of the Voyage to the White Shark Café. White points: pop up locations of archival tags, Green lines: SailDrone tracks, Yellow points: Slocum glider surfacing locations, Blue line: R/V *Falkor* track.

Figure 2. Sample catch with the Isaacs-Kidd Midwater Trawl. Schmidt Ocean Institute/Connor Gallagher

We conducted CTD casts (w/fluorometer and oxygen sensors) at 28 stations and collected water for Chl-a and nutrient measurements, and deployed a Slocum glider to collect fine-scale measurements independent of the ship. To quantify the midwater organisms within the scattering layers we gathered acoustic backscatter data from two Saildrones and the ship-based 5-frequency EK60 echosounder, and conducted 16 midwater trawls as well as nine midwater ROV dives. Both Saildrones also had ADCPs and current velocity was collected simultaneously to map mesoscale eddy features. We found a rich midwater environment in the area, with a deep Chl-max, a diverse assemblage of midwater organisms, and evidence of a food web that spanned phytoplankton and micronekton, squid, mesopelagic predators, tunas, and sharks. The conclusion was that the trophic structure was capable of supporting a population of white sharks. Tissue samples from over 1000 midwater animals were stored for stable isotope analysis to further ascertain food web dynamics in the

region. Environmental DNA was collected, with shipboard sequencing detecting over 100 vertebrate species, including white shark and many of the fishes observed in the trawls. Finally, 9 satellite archival tags were recovered throughout the expedition, and another back in Monterey from a shark that had visited the café just before the expedition, doubling the days of tag data that have been collected in the café realm over the past 20 years. In post-cruise analysis, the team will synthesize the numerous oceanographic datasets to better understand how characteristics of the ecosystem relate to the fine-scale behavior of the sharks, in the ongoing investigation to solve the mystery of the White Shark Café.

More information about the expedition as well as preliminary data are available online.

Project Focus

High-resolution 3D anatomy with a particle accelerator

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Traditionally, 3D anatomical reconstruction and quantification required the extremely laborious method of serial sectioning. Commercial micro-CT scanners provides a non-destructive and accurate method for generating 3D data of hard parts such as molluscan shells or foraminifera tests, but the relatively low and unstable x-ray energy makes it difficult to use for soft parts due to shrinkage and movement associated with long scan times. Hard x-ray from synchrotron electron accelerators, however, have much higher and more stable energy, which allows generating low-noise scans in a much shorter time. The authors have recently scanned deep-sea molluscs at beamline 8.3.2 at the Advanced Light Source, Lawrence Berkeley National Laboratory in California, USA, with wonderful results (Figure 1). The specimens were fixed in formalin or paraformaldehyde, decalcified, and post-stained with 1% iodine solution prior to the scans. The scans were done at the energy of 23 keV and the collection of 2049 images across 180° rotation took about 20 minutes per specimen. High-resolution data in morphology is vital in understanding the adaptation, autecology, and evolution in complex metazoans, which cannot be simply interpreted from omics data, especially for highly derived deep-sea taxa. Synchrotron CT is capable of rapidly delivering exactly that, and with this method it becomes possible to obtain high-quality quantitative anatomical data across many taxa as well as across ontogeny within each taxon towards a comprehensive understanding of adaptive evolution in functional morphology.

Figure 1: Results from synchrotron CT for a deep-sea neomphaline snail seen in the specialist software Amira v6.2. Left: an example slice from the image stack; right: volume rendering showing the external anatomy. Scale bars = 500 µm.

A multi-disciplinary step towards better understanding benthic ecosystems off the west coast of South Africa

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The Cape Canyon, off the West Coast of South Africa, is the largest known submarine canyon in the country, with a

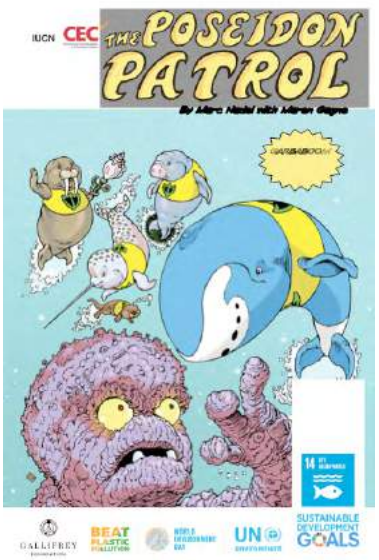
total estimated area a thousand times greater than that of all the Sodwana canyons (the coelacanth capture sites located off South Africa's East Coast) combined. Vertically it extends up to a minimum of 200 m depth where the head incises the continental shelf near St Helena Bay, and down to a maximum of 3000 m further offshore. In March 2018, researchers returned from the last Canyon Exploration Survey, marking the final cruise in a three year (2016–2018) multi-institutional campaign, initiated and carried out by the Department of Environmental Affairs.

Left to right: Figure 1. Brisingid sea stars and pumpkin sea urchins, *Dermechinus horridus*, in a canyon habitat at 404m; Figure 2. Eel, canyon habitat at 473m; Figure 3. A pink Stylasterene and white Gorgonians inhabit inshore rocky habitats, 85m; Figure 4. A sandy outer shelf habitat is home to a purple cnidarian, 422m.

The sampling undertaken was designed to provide insights into the functionality of the Cape Canyon in relation to both the nearshore and offshore areas. With this in mind, a variety of measurements were made, with outputs including data on: benthic biodiversity, physical oceanography, seabird and cetacean ecology. A total of 50 camera, 115 grab, 65 dredge, and 500 CTD stations have been sampled within the three years. The areas sampled and surveyed within the operational grid yielded: (i) the first high-resolution bathymetric map for the area, (ii) the first seabed visuals of the canyon (and surrounding inshore rocky and offshore muddy areas), (iii) valuable sediment data for the region, and (iv) cetacean and seabird abundance data. These new findings will contribute as baseline data to inform national marine spatial planning efforts, and have already assisted with the implementation of a new marine protected area network.

COMICS UNITING NATIONS

Comics Uniting Nations is a partnership of UNICEF and NGOs PCI Media Impact, PVBLIC Foundation and Reading with Pictures, to make the UN Sustainable Development Goals accessible to the citizens of the world through comics. With the help of creative, academic, publishing and technology partners from around the globe, they will create and distribute The Comics Guide to the Global Goals. This series leverages the universal visual language and transformative power of comics to educate people in every corner of the globe about the SDGs and empower them to create positive and lasting change in their own communities and worldwide.



A new comic for SDG14 (for life below water) has just been launched – share it with your family and friends! It is available online in 8 languages and has been produced in partnership with Comics UN, the IUCN Global Marine and Polar Porgramme with support from the Gallifrey Foundation.

DEEP OCEAN OBSERVING STRATEGY: ONLINE INVENTORY AND INTERACTIVE MAP

During the initial planning phase of the Deep Ocean Observing Strategy (DOOS) Project, an online, community-wide inventory tool was developed to assess the current state of deep-ocean observations. The inventory questionnaire is designed to solicit information concerning programmatic and academic research, standard operating procedures for data collection and sensor-specific variables, data archiving and dissemination, and expansion and collaboration opportunities. The inventory specifically seeks to assess the status of deep-ocean observing with respect to geographic coverage, water depths, platforms, sensors, variables measured, and temporal and spatial coverage. It informs development of DOOS priorities and helps identify potential partners, and to reach agreement on a common statement of requirements, leading to an initial strategy for sustained global deep-ocean observations. The inventory considers all Essential Ocean Variables (EOVs), regions, technologies, and societal imperatives in order to extract high priority, feasibility, and GOOS fit-for-purpose actions for the next 5-10 years; as well as identifies gaps in geographic coverage, water depth, and EOVs.

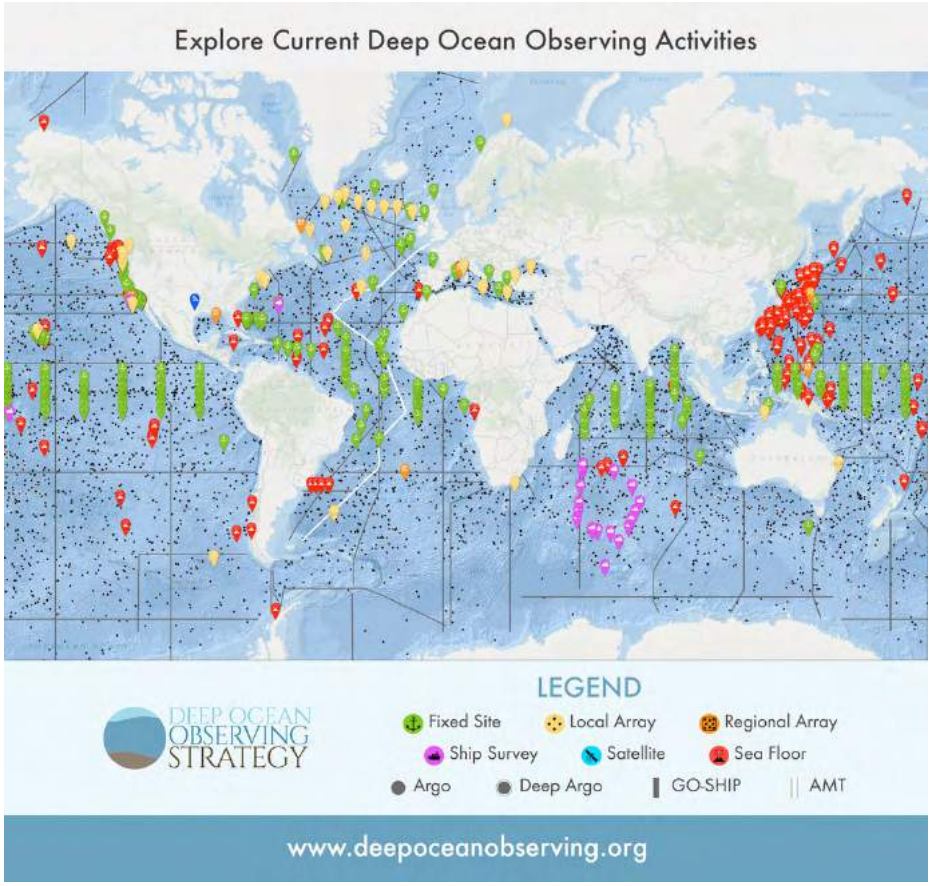


Figure 1. Snapshot of current interactive online map with observation efforts being conducted across the globe and at different depths.

In preparation for the DOOS Community Workshop, an initial analysis was conducted using data from responses through November 2016. Seventy responses from 39 organizations, representing 83 countries, and funded by 29 agencies were examined. The overarching goal of the analysis was to identify gaps in geographic coverage, water depth, and EOVs. Of the responses, most program-wide sampling occurred across large depth ranges (200- 6000 m) and spatial scales (>1,000 km). The most common platforms used for observations were research ship surveys, bottle samplers, and moorings; the most common instruments were CTD's, oxygen sensors, and ADCPs. The most common mature EOVs sampled were temperature, salinity, dissolved oxygen, and carbonate system; additional variables commonly suggested by respondents as key to include in DOOS were primary productivity, water velocity, inorganic nutrients, and species abundance and diversity; many of these already exist as EOVs in some form.

Based on inventory results, an interactive map located on the DOOS website provides a snapshot of observation efforts being conducted across the globe and at different depths. Visualization of the data was produced via ESRI. The map is updated quarterly, as data are modified.

The interactive map and link to the inventory can be found here.

The interactive map shows spatial gaps in observations and opportunities for expansion. The data obtained through the inventory feeds into the overall DOOS mission to bring together the broad range of expertise required to identify the challenges and seek solutions that will advance our understanding of- and maintain the functioning and services of the deep ocean. Gap analysis is an ongoing objective of DOOS.

GLOBAL SEAMOUNTS PROJECT (GSP)

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A new international project has been proposed called the Global Seamounts Project (GSP), to intensively survey a range of 18 seamounts in the Atlantic, Pacific and Indian Ocean basins, over eighteen expeditions beginning in 2019 and continuing through 2023. The project will generate standardized sets of inter-calibrated, multidisciplinary field data over the survey range to develop a new ecosystem model for seamounts. The project was collaboratively developed by a team of seamounts scientists and ecosystem modelers and is inviting scientists from a wide range of disciplines and regions to participate.

Each expedition plans to survey two seamount systems, with about half of target sites surveyed over multiple seasons for temporal resolution, resulting in a total of 36 site surveys. For re-visited sites, the plan calls for a range of leave-behind instruments, moorings and gliders.

Figure 1. GSP Working Group chart

The GSP is unique in several ways: 1) it involves collaboration from the outset of the project between ocean scientists and seamount specialists from all disciplines, with ecosystem modeling experts, to jointly develop the scope and resolution of data needed to design new computer models of complex ecosystem function for seamounts; 2) the project will be run along two "tracks", in tandem: a) the multidisciplinary field expedition and data processing work, and b) the biophysical modeling work, which will facilitate feedback and adjustments between these activities over the project duration; and 3) the MARV research vessel model of mobilizing chartered global-class vessel platforms from the offshore sector for scientific research will be utilized to provide the at-sea capacity required, when and where it is needed, for the intensive level of research and observations that are proposed. More information about Modular Adaptive Research Vessels (MARVs) can be found at www.global-oceans.org.

In addition to new ecosystem models, the project will also provide a legacy of detailed biophysical data on eighteen seamount systems that will be fully mapped and documented as baselines for future monitoring. The study sites may also provide a basis for establishing future local or regional Marine Protected Areas

Figure 2. GSP Timeline

Figure 3. Crab taking a rest on a sponge. Credit: Oceaneering, Inc.

associated with these systems, supported by improved understanding of productivity, biodiversity, potential species and community endemism, extent of important biogenic habitats such as cold-water coral reefs, and whether certain systems may be degraded or threatened.

The project proposal is accessible on the Global Seamounts Project section of the Open Science Framework (OSF) website at: https://osf.io/xtg5c/. The OSF is an open-access, collaborative research platform hosted by the Center for Open Science, which is partnering with this project. Scientists can sign-in on the OSF site and at the GSP Working Groups document page can enter comments, ideas and indications of interest. We look forward to hearing from interested scientists, post-docs, students and technicians from around the world to participate.

The Global Seamounts Project has been endorsed by the Steering Committee Core Group of the 2nd International Indian Ocean Expedition (IIOE-2) as a contributing project to IIOE-2 (Endorsement No. IIOE2/EP29).

Funding is currently being sought for the GSP including for workshops, field expedition operations, research, data processing and modeling, primarily but not exclusively from the private-sector (foundations and other private sponsors). Updates and project news will be posted to the OSF site as it becomes available.

An extensive museum collection of Atlantic deep-sea mollusks

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The gastropod and bivalve material collected by the Woods Hole Oceanographic Institution's Deep-Sea Benthic Sampling Program (Sanders, 1977) has now been accessioned and catalogued in the Mollusk Department of the Museum of Comparative Zoology at Harvard University. The collection comprises over 110,000 individuals distributed among more than 1000 species dredged by epibenthic sleds from basins in the Atlantic (North American, Western European, Gambia, Guiana, Brazil, Angola, Cape and Argentine). Most of the material is classified as macrobenthos. A detailed description of the gastropod samples is provided by Stuart and Rex (2009), and for bivalves by Allen (2008).

This is one of the largest museum collections of deep-sea mollusks, both in terms of biodiversity and geographic coverage. Specimens are preserved in alcohol and are maintained as a separate collection. It is an indispensible resource for taxonomy and biogeography, as well as studies of larval development and dispersal, connectivity, phenotypic and genetic analyses of population differentiation and speciation, adaptation to deep-sea conditions, and functional ecology. As exploration of the deep sea continues, carefully archived material and associated databases will have vital roles in understanding global biogeography, developing conservation protocols to preserve biodiversity, and detecting the effects of climate change.

To work with the collection, please contact Adam Baldinger, Curatorial Associate (abaldinger@oeb.harvard.edu). For the database on museum holdings, please see https://mczbase.mcz.harvard.edu/SpecimenSearch.cfm

References cited:

H.L. Sanders (1977). Evolutionary ecology of dee-sea benthos. *In: The changing scenes in natural sciences 1776–1976*, C. E. Goulden (Ed.), Academy of Natural Sciences, Philadelphia.

J.A. Allen (2008). Bivalvia of the deep Atlantic. *Malacologia* 50: 57-173.

C.T. Stuart, M.A. Rex (2009). Bathymetric patterns of deep-sea gastropod species diversity in 10 basins of the Atlantic Ocean and Norwegian Sea. *Mar. Ecol. 30*: 164-180.

The first big dataset from the deep-sea NW Pacific is now available worldwide

Hanieh Saeedi* and Angelika Brandt

Senckenberg Research Institute and Natural History Museum; Department of Marine Zoology, Germany

* Postdoctoral Researcher & OBIS Data Manager, Deep-Sea Node

Email: hanieh.saeedi@senckenberg.de

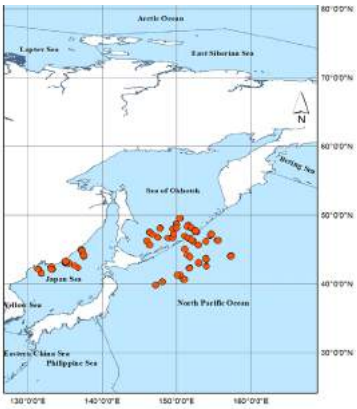


Figure 1. Coordinate midpoints of all stations from three cruises

Our first data mining and mobilization attempt for the NW Pacific deep-sea benthos (Biogeography of the NW Pacific deep-sea fauna and their possible future invasions into the Arctic Ocean, Beneficial Project) has been successfully published in OBIS in April 2018.

We mined and mobilized 5,770 unique deep-sea taxa records, with 1,319 records at the species level and 1,795 at the genus level (more than 50% at the species and genus level, the rest are at the higher taxa level, mostly family, order, and class) from our three deep-sea cruises in the NW Pacific, including SojaBio (Sea of Japan), SokhoBio (Sea of Okhotsk), and KuramBio I (Kuril Kamchatka Trench). We already almost tripled the available deep-sea data records in OBIS for the NW Pacific from 1,936 to 6,000 records. We believe that this is a great achievement and a very significant contribution to the deep-sea community. We also published 5,626 measurement records related to the abiotic factors, abundance data, and species morphometrics for the 3 cruises, which can all be used in future deep-sea studies. The access link to the published dataset may be found here.

We also held the second Beneficial Project workshop on “deep-sea data mobilization and quality control of the NW Pacific fauna” at Senckenberg Biodiversity and Climate Research Center (BiK-F), Frankfurt am Main, Germany, from 16-18 April 2018. We had 24 participants and Leen Vandepitte, Thomas Lanssens and Hanieh Saeedi from WoRMS and OBIS were the trainers. Our workshop aimed at training the deep-sea scientists on how to prepare, manage, and quality check their data before submission to OBIS.

Figure 2. A group photo of the workshop

DEEP SEARCH: Deep Sea Exploration to Advance Research on Coral/Canyon/ Cold-seep Habitats

Erik Cordes

Temple University, USA

Figure 1. The ROV *Deep Discoverer* explores the corals of one of the canyons off the east coast of the US from the NOAA Ship Okeanos Explorer.

The DEEP SEARCH project will focus on the deep-water habitats along the U.S. Atlantic coast offshore of Virginia, North and South Carolina, and Georgia - an area that is currently under consideration for future energy development. Submarine canyons, cold seeps, lithoherms capped with corals, and coral-formed bioherms add considerable environmental complexity throughout the bathyal region. DEEP SEARCH includes a diverse team of scientists including U.S. Bureau of Energy Management contractors through TDI Brooks International, USGS scientists, and support from the NOAA Office of Ocean Exploration and Research. These investigators will seek to characterize faunal and habitat distributions, determine the processes that shape patterns in population and community structure, and determine the linkages between physical, chemical, and biological processes to better understand ecosystem function. Such interdisciplinary data sets are essential for predicting organism and ecosystem-level responses to potential anthropogenic impacts and for assessing the severity of different impact types on sensitive deep-sea communities. Through this study, we will fill in the data gaps for poorly known deep-water ecosystems in order to help refine regional mitigation measures in the deep sea. The improved understanding of the habitats and communities in offshore areas of the Atlantic Large Marine Ecosystem will augment the capacity to predict the distribution of sensitive areas with respect to the potential development of energy and marine minerals managed by the Bureau of Ocean Energy Management and their concurrent mission to protect the environment.

Celebrating a Decade of the World Register of Marine Species

Tammy Horton

National Oceanography Centre, Southampton, UK

In 2018, to celebrate a decade of WoRMS' existence, it was decided to compile a list of our top marine species, both for 2017 and for the previous decade. Almost half of top 20 marine species are from the deep ocean!

These top 10 marine-species lists were compiled in order to highlight the fascinating discoveries of the numerous new marine species being made every year. A list of the 'Top Ten Species' described from ALL habitats and taxa has been announced annually since 2008 by the College of Environmental Science and Forestry (ESF). Although this list often contains one or two marine species, we decided to pay homage to the 'largest habitat on earth' by producing our own list of the top marine species. We hope some of our favourites will make it to global list…

Jesse Ausubel's 'terrible claw' lobster: discovered in 2008 during a Census of Marine Life expedition, was given the scientific name Dinochelus ausubeli Ahyong, Chan & Bouchet, 2010, derived from the Greek dinos, meaning terrible and fearful; chela, meaning claw; and ausubeli, in honor of Jesse Ausubel, a co-founder of the Census of Marine Life. Photograph courtesy Tin-Yam Chan, National Taiwan Ocean University, Keelung

All editors of WoRMS were given the opportunity to nominate their favourite marine species from both the last year (2017) and the previous decade (2007-2017). A small committee (including both taxonomists and data managers) was brought together to decide upon the final candidates. The final decisions reflect the immense diversity of animal groups in the marine environment (fish, crustaceans, molluscs, corals, sponges, jellies, worms) and highlight some of the challenges facing the marine environment today (e.g. invasive species, fragile reef ecosystems threatened by climate change, deep-sea environments impacted by resource extraction).

The final candidates also feature particularly astonishing marine creatures, notable for their interest to both science and the public. Each of these marine animals has a story. It may be the among the deepest living or largest fish known, be considered a 'living fossil', an invasive species, the most abundant organism in a habitat, or have remained hidden in plain sight, hoodwinking researchers for decades…

Curious about the actual lists? Quickly check out the full press release on the LifeWatch website!

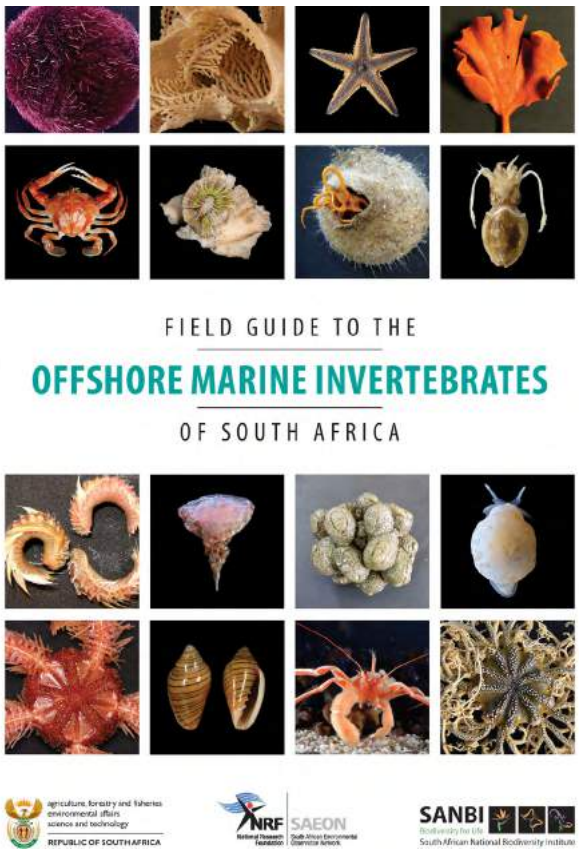
Link to press release: http://www.lifewatch.be/en/2018.04.23-WoRMS-LifeWatch-press-release

South Africa's first offshore marine invertebrate field guide

Lara Atkinson

South African Environmental Observation Network (SAEON), South Africa

The South African Environmental Observation Network (SAEON), in collaboration with the South African National Biodiversity Institute (SANBI) and many other institutes, have launched the first *Field Guide to the Offshore Marine Invertebrates of South Africa*. The publication is a photograph-based field guide that enables researchers, fishery observers and fishers to readily recognise and identify up to 409 commonly occurring invertebrate epifauna from South Africa's offshore region. Over the past seven years, a dedicated team of researchers, a large team of co-authors and collaborators from South Africa and abroad, implemented and maintained a long-term, offshore invertebrate monitoring programme. Led by Dr Lara Atkinson (SAEON) and Dr Kerry Sink (SANBI), the team collated invertebrate information collected during the Department of Agriculture, Forestry and Fisheries demersal trawl research surveys (limited to west and south coasts only) to produce this publication.



The field guide is a significant milestone in the description and mapping of South Africa's deep-water invertebrate biodiversity, advancing taxonomy and biogeographic research by contributing

to the description, mapping and assessment of marine ecosystems in South Africa. In addition to the book compilation, the monitoring programme has also enabled a rapid increase in local knowledge and understanding of offshore invertebrate taxonomy in South Africa and laid a foundation for future offshore benthic ecosystem research.

A link to download the complete (or chapters thereof) Field Guide to the Offshore Marine Invertebrates of South Africa can be found at:

http://www.saeon.ac.za/offshore-marine-invertebrate-identification-guide

Direct DOI link: https://bit.ly/2L2ZvlG

Funding to publish the Field Guide to the Offshore Marine Invertebrates of South Africa was provided by the Department of Science and Technology through the Global Change Programme and the SANBI SeaKeys Project funded through the NRF Foundational Biodiversity Information Programme. Additional specimens and photographs were collected through the NRF African Coelacanth Ecosystem Project funded Deep Secrets Project. The Fisheries Branch of the Department of Agriculture, Forestry and Fisheries (DAFF) provided in-kind support, enabling participation in their research surveys.

Meetings & Workshops

15th Deep-Sea Biology Symposium

9-14 September, Monterey, California

Contact: dsbs@dsbs2018.org

We are looking forward to welcoming you in Monterey, California for the 15th Deep-Sea Biology Symposium! Although the oral and poster presentation deadlines have passed, registration for the meeting is still open!

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 Annual General Meeting (see page 45).

There is a limited number of specially discounted rooms available at the conference hotel. Book through the link on this page to receive these special rates. It would help the Society and the Local Organising Committee greatly if you make your room bookings at this hotel.

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.

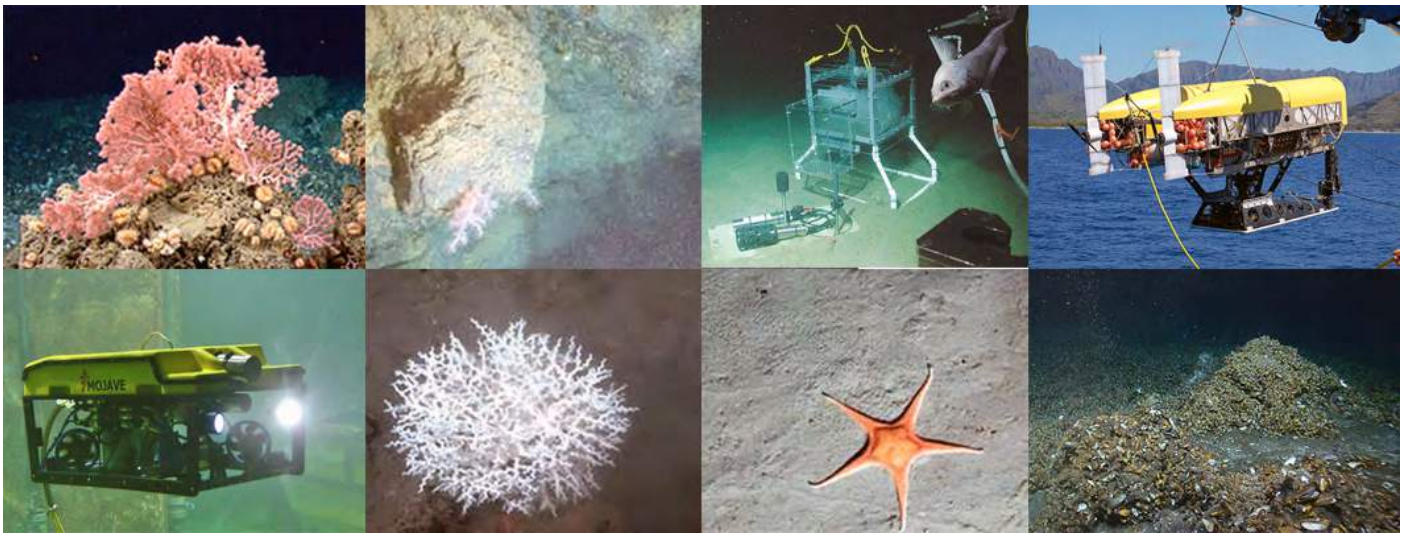
Welcome to INCISE2018!

5-7 November 2018, Shenzhen, Guangdong, China

INCISE, the International Network for Submarine Canyon Investigation and Scientific Exchange, is an initiative that aims to bring together scientists working on all aspects of submarine canyon research, and to stimulate discussions across disciplines. The 2018 INCISE Symposium will take place in Shenzhen, Guangdong, China, from 5-7 November 2018. The event is hosted by the Department of Ocean Science & Engineering, a department of SUSTech that concentrates on exploring global oceans.

Abstract submission is open through 15 September 2018. CLICK Sign In TO START!

Why study submarine canyons?



According to recent studies derived from high-resolution seafloor mapping, in the order of 10,000 submarine canyons exist worldwide. Fewer than one hundred canyons (only 1%) have been studied with some level of detail in terms of geology, physical oceanography, or habitat heterogeneity and biodiversity.

Submarine canyons are very important features along the world's continental and island margins. They create terrain habitat heterogeneity and provide important pathways for terrestrial sediments and carbon, detrital organic matter, pollutants and marine debris from the shelf to the deep sea. Canyons often concentrate organic matter enhancing overall ecosystem biomass and fisheries and acting as biodiversity hotspots. Canyons are also conduits for destructive gravity flows that caused devastating geohazards.

Recent advances in technology (e.g., ROVs, AUVs, gliders, etc.) allowed the expansion in the exploration of submarine canyons, revealing exuberant ecosystems with never-seen before life forms and entire habitats. However, while the scientific exploration on canyons advances, so does the human footprint into the deep sea, and on canyons in particular, with the increased worldwide demands for oil and gas, mineral deposits, and fisheries.

Therefore, the scientific community has the responsibility to prepare a comprehensive assessment of the role of submarine canyons in generating and maintaining deep-sea biodiversity, ecosystem function and services; and in support of developing marine policies defining clear strategies for conservation.

Are you a professional communicator working in a marine institute, governmental body or a NGO, or a marine scientist that would like to be speed-trained by experts in the skills of modern ocean science communication? Then CommOCEAN 2018 is for you. Our conference programme combines hands-on exercises in current science communication skills for disseminating ocean research and technology, with plenty of expertise-sharing, social interaction and fascinating marine science along the way.

Come to Southampton, United Kingdom, on 4-5 December 2018 and join us! Registration and call for abstracts are now open (Abstract submission deadline: 1 July 2018; Early Bird registration before 31

August 2018). You can find out more information about the conference, programme, fees and venue at http://www.commocean.org/

Dissemination, outreach and communication of scientific knowledge are becoming more and more important in today's society, where social inclusion is an integral part of environmental protection and sustainable development. This is particularly true for the world of ocean research, a world that is largely hidden from our view, representing an added challenge to the communication of marine research. From its inception, the Ocean Literacy movement has advocated closer interaction between marine scientists, educators and other stakeholders (the public, policy-makers, private sector), and inspired new events and networks all over the world. Both the EMSEA (European Marine Science Educators Association) annual conferences and CommOCEAN are prime examples of such new initiatives. CommOCEAN as the International Marine Science Communication Conference, was launched by the European Marine Board Communications Panel (EMBCP) and organized in the first instance by its Portuguese partners (CIIMAR, Ciencia Viva) in Porto in 2014, and a second was held in Belgium in 2016 (Bruges-Ostend) and organized by VLIZ, EMB, EMBCP and UNESCO/IOC/IODE. CommOCEAN focuses on a target audience of young marine scientists and communicators who want to be trained in science communication skills. The third event, in Southampton, UK, is being arranged and hosted by the National Oceanography Centre (NOC) and will see some of the programme split for marine scientists and professional communicators ensuring the programme is relevant, challenging and inspiring.

Keep track of CommOCEAN 2018 on Twitter and Facebook.

Conference Organisers:

National Oceanography Centre, United Kingdom
Working with European Marine Board Communications Panel

E-mail: communications@noc.ac.uk

Report: A collaborative session in JpGU: Mud Volcano and Chemosynthesis-Based Ecosystem

Hiromi Kayama Watanabe[1], Miho Asada[1], Robert G. Jenkins[2], Akira Ijiri[1], Tomohiro Toki[3], Takami Nobuhara[4]

[1]Japan Agency for Marine-Earth Science and Technology, [2]Kanazawa University, [3]University of Ryukyus, [4]Shizuoka University

A collaborative session on Mud Volcanos and Chemosynthesis-Based Ecosystems was organized during the Japan Geoscience Union (JpGU) meeting, which had ~8000 participants and 236 sessions, including 12 ocean-science sessions (20-24 May 2018, at Makuhari Messe, Chiba, Japan).

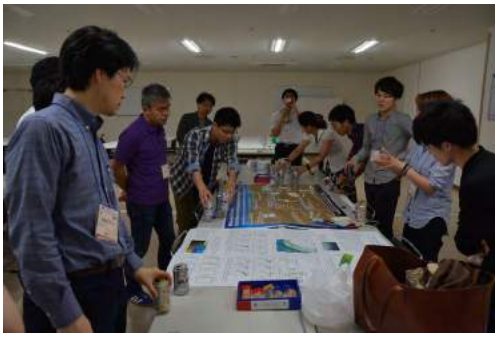


Figure 1. Hot-topic discussion which was accelerated by beers and sweets.

Mud volcanos are one of the geological features on the seafloor that are formed by the movement of fluid and sediments from depth to the surface of the Earth. Hydrocarbon seepage and related phenomena sustaining chemosynthesis-based faunal communities on the seafloor could be categorized as part of mud volcano activity. During the mud volcano session, geophysists and geochemists discussed the processes that form mud volcanos, or how the materials in deep subsurface are transported to the surface. In the chemosynthesis-based ecosystem session, paleontologists and biologists discussed the processes of forming chemosynthesis-based communities and their function in marine ecosystems, or how the materials

derived from deeper subsurface are used by marine fauna. Collaboration of these two sessions attempted to elucidate how material transport from the subsurface affects marine ecosystems, through chemosynthesis on the deep-sea floor.

We are planning to have a workshop in Shirahama, Wakayama, Japan in late Summer/Autumn, to discuss our ideas of future studies, including a field trip to observe fossil chemosynthesis-based communities in this area. Please contact Hiromi Watanabe (hwatanabe@jamstec.go.jp) and/or Miho Asada (masada@jamstec.go.jp) if you are interested and have any ideas or input for our collaboration.

Scientist Profiles

Aurélie Goineau

Postdoctoral Researcher - Ecology and taxonomy of benthic foraminifera

National Oceanography Centre Southampton, University of Southampton Waterfront Campus, European Way, Southampton SO14 3ZH, UK

Contact: goineau.aurelie@gmail.com

Originally, I am a trained geologist, specialised in marine geosciences, passionate about the mysteries of palaeoceanography and palaeoclimatology. I say "originally", not because I am not interested anymore in ancient oceans, but because my path took an unexpected direction during my PhD, when I started studying… the ecology of benthic foraminifera!

I completed my PhD in 2011 at the University of Angers in France where I studied benthic foraminifera from a continental shelf under a riverine influence in the Mediterranean Sea (Rhône prodelta, south of France). The aim of my work was to use benthic foraminifera as bio-indicators of present and past environmental conditions through the investigation of a wide range of topics – taxonomy of 'live' and recently dead foraminiferal faunas, spatial distribution and temporal dynamics, taphonomic processes, sediment and water column geochemistry related to carbon cycle, sedimentary organic matter quality/quantity, bentho-pelagic coupling etc.

After my PhD, I spent time teaching at two French universities, before jumping into the world of deep-sea biology – quite a big step! Over the past 5 years, I had the chance to work at the National Oceanography Centre, Southampton with Pr. Andrew Gooday. We were involved in the ABYSSLINE project aimed to investigate the biodiversity and geographic distribution of deep-sea ecosystems in areas of the abyssal eastern equatorial Pacific licensed for nodule-mining exploration. From meiofaunal foraminifera to giant xenophyophores, we looked at everything in order to estimate their vulnerability to potential future mining activities in the area. The outstanding feature of our results is that meiofaunal foraminifera are very abundant and diverse, with more than 600 species identified (with the potential of about 400 more to be discovered), and the overwhelming predominance of monothalamids, a group often ignored in foraminiferal studies. As in most deep-sea environments, only ~10% of all the species are scientifically described and many are rare. Nevertheless, their geographic distribution seems to be quite homogeneous, at least at a local scale (i.e. ~3,000 km²).

So far, only few studies of abyssal ecosystems have involved a deep look at benthic foraminifera, and this number is even smaller in areas that may experience major impacts from future mining activities. This emphasises how little is known and therefore how much effort has to be done in order to increase our knowledge.

In a context of accelerating climate change and increasing number of human-impacted environments, I do believe that benthic foraminifera are a key element in better understanding marine ecosystems, from the coast to the deep sea. While live benthic foraminifera are very good bio-indicators of present marine environments, fossilised faunas allow investigating the past and how were our oceans before human-induced disturbance. If you also do believe that

benthic foraminifera deserve more consideration and attention, please feel free to contact me, whether you know of any position available, or you want to discuss more about my work.

Hanieh Saeedi

Postdoctoral Researcher (deep-sea biogeography) & OBIS Data Manager (deep-sea node)

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

Contact: hanieh.Saeedi@senckenberg.de

Biography

- 2017 – Present Postdoctoral Researcher in Deep-sea Biogeography (Beneficial Project), Goethe University Frankfurt & Senckenberg Research Institute and Natural History Museum, Germany.
- 2017 – Present OBIS Data Manager, deep-sea node.
- 2015 - 2017 Postdoctoral Fellowship in Deep-sea Biodiversity and Ecology (BioSuOr Project)/ Lecturer in Biogeography, University of Espirito Santo, Brazil.
- 2011 - 2015 PhD in Marine Science (topic: taxonomy and biogeography) / Teacher Assistant at University of Auckland, New Zealand.
- 2009 - 2011 Research Advisor and Environmental Consultant at Shill Amayesh Consultant Engineering Company, Iran.
- 2008 - 2009 Research Fellowship in Marine Toxicology at Shahid Beheshti University, G.C, Iran.
- 2006 - 2008 MSc in Marine Biology (1st rank student), Shahid Beheshti University, G.C, Iran.

Areas of expertise

- Marine Biodiversity and Biogeography (shallow and deep-sea)
- Bioinformatics and Data Analysis
- Ecological Modelling
- Morphological and Molecular Taxonomy (mainly bivalves)

Research Interests

I am interested in understanding the driving ecological and evolutionary processes that shape biodiversity and biogeographic patterns of marine species (shallow and deep sea), and also to predict how species richness and distribution ranges will shift under future climate change. My longer-term goals will be focused on connectivity and evolutionary biology studies on deep-sea benthic species using molecular genetics, 3D modelling and mathematical techniques.

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

The aim of our project is to deliver a sound biogeographic baseline study of the NW Pacific area, including our available data from the Sea of Japan, Sea of Okhotsk, Kuril-Kamchatka Trench (KKT), Aleutian Trench (AT), SW Bering Sea and the NW Pacific open abyssal plain. We aim at compiling a novel book on the biogeography of the NW Pacific faunas, which will also provide information on highly abundant key species that might potentially invade the Arctic Ocean in the future, under decreasing sea-ice conditions. Thus, our data will be "beneficial" for the assessment of state and quality of the Arctic marine ecosystems in a changing environment.

Access to full publications at https://www.researchgate.net/profile/Hanieh_Saeedi

Full Contacts

- Senckenberg Research Institute and Natural History Museum; Department of Marine Zoology, Crustaceans; Senckenberganlage 25; 60325 Frankfurt am Main, Germany. Phone: +49-69-75421344
- Goethe University Frankfurt, FB 15 Biological Sciences, Institute for Ecology, Diversity and Evolution, Biologicum, Campus Riedberg, Max-von-Laue-Str. 13, 60438 Frankfurt am Main.

Opportunities

Job Opportunity: Marine Ecologist

National Oceanography Centre, Southampton

Salary: Band 6: £28,200 to £32,430 per annum
Full time 37 hours per week; Fixed term for 3 years

About the role:
The successful applicant will support existing and new research programmes using sustained observations to investigate natural and anthropogenic change, for example work at the Porcupine Abyssal Plain. The aims include applying a quantitative ecological approach to understanding fundamental theoretical mechanisms in ecology and ecosystem function. Such mechanistic research could include focus on factors controlling the spatial and temporal dynamics of benthic ecosystems. The position will focus on deep-sea megafauna. It is expected that the work also will be applied to issues of ocean management such as marine conservation zone management, potential impacts of oil and gas industry activity, carbon capture and storage and seafloor mining.

The job will have the following responsibilities:
- Develop a globally important research programme
- Integrate and add value to existing NOC research programmes
- Present work through a range of media, including through scientific publications and talks
- Supporting NOC sustained observation programme and lead field data acquisition
- Benthic ecological assessment, analysis, reporting and publication
- Engage with national and international network of collaborators and other stakeholders, including industry
- Be willing and able to work at sea and globally
- Administration, project and financial management

About you:
- The successful candidate shall have the following key skills and experience
- PhD in biological science or related discipline
- Knowledge of marine ecology, ideally deep-water benthic ecology
- Experience of working in the marine environment, ideally on research cruises
- Preferably have experience of deep-sea biology
- Experience of academic working (writing and publishing papers, presentation, research grant preparation etc), including leading high-quality academic publications
- Skills in quantitative ecology (ideally including understanding of some aspects of theoretical ecology)
- Ideally have experience in working with images to extract biological information.
- Experience in data manipulation and analysis, including statistics. Ideally experience in computer programming (e.g. in R or Matlab).
- Specialist knowledge of a particular megafaunal marine taxon
- Ability to work with wide variety of personnel, different organisations and in multidisciplinary teams.

- Proactive and motivated
- Ability to manage time, projects and resources to deliver high-quality science to project deadlines.

Other information:
This position will require the candidate to travel globally and spend significant time onboard research or offshore industry vessels (usually 6-8 weeks per voyage). The position will be dependent on passing a medical evaluation to ensure that the candidate can perform their duties at sea.

For more information, please contact Dr Daniel Jones at dj1@noc.ac.uk

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Job Opportunity: Post-doctoral Fellow

IMAR, Azores

We are looking for a Post-doctoral Fellow to work on the impact of fishing activities on deep-sea sponge grounds.

The post-doc will be based in the Azores but will be in close collaboration with colleagues from the Bedford Institute of Oceanography (Canada) and the University of Bergen (Norway).

The IMAR (Instituto do Mar) opens a call for the selection of candidates with a PhD degree for a post-doctoral fellowship within the EU funded project "Deep-sea Sponge Grounds Ecosystems of the North Atlantic: an integrated approach towards their preservation and sustainable exploitation" (H2020-BG-2015-2-679849-2). The selected candidate will be granted a scholarship for the duration of 12 months, starting October 2018, to develop research activities on the impact of fishing on deep-sea sponges of the North-Atlantic.

Project:
In the deep sea, sponge aggregations are considered to be a hotspot of biodiversity, providing key ecosystem function and services. The objective of SponGES is to develop an integrated ecosystem-based approach to preserve and sustainably use vulnerable sponge ecosystems of the North Atlantic. The candidate will work within the work package that focus on assessing anthropogenic impacts (particularly fishing activities) on sponge grounds. The work will involve using a wide range of techniques to evaluate the impacts of fishing on sponge grounds and their potential for recovery, including the analysis of video footage of impacted and pristine sponge grounds of the North-Atlantic, analyze bycatch and fishing effort data and finally developing dynamic models (e.g. STELLA) to identify ecological tipping points for different ecosystem functions of sponge grounds impacted by bottom trawling but also for predicting recovery trajectories.
The candidate will prepare technical and scientific reports and collaborate in the writing of scientific publications.
The work will be based in the island of Faial (Azores - Portugal) and it is mandatory that the candidate lives in Faial for the duration of the scholarship.

Informal enquiries can be made to Christopher K. Pham (christopher.k.pham@uac.pt) and Ana Colaço (ana.colaço@uac.pt)

Further details:
http://www.horta.uac.pt/intradop/index.php/pt/86-notas/3359-call-for-applications-for-a-post-doctoral-fellow-imar-bpd-sponges-002-2018

Job Opportunity: PhD Position

Senckenberg Gesellschaft für Naturforschung, Germany

Job offer ref. #01-18012

The Senckenberg Gesellschaft für Naturforschung (SGN) is a member of the Leibniz Association and is based in Frankfurt am Main, Germany. SGN conducts natural history research with almost 800 employees and research institutions in six federal states, and is also custodian of the UNESCO World Heritage Site at Messel.

The Senckenberg Research Institute invites applications for a PhD Position in a project funded by the German Science Foundation (DFG) with the title: **The role of hadal zones in the long-term fate of marine microplastics: Identification of microplastics in the deep sea of the Kuril-Kamchatka Trench, Northwest Pacific (Deep-MiPoll).**

PhD position in marine biology, chemistry or environmental research
(75 %)

Your tasks:

You will be working with the FTIR Spectroscopy Systems (including FTIR Imaging) for the analysis of synthetic polymers (microplastics) and the Raman Imaging System for the identification and analysis of hadal microplastics from the Kuril-Kamchatka Trench.

Your profile:

- MSc in biology, chemistry or environmental sciences
- Team work capabilities in a multidisciplinary team, fluency in English and German (written and spoken)
- Experience with FTIR and Raman Spectroscopy
- Willingness of mentoring students (Master)
- Willingness to publish in peer-reviewed journals and present results at international conferences
- Experiences in polymer science would be beneficial

Salary and benefits are according to a full time public service position in Germany (TV-H E13, 75 %). The contract should start on 01.10.2018 and will initially be limited until 30.09.2021 (3 years). The place of employment will be the Senckenberg Research Institute and Museum in Frankfurt. Most of the laboratory work will be performed at the AWI on Helgoland.

The Senckenberg Gesellschaft für Naturforschung supports equal opportunity of men and women and therefore strongly invites women to apply. Equally qualified handicapped applicants will be given preference. The place of employment will be Frankfurt am Main, Germany. The employer is the Senckenberg Gesellschaft für Naturforschung.

How to apply

Please send your application, mentioning the reference of this job offer (ref. #01-18012) before 30 June 2018 by e-mail (attachment in a single pdf document) and including a cover letter detailing research interests and experience, a detailed CV and a copy of your Master degree to: Senckenberg Gesellschaft für Naturforschung, Senckenberganlage 25 60325 Frankfurt am Main. E-Mail: recruiting@senckenberg.de

For scientific enquiries please get in contact with angelika.brandt@senckenberg.de and/or Gunnar.Gerdts@awi.de
Special Issue “Spatial and Temporal Dimensions of Biodiversity-Ecosystem Function Relations”

A special issue of Diversity (ISSN 1424-2818)

Deadline for manuscript submissions: 31 January 2019

Special Issue Editor: Prof. Martin Solan
National Oceanography Centre Southampton, University of Southampton, U.K.

Special Issue Information

A consensus has been reached that various components of biodiversity influence ecosystem functioning, but inferences regarding the ecological consequences of altered biodiversity are largely derived from small-scale studies. Natural ecosystems are dynamic over a variety of temporal and spatial scales, changing processes of community assembly, and altering how species interact with one another and their environment. Consequently, tremendous uncertainty surround estimates of the functional consequences of alternative biodiversity-environmental futures. This Special Issue considers how the spatial and temporal dimensions of ecosystems may moderate biodiversity-functioning relations across a range of environmental contexts.

Manuscript Submission Information

Manuscripts should be submitted online at www.mdpi.com by registering and logging in to this website. Once you are registered, click here to go to the submission form. Manuscripts can be submitted until the deadline. All papers will be peer-reviewed. Accepted papers will be published continuously in the journal (as soon as accepted) and will be listed together on the special issue website. Research articles, review articles as well as short communications are invited. For planned papers, a title and short abstract (about 100 words) can be sent to the Editorial Office for announcement on this website.

Submitted manuscripts should not have been published previously, nor be under consideration for publication elsewhere (except conference proceedings papers). All manuscripts are thoroughly refereed through a single-blind peer-review process. A guide for authors and other relevant information for submission of manuscripts is available on the Instructions for Authors page. *Diversity* is an international peer-reviewed open access quarterly journal published by MDPI.

Please visit the Instructions for Authors page before submitting a manuscript. The Article Processing Charge (APC) for publication in this open access journal is 850 CHF (Swiss Francs). Submitted papers should be well formatted and use good English. Authors may use MDPI's English editing service prior to publication or during author revisions.

NOAA OER Federal Funding Opportunity

NOAA's Office of Ocean Exploration & Research (OER) is soliciting proposals for ocean exploration in waters under U.S. jurisdiction, including the U.S. Exclusive Economic Zone (EEZ), and areas mapped by, or of interest to, the U.S. Extended Continental Shelf (ECS) Project. Presently, important marine habitats and living and non-living resources are neither fully explored nor characterized. OER's intent is to address these knowledge gaps and support growth in the Nation's Blue Economy by soliciting ocean exploration proposals that focus on:

1. Discovering microorganisms, sponges, corals, and other organisms with biopharmaceutical or biotechnical potential;

2. Acquiring baseline ocean environmental information to better inform decision-making where future ocean energy development or critical mineral extraction may occur;

3. Finding and characterizing shipwrecks and submerged cultural resources that played a role in America's past ocean-based economy (e.g., transport, trade, warfare, etc.) and could inform decisions on future seabed activities and potential environmental impacts.

The deadline for the pre-proposal submission is July 26, 2018.

Please visit https://oceanexplorer.noaa.gov/about/funding-opps/welcome.html for more information, and please, share widely with your networks. Thank you.

Society Awards and Prizes

Report on 2017 Calls

The Society awarded two Dive Deeper bursaries, four travel awards, one Lounsbery workshop award and the paper of the year in 2017.

Michelle Taylor (University of Essex, UK) and Brit Finucci (Victoria University of Wellington, NZ) received a Diver Deeper Award, you can read about how the bursaries aided them in their research here.

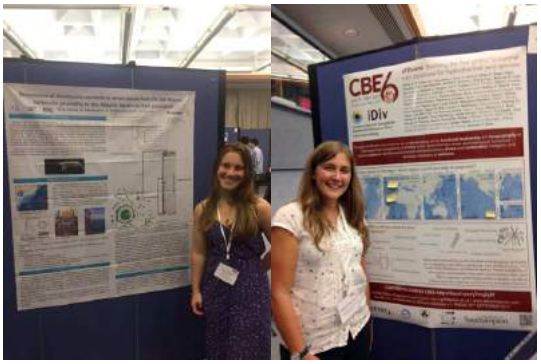


Figure 1: 2017 travel-awardees Olivia Soares Pereira (left) and Abbie Chapman (right) presenting their work during the 6th Chemosynthetic Based Ecosystems symposium.

Travel awards for the 6th Chemosynthetic Based Ecosystems symposium at Woods Hole, MA, USA were awarded to: Shelbi Russell (University of California Santa Cruz), Jessica Panzarino (Harvard University), Olivia Pereira (Scripps Institute of Oceanography) and Abbie Chapman (University of Southampton), who also was awarded the Deep-Sea Biology Society prize for the best student talk. Blogs from our travel awards can be found here.

Kerry Howell (Plymouth University) organised the first Lounsbery workshop with the Marine Institute (Plymouth University). It was also the first international workshop on the development of a standardised deep-sea species image catalogue for the North Atlantic. During the workshop formalised tools and training materials were developed for new researchers working on field identification of taxa at a regional level. It was held in Plymouth 6th December 2017, 31 researchers attended and the results and recommendations will be published in a peer-reviewed journal later this year.

Finally the paper of the year award was awarded to Andrea Quattrini and co-authors for their paper titled 'Environmental filtering and neutral processes shape octocoral community assembly in the deep sea.' The award was presented to Andrea at the DSBSoc AGM at the 6th Chemosynthetic Based Ecosystems symposium in Woods Hole MA, USA. You can read the paper here.


DEEP-SEA BIOLOGY SOCIETY

We hereby award the

2017 PAPER OF THE YEAR AWARD

to

ANDREA M. QUATTRINI, CARLOS E. GÓMEZ, AND ERIK E. CORDES

AT THE 6TH INTERNATIONAL SYMPOSIUM ON CHEMOSYNTHESIS-BASED ECOSYSTEMS

DR. ADRIAN GLOVER, PRESIDENT

DATE

Calls open for 2018

We have awarded Dive Deeper awards this year to Madeleine Braiser (University of Liverpool and NHM, UK) and Matthew Galaska (Lehigh University, USA) see here for more details.

We will be announcing the winners of the Deep-Sea Biology Society travel awards for the 15th Deep-Sea Biology symposium shortly, we have awarded 12 travel awards this time.

Dr Madeleine Braiser (left) and Dr Matthew Galaska (right), recipients of the 2018 Dive Deeper award.

We currently have four awards still open in 2018. Three awards for excellence in scientific publishing, the triennial Landmark paper award (last awarded to Nicholas Higgs in 2015), the paper of the year award and a new award for the best Ph.D. paper. We really value your input to these awards and they should be driven by the community so please send in your nominations for these three awards.

We also have a call open for the Lounsbery workshop and we will be awarding prizes for best oral and poster presentation at the 15th Deep-Sea Biology Symposium in Monterey in September. A short description of each award is outlined below and the terms and conditions for these awards can be found on our website.

The deadlines for these awards are fast approaching (July and August), so please get in contact soon if you have any questions.

Lounsbery Workshop Award 2018

Deadline:31 August 2018

The Lounsbery Workshop Award is an annual Society award towards the costs of organising a focussed workshop related to a particular field of deep-sea biology, or related to a cross-cutting issue, in particular training-focussed such as science communication, policy, taxonomy, 'big-data' analysis and analytical methods. It is expected that these workshops would be held over 3-4 days involving 10-30 scientists, with the funds being available for any cost associated with the workshop (e.g. travel for senior or junior researchers, catering) but excluding institutional meeting room hire and salary costs. The lead applicant (PI) of the application should be a member of the society, but this is not required for the workshop attendees. Applications are encouraged that include a large training component particularly in new techniques or methods, and partnerships with training organisations or companies are welcomed especially if cost-sharing is well demonstrated. The scheme provides up to 4000 GBP towards the costs of the workshop, and successful applicants will be expected to write a short report of the workshop in the open-access flexible journal Research Ideas and Outcomes (the OA fee will be paid by the Society) as well as providing an ongoing twitter feed during the workshop with links and credit to the Society. Applications can be made here.

Deep-Sea Biology Society Landmark Paper Award

Deadline: Nominations to be received by 31 July 2018

The Deep-Sea Biology Society is pleased to accept nominations for the triennial award for the Landmark Paper in Deep-Sea Biology Research. This award honors current and major advancements in research that either reveal key information, challenge our current understanding, overturn paradigms or significantly bolster the field of deep-sea biology. We are currently accepting nominations for papers published from late 2014 to 2018 (see below). The prize is 500 GBP cash prize, free society membership and a feature write up on the Deep-Sea Biology Society website and in the DSBSoc and INDEEP newsletter 'Deep-Sea Life'. In order to apply you need to submit a pdf of the paper and the nominator needs to supply a letter (1 page of A4) explaining why they consider this paper to be a landmark contribution to deep-sea biological science. Please email nominations to Erin Easton: erineeaston@gmail.com

Deep-Sea Biology Society Paper of the Year

Deadline: Nominations to be received by 31 July 2018

In addition to the triennial 'Landmark Paper' award, the Society is also awarding a 'Paper of the Year' award, which will be awarded to an outstanding paper published in the period leading up to the DSBS meeting and AGM of the Society. The prize will be one-year free membership of the Society and a 100 GBP cash prize. Please email nominations to Rachel Jeffreys: rachel.jeffreys@liverpool.ac.uk

Award for outstanding Ph.D. thesis paper

Deadline: Nominations to be received by 31 July 2018

This award is to recognise a promising young researcher in the area of deep-sea biology. The first author of the paper must be a current or recent Ph.D. student and a member of the DSBS society. The paper must originate from a Ph.D. thesis within three years of the award deadline. Articles that have been accepted but not published are also eligible. In order to apply an electronic copy of the paper must be submitted alongside a statement from the supervisor of the applicant/nominated Ph.D. candidate, which outlines the importance of the nominated paper and its contribution to the field. The prize is a 500 GBP cash prize. Please email nominations to Paris Stefanoudis: pstefa@windowslive.com

Prize for best student Talk and Poster

15th Deep-Sea Biology Symposium (DSBS)

To be awarded at the 15th DSBS in Monterey September 2018. The Society will award one-year free membership of the Society and a 100 GBP cash prize to the best student oral and poster talks at DSBS.

Students and Early-Career Researchers

Students and early-career researchers represent the future of deep-sea biology and are thus an invaluable part of our society. Currently, students make up 31% of the society's membership, and together with early-career researchers a combined 45% identified representing 27 countries (including 7 developing countries). 65% student and early-career members are females. We are proud to have increased the demographic diversity of our student and early-career community, but we are determined to do so more in the coming years by increasing support to individuals from developing nations and minorities through the society's awards, by sharing information on upcoming opportunities and events through the society's communication channels, and finally by providing networking and mentoring opportunities through society-sponsored events and schemes. Following the AGM at the 15th Deep-Sea Biology Symposium in Monterey, there will be two dedicated officers, one for students and for the first time one for early-career researchers, in order to reflect the different needs of these two distinct communities. For now though, students and early-career researchers attending the 15th Deep-Sea Biology Symposium in Monterey, can communicate and connect with each other via this newly-created Facebook group.

Support for students and early career researchers in 2018 included:

Student email updates. These are bi-weekly emails containing information on upcoming events (workshops, conferences) and opportunities (jobs, Ph.D. ads, awards, grants/funding schemes), sent through Wild Apricot.

Life-after-Ph.D. scheme

Anxious about what life post-PhD will look like? Torn between pursuing a career in academia or in industry? At which stage of your PhD should you be starting to apply for jobs and/or postdoctoral fellowships? In this section members of the Society share their personal experiences about this important transition in a researcher's life. You can read the stories of Dr James Bell and Dr Lidia Lins here. If you would like to contribute as well please email Paris Stefanoudis, the Society's student representative, at pstefa@windowslive.com.

15th DSBS student events

There are two planned student events for the upcoming 15th Deep Sea Biology Symposium, both of which will be a great opportunity for networking and mixing. The first event will take place at the beginning of the conference, on the 10th September at 5.30 pm, and include reports from the current student representative, career talks from senior researchers, and networking. The second will be a social event (likely a BBQ) that will take place at the Hopkins Marine Station on the 13th September at 6 pm.

Mentoring network scheme

This year also saw the launch of our mentoring network scheme. This followed a questionnaire that was filled in by approximately 30 individuals who were interested in a mentoring network. Rachel Jeffreys then contacted Susan Lozier a physical oceanographer at Duke University to gain some insight and advice on the MPOWIR network that Susan started and runs. A group of around 10 members of the society then participated in a webinar with Susan. This discussion formed the basis of the current mentoring network. Presently we have three mentoring groups consisting of two more senior researchers/academics and approximately 4 early career researchers (graduate students and postdoctoral researchers). The groups are split across approximately three time zones and have been meeting monthly to discuss a variety of topics e.g. career advice, paper and grant writing etc. Rachel will be holding a mentoring lunch (for those already in the network and those interested in joining) at the 15th Deep-Sea Biology Symposium, Monterey, California. Rachel hopes to be able to continue this network and set up a similar network for our masters undergraduate students.

Hot off the Press

Deep-sea hydrothermal vents as natural egg-case incubators at the Galapagos Rift

P. Salinas-de-Leon, B. Phillips, D. Ebert, M. Shivj, F. Cerutti-Pereyra, C. Ruck, C.R. Fisher, L. Marsh (2018)

Scientific Reports 8:1788

The discovery of deep-sea hydrothermal vents in 1977 challenged our views of ecosystem functioning and yet, the research conducted at these extreme and logistically challenging environments still continues to reveal unique biological processes. Here, we report for the first time, a unique behavior where the deep-sea skate, *Bathyraja spinosissim*a, appears to be actively using the elevated temperature of a hydrothermal vent environment to naturally "incubate" developing egg-cases. We hypothesize that this behavior is directly targeted to accelerate embryo development time given that deep-sea skates have some of the longest egg incubation times reported for the animal kingdom. Similar egg incubating behavior, where eggs are incubated in volcanically heated nesting grounds, have been recorded in Cretaceous sauropod dinosaurs and the rare avian megapode. To our knowledge, this is the first time incubating behavior using a volcanic source is recorded for the marine environment.

Link to paper: https://www.nature.com/articles/s41598-018-20046-4

In situ observations of the meso-bathypelagic scyphozoan, *Deepstaria enigmatica*, (Semaeostomeae: Ulmaridae)

D.F. Gruber, B.T. Phillips, L. Marsh, J.S. Sparks (2018)

American Museum Novitates (3900): 1-14

Deepstaria enigmatica (Semaeostomeae: Ulmaridae) is one of the largest and most mysterious invertebrate predators of the deep sea. Humans have encountered this jellyfish on only a few occasions and many questions related to its biology, distribution, diet, environmental tolerances, and behavior remain unanswered. In the 45 years since its formal description, there have been few recorded observations of *D. enigmatica*, due to the challenging nature of encountering these delicate soft-bodied organisms. Members of *Deepstaria*, which comprises two described species, *D. enigmatica* and *D. reticulum*, reside in the meso-bathypelagic region of the world's oceans, at depths ranging from ~600 to 1750 m. Here we report observations of a large *D. enigmatica* (68.3 cm length x ~ 55.7 cm diameter) using a custom color high-definition low-light imaging system mounted on a scientific remotely operated vehicle (ROV). Observations were made of a specimen capturing or "bagging" prey, and we report on the kinetics of the closing motion of its membranelike umbrella. In the same area, we also noted a *Deepstaria* "jelly-fall" carcass with a high

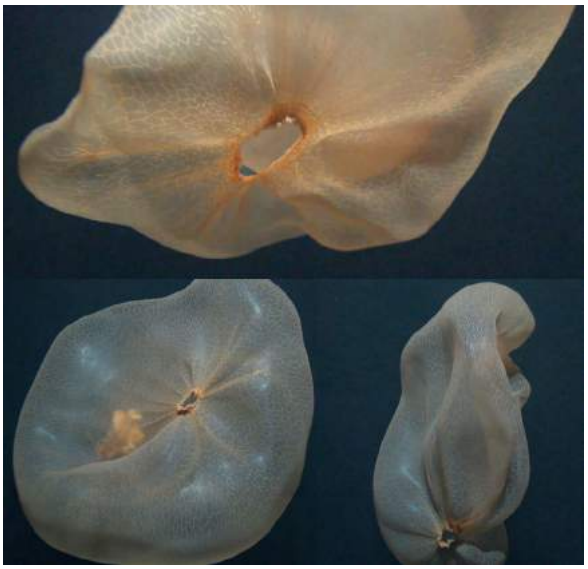


Figure 1. *Deepstaria enigmatica*

density of crustaceans feeding on its tissue and surrounding the carcass. These observations provide direct evidence of singular *Deepstaria* carcasses acting as jelly falls, which only recently have been reported to be a significant food source in the deep sea.

Link to paper: http://digitallibrary.amnh.org/handle/2246/6874

Ecotoxicological responses to chalcopyrite exposure in a proxy for deep-sea hydrothermal vent shrimp: implications for seafloor massive sulphide mining

A. Brown, C. Hauton (2018)

Chemistry and Ecology, 34: 391-396

Deep-sea mineral prospecting has raised concerns regarding potential ecotoxicological impacts of deep-sea mineral extraction. Although metal mineral phases are predicted to exhibit low bioavailability, few data explore the relative toxicity of mineral phases and dissolved constituent metals. Acute 96 h chalcopyrite (CuFeS2) (<250 µm grain size) exposures using the shallow-water ecophysiological model organism *Palaemon varians* as an ecotoxicological proxy for deep-sea hydrothermal vent shrimp revealed no effect in both lethal and sublethal assays up to 2.888 g L^{-1}, suggesting that chalcopyrite is not bioavailable. Deep-sea species, therefore, appear at greater ecotoxicological risk from dissolved metals during seafloor massive sulphide (SMS) mining. Consequently, an approach combining modelling the release, and spatial and temporal dilution of dissolved metals during SMS mining, with data on sublethal effects of dissolved metals on shallow-water proxies, may best constrain the potential ecotoxicological impacts of SMS mining, and deliver ecotoxicological threshold concentrations for active SMS extraction.

Link to paper: https://doi.org/10.1080/02757540.2018.1427231

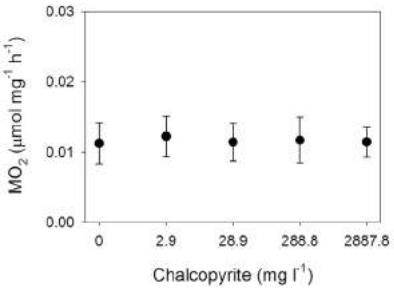


Figure 1. Respiration rate in *Palaemon varians* was not significantly affected by exposure to 2887.8 mg l^{-1} 168 chalcopyrite (<250 µm grain size) addition, equivalent to a copper concentration 1000 times greater than that eliciting a respiratory response to dissolved copper (Brown et al. 2017 Environ Sci Tech). These results are consistent with other available data on the relative toxicity of dissolved copper and mineralic metal phases, indicating greater bioavailability in dissolved form than in mineralic form, but the magnitude of the difference in bioavailability is unprecedented. This disparity suggests that chalcopyrite may not be bioavailable to *P. varians*, and by extension to deep-sea shrimp species.

Scientific rationale and international obligations for protection of active hydrothermal vent ecosystems from deep-sea mining

C.L. Van Dover, S. Arnaud-Haond, M. Gianni, S. Helmreich, A. Huber, A.L. Jaeckel, A. Metaxas, L.H. Pendleton, S. Petersen, E. Ramirez-Llodra, P.E. Steinberg, V. Tunnicliffe, H. Yamamoto (2018)

Marine Policy 90: 20–28

There is increasing interest in mining minerals on the seabed, including seafloor massive sulfide deposits that form at hydrothermal vents. The International Seabed Authority is currently drafting a Mining Code, including environmental regulations, for polymetallic sulfides and other mineral exploitation on the seabed in the area beyond national jurisdictions. This paper summarizes 1) the ecological vulnerability of active vent ecosystems and aspects of this

vulnerability that remain subject to conjecture, 2) evidence for limited mineral resource opportunity at active vents, 3) non-extractive values of active vent ecosystems, 4) precedents and international obligations for protection of hydrothermal vents, and 5) obligations of the International Seabed Authority under the UN Convention on the Law of the Sea for protection of the marine environment from the impacts of mining. Heterogeneity of active vent ecosystems makes it extremely challenging to identify "representative" systems for any regional, area-based management approach to conservation. Protection of active vent ecosystems from mining impacts (direct and indirect) would set aside only a small fraction of the international seabed and its mineral resources, would contribute to international obligations for marine conservation, would have non-extractive benefits, and would be a precautionary approach.

Link to paper: https://doi.org/10.1016/j.marpol.2018.01.020

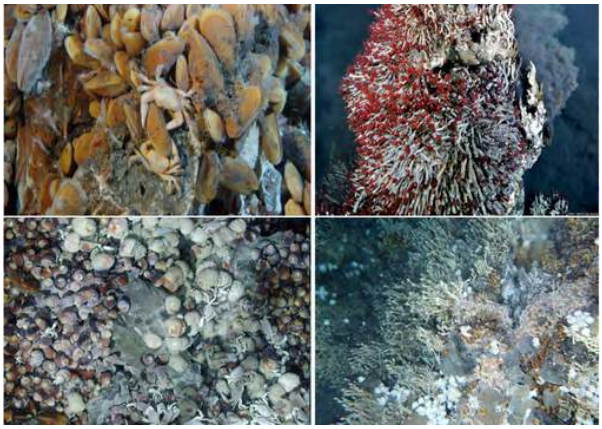
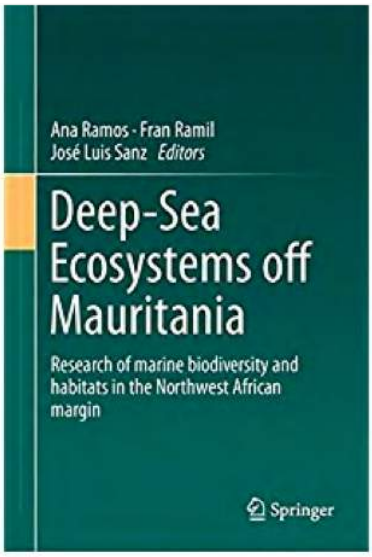


Figure 1. Variation in the dominant, symbiont-hosting invertebrates at active hydrothermal vents. Vent communities differ widely among biogeographic regions.
Top left: **Atlantic Ocean**: Mussels (*Bathymodiolus azoricus*) with bythograeid crabs, Lucky Strike Vent Field, Mid-Atlantic Ridge; courtesy IFREMER; top right: **North Pacific Ocean**: Tubeworms (*Ridgeia piscesae*) with alvinellid polychaetes, Endeavour Hydrothermal Vents Marine Protected Area, Juan de Fuca Ridge; courtesy Ocean Networks Canada
Bottom left: **South Pacific Ocean**: Hairy (*Alviniconcha* spp.) and black (*Ifremeria nautilei*) snails with bythograeid crabs (*Austinograea alaysae*), Tu'i Malila Vent Field, Lau Basin; courtesy Woods Hole Oceanographic Institution; bottom right: **Indian Ocean**: Lepadid barnacles, scaly-foot snails (*Chrysomallon squamiferum*), mussels (*Bathymodiolus aff. brevior*), Solitaire Vent Field, Central Indian Ridge; courtesy JAMSTEC.

Deep-Sea Ecosystems Off Mauritania

Research of Marine Biodiversity and Habitats in the Northwest African Margin

Editors: Ana Ramos, Fran Ramil, José Luis Sanz



- Presents an excellent comprehensive overview on the biodiversity and marine ecosystems, geomorphology and oceanography of the west African continental margins
- Unique mapping of the sea bottom, including new discoveries such as a giant coral carbonate mounds barrier, canyons and seamonts
- Serves as an important reference work for marine research in Northwest Africa including the fascinating waters of Mauritania

This book compiles the main findings of the multidisciplinary long-term research program developed in the continental margin of one of the more productive and unknown areas of the world oceans, Northwest Africa. The more than 25,000 preserved fishes and benthic invertebrates and quantitative data collected in 342 trawling stations, the 267 oceanographic profiles, the 211 sediment samples and the 28,122 km2 prospected by multi□beam echo sounding allowed to obtain an overview of the amazing biodiversity of the demersal and benthic fauna inhabiting soft- and hard-bottom habitats, as well as the fascinating geomorphology and oceanography, hidden in the Mauritanian slope.

Age and Growth of Blue Antimora *Antimora rostrata* (Moridae) in Southwestern Greenland Waters

A.M. Orlov, E.V. Vedishcheva, A.O. Trofimova, S.Yu. Orlova (2018)

Journal of Ichthyology 58 (2): 192-200

The results of determination of age and study on growth of blue antimora *Antimora rostrata* from the waters of Southwestern Greenland are presented. The results are based on the analysis of 200 fish otoliths. In the catches, we found specimens of antimora with total lengths of 18–70 cm, body weights of 23–2731 g, at the age of 7–38 years. Minimal age of males (not considering juvenile individuals) was 10 years at body length of 27–33 cm; maximal age was 18 years at 42 cm. Minimal age of females was 9 years at length of 21–27 cm; maximal age was 38 years at 70 cm. The rate of linear growth in blue antimora from Southwestern Greenland waters is comparable to that in the fish from New Zealand and Ross Sea waters but considerably lower than indicated earlier for fish from the waters of Iceland, Greenland, and the Mid-Atlantic Ridge. The age of reaching sexual maturity in males and females is preliminary determined as 15 and 19–20 years, respectively.

Link to paper: https://link.springer.com/article/10.1134/S0032945218020108

Growth and Age of the Roughhead Grenadier *Macrourus berglax* in Waters off Southwest Greenland

A.M. Orlov, E.V. Vedishcheva, A.O. Trofimova, and S.Yu. Orlova (2018)

Journal of Ichthyology 58 (3): (in press)

Data on the age and growth of the roughhead grenadier *Macrourus berglax* from waters off Southwest Greenland have been obtained based on the analysis of otholiths. Specimens with a preanal length of 5–39 cm, a weight of 7–5275 g, and age from 2 to 22 years are recorded in trawl catches. Roughhead grenadier exhibits a similar rate of linear growth in waters off Southwest Greenland and other parts of the range in the Northwest Atlantic. No considerable differences from the rate of the linear growth calculated earlier from scales for the species in waters off West Greenland have been found. In the recent period, the rate of weight gain in roughhead grenadier in waters off Southwest Greenland has been lower than in the Northwest Atlantic in the first half of the 1980s. The age of mass maturation in males (7–9 years) and females (16–17 years) in waters off West and East Greenland is somewhat higher than in coastal waters of Norway and the Northwest Atlantic.

Metabolic rates are significantly lower in abyssal Holothuroidea than in shallow-water Holothuroidea

A. Brown, C. Hauton, T. Stratmann, A. Sweetman, D. van Oevelen, D.O.B. Jones (2018)

Royal Society Open Science, 5: 172162

Recent analyses of metabolic rates in fishes, echinoderms, crustaceans and cephalopods have concluded that bathymetric declines in temperature- and mass-normalized metabolic rate do not result from resource-limitation

Figure 1. Sampling abyssal holothurian respiration rates in situ. (a) The Benthic Incubation Chamber System 3 (BICS3) mounted on the GEOMAR ROV elevator platform for deployment. (b) A holothurian specimen being collected from the sediment using the suction sampler of the GEOMAR ROV Kiel 6000. (c) Holothurian specimens placed in the respirometry chambers (15.38 l capacity) at 4,196.5m depth.

(e.g. oxygen or food/chemical energy), decreasing temperature or increasing hydrostatic pressure. Instead, based on contrasting bathymetric patterns reported in the metabolic rates of visual and nonvisual taxa, declining metabolic rate with depth is proposed to result from relaxation of selection for high locomotory capacity in visual predators as light diminishes. Here, we present metabolic rates of Holothuroidea, a non-visual benthic and benthopelagic echinoderm class, determined in situ at abyssal depths (greater than 4000m depth). Mean temperature- and mass-normalized metabolic rate did not differ significantly between shallow-water (less than 200m depth) and bathyal (200–4000m depth) holothurians, but was significantly lower in abyssal (greater than 4000m depth) holothurians than in shallow-water holothurians. These results support the dominance of the visual interactions hypothesis at bathyal depths, but indicate that ecological or evolutionary pressures other than biotic visual interactions contribute to bathymetric variation in holothurian metabolic rates. Multiple nonlinear regression assuming power or exponential models indicates that in situ hydrostatic pressure and/or food/chemical energy availability are responsible for variation in holothurian metabolic rates. Consequently, these results have implications for modelling deep-sea energetics and processes.

Link to paper: https://doi.org/10.1098/rsos.172162

Out of sight, but within reach: A global history of bottom-trawled deep-sea fisheries from >400 m depth

L. Victorero, L. Watling, M.L. Deng Palomares, C. Nouvian (2018)

Frontiers of Marine Science 5: 98

This historical perspective reveals that the extent and amount of deep-sea fish removed from the deep ocean exceeds previous estimates. This has significant implications for management, conservation and policy, as the economic importance of global bottom trawling is trivial, but the environmental damage imposed by this practice, is not.

Link to article: https://doi.org/10.3389/fmars.2018.00098

The black coral fauna (Cnidaria: Antipatharia) of Bermuda with new records

D. Wagner, A. Shuler (2017)

Zootaxa 4344 (2): 367-379

The black coral fauna of Bermudan waters is poorly known, in large part due to the logistical challenges of surveying deep-water (>50 m) environments where most species occur. In 2016, the Nekton Expedition sought to survey the deep-water biodiversity around Bermuda using manned submersibles and mixed-gas technical SCUBA. A total of 28 black coral specimens were collected, and these were examined based on skeletal spine morphology, polyp morphology, colony branching pattern and in situ photographs. The specimens were assigned to seven species in three families and four

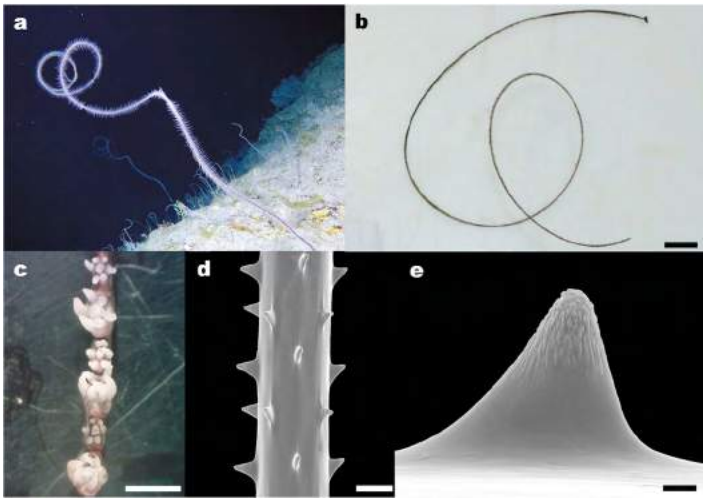


Figure 1. *Stichopathes pourtalesi* from Bermuda showing (a) colony *in situ*, (b) preserved specimen (scale bar= 2 cm), (c) polyps on terminal branch under light microscopy (scale bar= 2 mm), (d) skeletal spines on terminal branch under SEM (scale bar= 200 µm), and (e) close-up of polypar spine under SEM (scale bar= 20 µm).

genera, including (1) *Antipathes atlantica* Gray, 1857, (2) *Antipathes furcata* Gray, 1857, (3) *Stichopathes pourtalesi* Brook, 1889, (4) *Stichopathes* sp., (5) *Distichopathes filix* (Pourtales, 1867), (6) *Tanacetipathes hirta* (Gray, 1857), and (7) *Tanacetipathes tanacetum* (Pourtales, 1867). Of these, three species (*Stichopathes* sp., *S. pourtalesi*, and *D. filix*), one genus (*Distichopathes*) and one family (Aphanipathidae) are reported from Bermudan waters for the first time, thereby increasing the known black coral diversity of Bermuda to twelve species, five genera and four families. The diagnostic characters of the taxa identified as part of this study are illustrated and described.

Link to paper: https://doi.org/10.11646/zootaxa.4344.2.11

A Multidisciplinary Approach for Generating Globally Consistent Data on Mesophotic, Deep-Pelagic, and Bathyal Biological Communities

L.C. Woodall , D.A. Andradi-Brown, A.S. Brierley, M.R. Clark, D. Connelly, R.A. Hall, K.L. Howell, V.A.I. Huvenne, K. Linse, R.E. Ross, P. Snelgrove, P.V. Stefanoudis, T.T. Sutton, M. Taylor, T.F. Thornton, A.D. Rogers (2018)

Oceanography 31 (3)

Approaches to measuring marine biological parameters remain almost as diverse as the researchers who measure them. However, understanding the patterns of diversity in ocean life over different temporal and geographic scales requires consistent data and information on the potential environmental drivers. As a group of marine scientists from different disciplines, we suggest a formalized, consistent framework of 20 biological, chemical, physical, and socioeconomic parameters that we consider the most important for describing environmental and biological variability. We call our proposed framework the General Ocean Survey and Sampling Iterative Protocol (GOSSIP). We hope that this framework will establish a consistent approach to data collection, enabling further collaboration between marine scientists from different disciplines to advance knowledge of the ocean (deep-sea and mesophotic coral ecosystems).

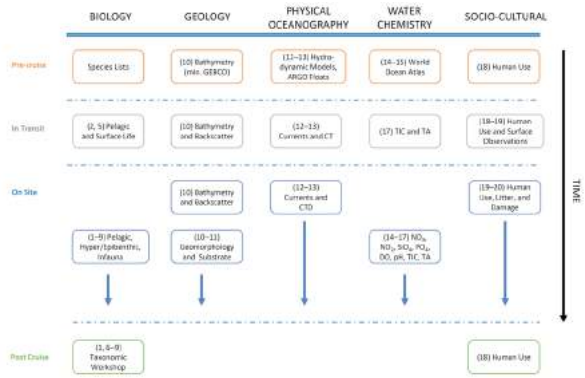


Figure 1. A flow diagram that reflects the timeline of when to conduct activities associated with parameters listed in Table 1 of the paper. Activities are grouped by discipline, a summary of the data collection is provided, and numbers relate to parameter identification numbers in Table 1.

Link to paper: https://doi.org/10.5670/oceanog.2018.301

NMDA receptor regulation is involved in the limitation of physiological tolerance to both low temperature and high hydrostatic pressure

Alastair Brown, Sven Thatje (2018)

Frontiers in Marine Science, 5: 93

Figure 1. NMDA receptor regulation may be involved in limitation of physiological tolerance to both low temperature and high hydrostatic pressure in marine invertebrates such as the lithodid crab *Lithodes maja*.

Polar and deep marine environments are physiologically challenging to invertebrates. Low temperature and high hydrostatic pressure both reduce the functionality of membranes, affect the function of macromolecules, and induce macromolecular damage, with diverse physiological consequences that have resulted in physiological adaptation among taxa inhabiting these environments. The similar molecular and cellular effects of, and adaptations to, low temperature and high hydrostatic pressure have prompted the hypothesis that a common mechanism underlies physiological tolerance to both factors (Brown and Thatje, 2014, 2015). The physiological concept of oxygen- and capacity-limited thermal tolerance describes a mechanism where temperature tolerance is constrained by the ability to supply sufficient oxygen to meet metabolic demand. Recent experimental evidence indicates that hyperbaric tolerance is oxygen- and capacity-limited, too. However, whether the same fundamental mechanism limits both temperature and hydrostatic pressure tolerance, and what that mechanism may be, remains uncertain. Here, we synthesize relevant literature focusing on reptant decapods, the invertebrate taxon with most thoroughly explored low temperature (<5°C) and high hydrostatic pressure (>5 MPa ≈ >500 m depth) tolerance, and identify a potential mechanism limiting tolerance of both environmental factors.

Link to paper: https://doi.org/10.3389/fmars.2018.00093

The State of Deep-Sea Coral and Sponge Ecosystems of the United States.

Tom F. Hourigan, Peter Etnoyer & Steve D. Cairns (2017)

NOAA Technical Memorandum NMFS-OHC-4. Silver Spring, MD. 467 p.

Over 50 authors contributed to the report, which includes an introduction, chapters on each U.S. region, and spotlight chapters highlighting advances on specific scientific topics related to these ecosystems. Each chapter and species list was independently peer-reviewed, and we are grateful to the more than 40 reviewers from the deep-sea community who helped in this project. The report will primarily reside on-line, however we will be printing a limited number of hard copies. Our plan is for the online deep-sea coral species lists to be updated on an annual basis. We are also hoping to add lists of deep-sea sponges in the future.

A few highlights of the Report

- The first comprehensive inventory of deep-sea coral diversity in U.S. waters, revealing 662 species of deep-water corals, including 62 new species discovered from 2007-2016.
- The first summary of information on U.S. deep-sea sponge ecosystems.

- New deep-sea coral “gardens” discovered in every U.S. region, especially Alaska, where new evidence points to their role as habitat for fisheries of national and international importance.
- New exploration and research of previously unexplored U.S. Pacific Island slopes, oceanic ridges, and seamounts.
- A summary of deep-sea coral damage assessments and management responses after the Deepwater Horizon oil spill.
- Development and use of habitat models that were used in designating protection for 38,000 square miles of Northeast U.S. deep-sea habitats.
- Enhanced protection in the Southeast U.S. across areas containing the largest concentration of deep-sea coral reefs in the U.S.
- Expansion of National Marine Sanctuaries along the West Coast and establishment of the first Marine National Monument in the U.S. Atlantic.
- A conservation status and threat analysis for U.S. deep-sea coral and sponge ecosystems reveals progress in conservation over the last decade and potential implications of emerging industries such as deep-sea mining.

The complete report as well as links to individual chapters and the independently citable online deep-sea coral species lists (Regional lists and the first comprehensive U.S. species list) can be found here:

https://deepseacoraldata.noaa.gov/library/2017-state-of-deep-sea-corals-report

Here’s a short web story, which also has the links.

Variability in hydrostatic pressure tolerance between *Palaemon* species: Implications for insights into the colonisation of the deep sea

Lorenzo Pallareti, Alastair Brown, Sven Thatje (2018)

Journal of Experimental Marine Biology and Ecology, 503: 66-71

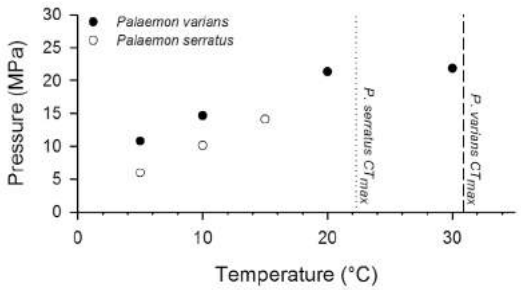


Figure 1. Hydrostatic pressure tolerance was significantly lower in *P. serratus* than in *P. varians*, but the effect of temperature on hydrostatic pressure tolerance was consistent among species: CPmax decreased with decreasing temperature.

Experimental approaches to assess whether shallow-water benthic invertebrates can extend bathymetric ranges in response to changing climate have focused on the developing ecophysiological model *Palaemon varians*. However, *P. varians* may not be representative of other shallow-water shrimp species: this species inhabits the highly variable salt marsh environment and is eurythermal, euryhaline, and euryoxic. Inferences concerning the capacity of an ancestral species to directly colonise the deep sea have therefore been regarded with caution. We provide evidence that acute thermal and hyperbaric tolerance in the intertidal and subtidal shrimp *Palaemon serratus* are lower than in the salt marsh and brackish-water shrimp *P. varians*, suggesting that adaptation to differing habitats has resulted in differing physiological tolerance to acute stress conditions. Nonetheless, hyperbaric tolerance in *P. serratus* supports the proposition that the common ancestor of these species may have possessed the physiological capability to colonise bathyal depths. The consistent interaction between temperature and hydrostatic pressure tolerance in these species supports the suggestion that shallow-water

species may have the capacity to deepen bathymetric distribution in response to ocean warming.

Link to paper: https://doi.org/10.1016/j.jembe.2018.02.011

Review on the Phylogeography of Potentially Chemoautotrophic Bacteria from Major Vent and Seep Fauna and Their Contribution to Primary Production

Tresa Remya A. Thomas, Anindita Das & Loka Bharathi Ponnapakkam Adikesavan (2018)

Geomicrobiology Journal, 35:7, 612-634

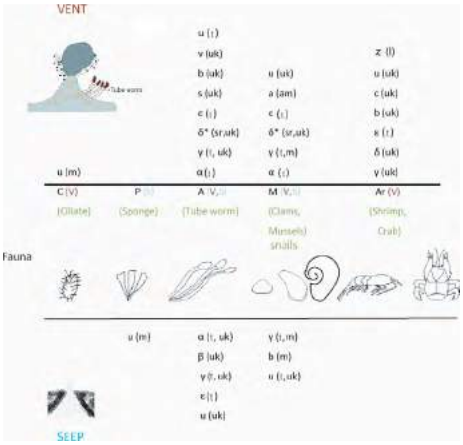


Figure 1. Potential chemoautotrophic bacterial associates of vent and seep fauna and their functions.
V-Vent, S-Seep, C-Ciliophora, P-Porifera, A-Annelida, M-Mollusca, Ar-Arthropoda, α, β, γ, δ, ε, z (Proteobacteria), a-Actinobacteria, b-Bacteroidetes, s-Spirochete, v-Verrucomicrobia, u-Unidentified, t-Thiotroph, sr-Sulfate reducer, m-Methanotroph, am-Ammonia oxidizer, uk-unknown function. Though δ-Proteobacteria are sulfate reducers, some of them are known for anaerobic methane oxidation in consortia. Yet in others, the function is still unknown.

Though geochemically and microbially well-defined, the phylogeographic data of microbial symbionts in these highly productive vent and seep systems require a closer examination and synthesis. QIIME analysis of 16S rDNA of bacterial associates of major fauna from 1995 to 2015 was thus undertaken to examine phylogeography of their microbial symbionts along with host specificity. While phylotypes were generally unrelated, bivalve *Calyptogena* exhibited vertical transmission sharing similar symbionts in geographically separated geosystems. Different species of tubeworms possessed identical symbionts through horizontal acquisition at geographically distinct Guaymas basin vent and the Arctic seep. Vents were more versatile with both mobile and sessile fauna hosting ecto- and endo-symbionts. Comparatively, seeps were more specialized with sessile animal hosts with endosymbionts. C-fixation rate measurements are still scanty for sediments, bedrocks and serpentine systems; vent, seep, anoxic and oxic basins were shown to fix up to 22, 325, 96, and 37,400 g C m^{-3} y^{-1}, respectively. Estimation of chemosynthetic primary production rates in chemoautotrophic ecosystems could endeavor to improve existing biogeographic models by coupling volcanism and plate-tectonics to global climate and phylogeography.

Link to paper: https://www.tandfonline.com/doi/full/10.1080/01490451.2018.1440035

Food quantity and quality in Barkley Canyon (NE Pacific) and its influence on macroinfaunal community structure

Neus Campanyà-Llovet, Paul V.R. Snelgrove & Fabio C. De Leo

Progress in Oceanography (In Press)

The highly heterogeneous nature of submarine canyon physical landscapes can influence organic matter spatial distribution and thus benthic community and food web structure. We therefore studied patterns in quantity and quality (i.e., nutritional value for benthic organisms) of sediment and bottom-water particulate organic matter and their influence on macroinfaunal community structure in Barkley Canyon (NE Pacific) at multiple spatial scales (10s to 100s of meters). At large scales (100s of meters), we hypothesised that canyon heterogeneity would drive organic matter patterns: topographic features (slope, aspect, curvature, rugosity, and benthic positioning index) and

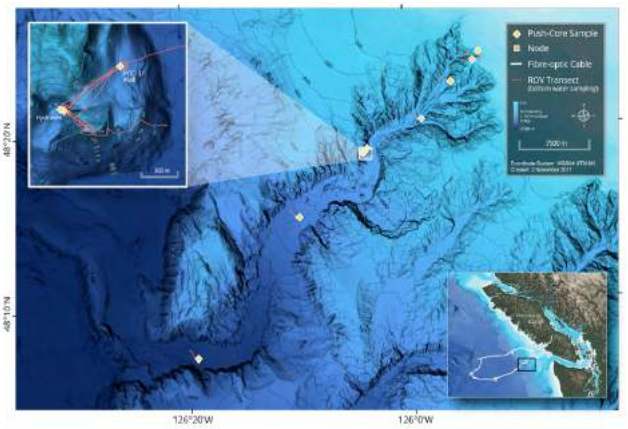


Figure 1. Location of Barkley Canyon (NE Pacific) and sampling sites.

other environmental variables (depth, dissolved oxygen concentration, surface primary productivity, and sediment type). Our multivariate distLM analysis identified mean grain size, surface primary productivity and benthic positioning index (concave/convex seafloor topography) as the primary drivers of organic distribution in sediments. Noting different degradation rates among food variables, we inferred that the freshest organic matter reaches bottom waters of Barkley Canyon at 400 m, where ambient currents at the canyon head region likely concentrate primary productivity from surface waters. Evidence of deposition (increased amounts of fresh food) first appeared at 600 – 800 m, coincident with finer sediments, convex topography, and convergence of canyon branches. Degraded organic matter accumulated at 1500 and 2000 m where the comparatively fine sediments adsorb a greater proportion of available organic material than at shallower depths but limited delivery of surface primary productivity reduces overall food quality. Despite clear differences in food quantity and quality among sites (100s of m apart), dissolved oxygen primarily drove macrofaunal distribution, along with hydrocarbons, indicative of a chemosynthetic ecosystem. At smaller spatial scales (10 s of meters) we found greater food patchiness associated with the topographically complex upper canyon (≤ 800 m). We also found distinct communities at smaller spatial scales (10 s of m apart) at 200 m, where fatty acid biomarkers distinguished a food patch rich in zooplankton. Overall, canyon heterogeneity rather than depth primarily determines patterns of organic matter (quantity and quality) in Barkley Canyon, with greater food patchiness at sites ≤ 800 m depth. Organic matter distribution appears to influence macroinfaunal community structure more strongly at smaller spatial scales in contrast to major stressors (i.e., oxygen) that act over larger scales.

Link to paper: https://www.sciencedirect.com/science/article/pii/S0079661117301842?via%3Dihub

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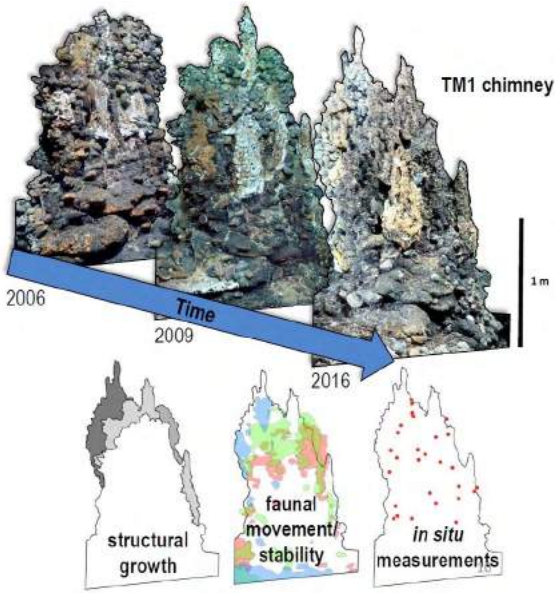
Long-Term Stability of Back-Arc Basin Hydrothermal Vents

Cherisse Du Preez & Charles R. Fisher (2018)

Frontiers Marine Science 5:54



Since the discovery of hydrothermal vents 40-years ago, long-term time-series have focused on mid-ocean ridge systems. Based on these studies, hydrothermal vents are widely considered to be dynamic, ephemeral habitats. Under this premise, national, and international regulatory bodies are currently planning for the commercial mining of polymetallic sulfide deposits from hydrothermal vents. However, here we provide evidence of longevity and habitat stability that does not align with historic generalizations. Over a 10-year time-series focused on the back-arc basin systems off the west coast of the Kingdom of Tonga (South Pacific), we find the hydrothermal vents are remarkably stable habitats. Using high-resolution photo mosaics and spatially explicit in situ measurements to document natural changes

Figure 1: Zoom in of high-resolution photo mosaics. Image credit: Cherisse Du Preez & Chuck Fisher (Schmidt Ocean Insitute/Canadian Scientific Submersible Facility).

of five hydrothermal vent edifices, we discovered striking stability in the vent structures themselves, as well as in the composition and coverage of the vent-associated species, with some evidence of microdistribution permanence. These findings challenge the way we think about hydrothermal vent ecosystems and their vulnerability and resilience to deep-sea mining activities.

Link to paper: https://www.frontiersin.org/articles/10.3389/fmars.2018.00054/full

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Both rare and common species make unique contributions to functional diversity in an ecosystem unaffected by human activities

Chapman ASA, Tunnicliffe V, Bates AE. (2018)

Diversity and Distribution 2018, 24:568–578

Aim: Rare species typically contribute more to functional diversity than common species. However, humans have altered the occupancy and abundance patterns of many species—the basis upon which we define "rarity." Here, we use a globally unique dataset from hydrothermal vents—an untouched ecosystem—to test whether rare species over-contribute to functional diversity.

Location: Juan de Fuca Ridge hydrothermal vent fields, Northeast Pacific Ocean.

Methods: We first conduct a comprehensive review to set up expectations for the relative contributions of rare and common species to functional diversity. We then quantify the rarity and commonness of 37 vent species with relevant trait information to assess the relationship between rarity and functional distinctiveness—a measure of the uniqueness of the traits of a species relative to traits of coexisting species. Next, we randomly assemble communities to test whether rare species over-contribute to functional diversity in artificial assemblages ranging in species richness. Then, we test whether biotic interactions influence functional diversity contributions by comparing the observed contribution of each species to a null expectation. Finally, we identify traits driving functional distinctiveness using a distance-based redundancy analysis.

Results: Across functional diversity metrics and species richness levels, we find that both rare and common species can contribute functional uniqueness. Some species always offer unique trait combinations, and these species host bacterial symbionts and provide habitat complexity. Moreover, we find that contributions of species to functional diversity may be influenced by biotic interactions.

Main conclusions: Our findings show that many common species make persistent, unique contributions to functional diversity. Thus, it is key to consider whether the abundance and occupancy of species have been reduced, relative to historical baselines, when interpreting the contributions of rare species to functional diversity. Our work highlights the importance of testing ecological theory in ecosystems unaffected by human activities for the conservation of biodiversity.

Link to paper: https://onlinelibrary.wiley.com/doi/full/10.1111/ddi.12712

Exploration before exploitation (editorial)

Cordes EE, Levin LA. (2018)

Science 359: 719

The current U.S. administration has proposed to open up 90% of the U.S. continental shelf to oil and gas drilling as part of a new Bureau of Ocean Energy Management Draft Proposed Program. Although there is a clear need to move beyond fossil fuels for America's energy needs and energy security, there are also a number of immediate existential threats posed by an increase in offshore drilling.

Link to editorial: http://science.sciencemag.org/content/359/6377/719.full

Obituaries

John Brodie Wilson

1938-2017

Pioneering marine geologist and biologist whose manned submersible dives illuminated the cold water corals of UK western shelf.

Figure 1. Photo by André Freiwald taken in 1997 aboard ship, with his beloved coral.

John was a marine scientist who worked on the boundary between geology and biology by studying modern shelf sea environments, how these control the distribution of organisms living there and how these organisms became preserved in the fossil record. More specifically he focused on those with calcareous skeletons such as molluscs and corals, their ecology and taphonomy, and how they contributed to the production of calcareous sediment on the UK shelf.

Born and educated in Edinburgh, John obtained a first class honours degree from Edinburgh University. After a year at Caltech he continued at Edinburgh with a PhD studying how bivalve molluscs became preserved in the intertidal sediments of the Solway Firth. Using an 'actuopalaeontological' (Aktuopaläontologie) approach, being promoted at that time by German workers such as W Schäfer, he was able to demonstrate the differences between shell beds formed on tidal flat surfaces and those on the floors of tidal channels and how different bivalve species were preferentially preserved in these sediments.

IOS & classic papers

Following his PhD in 1965, John obtained a lectureship for four to five years at Aberdeen before beginning his productive career at the Institute of Oceanographic Sciences (IOS), near Godalming, Surrey. Here he joined an active research group who were making major advances in the hydrography, sedimentology, and ecology of the UK's shelf seas using innovative equipment such as side-scan sonar. At IOS John was one of the first to use manned submersibles to study deep-water coral reefs or thickets in waters 200-300m down off the western shelf of the British Isles. This work led to a number of classic papers and his major contribution to our science. Fortunately, the videos and commentaries of some of his 1973 dives have been saved by colleagues working with the British Film Institute and can be viewed at http://www.lophelia.org/case-studies/pisces-and-rockall-bank/pisces-videos.

In these pioneering submersible dives John made critical observations on how cold-water coral patches formed by Lophelia pertusa developed to form coral rings; large colonies expanding out from existing small fragments of hard substrate. Today, referred to as 'Wilson rings', the environmental controls on these formations are still of research interest. Working in the cramped conditions in Pisces submersibles John's keen eye and observational skills were the vital ingredients that laid foundations for work on cold-water corals that has been growing exponentially since the late 1990s.

Royal Holloway

With the closure of the IOS at Godalming in 1995 John moved to an Honorary Research Fellowship at Royal Holloway University of London where he carried out research on material collected during his many IOS cruises and assisted with teaching and PhD research supervision. A fortuitous meeting with André Freiwald led to fruitful collaboration on Lophelia reefs and thickets - most notably, the extensive Sula reef on the Norwegian shelf.

Throughout his career John was always the most enthusiastic and supportive colleague and mentor. This enthusiasm

for his subject was infectious and no one who worked alongside John at sea or back in the lab will forget the passion he brought to his work and his sheer joy at seeing something new or unexpected for the first time.

Outside his passion for his subject John was an avid collector of militaria, memorabilia from the White Star Line and the Titanic (his father was a nautical engineer who transferred skills to build an oil refinery for the Burma Oil Company). John is survived by his wife Leta, his two sons, Angus and Bruce, and by three grandchildren Jonathon, Hannah and Chloe.

By Dan Bosence and Murray Roberts with assistance from Leta Wilson. Photo by André Freiwald. Previously published on www.geolsoc.org.uk

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Heiko Sahling

19 March 1969 – 23 April 2018

IN MEMORIAM

It is with profound sorrow that we must announce that Heiko Sahling, our much-loved colleague, has passed away. He fought his disease for a long time, and with great courage and dignity.

Despite the fact that for many years, the main area of Heiko's scientific activity was geochemistry, for us deep-sea biologists, Heiko always was a colleague-biologist, bright, and outstandingly talented. His deep biological knowledge, together with his understanding of geochemical processes, resulted in studies that have already become classics in the biology of chemosynthesis-based communities.

Many people in our lab had happy partnerships with Heiko - some were involved in joint projects, others worked together at sea, and they will all always remember his friendliness and readiness to help, and his absolute reliability.

Heiko was a very "marine" person in many ways. He was born in Helgoland, he studied marine life, he loved the sea and to be at sea. His great contributions to deep-sea biology will be remembered by his colleagues, and will be stimulating for generations of oceanographers to come.

By Elena Krylova and colleagues from the Laboratory of Ocean Benthic Fauna, P.P. Shirshov Institute of Oceanology

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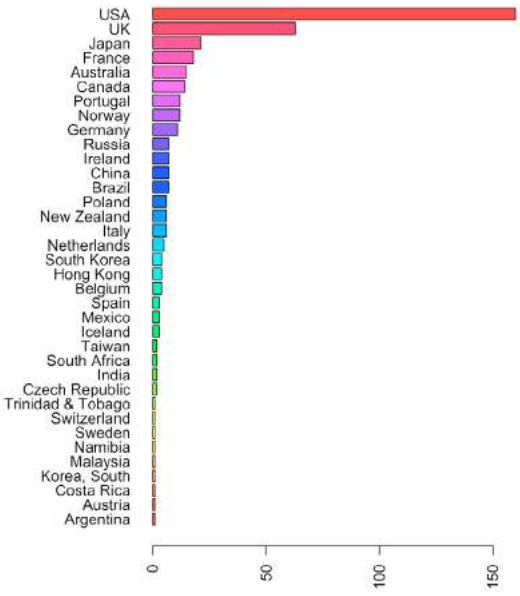
Deep-Sea Biology Society Business

President's Letter, June 2018

Dear Deep-Sea Biology Colleagues,

I am delighted to report to you that since my last President's Letter in January the membership of our Society has increased by a staggering 126% to a total of 415 members (57% females, 31% students) from 36 countries (including 10 developing countries). The more politically-minded President might retire gracefully at this point, before disaster befalls. But the more observant amongst you will have noted that this excellent news is not down to me campaigning across the lands but the rather more simple process of linking membership to registration for the most important meeting of the year: the 15th Deep-Sea Biology Symposium to be held in Monterey, California from 9-14 September. Nevertheless, this marks a very important moment for the Society - the first complete integration of membership into the triennial Symposium which we hope will bring membership and the benefits of membership to a much wider audience.



ADRIAN/PARIS - caption needed

Our VP for Conferences, Steve Haddock, will have more to say on the Symposium later in this issue of Deep-Sea Life. The most important thing to note is that although the deadline for talk and poster abstracts has passed, anyone can still register to attend the meeting up until 24 August. We are incredibly grateful for the effort Steve and the local organising team in Monterey have made so far in preparations for the conference, which is already on track to be the largest ever meeting of its kind.

Over the last 6 months, the Society has been active in many areas. All of the work undertaken by the Society Officers and Trustees is on a completely voluntary basis, and all of us should be very grateful for the efforts they have undertaken. Alongside the support to the forthcoming 15th DSBS, we have been delivering our Awards that help to re-distribute Society funds to students and early-career researchers (thank you Rachel Jeffreys), communicating and supporting Students alongside planning Student events at the next Symposium (thank you Paris Stefanoudis), launching a new mentoring network (thank you again Rachel), organising all our meetings, minuting them and re-activating our web and social media feeds (thank you Diva Amon and Paris), re-organising our membership system to comply with Data Protection law and linking membership to the Symposium (thank you Santiago Herrera and Steve Haddock), re-launching the Deep-Sea Life newsletter with sponsorship from the Society (thank you Maria Baker and Paris) and keeping an expert eye on, and handling, our Finances and legal requirements (thank you Chris Yesson).

Throughout this process, our 'non-executive' Trustees of the Society - those that sit on the main bi-monthly DSBS committee meeting and have voting rights but not a distinct portfolio, have been keeping a watchful eye on our activities and providing much useful contribution. We are especially grateful to Malcolm Clark, Craig McClain, Moriaki Yasuhara, Rachel Boschen, Erin Easton and Paul Snelgrove for this.

This brings me neatly to perhaps the most important point I want to make in this letter. At the 15th DSBS, all of the positions for Officers and Trustees will be up for re-election. There is thus an opportunity for any member of the Society to stand for one of these positions and help shape the future of the Society and the work of all deep-sea biologists. Later in this issue of Deep-Sea Life, and also concurrently posted on the DSBS website, will be descriptions of all the positions available.

Why apply for an unpaid position in a Society when you are already extremely busy? I think that for most of us, being part of a global, communicating and collaborating community of researchers and educators in a discipline that we love is a fairly important thing. But communities do not form without some work - communication channels, meetings,

workshops, mentoring and financial support for those that need it. Above all, our community must be open. Deep-Sea Biology, perhaps more than most disciplines, has been a 'Rich Man's Game' - quite literally - for most of its existence. One of the founding goals of the Society was to try to overcome that - creating networks and sources of funding to improve demographic diversity and open-up the resources and cliques of the traditional players. There is still a long way to go. But we are making progress.

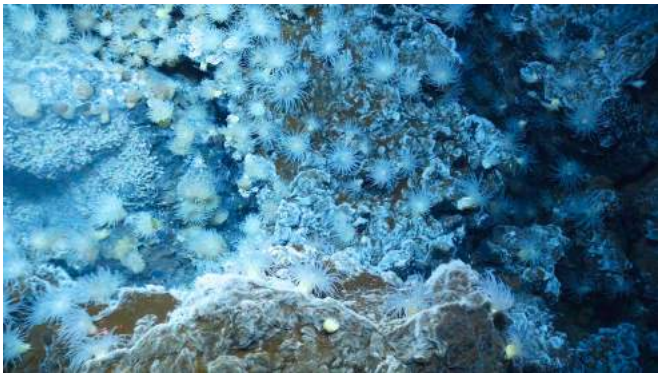


Figure1: Hydrothermal vent fauna in the Cayman Trough. Image credit: Jon Copley , University of Southampton / Natural Environment Research Council

We are not yet a large enough Society to sponsor expeditions or pay salaries. But we can now make a difference. This year, we have been able to make twelve travel awards (more than ever before) to the 15th DSBS in Monterey that we hope will play a small, but important part in this process. With rapidly-growing membership, we can increase our financial turnover, but perhaps most importantly, start to gain recognition on a global basis as an organisation supporting the education and careers of all those interested in deep-sea biology and conservation. With this will come opportunities to further diversify and grow income to support the work of all deep-sea biologists.

Some of the Society Officers will report back in this issue of Deep-Sea Life on aspects of work in the Society. For those of you reading this as an email, you will be able to download Deep-Sea Life from the website or read articles directly on there. Most importantly, the date to remember for your diaries is not just the 9-14 September, but in fact the evening of the 12th September, mid-week at the 15th DSBS, when we will have the second Annual General Meeting of the Deep-Sea Biology Society. All members are invited, and although there is important business to attend to, we promise to make it fun as well.

Adrian Glover, President
a.glover@nhm.ac.uk

Annual General Meeting and Nominations for Officers and Trustees of the Society

Notification of the 2018 Annual General Meeting (AGM) of the Deep-Sea Biology Society. The 2018 AGM will be held at 6.30pm on 12th September 2018 during the 15th Deep-Sea Biology Symposium at the Monterey Conference Centre, 1 Portola Plaza, Monterey, CA 93940, USA. An agenda will be circulated to all members.

The AGM will include reports from the Officers, Nominations and Voting for Officers and Trustees of the Deep-Sea Biology Society, and a social event.

There are 15 positions on the board of Officers and Trustees of the Deep-Sea Biology Society. 14 of these are currently filled, and all positions are up for election at the AGM 2018. We would like to encourage all members interested to consider standing for a position. These are important roles that will help to shape the future of deep-sea biology research, education and professional development.

The procedure is that nominations must be sent directly to the current Secretary, Dr Diva Amon (divaamon@gmail.com) **by 31 July 2018.** Each nomination should include the candidate's written agreement (email is acceptable) for nomination and a short statement (less than 200 words) describing their interest in the position.

Positions open for nominations (closing 31 July 2018):

Executive (Officer) roles:

President. From the constitution: 'The President shall be the principal officer of the DSBS and shall in general supervise and have charge of all of the affairs of the DSBS pursuant to the direction and oversight of the trustees.' In less formal terms, the main duties of the President are providing leadership and a strategic direction for the Society, chairing Trustee Meetings and the AGM, and writing the President's Letter twice per year.

Secretary. From the constitution: 'The Secretary shall record the minutes of all meetings of the Trustees and membership meetings; maintain such minutes…see that all notices are duly given in accordance with the provisions of the Constitution of the CIO or as required by law…'. In less formal terms, the Secretary is a vital voting member of the Trustees that not only is responsible for arranging and minuting meetings but also that the Society is following the Law under our status as a Charitable Incorporated Organisation (CIO).

Treasurer. From the constitution: 'The Treasurer shall exercise oversight over all financial business, including funds and securities of the CIO…'. In less formal terms, the Treasurer is a key role with oversight and administration of all financial matters.

Membership Secretary and Data Protection Officer. From the constitution: 'The Membership Secretary shall oversee every aspect of the membership process including but not limited to: approve, or in special cases present to the trustees, qualifications for membership; ensure members pay membership fees…'. In less formal terms, the Membership Secretary will be mainly responsible for all membership issues including administration of the Society membership software (a web platform called Wild Apricot). The role has been expanded to include the position of Data Protection Officer, which is in charge of ensuring that the society applies laws protecting individuals' personal data.

Vice President for Conferences. From the constitution: 'The Vice President for Conferences shall oversee the planning, funding, and hosting of the triennial Deep-Sea Biology meeting. The Vice President of Conferences should be from the institution and/or geographic locality of the meeting. The Vice President of Conferences may call committees to accomplish specific tasks as related to the meeting.' In less formal terms, the VP Conferences is responsible for ensuring that the Deep-Sea Biology Symposium takes place and would be the lead of the Local Organising Committee (LOC) of that Symposium, providing a link between the Society, its Trustees, Membership and the LOC. **This position is not open for nominations except via submission of a bid to host the 16th Deep-Sea Biology Symposium.**

*Vice President for Award*s. From the constitution: 'Vice President for Awards shall oversee the process for nomination, judging, and awarding of travel awards, student awards, honorary memberships, and other awards.'

Vice President for Public Affairs and Communication. From the constitution: 'Vice President for Public Affairs and Communications shall oversee the creation and maintenance of the society's website, social media, press releases, and other public statements on behalf of the society...They will develop and maintain a social media strategy as approved by the Trustees.' In less formal terms, the VP Public Affairs and Communication is responsible for the website, social media presence and contributions to the Deep-Sea Life Newsletter.

Vice President for Development. From the constitution: 'Vice President for Development shall support the financial development of the Society by supporting charitable giving to the Society including endowments, grants and links to philanthropic organisations.'.

Early-Career Officer. From the constitution: 'The Early-Career Officer shall represent the Early-Career Researcher interests of the Society in all trustees meetings. The Representative will assist with the Societies mission to further the professional development of Early-Career Researchers e.g. through mentoring programs and awards, as well as facilitate communication to Early-Career Researchers within and beyond the Society, and support the demographic diversity of the Early-Career membership of the Society'. Early-Career is defined as post-PhD but pre-tenure, or equivalent permanent position.

Student Officer. From the constitution: 'The Student Officer shall represent the student interests of the Society in all trustees meetings. The Student Representative will assist with the process of awards for student accomplishment at the Deep-Sea Biology Symposium, facilitate communication with student members about opportunities within and beyond the Society, will act to support the demographic diversity of the student membership of the Society'.

Non-executive (Trustee) roles:

Past-President. From the constitution: 'The Past-President shall assist the President as needed, and provide continuity to the trustees.

Trustees without designated roles. From the constitution: 'There are a maximum of 4 additional Trustees without designated roles. These trustees will support the charity with specific roles and cast votes on issues requiring Trustee

support.'. In less formal terms, these important positions are there to provide guidance, voting and oversight of the Executive Officers.

Society Web and Social Media Communication

In anticipation of the XVth Deep-Sea Biology Symposium, we have created a public Slack team for the Deep-Sea Biology Society. If you haven't used slack, it is a like a hybrid between facebook and email, where you can post messages and reactions - only a lot more efficient than an email list.
To join the team, follow this link: http://j.mp/deepslack

Some recommendations:

- Create a screen name that is similar to your real name (not your favorite organism) so others can tell who is posting.
- It is more efficient if you install the slack apps on your computer and even your phone, to make posting and reading messages easier.

We will share information for the conference on the slack team, as well as other opportunities and news related to deep-sea research in general.

Having re-activated our web and social media feeds, we now have regular updates and blog posts on the Society's webpage. You can see some recent blog posts from the Society's 2018 awardees here. Following the integration between the Deep-Sea Biology Society and communication aspects of INDEEP, Deep-Sea Life (DSL) news pieces will be featured on the DSBS website and social media feeds in the weeks following the release of a new DSL issue.

Acknowledging the limited funds available to conduct marine biological research, we now also provide information on external funding opportunities. You can find that information here. We plan to keep updating the list so that it becomes a valuable online source for deep-sea biologists seeking for funding, thus we welcome any contributions from you (please email Paris Stefanoudis at pstefa@windowslive.com).

Finally, we witnessed a staggering 25% increase of our Twitter followers over the last six months, which now stand at ~2,100. We are committed to strengthen our social media presence in the coming months even more, so as to ensure that we stay connected with the growing community of deep-sea biologist around the world. You can follow us here.