Deep-Sea Life

Issue 2, October 2013

Welcome to issue 2

Welcome to the second edition of Deep-Sea Life: a new informal publication for the deep-sea biology community. I hope you enjoy browsing this latest information from your fellow colleagues concerning their current projects, new papers, meetings and workshops, cruises and so on.

In the next issue, we wish to start a new effort – as suggested by Yoshihiro Fujiwara (JAMSTEC, Japan) – called "Photo of the Issue"! The winning submission will adorn our front page. For this issue, Yoshi has provided us with a beautiful image to get the ball rolling. Thanks Yoshi!

Other notable changes for this issue are that the Student Profiles section has changed to the Scientist Profiles section (I hope for further staff submissions for this section next issue) and we now have a "Wanted" section on the final page.

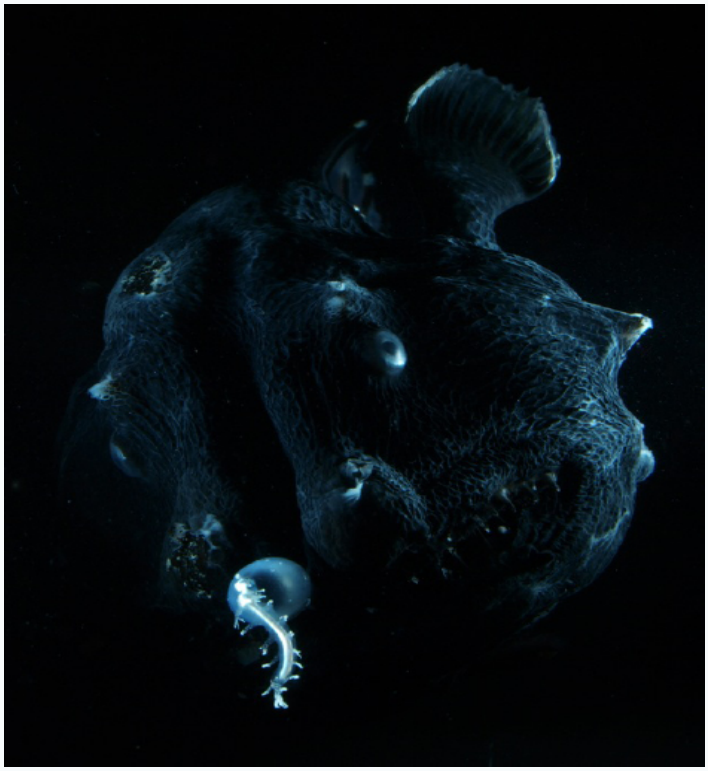
I had wonderful (and extensive!) feedback following the publication of DSL issue 1 and it certainly gave me the impetus to continue with this venture. Thank you. I will always appreciate any feedback regarding any aspect of the publication, so that it may be improved as we go forward. Might I ask please that you send comments only to me – rather than bothering the wider community!

Please circulate this issue to your colleagues and students who I have not reached as yet, and have them contact me if they wish to be placed on the mailing list for this publication in future.

I would like to sincerely thank all those that have contributed to this second issue. And of course, thanks once again to Dr Abigail Pattenden (University of Limerick, Ireland) and Dr Eva Ramirez-Llodra (ICM-CSIC, Spain but on the move shortly - see page 43) for their invaluable help with production.

Dr Maria Baker (Editor)

INDEEP Project Manager
University of Southampton
National Oceanography Centre, Southampton, UK



Anglerfish (Linophryne sp.- italics) lure prey with a luminescent lobe attached to a rod arising from the snout and hanging in front of the mouth. This robust individual is female, and a tiny male is attached to her side. Their blood circulatory systems will eventually fuse. This specimen was caught via plankton net in Sagami Bay in 2009. Courtesy of Yoshihiro Fujiwara/JAMSTEC

Issue Contents

Hot off the Press

Biogeography of the Arctic Ocean

Mironov A.N., Gebruk A.V. and Dando P.R. (Editors)

Invertebrate Zoology 10 (1)

In the present thematic issue of the journal Invertebrate Zoology (Moscow) various aspects of biogeogrpahy of the Arctic Ocean are considered, including biogeographical regionalization, scenarios of colonization of the basin, depth-related speciation, patterns of faunal changes in areas of overlap of Arctic and boreal faunas, etc. Over the last 3 million years the marine biota of the Arctic Ocean has changed, influenced by dramatic environmental fluctuations. During periods of glaciation, the biota was strongly depressed, geographical and bathymetric species ranges changed and some species vanished. During periods of warming and transgression, the Arctic biota was strongly supplemented by invaders from the Atlantic and Pacific Oceans.

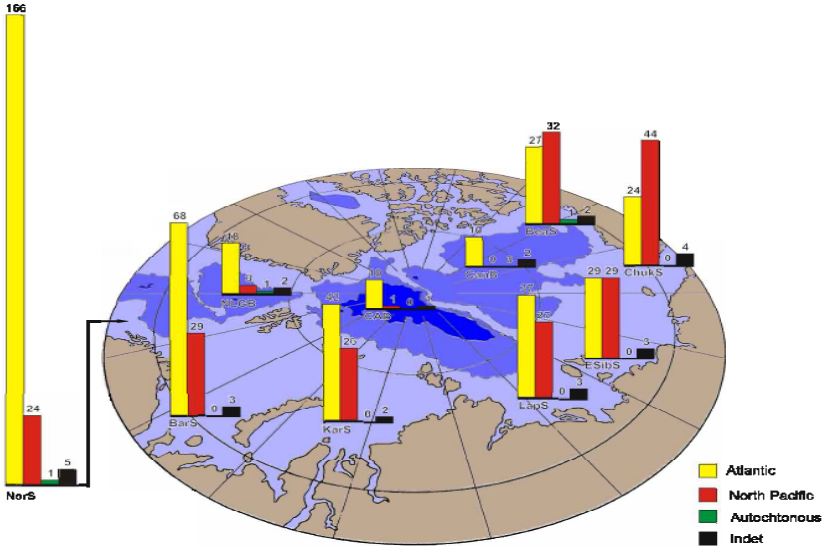


Figure 1: Number of species of Bivalvia of different origin in various Arctic regions.

Attempts to estimate the scale of changes of the Arctic biota have been made for more than a hundred years. Publications have mainly focused on the presence of pre-Pliocene elements in the modern Arctic biota, the ratio of biota of North-Atlantic and North-Pacific origin in the modern Arctic biota, the dispersal of the Arctic fauna along the depth gradient and the role of Arctic depths as a refuge for shallow-water fauna and the biogeographical regionalization of the Arctic Ocean. Previously published data and the original results, all indicate a rapid reaction of the benthic fauna to fluctuations in the environment of the Arctic Ocean. Global changes of biota in the post-glacial Arctic Ocean occurred over a very short geological time scale. The Arctic biota provides a rare opportunity to study large-scale marine ecosystems at early stages of evolution.

Link to paper: http://www.nature.air.ru/invertebrates/

Is there a link between deep-sea biodiversity and ecosystem function?

Daniel Leduc, Ashley Rowden, Conrad, Elizabeth Maas and P. Keith Probert (2013)

Marine Ecology 34: 334–344

Studying the diversity-ecosystem function relationship in the deep sea is of primary importance in the face of biodiversity loss and for our understanding of how the deep sea functions. Results from the first study of diversity-ecosystem function relationships in the deep sea (Danovaro et al. 2008; Current Biology, 18, 1–8) are unexpected and show an exponential relationship between deep-sea nematode diversity and ecosystem function and efficiency, although this relationship appears largely restricted to relatively low diversities [ES(51) <25]. Here, we investigate the relationship between

Figure 1: Desmoscolecid nematode from NZ's upper continental slope. Courtesy of Daniel Leduc

nematode diversity and several independent measures/proxies of ecosystem function (sediment community oxygen consumption, bacterial biomass, bacterial extracellular enzyme activity) and efficiency (ratio of bacterial/nematode carbon to organic C content of the sediment) on the New Zealand continental slope. Nematode diversity at our study sites was relatively high [ES(51) = 30–42], and there was no relationship between species/functional diversity and ecosystem function/efficiency after accounting for the effects of water depth and food availability. Our results are consistent with a breakdown of the exponential diversity-function relationship at high levels of diversity, which may be due to increased competition or greater functional redundancy. Future studies need to take into account as many environmental factors and as wide a range of diversities as possible to provide further insights into the diversity-ecosystem function relationship in the largest ecosystem on Earth.

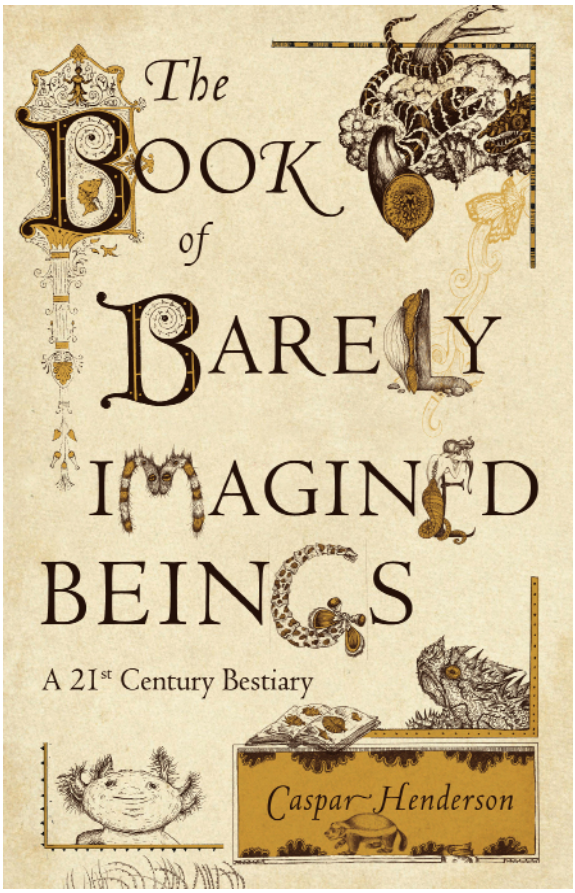
Link to the paper: http://onlinelibrary.wiley.com/doi/10.1111/maec.12019/abstract

The Book of Barely Imagined Beings

Caspar Henderson

Granta (UK), Chicago University Press (US)
£25 (hardback), £10.99 (paperback) $29 (US hardback)

We don't have to invent animals such as the unicorn or the manticore to encounter the surreal, the weird and the wonderful. From the *Gonodactylus*, a crustacean the size of a gherkin with appendages which look like genitals but can smash your arm, to the *Quetzalcoatlus*, a flying lizard as big as a Spitfire, our world has produced creatures that are more astonishing than we could ever have dreamed. Caspar Henderson uncovers the beauty and bizarreness of a host of barely imagined beings in a series of essays and meditations on human imagination, and our capabilities and responsibilities in a time of rapid change.



Described by The Guardian as «Spell-binding, brilliantly executed, extraordinary» and by The Sunday Times as «Magnificent, bravura, astoundingly interesting, beautiful,» The Book of Barely Imagined Beings has been short listed for the 2013 Royal Society Winton science book prize, whose judges describe it as "a treasure which encapsulates the pure wonder of discovery and the strangeness of the world around us." It has also been shortlisted for an award from The Society of Biology and for a British Book Design Award.

Editors note: look out for the yeti crab within....!

Debris in the deep: Using a 22-year video annotation database to survey marine litter in Monterey Canyon, central California, USA

Kyra Schlining, Susan von Thun, Linda Kuhnz, Brian Schlining, Lonny Lundsten, Nancy Jacobsen Stout, Lori Chaney and Judith Connor (2013)

Deep Sea Research Part I: Oceanographic Research Papers 79: 96-105

Debris in the deep sea: Bringing a hidden problem to light

Figure 1 (top): Plastic chair on the muddy seafloor of Monterey Canyon, 3,200 meters below the ocean surface. Image credit: © 2010 MBARI; Figure 2 (above): A discarded tire sits on a ledge 868 meters (2,850 feet) below the ocean surface in Monterey Canyon.Image credit: © 2009 MBARI.

Our study focused on anthropogenic debris within about 60 miles of Monterey Bay—an area in which the Monterey Bay Aquarium Research Institute (MBARI) conducts over 200 remotely operated vehicle (ROV) dives each year investigating biology, geology, chemistry, and physical oceanography in deep waters. We repurposed our vast scientific video database to record and characterize litter on the seafloor to depths of 4,000 m. We reviewed 22 years of video data consisting of 3.6 million annotations from over 18,000 hours of video and compiled data on every observation of manmade debris, characterizing the debris types, locations, pervasiveness, and any animal associations.

We recorded over 1,150 pieces of debris. The largest proportion of the debris - about one third of the total - consisted of objects made of plastic; more than half of these were plastic bags. Metal objects were the second most common type of debris observed. About two thirds of these objects were aluminum, steel, or tin cans. Other common debris included rope, fishing equipment, glass bottles, paper, and cloth items.

We noted that trash was not randomly distributed on the seafloor, but appeared to be relatively more abundant in Monterey Canyon. We speculate that sediment transport mechanisms may carry debris down canyon until it lodges on steep, rocky outcrops, in depressions, and along other physical barriers, found commonly within submarine canyons. An analogy on land might be that of a tumbleweed rolling along, driven by wind, until it reaches a physical barrier, such as a fence.

Due to the technical challenges and significant costs of conducting research in the deep sea, the effects of anthropogenic debris on deep-sea life are still largely unknown. We observed a few obvious detrimental impacts upon marine life (e.g. entanglement), but the majority of animal associations appeared to be benign (e.g. providing an attachment surface or shelter). Yet, the debris may be altering ecosystem dynamics by providing habitat for alien or invasive species, creating changes in the natural biological communities, or even leaching harmful chemicals into the environment. To make matters worse, the impacts of deep-sea trash may last for years. Near-freezing water, a lack of sunlight, and low oxygen concentrations discourage the growth of bacteria and other organisms that break down debris. Under these conditions, a plastic bag or aluminum soda can might persist for decades or even centuries.

Figure 3: Kyra Schlining in the R/V Point Lobos control room (Image by Rob Sherlock)

During scientific expeditions, researchers may occasionally retrieve trash items

from the deep seafloor. However, removing debris on a large scale is prohibitively expensive and can sometimes do more damage than simply leaving it in place. Our hope is to inspire coastal residents and ocean users to reduce use of single-use items and recycle their trash instead of allowing it to end up in the ocean. Ultimately, preventing the introduction of litter into the marine environment through increased public awareness is the most efficient and cost-effective solution to this problem.

At MBARI we are continuing efforts to understand the long-term biological impacts of debris in the deep sea. We have been collaborating with scientists from the Monterey Bay National Marine Sanctuary to investigate the physical and chemical impacts of a shipping container that was lost overboard during a severe storm in 2004. Initial results indicate that the impacts are quite pronounced.

Link to paper:
http://www.sciencedirect.com/science/article/pii/S0967063713001039

Link to YouTube video:
http://www.youtube.com/watch?feature=player_embedded&v=mOZngsJU2k0

Benthos of the sub-polar front area on the Mid-Atlantic Ridge: Results of the ECOMAR project

Andrey Gebruk and Imants Priede (Guest Editors)

Marine Biology Research Special Issue 5 (5-6)

Figure 1 (left): Imants Priede, OceanLab, University of Aberdeen, Scotland.; Figure 2 (right): Andrey Gebruk, Shirshov Institute, Moscow, Russia

Marine Biology Research has published a thematic issue containing the results of studies of benthos from the Mid-Atlantic Ridge (MAR) in the framework of the UK consortium programme ECOMAR (Ecosystems of the Mid-Atlantic Ridge at the Sub-Polar Front and Charlie-Gibbs Fracture Zone). The aim of ECOMAR was to reveal the effect on benthos of three major features of the open ocean in the North Atlantic: the ridge, the fracture zone and the Sub-Polar front – a divide between the cold Arctic and warmer Atlantic water masses. Benthos samples were obtained during 3 voyages of RRS James Cook in 2007, 2009 and 2010, at four stations at 2500 m depth on the flanks of the MAR, two north of the Charlie-Gibbs Fracture Zone and the Sub-Polar front and two to the south. Taxonomic groups considered in the thematic issue include shell-bearing protists or 'forams' (Foraminifera), glass sponges (Hexactinellida), mushroom soft corals (Alcyonacea), bristle worms (Polychaeta), crustaceans (Amphipoda) and echinoderms (Asteroidea and Holothuroidea).

One innovative advantage of benthos sampling in ECOMAR was the targeted collection of specimens using the ROV Isis during the 2010 cruise. Many papers in this issue benefited from the quality of the samples obtained using the ROV, especially the contributions on minute foraminifera, soft and delicate pterastrid asteroids, elasipodid holothurians and fragile glass sponges.

Link to special issue:
http://www.tandfonline.com/doi/abs/10.1080/17451000.2012.749999#.UjoO1cbIb50

Ecological restoration in the deep sea: Desiderata

Cindy Van Dover, James Aronson, Linwood Pendleton et al (2013)

Marine Policy (Issue not yet assigned)

An era of expanding deep-ocean industrialization is before us, with policy makers establishing governance frameworks for sustainable management of deep-sea resources while scientists learn more about the ecological structure and functioning of the largest biome on the planet. Missing from discussion of the stewardship of the deep ocean is ecological restoration. If existing activities in the deep sea continue or are expanded and new deep-ocean industries are developed, there is need to consider what is required to minimize or repair resulting damages to the deep-sea environment. In addition, thought should be given as to how any past damage can be rectified. This paper develops the discourse on deep-sea restoration and offers guidance on planning and implementing ecological restoration projects for deep-sea ecosystems that are already, or are at threat of becoming, degraded, damaged or destroyed. Two deep-sea restoration case studies or scenarios are described (deep-sea stony corals on the Darwin Mounds off the west coast of Scotland, deep-sea hydrothermal vents in Manus Basin, Papua New Guinea) and are contrasted with on-going saltmarsh restoration in San Francisco Bay. For these case studies, a set of socio-economic, ecological, and technological decision parameters that might favor (or not) their restoration are examined. Costs for hypothetical restoration scenarios in the deep sea are estimated and first indications suggest they may be two to three orders of magnitude greater per hectare than costs for restoration efforts in shallow-water marine systems.

Link to paper: http://dx.doi.org/10.1016/j.marpol.2013.07.006

Biotic and Human Vulnerability to Projected Changes in Ocean Biogeochemistry over the 21st Century

Mora C, Wei C-L, Rollo A, Amaro T, Baco AR, et al. (2013)

PLoS Biology 11(10): e1001682. doi:10.1371/journal.pbio.1001682

Author Summary: Climate change caused by human activity could damage biological and social systems. Here we gathered climate, biological, and socioeconomic data to describe some of the events by which ocean biogeochemical changes triggered by ongoing greenhouse gas emissions could cascade through marine habitats and organisms, eventually influencing humans. Our results suggest that the entire world's ocean surface will be simultaneously impacted by varying intensities of ocean warming, acidification, oxygen depletion, or shortfalls in productivity. Only a very small fraction of the oceans, mostly in polar regions, will face the opposing effects of increases in oxygen or productivity, and almost nowhere will there be cooling or pH increase. The biological responses to such biogeochemical changes could be considerable since marine habitats and hotspots for several marine taxa will be simultaneously exposed to biogeochemical changes known to be deleterious. The social ramifications are also likely to be massive and challenging as some 470 to 870 million people – who can least afford dramatic changes to their livelihoods – live in areas where ocean goods and services could be compromised by substantial changes in ocean biogeochemistry. These results underline the need for urgent mitigation of greenhouse gas emissions if degradation of marine ecosystems and associated human hardship are to be prevented.

Link to paper: http://www.plosbiology.org/article/info%3Adoi%2F10.1371%2Fjournal.pbio.1001682

Megabenthic biodiversity in two contrasting submarine canyons on Australia's southern continental margin

David R. Curriea and Shirley J. Sorokin (2013)

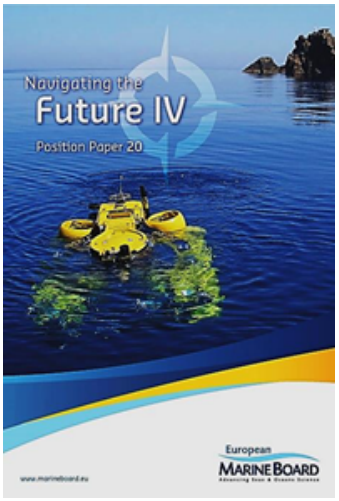
Marine Biology Research 10 (2)

Submarine canyons are known to play an important role in enhancing productivity in adjacent surface waters, but their influence on the seabed fauna is poorly understood. Here we examine environmental conditions in two canyons with contrasting topographies, and evaluate their relative importance in structuring benthic megafaunal assemblages. Samples of benthic megafauna, sediment and water were collected from five sites at du Couedic Canyon (100–1500 m) and six sites at Bonney Canyon (100–2000 m) off South Australia. Sessile suspension-feeding organisms (primarily sponges, molluscs and cnidarians) dominated samples and comprised 97% of the biomass and 77% of the total species richness (184 spp.). Megabenthic biomass and species richness broadly declined with increasing depth in both canyons, but was markedly higher at du Couedic Canyon in an area subject to organically enriched seasonal outflows from Spencer Gulf. Multivariate analyses showed a strong environmental gradient running perpendicular to the coast in both canyons, and highlighted a progressive shift in species composition. Three station groupings were identified on the shelf (100–200 m), upper slope (500 m) and mid slope (1000–2000 m). These community groupings were largely explained by depth and dissolved oxygen concentration and coincided with depth-related discontinuities in water masses on Australia's southern continental margin.

http://www.tandfonline.com/doi/full/10.1080/17451000.2013.797586

European MARINE BOARD Advancing Seas & Oceans Science

Launch of Navigating the Future IV



The Marine Board Navigating the Future series provides regular pan-European summaries of the current status of marine research, priority recommendations and future scientific challenges in the context of European societal needs. Navigating the Future is a blueprint to guide both the research and the science policy agendas at European and national level. Since 2001 when the first Navigating the Future position paper was published, the series has been widely recognized, both by researchers and science policymakers, as providing critical periodic foresight and recommendations on emerging marine science topics and needs, and associated societal challenges and opportunities.

Navigating the Future IV is designed to inform the Commission calls under the forthcoming Horizon 2020 programme. The paper is organized around the framework of key societal challenges in the areas of climate, human health, food security, energy and safe and sustainable use of marine space. NFIV also addresses strategic and enabling issues such as European Ocean Observing System (EOOS), training, the science-policy interface and ocean literacy.Navigating the Future IV (Marine Board Position Paper 20) was launched on 20 June 2013 at the Royal Flemish Academy of Belgium for Science and the Arts in Brussels, Belgium.

This position paper can be downloaded from the Marine Board's publications webpage:

http://www.marineboard.eu/component/publications/?Itemid=112

INDEEP Workshop Report – Deep-Sea Colonizers

Maria Baker[1] & Anna Metaxas[2]
[1]University of Southampton, UK, [2]Dalhousie University, Canada

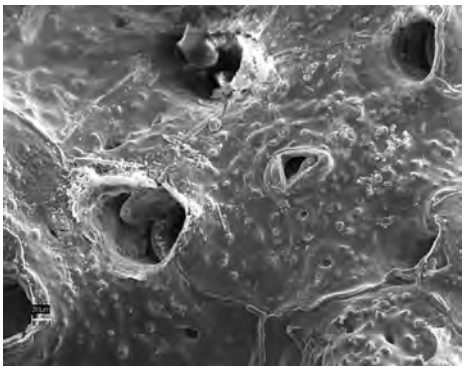


Figure 1 (top): Craig Young explains SEM sample preparation techniques;
Figure 2 (above): SEM of bryozoan courtesy of Richard Pearse, NOC

In June this year, twenty-seven scientists from around the globe took part in a week-long INDEEP workshop - this one on deep-sea colonizers, their collection and identification. This was a very hands-on workshop and included both morphological and molecular identification of specimens, lectures on particular groups and many fruitful discussions.
Many of the specimens that we used were from the frames with colonization substrates that INDEEP was involved in deploying around the world's oceans. So far, we have deployed frames on a Transocean rig in Claire Ridge, North Sea and at each of two depths on landers in the Baltimore Canyon in collaboration with Sandra Brooke and Steve Ross. The first two sets were recovered and used in our workshop. It was very exciting to take a look at these samples and see that they were indeed colonized. Additional frames have been deployed in Barkley Canyon as part of the "Deep-sea benthic ecosystems" study in Ocean Networks Canada (in collaboration with Anna Metaxas), in the Cayman Trough on a vent site (in collaboration with Jon Copley) and on landers at 1500 and 3300 m off Brazil (in collaboration with Angelo Bernandino and Paulo Sumida).

The workshop opened with a background lecture on molecular tools for identification from Pedro Ribeiro (University of the Azores). During the course of the week, participants learned the art of molecular sample preparation, DNA extraction, PCR amplification, sequencing and finally molecular data analysis. Pedro was an excellent tutor and for many it was a real eye-opener as to the amount of time that each stage of the process consumes! On more than one occasion, the groups involved in the molecular training were very late for lunch!

Lisa Levin (Scripps Institute of Oceanograophy) led interesting discussions on scientific questions on colonization, relevant sampling designs, sample sorting and specimen processing. Craig Young (University of Oregon) talked about sample processing and the identification of sessile faunal (bryozoans, hydrozoans and ascidians). He led sample preparation exercises for SEM and the group were able to view their handywork with the help of Richard Pearce (NOC) who drove the SEM (Figs 1&2). Sylvie Gaudron (Université Pierre et Marie Curie) and Lisa Levin talked about polychaete identification and this was followed by sample viewing. Susan Mills (WHOI) and Sylvie Gaudron led the talks, discussions and practical demonstrations on mollusc identification and preparation. On the last day, Andy Gooday (NOC) informed the group about the joys of foraminifera and Andreia Henriquez (University of the Azores) gave an interesting overview of deep water corals.

Throughout the week, participants engaged with the sorting, photographing and preservation of samples from the INDEEP WG3 colonization programme (Figs 3&4). Hydroids were the group of the week in this regard!

Figure 3 (right): Anna Metaxas and Susan Mills photograph INDEEP settlement frame samples;
Figure 4 (far right): INDEEP wood blocks from Baltimore Canyon frames inhabited by numerous boring bivalves.

Cruise News

From mollusks to muskets: Interdisciplinary experiences aboard the E/V Nautilus

Jamie Wagner

Marine Laboratory, Nicholas School of The Environment, Duke University, USA

I recently joined two cruise legs in the Gulf of Mexico during the E/V Nautilus expedition season after applying for an internship through the Ocean Exploration Trust. Onboard, I became an exploration team member, contributing to innovative research that I never expected to be involved in. As a graduate student studying megafauna at methane seeps, I anticipated that my time at sea would involve expeditions with a focus on biological observation and sample collection. However, through these July 2013 Nautilus expeditions, I learned about the process of discovering seeps and gained understanding of shipwreck archeology and associated biological communities.

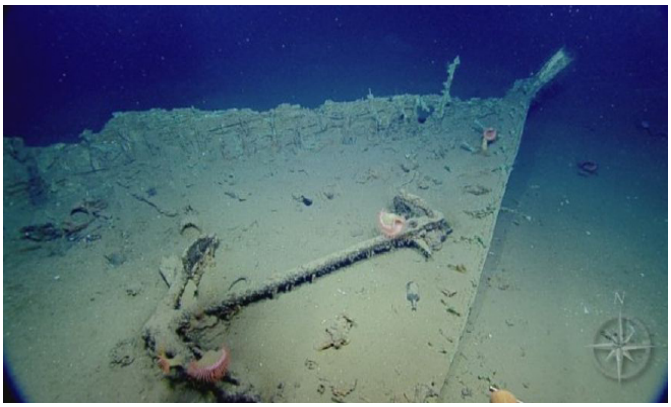


Figure 1: Bow of a shipwreck 1333 m down, with flytrap anemones on the anchor. Credit: Ocean Exploration Trust and Meadows Center for Water and the Environment.

During expedition leg NA030, we applied mapping tools to our search for new locations where methane naturally bubbles up from the ocean floor. The exploration team used a recently developed technique, employing the multibeam echosounder not only to examine bathymetry, but also to identify vertical streaks in the midwater display that would likely indicate the presence of a seafloor seep releasing methane bubbles into the water column. Through the hours of carefully scanning monitors and speaking with mapping experts onboard, I gained an appreciation of acoustical theory, equipment, and software underlying this discovery process. This approach allows subsequent refined geological, chemical, and biological investigations by ROV or AUV; Nautilus followed-up a few weeks later with submersibles and successfully ground-truthed several new seeps with mussel beds.

On earlier expeditions Nautilus became well known for locating amphorae (ancient storage containers) at shipwrecks in the Black Sea; however, artifact recovery did not occur on these missions. In contrast, expedition NA031 launched with permits in place to recover from U.S. waters. Our team explored three shipwrecks; the thrilling final day of the voyage was highlighted by the discovery of two additional wrecks. From preliminary observations, the archeologists deduced that all three wrecks appear to date from the early 19th century – a possible convoy that may have met a catastrophic storm. During examination of the first wreck, the pilots of ROV Hercules excelled at delicate maneuvering of sampling tools, with manipulator arms recovering an octant or scooping up fragile muskets. When I viewed the seafloor through the combined insights of archeologists and biologists, the impact of human influence on the seafloor became clearer to me. The wreck created structures where fauna such as flytrap anemones have settled; in contrast, the leaching of toxic copper from the vessel hull inhibited widespread invertebrate colonization.

On both cruises, the excitement of real time discovery was heightened by telepresence. Video and audio links to off-ship scientists and the public resulted in on-going dialogue explaining the organisms and artifacts. Joining with this expanded group of intrigued participants heightened the scientific and conservation value of these voyages. I first

experienced deep-sea telepresence in 2012, shore-side; adding the ship-side of telepresence this year has greatly expanded my understanding by obtaining both perspectives. If you have not taken advantage of this incredible resource, from sea or land, I highly recommend you become involved as soon as possible. You can start by checking out the links below:

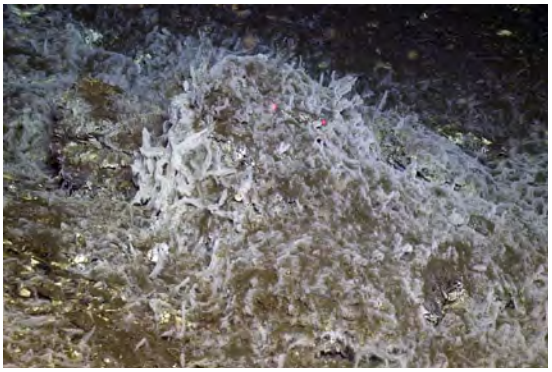
Explore in real-time with the Nautilus – http://www.nautiluslive.org/ or with several other research vessels equipped with telepresence technology – http://www.explorationnow.org/

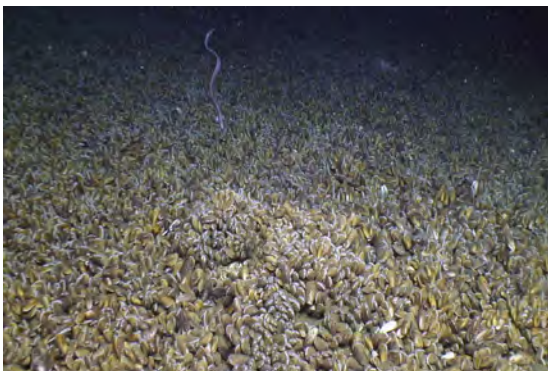
Figure 2: Jamie Wagner examines a small anemone sampled from a dinner plate retrieved on the shipwreck. Credit: Alan Franks/ Ocen Exploration Trust.

Students: apply for an internship with Nautilus: http://www.oceanexplorationtrust.org/#!internships/c20ru

Massive new cold seep discovered near Norfolk Canyon, USA.

Sandra Brooke (*Florida State University*), Steve W. Ross (*University of North Carolina, Wilmington*) and the Atlantic deep-water canyons science team





On 8 May 2013 aboard the NOAA ship Ronald H. Brown, the ROV Jason II (WHOI) began a dive on a prospective new seep southeast of the mouth of Norfolk Canyon at 1600 m depth. We were exploring this area to follow up on the discovery of potential bubble plumes indicated during a mapping cruise in November 2012 by the NOAA ship Okeanos Explorer. Early in the dive we observed large bacterial mats, followed by dead mussels, and soon we came across one of the two main seep areas. This place was a vast and spectacular expanse of predominantly live adult bathymodiolid mussels, along with large, dense patches of juvenile mussels. Methane bubbles and frozen hydrates were commonly observed among the carpets of mussels. The diversity and abundance of seep-associated macrofauna was lower than observed elsewhere with the exception of numerous small holothurians that were tangled among the mussels. The topography of the seep was often complex with collapsed authigenic carbonates creating caves and holes that were frequently occupied by the demersal fish Gaidropsarus sp. The new seep may be the largest yet discovered in the Atlantic Ocean. Until this dive, there were only three confirmed cold seeps along the US Atlantic coast: Blake Ridge (2155 m), Cape Fear Diapir (2600 m) and one adjacent to Baltimore Canyon (430 m); however, several more cold seeps (~ 450 & 1600 m) were discovered this fall by the Okeanos Explorer north of Norfolk Canyon. The Atlantic deep-water canyons project is funded by BOEM, NOAA and USGS, and the science team is composed of participants from academic institutions and government agencies.

Figure 1: Thick mats of bacterial filaments cover the underlying rocks and mussels; Figure 2: Dense beds of adult and juvenile mussels with a synaphobranchid eel, a fish that was commonly observed near the seep; Figure 3: Mounds of live mussels shelter a Gaidropsarus *sp.*

Project Focus

How different are deep-sea habitats? A change in research focus

Malcolm R. Clark and Ashley A. Rowden (malcolm.clark@niwa.co.nz)

NIWA, Wellington, NZ

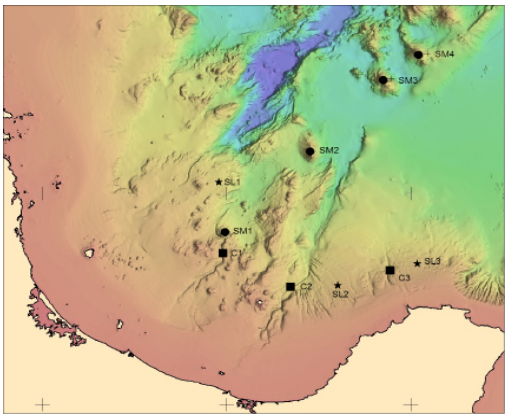


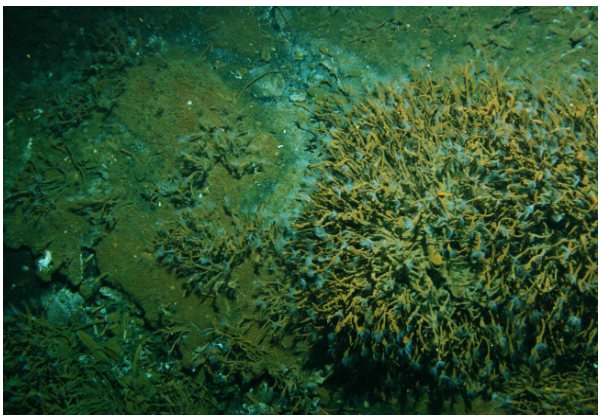
Figure 1: The 2012 survey area off the north-east coast of New Zealand, showing the diversity of habitat types surveyed.

For many years New Zealand has carried out research on deep-sea fisheries, and their impacts on benthic habitats. This has tended to have a seamount focus, because major target species such as orange roughy sometimes form aggregations on such features for spawning or feeding, and trawling has a major effect on coral-dominated benthic communities. However, we know that deep-sea features are not isolated, and different types of habitat need to be considered as part of a much larger ecosystem. This was illustrated by an increasing number of studies during the time of the Census of Marine Life project that showed seamount faunal communities were often similar to those on the adjacent continental slope. Hence, in recent years, the seamount research carried out at NIWA has evolved to address the biodiversity and vulnerability of multiple deep-sea habitats.

NIWAs "Vulnerable Deep-Sea Communities" research programme is now just over halfway through its funding term, and has carried out two dedicated surveys which have examined multiple habitat types: these include continental slope, seamounts (including knolls and hills), hydrothermal vents, cold seeps, and canyons. The figure shows an example of the sites sampled in 2012 off the North island of New Zealand, which covered 3 canyons (C), 3 slope (SL) sites, and 4 seamounts (SM), of which 2 were hydrothermally active.

The surveys utilise several gear types, with a sequence comprising multibeam mapping of the site, then deployments of a towed camera system (video and stills), a multicorer (or boxcorer depending on substrate), and an epibenthic sledge or beam trawl. This combination enables us to sample a variety of faunal communities from infaunal macrofauna through to epibenthic megafauna. Sampling occurs at 4 consistent depths (700 m, 1000 m, 1200 m, 1500 m) to enable comparisons of faunal change with depth both within, and between, sites.

Results to date show a degree of similarity between sites with similar substrate, but also clear differences where environmental conditions change. Hydrothermal and seep communities, with their specialised chemosynthetic species, are clearly different (e.g., image of stalked barnacles), but seamounts, slope and canyons can also have characteristic communities (see images of coral and sponge on rocky seamounts, sea cucumbers and eels on



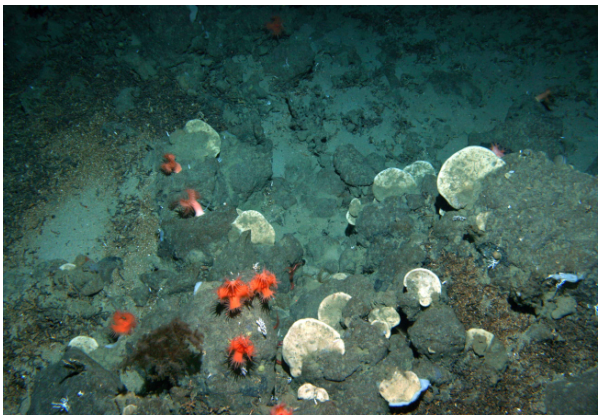
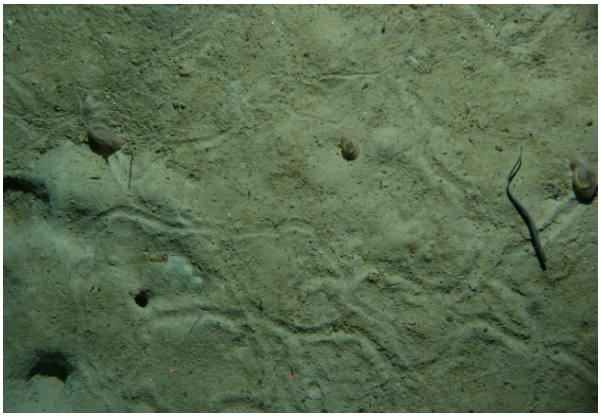


Figure 2 (top): Stalked barnacles in the region of hydrothermal venting at 900 m on Tangaroa Seamount.
Figure 3 (bottom): Lithistid sponges and anemones at 850 m on the flanks of Matatara Knoll.



the slope). Differences in benthic invertebrate communities are being translated into relative vulnerability profiles to assess the ecological risk of human activities (bottom trawling and seabed mining) on the range of deep-sea habitats.

Figure 4 (left): Elasipodid holothurians (and their trails) and a synaphobranchid eel on soft sediment on the continental slope at 700 m.

CARCACE: cow carcasses mimic whale falls in the deep-Atlantic

Ana Hilário and the CARCACE team

Departamento de Biologia, Universidade de Aveiro, Portugal

Since the fortuitous discovery of a whale skeleton in 1987 researchers have documented dozens of sunken whale carcasses, both natural and experimentally implanted, and have described more than 400 species that are living on, in and around them. Whale falls provide a large amount of organic enrichment, shelter and substrate to the deep-sea floor that can sustain generalist-scavenging species, chemosynthetic fauna related to those from hydrothermal vents and cold seeps, and bone-specialist species such as *Osedax* worms.

A close look at the distribution of whale falls shows a clear bias towards studies carried out in the Pacific Ocean. In the Atlantic, most observations come from shallow water experiments off Scandinavia. Porpoise carcasses were deployed in the Porcupine Seabight, at approximately 2500 m, but porpoise bones do not have the size and degree of calcification that is required to ensure slow decomposition and release of bone-lipid reserves and therefore no chemoautotrophic communities were found. Interestingly, the chemical composition of cow bones, including their high lipid content, makes them a suitable substitute for the study of whale fall faunal assemblages. Moreover, cow carcasses are also relatively easy to obtain and so we perceived the idea of sinking cow carcasses to study whale fall communities in the deep Atlantic.

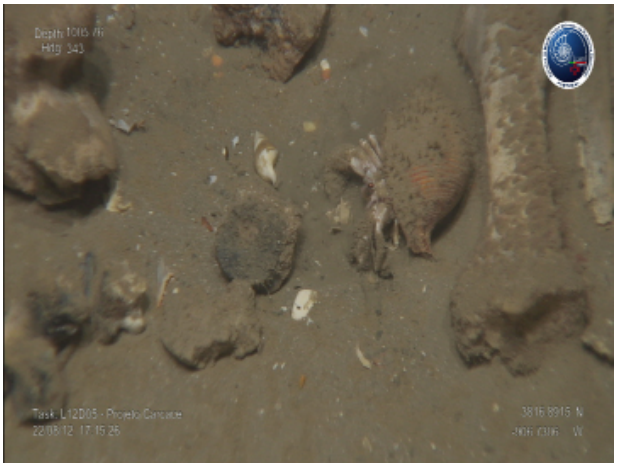


Figure 1: Idas ophryothrocha ***ampharetidae*** *inside cow bone, A. Hilario*

In March 2011 we deployed five (naturally deceased) cows in the Setubal Canyon, at 1000 m depth, under a migration path of cetaceans. Since then we visited the deployment site twice, after 18 and 26 months using the Portuguese ROV Luso and the Belgian ROV Genesis, respectively. During both dives we were able to retrieve several bones that are currently being examined for faunal and microbial diversity and succession, as well as trophic ecology and population connectivity.

Preliminary results show that after 18 months the species richness of the macrofaunal community is comparable to, or higher than, that found on whale falls at similar depths. At this point in time the fall sustained opportunistic (e.g. *Ophryotrocha* sp.), chemosymbiotic (*Idas simpsoni*) and bone-specialist (*Osedax* sp.)

Figure 2: Cow bone deployed for 18 months, A. Hilario and EMEPC

suggesting an overlap of the enrichment-opportunistic and sulphophilic stages: the second and third of the typical four successional stages. The presence of filter-feeding species after 26 months indicates a transition to the fourth stage, the "reef stage". However, representatives of the previous two stages were also still highly abundant. Vent and seep endemics were also found, giving mammal carcasses in the deep Atlantic Ocean the potential role as dispersal stepping-stones for these species. Our findings, apart from providing new insights into the diversity and biogeography of whale fall communities, show that cow carcasses may serve as an accessible model system for the study of ecological processes at whale falls.

Note: the CARCACE project is funded by the Portuguese Science and Technology Foundation.

The World Ocean Council - Developing Industry Leadership in Ocean Sustainability Challenges

Paul Holthus
WOC, USA

Paul Holthus, WOC CEO.

The deep seas are not only home to important biodiversity, but also to a diverse and growing range of economic activities: oil/gas, shipping, fishing, mining, etc. The private sector is an essential partner in addressing the challenges of responsible ocean use, including conserving biodiversity, particularly in the deep seas. Many companies are working to bring good science and risk assessment to understanding and addressing the effects of their ocean activities. However, the inter-connected nature of the ocean means that the best efforts by a single company or an entire industry are not enough to tackle cross-cutting and cumulative effects.

The World Ocean Council (WOC) - the international business alliance on "Corporate Ocean Responsibility" - brings together responsible companies from across the sectors to develop industry leadership and collaboration in ocean sustainability, science and stewardship.

WOC Members include a growing number of companies from marine science, technology and data management, seabed mining, mining, oil/gas, shipping, fishing, offshore renewables and other sectors. WOC also has an increasing number of research/scientific "Affiliate Organizations" who see the value in working closely with responsible companies on science, technology and solutions to ocean challenges.

WOC is creating multi-industry working groups to address cross-cutting ocean sustainability challenges, e.g. marine sound, marine invasive species, marine debris, the Arctic, etc. Of particular note is the "Smart Ocean/Smart Industries" program to increase the number of companies sharing environmental data from baseline studies and monitoring and collecting ocean, weather and climate data from their vessels and platforms.

Contact: Paul Holthus, CEO paul.holthus@oceancouncil.org

Investigating Offshore New England Waters for Deep-sea Coral Presence

M. Kilgour, P. Auster, D. Packer, R. Waller, S. Auscavitch

In an effort to better understand the distribution of deep-sea corals off New England, members of the Auster Lab (P. Auster and M. Kilgour) have teamed up with scientists from NOAA's Northeast Fisheries Science Center (D. Packer and M. Nizinski) to conduct two surveys. The first cruise took place in October of 2012, with funding from the Waitt Institute. P. Auster, M. Kilgour, D. Packer and B. Sewell (of the National Resources Defense Council) used AUVs to investigate Physalia Seamount off Georges Bank for the presence of corals. This "high and fast" survey technique covered large areas of Physalia Seamount in order to document the presence of corals to a general taxonomic level. In July 2013, a second cruise, in collaboration with the University of Maine (R. Waller and S. Auscavitch) and funded by NOAA's Deep-Sea Coral Research and Technology Program, used the towed camera platform ISIS II to investigate areas of high relief in the Gulf of Maine: this expedition confirmed anecdotal and historical reports of corals in this region. Both of these expeditions documented coral presence in areas either thought to support corals historically (Gulf of Maine), or modeled to be prime coral habitats based on slope, depth and substratum factors (Physalia Seamount, Gulf of Maine). With continued efforts at exploration and increased collaboration with other researchers, we are better able to understand the distribution of deep-sea corals off New England and provide new data to resource managers for conservation planning and management of these sensitive habitats.

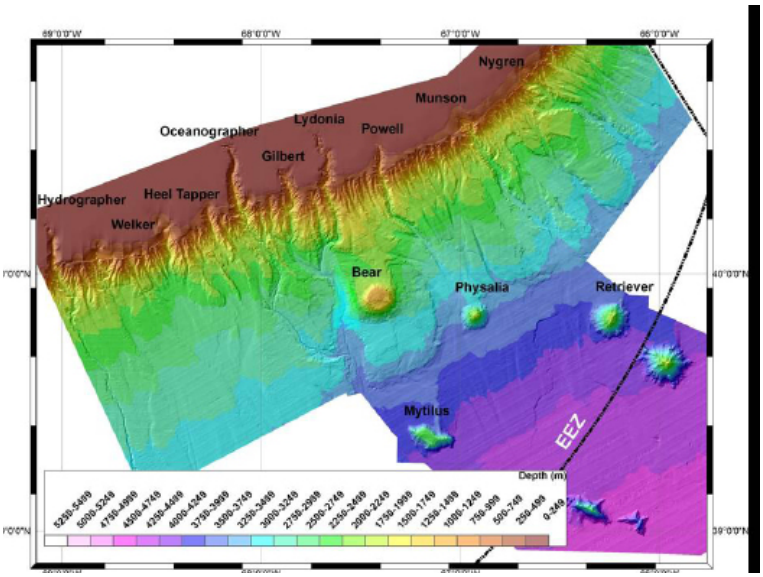


Figure 1: Bathymetric map of the study area

The MIDAS project: Managing Impacts of Deep Sea Exploitation

Phil Weaver

Seascape Consultants, UK

The European Commission has recently funded a project under the Framework 7 programme to investigate the environmental impact of deep-sea mineral and energy extraction: specifically, polymetallic sulphides, manganese nodules, cobalt-rich ferromanganese crusts, methane hydrates and the potential mining of rare earth elements. The project is called MIDAS (Managing Impacts of Deep-seA reSource exploitation) and, subject to the successful conclusion of contract negotiations, will start on 1 November 2013. The MIDAS partnership represents a unique combination of scientists, industry, social scientists, legal experts, NGOs and SMEs. MIDAS will carry out research into the nature and scales of the potential impacts of mining including 1) physical destruction of the seabed by mining, the creation of mine tailings and the potential for catastrophic slope failures from methane hydrate exploitation; 2) the potential effects of particle-laden plumes in the water column, and 3) the possible toxic chemicals that might be released by the mining process. Key biological unknowns, such as connectivity between populations, impacts of the loss of biological diversity on ecosystem functioning, and how quickly the ecosystems will recover will all be addressed. The plan is to use this information to develop recommendations for best practice in the mining industry. A key component is the involvement of industry within the project and through stakeholder engagements to find feasible

solutions. The project will also work closely with European and international regulatory organisations to take these recommendations forward into legislation. A major element of MIDAS will be to develop methods and technologies for 1) preparing baseline assessments of biodiversity, and 2) monitoring activities remotely in the deep sea during and after exploitation, including ecosystem recovery. For more information on MIDAS please contact the Project Coordinator, Prof. Philip Weaver at phil.weaver@seascapeconsultants.co.uk or visit the project website www.eu-midas.net

Mud, Mud Glorious Mud….
(Sampling at Station M in the Rockall Trough)

Bhavani Narayanaswamy, Natalia Serpetti & Peter Lamont
The Scottish Association for Marine Science (SAMS), Scotland, UK

«What's all the fuss about mud?» I hear you say – after all most of us deep-sea biologists have collected mud during our various research cruises!

After an 18 year gap, Station M in the Rockall Trough was finally re-sampled. Station M, for those of you that don't know, was one of the stations sampled regularly (seasonally and annually) from the mid 1970's through to the early 1990's by the late Professor John Gage. The samples were collected using a Woods Hole designed epibenthic sled which was used by John to collect the larger macrofauna. He was mainly interested in the seasonal growth variation of the deep sea fauna and this formed the basis for his future studies of the region which included amongst other things investigating the faunal community structure, seasonality, trophic ecology and life histories of the fauna in the region.

This large repository of samples has only partially been sorted and identified and the aim of the Deep-Sea Group at SAMS is to finish the task that John and his team started over 30 years ago. Again I hear you ask – so what? Well, we wish to look at these historical samples, plus the new samples that were collected in 2013 (with a newly refurbished epibenthic sled including new closing door mechanism and courtesy of the Extended Ellett Line cruise), and investigate if there have been any changes in the macrofaunal community structure, diversity, standing stock and function during this time. In addition we aim to try and link these potential changes in the macrofauna to changes observed by colleagues at SAHFOS with their Continuous Plankton Recorder data. Our aim is to try and re-start on a more permanent level the re-sampling of Station M (and potentially John's other site known as Station P) in conjunction with the Extended Ellett Line sampling programme. If this all works, we hope that this will become one of the first long-term time-series at bathyal depths.

Figure 1 (top) Gently processing the 2013 sled sample (Courtesy Natalia Serpetti – SAMS); Figure 2 (middle): Some of the ophiuroids collected on the 4mm sieve (Courtesy Natalia Serpetti – SAMS; Figure 3 (bottom): "We have mud!" Elation after the first successful deployment of the epibenthic sled (Courtesy Natalia Serpetti – SAMS)

Deep Ocean Stewardship Initiative

Lisa Levin, Elva Escobar, Maria Baker, Kristina Gjerde

Expanding human activity in the deep ocean has created an urgent need to engage experts in biology, law, policy, economics, business, regulation and conservation in stewardship issues. Many Deep-Sea Life readers will already be well aware of the new Deep-Ocean Stewardship Initiative (DOSI). This initiative, the fundamental goals of which were deliberated during a kick-off meeting in Mexico City in April 2013, is gathering momentum. A multi-disciplinary core team (see below) are working hard to launch DOSI, to generate proactive participation and to gain funding for each of the elements that are being planned and undertaken.

The current DOSI working groups consist of the following themes:

WG 1: Ecosystem-based management in the deep sea
WG 2: Knowledge Gaps and Global Ocean Assessments
WG 3: Transparency, compliance and industry engagement
WG 4: Awareness and build capacity in developing nations
WG 5: Deep-sea genetic resources
WG 6: Facilitate communication and networking
WG 7: Promote responsible and sustainable deep-sea fisheries

DOSI participants during the kick-off workshop held in Mexico City

DOSI Core Team:

Leads: Lisa Levin (SIO, USA), Elva Escobar (UNAM, Mexico), Maria Baker (University of Southampton, UK), Kristina Gjerde (IUCN, Poland)

Steering Committee:

Jeff Ardron (IASS, Potsdam, GERMANY), Tony Koslow (Scripps Institution of Oceanography, USA), Kathryn Mengerink (Environmental Law Institute, USA), Lenaick Menot (IFREMER, FRANCE), Christian Neumann (GRID- ARENDAL, NORWAY), Linwood Pendleton (Duke University, USA), Eva Ramirez Llodra (Institut de Ciències del Mar,CSIC, SPAIN), Craig Smith (University of Hawaii, USA), Tracey Sutton (Nova Oceanographic Center, USA), Andrew Sweetman (IRI, Stavanger, NORWAY), Verena Tunnicliffe (Univ. Victoria, CANADA), Cindy Van Dover (Duke University, USA), Ursula Witte (University of Aberdeen, Scotland, UK), Hiroyuki Yamamoto (JAMSTEC, JAPAN).

For further information, please visit the DOSI webpage: www.indeep-project.org/deep-ocean-stewardship-initiative

Should you wish to join the DOSI mailing list:

Please send an email to: Majordomo@lists.soton.ac.uk. Please leave subject line EMPTY and type this in the main body of email: subscribe dosi-alert. Be sure to remove all signatures or any other text from the email. You will then receive an automated confirmation email from DOSI.

International Network for Scientific Investigations of Deep-Sea Ecosystems INDEEP Phase 2

Lenaick Menot[1], Maria Baker[2], Eva Ramirez-Llodra[3], Bhavani Narayanaswamy[4]

[1]IFREMER, France, [2]University of Southampton, UK, [3]ICM-CSIC, Spain, [4]SAMS, UK

Supported by TOTAL FOUNDATION

The INDEEP Office is delighted to announce that Fondation Total has approved funding to keep INDEEP's great momentum going for another 3 years, until December 2016. The overall goal of the second phase of INDEEP is to continue advancing our knowledge of deep-sea ecosystems and to develop direct and effective communication pathways across sectors and stakeholders which are essential to the efficient management of resource use in the deep sea.

INDEEP is a unique and powerful programme as it is open to the whole community from all sectors (deep-sea research, economy, social sciences, industry, policy makers, NGOs and outreach and education groups). All interested individuals and groups can participate in INDEEP activities, under the coordination of the INDEEP Office and the Working Group (WG) leads. It is the exploitation of this enormous human and infrastructure potential (with its associated funds) based on the core funding provided by Fondation Total (2011-2013) that made the first phase of INDEEP a genuine global success. The programme's structure and international recognition are now solid and form the base of the second phase of INDEEP.

Understanding deep-sea species diversity, distribution and ecosystem function is essential to develop guidelines and advice for a sound deep-ocean stewardship. For the second phase of INDEEP, the research necessary to address these key gaps has been organized in 4 working groups: WG1 – Taxonomy & Evolution; WG2 – Biodiversity and Biogeography; WG3 – Population Connectivity; WG4 – Ecosystem Function. Some of the specific objectives for each WG are listed here:

- To continue the development of WoRDSS (WG1)
- To continue the development of the Deep Sea ID app (android version also) (WG1)
- Meeting and Royal Society special issue on "Evolution in the Deep Sea: Origins, Adaptation and Diversity" (WG1)
- To produce the first maps of global deep-sea biodiversity (WG2)
- To compare bioegographical areas with conservation status (WG2)
- To compare phylogeography and biogeography patterns (WG2)
- To investigate phylogenetic relationships amongst biogeographic provinces (WG2)
- Continuation of global in situ deep-sea recruitment study (WG3)
- Capacity building on population connectivity issues (WG3)
- New tools for standardised ecosystem-function analysis (WG4)
- Case study: To provide knowledge needed for Good Environmental Status (GES) of deep-sea habitats in the Gulf of Biscay in the framework of the European Marine Strategy Framework Directive (Lead: Menot)

For further details on INDEEP activities visit us at www.indeep-project.org.

If you want to get involved, get in contact with the WG leads (available from website) or the Project Manager:
Dr Maria Baker: mb11@noc.soton.ac.uk.

Difficult…..but not impossible!!
Important input to biodiversity knowledge in Northwest Africa

Ana Ramos
IEO Vigo, Spain

After spending the last few years unsuccessfully searching for funds to enable the taxonomic study of the impressive collections of benthic invertebrates collected in the bottoms of Northwest Africa, the dream of the ECOAFRIK team has come true! The 'MAVA Fondation pour la Nature' have recently committed to co-finance a project aiming to catalogue the species and benthic habitats in waters off Northwest Africa. The funding, of 639,000 €, will be spent over the next four years, and will almost entirely serve to finance the recruitment of taxonomists. These specialists will study the thousands of specimens collected in the 12 surveys conducted onboard Norwegian and Spanish research vessels ('Dr. Fridtjof Nansen' and 'Vizconde de Eza') in the region. These collections are of a great value, since they have been obtained (following the same methodology) in waters off the shelf and slope areas, up to 2000 m depth, in an areas whose marine biodiversity is amongst the poorest known of the oceans. Special attention will be devoted to the study of corals, gorgonians, sponges and other sensitive groups, as well as to the location and description of these vulnerable ecosystems, highly in need of protection and conservation. The project will be jointly carried out by the researchers of the Spanish Oceanographic Institute and the University of Vigo, the expectation being that the taxonomic expertise and work of this research team will become a global reference for the study of benthic taxonomy, with the capability of transferring their expertise to African research institutes.

Figure 1: Some species belonging to African benthos. Enypniastes eximia, one of main holothurids of deep communities; Ophiotrix maculata*; an unidentified solitary coral; and the hermit crab,* Ciliopagurus caparti.

The South Pacific VME Project

Ashley Rowden
NIWA, NZ

Vulnerable marine ecosystems (VMEs) are those ecosystems highly vulnerable to one or more kinds of human activity such as fishing. VMEs are identified by the vulnerability of their species, communities, and/or habitats to disturbance. There are concerns that VMEs are threatened by fishing in areas of the ocean beyond national jurisdiction ('high seas'). The United Nations, international conservation organisations, and fisheries management agencies all wish to implement management strategies to project VMEs, and thereby preserve ecosystem function in the deep oceans. Without such protection the calls for fishing to cease on the high seas will increase.

There is little information about the distribution or characteristics of VMEs, which is hampering the design of management measures. Recent studies have demonstrated that habitat suitability models can predict the occurrence of seabed animals that indicate the presence of VMEs. Various international bodies have called for the development of such models and their use in designing effective management of fishing on the high seas.

The South Pacific VME Project (2012-2015) is a New Zealand government-funded study that aims to produce predictive models for VMEs in the South Pacific – specifically the area covered by the South Pacific Regional Fisheries Management Organisation (SPRFMO) convention. The project is led by the National Institute of Water & Atmospheric Research (NIWA), with two main collaborating institutions - Victoria University (in Wellington, New Zealand) and the Marine Conservation Institute (in the USA). The project has already collated available biological and environmental data for building preliminary habitat suitability models.

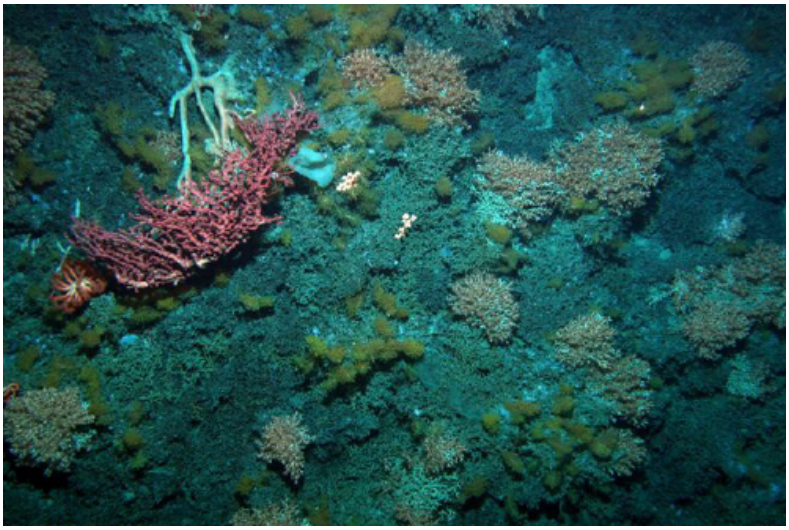


Figure 1: Example of a Vulnerable Marine Ecosystem: a deep-water coral reef on a seamount formed by the scleractinian Solenosmila variablis *(photo credit: NIWA).*

In February 2014, these preliminary models will be ground-truthed by an exploration survey to the Louisville Seamount Chain using NIWA's RV Tangaroa. The expedition will include collaborating scientists from New Zealand, Australia, UK and the USA, and will rely primarily on a tow-camera platform to recover data to refine the models. The effectiveness of potential management and conservation scenarios to protect VMEs in the SPRFMO area will be evaluated using the refined models.

Ways towards sustainable use and conservation of marine biodiversity in ABNJ

Aurélie Spadone

IUCN Global Marine and Polar Programme, Switzerland

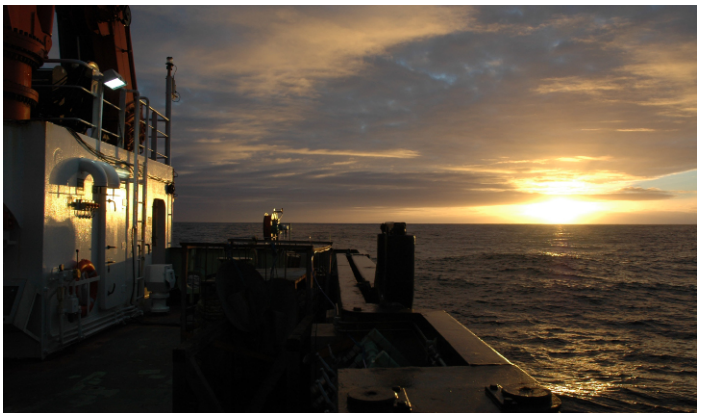


Figure 1 (top): South West Indian Ocean: after deck of the RRS James Cook (NERC; NOC), 2011.© IUCN / Aurélie Spadone
Figure 2 (above): Isididae *sp. – unknown Bamboo coral with Galatheid crab and brittlestars © Natural Environment Research Council (U.K.)*

IUCN Global Marine and Polar Programme coordinated a project on conservation of marine biodiversity associated with seamount ecosystems in the Southern Indian Ocean, between April 2009 and March 2013. This project, supported by United Nations Development Programme (UNDP), financed by the Global Environment Facility (GEF), aimed at applying an ecosystem approach to management of seamounts in Areas Beyond National Jurisdiction (ABNJ).

The project combined scientific activities with efforts towards an enhanced governance framework for high seas resources conservation and management. Two research expeditions were conducted on five seamounts of the South West Indian Ridge in 2009 and in 2011, gathering an important quantity of information and data on both the pelagic and benthic fauna associated with these deep-sea ecosystems, as well as observations of human impacts on the seabed. The project assessed the anthropogenic threats to seamount ecosystems, conducted a legal and institutional gap analysis and proposed options for improvement of the governance framework. Finally, the project proposed a road map process towards

sustainable use and conservation of marine biodiversity via the development of an adaptive and collaborative Management Plan.

A follow-on project with a focus on the South West Indian Ocean is being developed. It will most likely start end of 2013 / early 2014 and be financed by the FFEM (French Global Environment Facility) for a total duration of 4 years. This future project will seek to address two issues affecting marine biodiversity associated with deep-sea ecosystems in areas beyond national jurisdiction: existing pressure from the fishing industry and emerging threats from deep seabed mining.

For more information on both projects, please contact Aurélie Spadone (aurelie.spadone@iucn.org).

Website: http://www.iucn.org/about/work/programmes/marine/

Partners of the 2009-2013 project (including support and financial contribution): UNDP (www.undp.org), GEF (www.thegef.org), ACEP, ASCLME Project, CenSeam, ECOMAR, FAO & EAF-Nansen Project, IMR , IOZ/ZSL, NERC (U.K.), Norad, SIODFA, Total Foundation, University of Oxford.

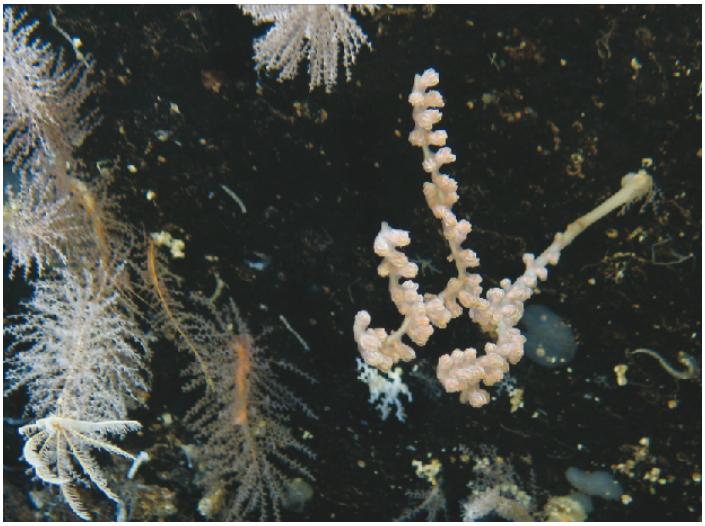


Figure 3 (top right): Isididae *sp. unknown, next to some bottlebrush octocoral (likely* Thonarella *sp.) © Natural Environment Research Council (U.K.); Figure 4 (right):* Anthomastus *sp. © Natural Environment Research Council (UK)*

Outcome documents of the 2009-2013 project can be downloaded here:

''An Ecosystem Approach to Management of Seamounts in the Southern Indian Ocean''

Volume 1 – Overview of Seamount Ecosystems and Biodiversity, by Alex Rogers. ISBN: 978-2-8317-1561-2 http://data.iucn.org/dbtw-wpd/edocs/2012-078-1.pdf

Volume 2 – Anthropogenic Threats to Seamounts ecosystems Chapter 1 Non-fisheries threats by Philomène Verlaan Chapter 2 Fisheries and Aquaculture by Garry Preston. ISBN: 978-2-8317-1563-6 http://data.iucn.org/dbtw-wpd/edocs/2012-078-2.pdf

Volume 3 – Legal and Institutional Gap Analysis, by Robin Warner, Philomène Verlaan and Gail Lugten. ISBN: 978-2-8317-1483-7 http://data.iucn.org/dbtw-wpd/edocs/2012-078-3.pdf

Volume 4 - A road map towards sustainable use and conservation of biodiversity in the Southern Indian Ocean by Serge M. Garcia, Harlan Cohen, David Freestone, Carole Martinez, Nilufer Oral, Alex Rogers, Philomène A. Verlaan and David Vousden. ISBN: 978-2-8317-1605-3 http://data.iucn.org/dbtw-wpd/edocs/2012-078-4.pdf

News

Deep-Sea Online Videos - Searchable Listing Created

Maria Baker

INDEEP/DOSI Co-Lead, UK

Figure 1: Q&A with Tim Shank. Image courtesy of WHOI. http://www.whoi.edu/main/images-multimedia

INDEEP/DOSI have created a comprehensive listing of online videos relating to the deep sea that will be of interest to the deep-sea research community. There are links to over 250 videos specifically related to the deep sea on subjects such as climate change, ocean acidification, hypoxia, circulation, disposal (CO_2, dredge spoil, litter, munitions, nuclear waste, plastics, sewage, ship wrecks and debris), exploitation (fishing, mining, oil and gas, pipelines, cables, acoustics, contamination) and exploration (biodiversity, vents, seamounts, seeps, corals, canyons, continental margins, trenches, technology, marine life). Many of these videos will be useful for teaching purposes so go ahead and have a search by subject area and see what's out there! Other useful information is also listed and searchable such as video title, presenter, affiliation, series type, duration and upload date. Are there any we've missed? If so, please let us know (mb11@noc.soton.ac.uk) so we can make them available to the community.

http://www.indeep-project.org/news/deep-sea-online-videos-searchable-listing-created

Revised InterRidge Vents Database Goes Live!

Stace Beaulieu, *WHOI, USA* & Zengxi Ge, InterRidge Coodinator, *Peking University, China*

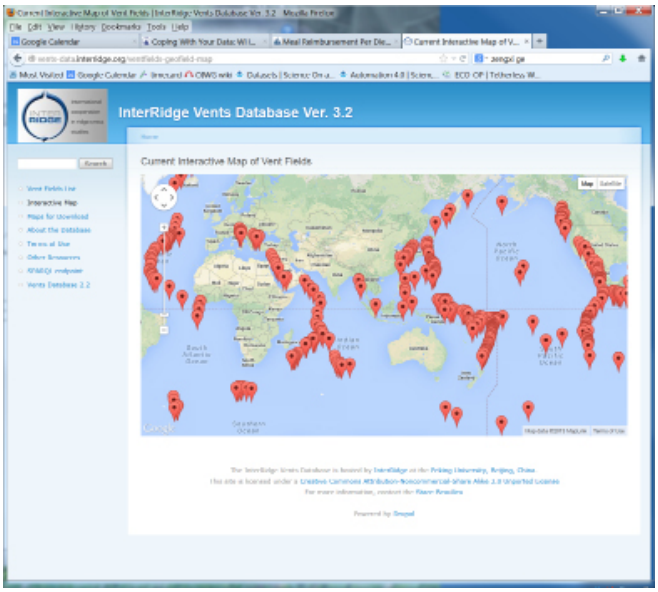


Figure 1: Screen-grab of the revised InterRidge Vents Database.

A revised, new version of the InterRidge Vents Database is available now at: http://vents-data.interridge.org. The purpose of the database (full name: InterRidge Global Database of Active Submarine Hydrothermal Vent Fields) is to provide a comprehensive list of active and inferred active (unconfirmed) submarine hydrothermal vent fields for use in academic research and education. A manuscript is currently in peer review for the listings in Version 2.1, which is comprehensive through the end of 2009 and forms the bulk of the listings in the new, live database. In this upgrade to Version 3, the database joins the semantic web of Linked Data. By structuring the database as Linked Data (http://en.wikipedia.org/wiki/Linked_data), an ultimate goal is to enable interoperability with many other global databases including the IODP, BCO-DMO, and R2R databases. The Version 3 database is in Drupal 7, an open source

content management system with Resource Description Framework (RDF) web services in its core. We implemented additional contributed modules for query over the web using the SPARQL standard. Most database content and taxonomy terms are mapped to default RDF namespaces, with three important exceptions: we mapped the "vent field" content type to (1) an rdf:type for hydrothermal vents in a semantic knowledge base (http://yago-knowledge.org/resource/) and (2) to an rdf:type for geographical features from the Open Geospatial Consortium (http://www.opengis.net/rdf#), and (3) we mapped the latitude and longitude positions of the vent fields to a semantic vocabulary for the WGS84 geodetic reference datum (http://www.w3.org/2003/01/geo/wgs84_pos#). Another new feature in Version 3 is live Google mapping of vent field positions (Figure 1). A new Google Earth kml file for Version 3.2 will soon be posted to the "Maps for Download" page on the website. Please contact Stace Beaulieu if you would like to edit or add to the database.

Call for Short Articles and Books on Deep-Sea Biology

Bob Carling

Editor of Marine Scientist, UK

Bob Carling is the Editor of Marine Scientist, the quarterly journal of the Institute of Marine Engineering, Science and Technology (IMarEST). He is actively looking for articles and short news items about your own particular area of Marine Science expertise.

Bob is also a freelance commissioning editor developing new publications – books, journals and electronic products – for various publishers. He was for many years the Ecology Editor at Chapman & Hall. He continues to commission new publications in the Life Sciences, with a particular interest in ecology, biodiversity, evolutionary biology, taxonomy and related areas. With his knowledge and contacts in the publishing world, he can place your idea with the right publisher. He can send you a project proposal questionnaire to help you in formulating an idea.

If you are interested in writing or co-writing an article for Marine Scientist, or in writing, co-writing or editing a book – or have other ideas for publication – please contact Bob with details of your idea.

Dr R C J Carling

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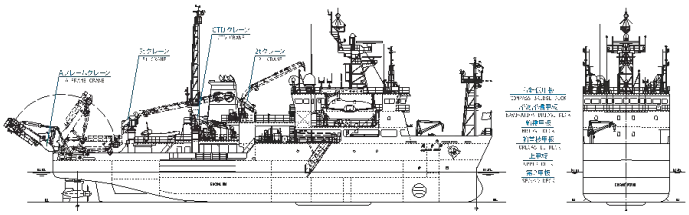
A new Japanese research vessel SHINSEI MARU available to the scientific community

Hiroshi Kitazato, Katsunori Fujikura, Yoshihiro Fujiwara

Japan Agency for Marine-Earth Science and Technology (JAMSTEC)

A new research vessel, SHINSEI MARU, which has been under construction at the Shimonoseki Shipyard & Machinery Works of Mitsubishi Heavy Industries, Ltd., was completed and delivered to JAMSTEC on the 30th June 2013. R/V SHINSEI MARU is the replacement for the R/V TANSEI MARU that was retired in January 2013, and will play an important role in the Tohoku Ecosystem-Associated Marine Sciences (TEAMS) project with her state-of-art functionality in coastal waters.

TEAMS is a research program investigating recovery in the Tohoku region, especially of fisheries, following the Great East Japan Earthquake. The program investigates the impact of the earthquake on marine ecosystems in coastal and offshore waters, and the recovery process of the marine ecosystems. Led by JAMSTEC, Tohoku University, and the Atmosphere and Ocean Research Institute (AORI) of the University of Tokyo, TEAMS brings together marine science researchers to investigate the sea off Tohoku in a decade-long program, which began in the Japanese fiscal year 2011.



SHINSEI MARU is equipped with two azimuth thrusters and a dynamic positioning system, and has a wide variety of observation systems and portable research equipment on board. She is expected to make a significant contribution to assessing the recovery of marine ecosystems and fisheries off Tohoku through interdisciplinary oceanographic studies.

The 11th International Polychaete Conference

Elena Kupriyanova

Australian Museum, Australia

Thirty years ago, way back in 1983, 85 people from 15 countries gathered at the Australian Museum to participate in the very first International Conference devoted to Polychaetes. The meeting, organised by Pat Hutching from the Australian Museum, lasted for a week. Since that historical event, we have had such meetings every 3 years; in Denmark (1986), USA (1989), France (1992), China (1995), Brazil (1998), Iceland (2001), Spain (2004), USA (2007), and Italy (2010). During the Conference in Lecce, Italy in 2010, we decided it was time to come back to Sydney in August 2013. This time, 30 years after the first conference, we gathered 145 delegates from 26 countries presenting 100 oral presentations and 105 posters. Thirty delegates from the first conference in 1983 came back to Sydney this year. Our organising committee included colleagues from Australian Museum (Pat Hutchings, Elena Kupriyanova, Anna Murray, Hannelore Paxton), Museum of Victoria (Robin Wilson), Museum and Art Gallery of Northern Territory (Chris Glasby, Charlotte Watson), a consultant (Lynda Avery) and some students (Lexie Walker), i.e., basically everybody in Australia who works on polychaetes. Thanks to generous support from the Australian Museum and CSIRO's National Research Flagship Programme (Wealth from Oceans) we were able to support 16 students, primarily from developing countries, to attend the meeting. The talks were held in the Australian Museum theatrette and each conference day started with a lecture by one of our four plenary speakers who addressed major issues in polychaete biology. We had 20 presentations highlighting various aspects of

polychaete diversity and biology in the deep sea. For example, Torkild Bakken (Norway) presented the results of the Norwegian MAREANO project, the study comparing the polychaete diversity of the deep sea to that of the slope and shelf area of the Norwegian Sea. Adrian Glover (UK) talked about siboglinid polychaetes from Antarctic hydrothermal vents (700-1150 m). Vinicius Miranda (Brazil) told us about the polychaetes associated with deep-sea (300-1000 m) coral reefs in Brazil. We had a wonderful week with many old friendships being resumed and many new collaborations being made. We are looking forward to the 12th International Polychaete Conference that will be held in 2016 in Cardiff, Wales.

The new UK Royal Research Ship Discovery, designed to support the multidisciplinary research required for the 21st century

The RRS Discovery is the fourth vessel to bear the name and continues the tradition of oceanographic research at sea. RRS Discovery was delivered to NERC, UK on the 8th July 2013 by builders CNP Freire, SA from Vigo in northern Spain. She is currently undergoing sea trials with scientific research due to start in 2014.

At almost 100-metres in length, with a displacement of 6,075 tonnes, Discovery carries a crew of 24 and accommodation for 28 scientists and technicians. She was formally named on 10 October at a ceremony alongside NOC in Southampton.

Discovery joins the RRS James Cook, previously accepted into service in 2006. Together they will form one of the most modern research vessel fleets in operation anywhere in the world, maintaining the UK's capability to work at the frontier of ocean research.

The royal research ship will be operated by the NERC-owned National Oceanography Centre's (NOC) National Marine Facilities Sea Systems group, based in Southampton. She will undertake a programme of technical trials to ensure its readiness to support the complex range of scientific activities required by the UK marine science community. Discovery is expected to be ready to undertake her first science cruise in early 2014. The multidisciplinary vessel has seismic capability, sub-bottom profiling and multibeam equipment, while its dynamic positioning capability allows it to support a wide range of over-the-side operations, including deployment of NERC's Isis Remotely Operated Vehicle (ROV) which can work at depths down to 6,500-metres.

For further details and specifications see: http://noc.ac.uk/research-at-sea/ships/rrs-discovery

What and Where are the Discovery Collections?

Tammy Horton
NOC, Southampton, UK

The Discovery Collections are an internationally important collection of deep-sea benthic and pelagic specimens. Samples date from as far back as 1925 when the first neuston nets were deployed in the Southern Ocean by the crew of Scott's ship Discovery (http://noc.ac.uk/data/discovery-collections). The Discovery Collections are now split into two parts. The first, consisting of the early Southern Ocean material and much of the early North Atlantic (mostly pelagic) material up to 1975, is housed at the Natural History Museum, London. The second part, consisting of mostly benthic samples from the North Atlantic collected since 1975, is housed at the National Oceanography Centre, Southampton. The collections are added to each year with recent additions from the Whittard Canyon, Porcupine Abyssal Plain and Charlie-Gibbs Fracture Zone (Mid-Atlantic Ridge). We also hold samples from international deep-sea sampling programmes, including the Arabian Sea and the Crozet Isles.

Dr Tammy Horton in the Discovery Collections at NOC, UK.

The Discovery Collections differ from other natural history collections in that they are dedicated solely to samples from the open ocean and the deep sea. They contain many unique, rare and exotic specimens, including specialist collections of amphipods, ostracods, siphonophores and foraminifera of worldwide importance.

We welcome scientific visitors to study the collections. This year we have hosted Anna Dilman (P.P. Shirshov Institute for Oceanographic Sciences) who studied the Hymenaster collection; and Pablo J. López-González & Francisco J. García Cárdenas (University of Seville, Spain) who studied the Pennatulacean collection. After a brief study of the holdings of >250 lots and 850 specimens belonging to at least 18 North Eastern sea pen species, Pablo remarked that "This collection should be considered as one of the most important in number of deep-sea pennatulacean species, and specimens from North-Eastern Atlantic". To find out more or to organise a visit please contact Tammy Horton (tammy.horton@noc.ac.uk).

Meetings & Workshops

Conference: Ocean Sciences 2014

Session 59: Illuminating the Deep Ocean – Limits to Understanding, Observation Requirements and Overcoming the Challenges

Honolulu, Hawaii

25-28 February 2014

http://www.sgmeet.com/osm2014/default.asp

The deep ocean plays a vital role in the climate system and for biodiversity on Earth. It paces climate change through the storage and cycling of heat, carbon and greenhouse gases. It is home to a plethora of organisms and ecosystems providing diverse functions and services. Far from being a quiescent, buffered system, it may respond quickly and in complex ways to powerful environmental and human perturbations over different spatial and temporal scales. The consequences of physical and biogeochemical changes and the re-structuring of deep-sea biological communities and their function remain poorly observed. Ocean parameters and their variability below 2000 m are collected or inferred globally through a sparse set of oceanographic transects, from isolated moorings, and from satellites measuring a limited set of integrated properties. We must bridge fundamental gaps in our understanding of the deep ocean, uncertainties regarding its spatial and temporal heterogeneities, as well as its role in, and responses to, climate change and human activities. Contributions are encouraged that describe advances in our knowledge of the deep ocean, present emerging observation capabilities and technologies, quantify requirements, lay out design strategies for deep-ocean observations of climate quality, climate-ecosystem interaction, or highlight current uncertainties through model or data assimilation-based studies.

Submission Details:

http://www.sgmeet.com/osm2014/start_process.asp

A picture is worth a thousand words (or some useful data)

Jennifer Durden

University of Southampton, UK

Are you overwhelmed by image analysis? Do you want to get into using images or videos for ecological data?

Imaging is increasingly used to assess communities in the deep sea. Improvements in photographic equipment, devices for carrying cameras, and data storage in recent years have made the collection of high-quality photographs on the seafloor a relatively easy and useful way of capturing biological/ecological information. We are collecting more and more images of the deep sea, but how do we get the best use of them?

Mark your calendars for 7-10 April 2014 when a workshop on imaging for marine ecology will be held in Southampton, UK! Topics will cover everything from the start to finish of image analysis: image collection, processing of images prior to annotation, still/video annotation, the future of annotation (including automation/crowd sourcing), and data management. Further details will be made available via the INDEEP mailing list.

VentBase

Wellington, NZ

2-4 April 2014

VentBase was established as a forum where academic, commercial, governmental, and non-governmental stakeholders can develop a consensus regarding the management of exploitation in the deep-sea, specifically the mining of seafloor massive sulfide (SMS) deposits.

A primary goal of VentBase is the production of best-practice documents that can inform stakeholders and highlight the most up-to-date science in order to underpin effective management.

VentBase 2012

The 2012 VentBase workshop was held at the National University of Ireland, Galway.

The aim of the VentBase 2012 workshop was to set standards for the data requirements of ecological assessment at SMS deposits (Collins et al. 2013a).

VentBase 2012 concluded that the first step in the development of coherent management approaches and practices is the collation of spatial information for describing hydrothermal-vent communities and their associated habitats. A three-stage sequence of events for the baseline survey of an SMS deposit during the exploratory stage was proposed, which includes the adoption of a standardized sampling approach.

A suite of standardized sampling methodologies were presented to the International Seabed Authority (ISA) and recommended for inclusion in the ISA's policies regulating the exploration and development of SMS resources in the high seas.

As a part of VentBase's aim to provide best-practice documents that can inform stakeholders, a primer for Environmental Impact Assessments of mining at SMS deposits was also developed at the 2012 workshop, and subsequently published (Collins et al. 2013b).

VentBase 2012 highlighted the need for: data generated from SMS EIA studies to be made available to inform future investigations through established, publicly available databases; any publications resulting from scientific studies at SMS deposits to be published Open Access to facilitate stakeholder engagement; and biological samples from EIA studies to be stored securely in conditions suitable for their long-term preservation, and their availability documented.

Participants in the workshop identified two significant knowledge gaps in the understanding of biological variability at SMS deposits: (1) the structure of benthic communities at inactive SMS deposits, and (2) biological succession (i.e. recovery) at hydrothermally active SMS sites subject to different levels of natural disturbance (e.g. fast versus ultra-slow spreading ridges). Both these knowledge gaps have important implications for the management of operations, and mitigation strategies suitable for particular sites and mining practices.

VentBase 2014

The 2014 VentBase workshop will be held on 2-4 April at the National Institute of Water & Atmospheric Research in Wellington, New Zealand.

The principal aim of the VentBase 2014 workshop will be to identify practical spatial management and mitigation strategies for the mining of SMS deposits. The workshop will also be an opportunity to further the development of 'primer-type' documents on other topics (e.g. a primer for conservation genetics at deep-sea SMS deposits).

The workshop will adopt an informal format to allow for easy and relaxed communication among participants, with presentations from experts in the field followed by one or more discussion sessions. The expectation is for these discussion sessions to result in the drafting of documents for publication by the ISA or in scientific journals.

The workshop is open to academic, commercial, governmental, and non-governmental stakeholders. However, the number of participants is limited (for practical purposes to about 35) - so abstracts should be submitted as soon as possible to enable the organisers to select the most suitable programme.

Abstracts that relate to the participants' experience in designing open and closed areas for the mining of other deep-sea mineral deposits (such as manganese nodules) are particularly welcome, as are abstracts about organism transplantation, substratum replacement and other possible mitigation strategies. The deadline for the submission of abstracts is 1 January 2014.

Registration for the workshop (NZ$200), and the submission of abstracts, can be done via the VentBase 2014 website (website under development). For urgent enquiries prior to the website launch, please contact Ashley Rowden, ashley.rowden@niwa.co.nz.

References

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Collins P.C., Croot P., Carlsson J., Colaco A., Grehan A., Hyeong K., Kennedy R., Mohne C., Smith S., Yamamoto H., Rowden, A.A. (2013b). A primer for the Environmental Impact Assessment of mining at seafloor massive sulfide deposits. Marine Policy 42: 198-209

Integrated Marine Biogeochemistry and Ecosystem Research (IMBER) Open Science Conference

23-27 June 2014, Bergen, Norway

"Future Oceans – Research for marine sustainability: multiple stressors, drivers, challenges and solutions"

Call for Abstracts – Open

The Integrated Biogeochemistry and Ecosystem Research (IMBER) Project will convene its Open Science Conference from 23-27 June 2014 in Bergen, Norway, with the goals of:

- highlighting research results from the IMBER project and activities,
- promoting integrated synthesis of IMBER research, and

• developing a science plan and implementation strategy for the next phase of IMBER research.

The Call for Abstracts for the IMBER OSC 2014 is now open! Deadline for abstract submission: 15 January 2014.

Contributions to the IMBER OSC 2014 are welcome from all marine and oceanographic communities!

We encourage you to forward this call widely to your colleagues and other interested parties, and we look forward to meeting you in Bergen!

IMBER IPO
imber@imr.no

MeioScool 2013: Meiofauna International Workshop: A dive in a microscopic world!

Brest, France

26-29 November 2013

http://meioscool2013.sciencesconf.org

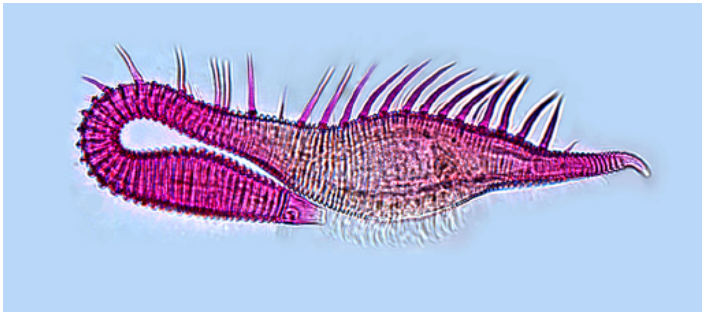
Meiofauna is one of the fundamental components of benthic communities and is characterized by high abundance and diversity, fast turnover rates and occupies a key position in the food web. Meiofauna contains most known animal phyla and is certainly the most abundant and diversified group in the world.

The objective of MeioScool 2013 is to bring together several meiofaunal experts in Brest in order to:

1) Increase awareness of researchers, students and general public about the fundamental role of meiofauna in marine ecosystems from the coastal zone to abyssal depths.

2) Train students and researchers in the identification and description of meiofauna through several complementary disciplines (taxonomy, ecology, molecular biology) and stimulate a new generation of meiobenthologists.

The first two days of the MioScool workshop will be devoted to conferences while the two following days will be devoted to field and laboratory work (sampling, extraction, identification of major meiofaunal taxonomic groups).



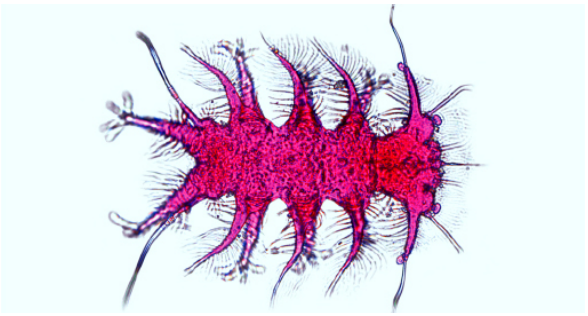
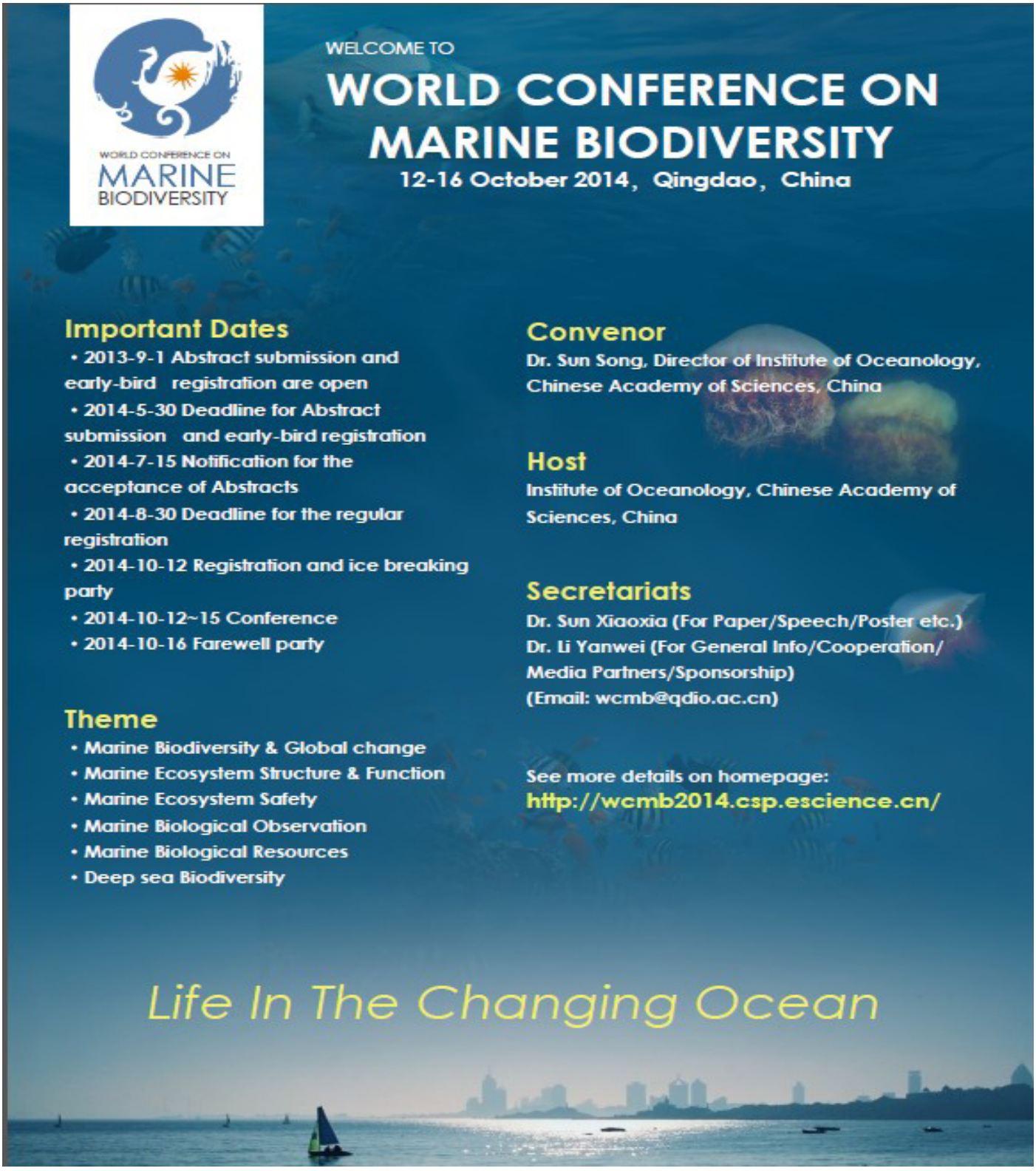


Figure 1 (left): Akanthepsilonema *sp.; Figure 2 (right):* Neostygarctus *sp.*

Pedro Martinez Arbizu, Diego Fontaneto, Andy Gooday, Reinhardt Møbjerg Kristensen, Viatcheslav Ivanenko, Martin Sørensen and Ann Vanreusel will enhance the conference by keynote lectures.

A MeioScool dedicated evening event (The Microscopic Night Event) will be organized at Océanopolis (29 November, 20:30h). This event will include scientific animation, photographic exhibition and a public lecture by Daniel Desbruyères in collaboration with the Theatre Company ImproInfini.

A photography competition focused on the microscopic universe is launched. The selection panel will be composed by researchers, graphic designers and professional photographers.



EurOCEAN conferences are major European marine science policy conferences. They provide a forum for the marine and maritime research community and wider stakeholders to interface with European and Member State policymakers and strategic planners, to consider, discuss and respond to new marine science and technology developments, challenges and opportunities.

The distinctive feature that characterizes EurOCEAN conferences is the focus on bringing the stakeholders together to speak with one voice towards policy. Since EurOCEAN 2004, conference delegates have delivered joint policy statements, EurOCEAN Declarations, to raise decision makers' awareness of the marine research priorities and propose concrete actions. These statements have been critical drivers of research and policy developments in Europe since. EurOCEAN 2014 will take place from 7 to 9 October 2014 in Rome, Italy, as an official event of the Italian Presidency of the Council of the European Union.

For further information:
http://www.euroceanconferences.eu/news
http://www.eurocean2014.eu/
info@euroceanconferences.eu

International Symposium on Foraminifera

University of Concepcion, Chile

19-24 January 2014

We are pleased to announce the International Symposium on Foraminifera (FORAMS 2014) to be held at the University of Concepcion, Chile, on 19-24 January 2014. Detailed information on Sessions of FORAMS 2014, instructions for abstract submission registration form and fees are available at:
www.udec.cl/forams2014

Deadline for abstract submission is 31st October 2013.

It's Your Opinion

How might marine scientists and historians benefit from collaboration?

Antony Adler
University of Washington, USA

Figure 1: Anthony Adler

A sea change is taking place in the history of science and in environmental history. Many historians have begun to acknowledge that the marine sciences represent a largely untapped subject. Some scholars have been calling for the study of the marine sciences for decades. The first international congress on the history of oceanography took place in 1966, and the first issue of the History of Oceanography Newsletter was issued in January 1989. Yet, many of the scholars who laid the foundations for the study of the history of the marine sciences were scientists themselves; their passion for the history of the marine sciences developed from a passion for marine science. Until recently, the history of the marine sciences remained an outlier in the scholarship of historians.

A quick scan of the conference programs for the meetings of the American Society for Environmental History, the Canadian Society for the History and Philosophy of Science, or the meeting of the International Congress for the History of Science Technology and Medicine shows that a change is underway. Increasingly, the oceans are a topic for historians, who are not immune to the changing tides of public interest. As climate change, ocean acidification, marine resource depletion, and pollution become hot topics of public debate, historians are beginning to shift their attention to the seas.

The January 1st, 2013 issue of the journal Environmental History featured a forum on marine environment history. As environment historian Nancy Langston writes in her "editor's note":

> «It's not always easy for historians to participate in scholarly and policy debates over marine management. Scientists, policymakers, and historians speak different languages and control different financial resources, which makes collaboration challenging. When a scientist wins a grant and invites a historian to participate in a research project, what the scientist needs from that historian often differs from what the historian wants to contribute. Historians excel at problematizing scientific approaches to knowledge building, but "Well … it's complicated" is rarely a useful answer when a policymaker asks a question. Nevertheless, it is critical for historians to participate—and participate usefully—in interdisciplinary marine research. Without a sense of history, how can we hope to understand, much less restore, marine ecosystems?»

Scientists have begun to come to similar conclusions. The recently published report of the Subcommittee on Ocean Science and Technology of the National Science and Technology Council, "Science for an Ocean Nation: Update of the Ocean Research Priorities Plan" notes under "research priority 2":

> «Understanding human impacts on marine ecosystems, whether positive (restoration) or negative (degradation), will require integrating traditional ocean science with socioeconomic science. […] Restoration science as a body of principles and best practices is rapidly growing in importance and relevance to our Nation's coastal resilience and sustainability. To determine and predict society's impact on marine ecosystems, social and economic factors (e.g., land, water, and energy use; coastal and watershed development; resource

> use perception; cultural history) that determine how society views and uses marine ecosystems should be assessed and modeled.[2]»

As previously noted, the pioneers of marine science history were marine scientists themselves. Writing in 1923, Sir William A. Herdman, former professor of oceanography at the University of Liverpool wrote in the introduction to his text Founders of Oceanography and their Work: An Introduction to the Science of the Sea:

> «It is not too soon to let the young university student, and the intelligent public in general, know that the oceans present wonderful phenomena and profoundly interesting problems to the observer and the investigator, and that a science of the sea having it's roots in the remote past has of recent years developed greatly and is now growing fast into an organized body of interrelated knowledge.[3]»

Sir Herdman's call to action is even more urgent today than it was then. The future of our oceans depends on the successful communication of marine science to the public. However, efforts at educating the public about the oceans are not recent. In the 19th century, naturalists produced monograph narratives of scientific voyages for public consumption. Writing in 1859, the celebrated marine naturalist Edward Forbes noted in the introduction to his text, The Natural History of the European Seas:

> «Our volumes may be, and often, from the very nature of their themes, are, comparatively dry and heavy. Yet the adding an ear, or even a grain of wheat to the great granary of human knowledge, whence the brains of future generations are to be nourished, is some small service to the good cause of enlightenment.[4]»

While it is true that the texts that Forbes created in the 19th century did not require interdisciplinary collaboration, over time, historians and scientists have continued to move further apart from one another. As one scholarly discipline now turns new sights upon another, a widened public, interested in oceans, oceanography, and their history, is being created. This is a moment in which fruitful interdisciplinary collaboration is becoming possible. What forms actual collaboration between members of these two disciplines may be forged waits to be seen. But, surely we can agree that it would be good to foster the growing conversation across the disciplines. In the words of marine environmental historian Christine Keiner, "the stakes are too high to allow the inevitable misunderstandings that mark all interdisciplinary efforts to stand. In this era, no discipline is an island."[5]

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1. Nancy Langston, "Editor's Note," Environmental History, Vol. 18, No. 1, (2013).

2. Subcommittee on Ocean Science and Technology of the National Science and Technology Council, "Science for an Ocean Nation: Update of the Ocean Research Priorities Plan," (February, 2013) p. 50.

3. Sir William A. Herdman, Founders of Oceanography and their Work: An Introduction to the Science of the Sea, (London: Edward Arnold & Co., 1923,) p. v.

4. Edward Forbes, The Natural History of the European Seas, (London: John Van Voorst, 1859,) p. 2.

5. Christine Keiner, "How Scientific Does Marine Environmental Science Need to Be?" Environmental History, Vol. 18, No. 1, (2013).

Status Update on Deep Water Horizon Blowout and Spill

Robert Carney
Louisianna State University, USA

At this time there are several efforts underway to initiate science-based conservation and management of deep-ocean habitats. Given the importance of these efforts, it is informative to consider the status of damage assessment and ultimate restoration in the US EEZ of the Gulf of Mexico following the blowout, explosion, and massive oil spill of the Deep Water Horizon.

On 20 April, 2010, control of a well at approximately 1500 m was lost and a failure of emergency systems resulted in an explosion that killed 11 offshore workers, sank the drilling platform, and initiated a massive oil spill that continued until August 4. The event triggered a series of activities prescribed by the Oil Pollution Act. That law establishes the legal relations among the federal government, the insured parties, and the responsible parties. In a coordinated fashion these parties must stop the spill, assess damage and either restore or make restitution. The responsible parties must bear the costs. A second law, the Clean Water Act, assess fines based on the amount of oil spilled and the degree of negligence.

Together the Oil Pollution and Clean Water Acts establish the legal environment in which scientific data become evidence, the meaning of which must be decided in a court of law. Has damage been found and conclusively linked to the spill? Even if damage has been demonstrated, what has been the actual monetary loss experienced by the injured parties? As with many legal actions, the evidence may not be made public until appeals are exhausted and a final settlement made.

Due to local circulation patterns, the 160 km long surface slick stayed largely offshore until May when oiling coastal habitats became progressively worse. Fisheries were closed and oil spread along the entire coast of the states of Louisiana, Mississippi, Alabama, and portions of Florida. In addition to environmental damage, the tourist and seafood industries experienced dramatic losses of revenue. Given the breadth of habitats impacted, the Natural Resources Damage Assessment (NRDA) process was quite extensive.

Among the NRDA deep studies whose results remain proprietary, three are especially important. Taking advantage of an existing study, NRDA investigation of deep corals was proposed early on June 27 and approved a few months later (1,2). Much early NRDA sampling focused on the water column, but surveys specifically aimed at mesopelagic fauna were proposed in late November of 2010 (3). Almost a year after the spill a deep soft-bottom benthic community survey was proposed and approved.

Greatly complicating the task of reaching a preliminary conclusion about deep damage is the fact that relatively small projects have been undertaken which lack restrictions on distributing results. Notable among these are RAPID projects funded by the U.S. National Science Foundation and projects funded by the Gulf of Mexico Research Initiative, a program voluntarily set up by BP. These provide glimpses of some impacts in the general vicinity of the spill but are neither as extensive nor as comprehensive as the proprietary NRDA efforts.

What happens about restoration once deep damages are proven? Unfortunately restoration mixes politics and law. The US Congress passed the RESTORE Act of 2011 (The Resources and Ecosystems Sustainability, Tourism Opportunities and Revived Economy) which gives the five US states on the Gulf of Mexico a very substantial voice in how any restoration funds are spent (5). It is reasonable to expect the governors of those five states to argue for projects carried out in their coastal waters. Other hindrances in the way of substantial deep-water activity is the relatively small size of any advocate group when compared to extensive coastal influence and the very high logistical cost of putting well-equipped vessels on station.

Stay tuned.

Latest key publications:

http://www.plosone.org/article/info%3Adoi%2F10.1371%2Fjournal.pone.0070540 – the damage assessment for the benthic in fauna
http://www.pnas.org/content/early/2012/03/23/1118029109.abstract - earlier report on coral damage

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2.https://www.piersystem.com/external/content/document/2911/1033223/1/NR_INVERT_Survey%20of%20Hard-Ground%20Macrofauna%20Communities.pdf
3.https://www.piersystem.com/external/content/document/2911/1102867/1/Offshore%20Deep%20Meso-Bathypelagic%20Fish%20Sampling-%20RV%20Pisces%20Winter%202010.pdf
4.https://www.piersystem.com/external/content/document/2911/1102899/1/Offshore%20&%20Deepwater%20Softbottom%20Sediment%20&%20Benthic%20Survey.pdf
5. http://www.restorethegulf.gov/council/about-gulf-coast-ecosystem-restoration-council

Deep-Ocean Junk!

Rachel Jeffreys
University of Liverpool, UK

A fair few of us have witnessed the loss overboard of expensive and often complex oceanographic instrumentation. I have been going to sea for just over 10 years and have observed quite a number of these catastrophe's: from box corers and Agassiz trawls to high-tech ROV operated experimental in-situ benthic chambers. The aftermath of watching a piece of kit disappear out of site into the abyss usually involves the manic retrieval attempts! When Marc Lavalye lost his Agassiz trawl, the ship's crew set about manufacturing anchors to dredge for it. Similarly when Ursula Witte's AEROBIC chambers disappeared into a Portuguese canyon the ROV crew searched for them for what seemed like an eternity. Sadly, neither search was fruitful. Indeed, I have only witnessed one successful 'search and rescue' for a piece of deep-sea kit. Henko de Stiger had successfully deployed the NIOZ BOBO lander in the Whittard Canyon and we happily set off for our next destination Galicia Bank. Well into our passage we received a warning from NIOZ via the ARGOS float that all was not well with the BOBO. We rushed back to the Whittard Canyon where we saw the BOBO bobbing around in the water (a faulty weight had caused it to resurface). We redeployed BOBO and after another 3 weeks at sea, we returned to NIOZ. Upon arrival, poor Henko received a call from the Police authorities in Brittany, to inform him that the BOBO lander had washed up on their shores near Brest!! It was badly damaged but not a total loss.

Space scientists face a similar problem, in that they also use expensive and highly technical kit to collect precious data about our planet, solar system, and beyond. It has been estimated that there are currently around 30 000 items larger than 10 cm circling Earth. Most of these items result from explosions in fuel tanks and batteries and high velocity impacts. At the 6th European meeting on space debris, scientists called for an urgent need to remove space debris. In the couple of months following this meeting (July 2013), a piece of historical space debris was retrieved from the Atlantic Ocean at depths of ~ 4300 m, 360 miles from Cape Canaveral. Some 44 years after it helped to launch the first men on the moon, the engines of Apollo 11 were retrieved with the financial aid of Jeff Bezos, (the founder and CEO of Amazon) in a secret expedition. Bezos and his team were able to locate the engines using sonar and retrieve them using ROVs. The engines plunged to the seafloor during the Apollo 11 mission once their fuel was spent, rendering them unrecognizable on recovery as the force of the impact had ripped them apart. One secret that the deep sea held back from Bezos and his team was the mission identification. Forty-four years in one of the most corrosive natural

environments, seawater, had eroded most of the serial numbers on the parts that the team had retrieved. Using black light and special lens filters the conservation team at the Kansas Cosmosphere and Space Centre were able to identify that one of the thrust chambers was from Engine 5 of the Apollo 11. During the next two years the conservation team will prepare the engines for public display.

Link to information video: http://www.theguardian.com/science/video/2013/mar/21/nasa-apollo-engines-atlantic-video

I wonder how much oceanographic and space junk remains in our deep oceans?

Art and Science: Envisioning Ocean Depths

http://oceanography.ml.duke.edu/discovery/

Cindy Lee Van Dover

Marine Laboratory, Nicholas School of the Environment, Duke University

My scientific training taught me to be objective, factual, precise, to forgo emotion. Art can convey emotion, capturing the wonder and delight that accompanies exploration and discovery. I have taken to inviting artists to join me on research expeditions, where they interpret deep-sea organisms and landscapes and bring the emotional impact of exploration to a wider audience.

Art and Science: Envisioning Ocean Depths is a new multi-media, on-line and traveling exhibition that features artists and artwork from a 2012 field expedition to Barbados seeps with R/V Atlantis and ROV Jason. The artists were challenged to capture the essence of discovery as the scientists mapped the seafloor, made measurements of water column properties, used a MOCNESS to sample zooplankton, and deployed the ROV to collect benthic invertebrates. The artist-scientist-crew discourse was lively as perspectives on the deep-ocean research experience were shared.

Gallery Features

- Water-color artist Karen Jacobsen worked with water washes in the Jason Control Van to create impressionistic 'pleine eau' paintings of the seafloor landscape.

- Batik artist Mary Edna Fraser tracked the seafloor morphology as it appeared on the multibeam waterfall and her brightly colored depictions of the sonar maps will be translated onto silk.

- Jolene Mok, an experimental artist who integrated practical and theoretical components in the creation process, created a triptych video installation Shipboard Romance that explores motion.

- Natasha Kermani, a New York City-based director, producer, and cinematographer created a short documentary with an original score that screened at the Woods Hole Film Festival in July 2012.

- PhD student and photographer Brandon Puckett used the camera lens to capture All Hands on Deck, a study of hands at work at sea.

- Realist painter Seth Tane and diorama artist Becca Barnet will contribute to the traveling show with a 'portrait' of the ship Atlantis (Tane) and a recreation of a seep habitat (Barnet).

Funding for Art and Science: Envisioning Ocean Depths was provided by the US National Science Foundation (OCE-1031050 to CLVD) and the Nicholas School of the Environment at Duke University. Web Designer: Celie Dailey.

Figure 1 (top): Exhibition examples with Cindy van Dover; Figure 2 (above left): Scientific illustrator Karen Jacobsen illustrating a bathymodiolin mussel from Barbados seeps. Photo: CL Van Dover; Figure 3 (right): Batik artist Mary Edna Fraser, with her open sketch book, Barbados seep cruise. Photo: CL Van Dover

Scientist Profiles

Masako Nakamura – Researcher (larval dispersal and recruitment)

Okinawa Institute of Science and Technology (OIST)

I am a young coral ecologist now attempting to understand community dynamics in deep-sea ecosystems by studying larval dispersal and recruitment

How do larval dispersal and recruitment processes influence benthic community dynamics? How do such processes change with short- and long-term environmental changes? How do such changes affect community dynamics?

Since my postgraduate studies at the University of the Ryukyus, in Okinawa, Japan, I have been trying to answer these questions in relation to scleractinian corals. I have been studying recruitment patterns and community structure at different sites near Iriomote Island, Okinawa, for over four years. I have also investigated the effects of environmental changes, especially those of ocean acidification, on larval dispersal and recruitment processes, using tank experiments. Since moving to OIST as a postdoctoral researcher in 2010, I have been working in a research unit whose goal is to understand the role of larval dispersal in maintaining connectivity among populations, using physical and biological methodologies. I am studying the challenging problem of larval dispersal and recruitment processes of benthic animals near hydrothermal vents in the deep sea from 2011. My first project in the vent study is to observe the spatio-temporal variability in recruitment of benthos. I have deployed colonization devices at different vent sites in the Okinawa Trough. Retrieval of the devices is scheduled for November 2013 and February 2014. These recruitment data will not only help us to understand larval dispersal processes in light of published data regarding reproductive and developmental characteristics, but also the resilience of these communities. Additionally, in collaboration with Dr. Hiromi Watanabe, of JAMSTEC and Prof. Takenori Sasaki, of the University of Tokyo, I am studying gametogenesis and population structure in a limpet species Lepetodrilus nux, that is almost ubiquitous in the Okinawa Trough, but poorly studied. Our data have already demonstrated that this limpet has the potential for continuous reproduction, but discontinuous recruitment. Combining these data with ocean current simulations developed by my mentor, Prof. Satoshi Mitarai, I want to understand larval dispersal processes and factors affecting the dynamics of benthic communities through recruitment. Recently, we began planning another project to investigate the vertical distribution of larvae in ocean currents. Vertical distribution of vent fauna has not been well understood because larvae are tiny and very difficult to directly observe in the water column. This effort is somewhat like treasure hunting in the vast ocean basin. However, if we can find larvae at unexpected depths, we may be able to gain valuable insights into larval dispersal patterns. Now we are analyzing samples from a pilot study. I believe that these projects may help to understand the dynamics of vent communities from the perspective of the supply side (larval dispersal and recruitment).

Dr Laura J. Grange - Teaching Fellow in Marine Biology & Researcher

School of Ocean and Earth Science, National Oceanography Centre, University of Southampton, UK

First and foremost I am a benthic marine ecologist, with a specialism in polar benthos. My primary research interests focus on using benthic systems as models to investigate marine ecological and biological theory against a backdrop of changing environmental conditions, and evaluating benthic ecosystem responses to climate change. I have studied

benthic ecosystems on both sides of the Antarctic Peninsula, in both shallow and deep-water habitats, with my main focus on epibenthic megafauna. I received my PhD in the reproductive success of Antarctic marine invertebrates from the University of Southampton, UK in 2005. I recently completed a postdoctoral scholarship at the University of Hawaii at Manoa, in Honolulu, where I gained over four years postdoctoral experience working on seafloor ecological processes in deep-water habitats off the Antarctic Peninsula. Here, I studied megafaunal abundance and biodiversity patterns in subpolar fjords along the West Antarctic Peninsula, and the benthic ecosystem response to a strong latitudinal sea-ice gradient to explore ecosystem consequences of sea-ice loss from climate change. During my final year of research in Hawaii, I was appointed as an Assistant Professor in the Department of Biology, where I was tasked with co-instructing, developing and designing the core-course curriculum for the first graduate program in Marine Biology offered in Hawaii.

Most recently I have been appointed to a new position as Teaching Fellow in Marine Biology in the School of Ocean and Earth Science, National Oceanography Centre, Southampton University, UK. In my new role I will be co-coordinating a Masters Key Skills and Literature Review module and a module in Contemporary Topics, and I will be contributing to several undergraduate and graduate level courses. I currently have a paper in press with PLoS ONE and co-authored by Dr Craig Smith, University of Hawaii at Manoa, highlighting the WAP subpolar fjords as hotspots of megafaunal abundance and biodiversity. This study provides new insights into the potential consequences of climate change along the Antarctic Peninsula, one of the most rapidly warming regions on the globe. Most recently, I have been on research leave at the Darling Marine Center, University of Maine, USA working alongside Dr Rhian Waller, a cold-water coral reproductive biologist, on the study of processes governing the emergence of deep-water corals into shallow-water habitats of the Northern Patagonian Fjords.

Several of the scleractinian corals currently identified from Chilean waters are known to occur at significantly shallower depths in these fjordic systems than they do elsewhere. This phenomenon termed ‘deep-water emergence’ has been documented in several high latitude systems, including several Alaskan, Norwegian and Swedish Fjords. However, our existing understanding of this phenomenon and the ecology of the species within which it has been observed is extremely limited. Of particular interest in this study is the solitary coral, *Desmophyllum dianthus* (Esper, 1794), a species characterised as widespread and ecologically important in its role as a co-reef building azooxanthellate coral in deep-sea habitats (> 1000m). In contrast, D. dianthus has been observed in notable densities and at unusually shallow depths (< 10m) in the Northern Patagonian Fjords providing an unprecedented opportunity to study a species, which is typically difficult to sample for logistical reasons.

Dr Waller and myself travelled to the Northern Patagonian fjords in September to study the reproductive ecology and population dynamics of D. dianthus, in the hope of developing a more complete understanding of connectivity between the coral populations within this fjord ecosystem, and beyond. It was an extremely successful field season and I was lucky enough to scuba dive several times collecting corals from this unique marine environment. I am excited to see the results and collaborate with Dr Waller on future projects.

Blog address: http://newswatch.nationalgeographic.com/author/rwaller/

Cherisse Du Preez

Deep-sea Benthic Ecology, Department of Biology at the University of Victoria, Canada

The ocean is my life’s passion and one of my favorite ocean-going activities has always been filming underwater. My

Ph.D. project is a dream come true, I explore and study the deep sea using submersible platforms and video imagery. Under the supervision of world-renowned deep sea ecologist, Prof. Verena Tunnicliffe, I have had the opportunity to participate in a number of oceanic expeditions, working in a variety of deep-sea environments, in four oceans, using an array of submersibles.

My Ph.D. research is dedicated to ocean health and sustainability. Marine biodiversity is an index of both qualities and is often considered in conservation decisions for marine ecosystems. Extensive sampling to collect deep-sea biodiversity data is logistically problematic but indirectly predicting biodiversity through surrogacy and habitat mapping is an emerging innovation. My research focuses on the relationship and potential for surrogacy between deep-sea biodiversity and seafloor structure. Using a combination of imagery and ship-based bathymetric remote sensing, I have investigated distribution patterns of commercially important rockfish, deep-sea sponges and corals, trawling-impact, and multiple biodiversity parameters with relation to multi-scale seafloor roughness and sediment variables.

Aside from ecology, a large component of my work is developing novel methods. I have recently published on remotely operated vehicle (ROV) operations, habitat mapping, fine-scale optical remote sensing of bathymetry, and am currently working on an improved method of calculating 3D terrain roughness.

I have thoroughly enjoyed my graduate student experience and I am excited to continue my career in ocean science. I plan to finish my Ph.D. by early 2014 and am currently searching for an interesting postdoc. Please feel free to contact me with information: cdupreez@uvic.ca or <https://sites.google.com/site/cpdupreezphd/>.

Leigh Marsh

Ocean and Earth Science, University of Southampton, NOCS, UK

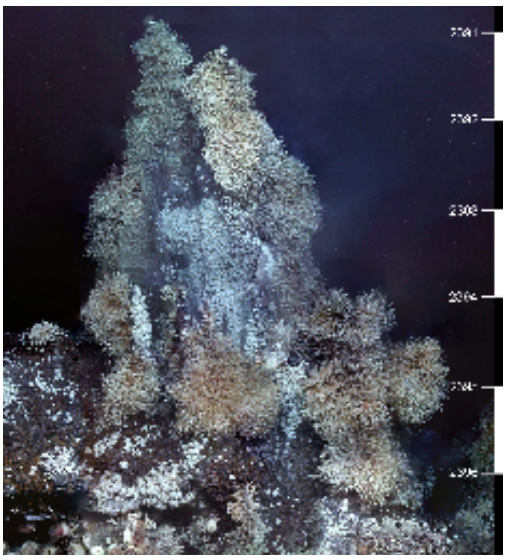

Figure 1: Vertical mosaic image created using sequential image captures from the 1080i video footage."Carwash" 9.7 m edifice, 2401 m depth, E9 vent field, East Scotia Ridge.

I am in the final year of my PhD at the University of Southampton based at the National Oceanography Centre, UK. Working in the colder climes of the Antarctic, my work focuses on the use of ROV technology to examine life at hydrothermal vents and how the fauna associated with these remote habitats change in both space and time.

Recently discovered hydrothermal vent fields on the East Scotia Ridge (ESR) Southern Ocean, represent a new province of vent biogeography. Through my research, I have determined patterns of faunal zonation, species associations, and relationships between faunal microdistribution and hydrothermal activity at the E2 and E9 vent fields. I have shown that the vent fauna present at the ESR reveal a distinct pattern in zonation of their faunal assemblages, not previously recognised from extant provinces of vent biogeography. When taxa are compared at family level, however, patterns revealed by the Southern Ocean vents, are similar to those known across global vent systems.

Visually dominated by the enigmatic anomuran *Kiwa* n.sp., the chimneys at the E2 and E9 vent fields may provide a unique «thermal envelope» for this species to survive in the otherwise hostile Antarctic environment, known for its

paucity of reptant decapod crustaceans. These «Kiwa assemblages» have been divided into three subtypes, based on the average size class of individuals and proximity to fluid exits, with individuals also observed outside the direct influence of hydrothermal fluid. By piecing together variation in faunal microdistribution, body size-frequency, sex ratio, ovarian and embryonic development, reveals a pattern in the distribution of female Kiwa n. sp. at Antarctic vent fields in relation to their reproductive development.

For my PhD research, I have been on three cruises to the East Scotia Ridge using the UK's Isis ROV and towed camera platforms. During my studies I have also participated in four further research cruises including hydrothermal vent exploration on both the Southwest Indian Ridge (Kiel 6000 ROV) and the Mid-Cayman Spreading Centre (Isis ROV and the EV Nautilus, Ocean Exploration Trust) and, field studies of seamount ecology in the Indian Ocean region (Kiel 6000 ROV). After submission of my thesis, I am delighted to be joining PI Laura Robinson (University of Bristol) on for the Tropics cruise (Tracing ocean processes using corals and sediments 14th October-31st November 2013), where I will be assisting in the collection and processing of ROV acquired data.

The goal of my research is to understand the key processes that determine the distribution and abundance of deep-sea fauna, and the biotic and abiotic interactions that structure their assemblages. By understanding these relationships, I hope I can contribute to the protection and sustainable use of marine ecological resources.

Megumi Shimizu

Division of Marine Science and Conservation, Marine Laboratory, Nicholas School of the Environment, Duke University, USA

I am a PhD student studying bacteria and archaea in marine sediment using lipid biomarker analysis, DNA sequence, and geochemical analysis in Dr. Cindy Lee Van Dover's lab. My interest is how microbial communities are vertically distributed in marine sediments and how they respond to seasonal and climate change. Marine sediments are one of largest microbial habitats and microorganisms in marine sediments play important roles in the carbon cycle and other elemental cycles. Geochemical components and microbial activities interact in marine sediments: geochemical stratification is an evidence of microbial activity and geochemical composition shapes the microbial community. The geochemical stratification could be changed due to the temperature and the amount of organic matter input. Part of my PhD dissertation focuses on microbes in Antarctic deep-sea sediments of the Larsen A embayment in the Weddell Sea. Larsen A experienced incremental ice shelf disintegration from the early 1900s to 2000. As a part of the LARISSA (Larsen Ice Shelf System, Antarctica) team, I collected a cross-shelf transect of sediment cores across the region of ice shelf disintegration. By using intact lipid lipid biomarkers and collaborating with scientists in the LARISSA team, my goal is to understand how the microbial community in the sediments changed as the ice shelf disintegrated. A key component of this work is to look for microbial community signals and biomass that transitioned from an oligotrophic to a eutrophic environment.

Paris Vasileios Stefanoudis

Deep-Seas Group, National Oceanography Centre, Southampton

Currently my world revolves around the fascinating group of shell bearing protists Foraminifera (a.k.a. Forams). I started my PhD at the National Oceanography Centre in Southampton in January 2013 and I am investigating how benthic foraminiferal assemblages at the Porcupine Abyssal Plain (PAP) respond to mesoscale environmental heterogeneity.

Knowledge of benthic biodiversity is fundamental to our understanding of how the marine ecosystems functions and the possible responses to future climate change. This project aims to refine the use of foraminifera as environmental indicators.

The first phase of my project includes analysis of foraminiferal samples taken at topographically contrasting locations at the PAP-area, encompassing "high" (abyssal hills) and "low" (abyssal plain) sites. The analysis of 3-5 replicates will improve our knowledge of small-scale (10s m) as well as mesoscale (10s km between the sites) faunal variability, and the relationship between diversity at these different spatial scales. All this translates to hours of lab work under the microscope, picking out Foraminifera and trying to identify them to species level. Identification is not an easy task and the current classification system has still many ambiguities but with the help of my supervisor Professor Andrew Gooday, I try to tackle any obstacles occurring in the process. I look at the entire components of the foraminiferal fauna, including the relatively poorly described groups of Komokiaceans and other soft-walled monothalamous taxa, as they can be particularly abundant at abyssal depths. The next steps include statistical data analysis and analysis of the environmental context of the sites using prokaryote abundances, sediment granulometry and biochemistry. I may also engage in phlyogenetic analysis to clarify the taxonomy of some species.

Participation in research cruises (JC085), workshops and conferences keep me quite busy and happy at the same time. Overall, my PhD is a unique experience and I am trying to get the most out of it. Contact: p.v.stefanoudis@soton.ac.uk

Rui Pedro Vieira

Graduate School of the National Oceanography Centre Southampton, UK

I am a first year PhD student in NOCS. My PhD research is focused upon changes in deep-sea benthic communities and fisheries in the region of the European margin under the supervision of Dr. Clive Trueman and Dr. Henry Ruhl (NOCS),

Dr. Marina Cunha (CESAM/University of Aveiro) and Dr. Jorge Gonçalves (CCMAR/University of Algarve). Continental slopes support highly diverse ecosystems, which are influenced by strong environmental depth-related gradients and human impacts. Primary production is limited to the upper layers of the oceans; therefore benthic production on the continental slope depends on passive and active nutrient transfer systems. The deep scattering layer is certainly important in fuelling benthic production, but its extent is uncertain. Human impacts were recently studied on the North Atlantic deep seabed, confirming the long-running concern on benthic trawling. Porcupine Seabight biodiversity hotspots and the Algarve coast crustacean trawl fishery will be investigated. Three datasets will be collected during the course of this project: visual assessments of trawling impacts and functional diversity in benthic ecosystems, stable isotope analyses of diet within fish communities and the deep scattering layer, and historical fishing and climate records. Data will be combined in ecosystem models to simulate the effects of changes in the benthic community on fisheries. Within this multidisciplinary framework, my PhD project will provide new biological data on European continental slope ecosystems' functioning and scientific evidence on human-induced disturbance on deep-sea that can be used to support future deep-sea management.

Eva Ramirez-Llodra

Between Barcelona (ICM-CSIC) and Oslo (NIVA)!

I am a deep-sea ecologist with a particular interest in understanding life-history patterns of meagafauna, biodiversity issues and the effects of natural and anthropogenic change to deep-sea ecosystems. Following four fantastic years conducting research for my PhD at the National Oceanography Centre (1998-2001, Uni. Southampton, UK) with Prof. Paul Tyler, Dr David Billett and Dr Craig Young (at the time at Harbor Branch Oceanography Centre, USA), and a postdoc at NOCS as Project Manager of the Census of Marine Life programme ChEss (2002-2005), I moved back to my home city, Barcelona. Here, I joined the Deep-Sea Renewable Resources research group of Prof Francesc Sardà and Dr Joan B. Company at the Institute of Marine Sciences (ICM-CSIC).

As with the DeepSeas research group in NOCS, it has been a great pleasure working at the ICM-CSIC, but it is time to move again…this time, we (the family has grown since my English days!) are heading north to Oslo! I am delighted to have been offered a Research Scientist position as Sediment Ecologist at the Norwegian Institute of Water Research (NIVA) in the team of Dr Mats Walday, where I will start in January 2014. At NIVA, I will develop new projects with my new research team and continue with existing collaborations, at the same time that I will continue to be co-PI of INDEEP and co-lead of INDEEP's WG3 on population connectivity with Dr Anna Metaxas, as well as continue with my tasks at the DOSI steering committee and some of the DOSI activities.

David Honig

Duke University Marine Laboratory, USA

Trophic structure at marine reducing habitats has been the theme of my PhD thesis, of which I am in my final semester, in Dr. Cindy Van Dover's lab at Duke University. My work has integrated DNA sequencing and stable isotope analysis to test hypotheses about predation and niche partitioning at hydrothermal vents in Manus Basin and at sunken whale bones along the Antarctic Peninsula. In Manus Basin, hydrothermal vents are dominated by provannid snails (Alviniconcha spp. and Ifremeria nautilei) that host symbiotic bacteria. I constrained contributions of symbiosis to snail nutrition and contributions of snails to diets of higher-order consumers. Along the Antarctic Peninsula, recently documented "super-aggregations" of whales raise the possibility that sunken whale bones may also be abundant. Sunken whale bones support chemoautotrophically based food webs for years, and nourish fabulously weird animals such as bone-eating snot worms in the genus *Osedax* As part of the Larsen Ice Shelf System, Antarctica (LARISSA) project, and in collaboration with researchers from Europe, I deployed whale bones on moorings along the Antarctic Peninsula. Animals recovered on the bones provided an opportunity to address a number of questions, including the extent to which trophic structure at these bones resemble those in other regions, the importance of chemoautotrophy in exporting bone energy, and the extent to which trophic niches of co-occurring species in the genus *Osedax* overlap. During my thesis, I have also developed several Bayesian models for analyzing stable isotope data that will be of use to the wider deep-sea community.

Opportunities

Between the Earth and Ocean: Tier 2 Canada Research Chair in Seafloor Processes and Properties

The Faculty of Science at Memorial University seeks candidates for a tenure track Tier 2 Canada Research Chair in the area of seafloor processes and properties. Tier 2 chairs "are for exceptional emerging researchers acknowledged by their peers as having the potential to lead in their field", and normally restricted to those within 10 years of completing their PhD. This position is subject to budgetary approval.

The ideal candidate will have a background in some combination of the disciplines of Marine Sciences and Engineering. Research interests should address the study of biological, chemical, geological, and/or physical processes at the seafloor and in the water column. We seek an individual who can build on existing institutional research strengths of cold ocean research to develop a vigorous research program and foster collaborative multidisciplinary research across the faculties of science and engineering. Scientists with research interests and backgrounds in this broad scientific area are encouraged to apply. Appointment will be made at the rank of Assistant or Associate Professor.

Ocean research is one of the focus areas declared in Memorial's Strategic Plan and excellent opportunities for collaborative research exist within the University as well as with researchers working in the wider St. John's Ocean Science and Technology cluster. Memorial's Faculties of Science and Engineering and Applied Science host a diversity of researchers with a wide range of interests including: causes of climate change determined from the marine sedimentary record, monitoring environmental change, seismic imaging in sedimentary basins, determining fundamental controls on benthic ecology, and studying how sediment is dispersed in these settings. In addition, there is great potential to establish collaborative projects with researchers studying the effects of climate change on terrestrial ecosystems. State of the art facilities for collection of seafloor datasets and sediment characterization may be accessed through Memorial University's Marine Institute, Faculty of Engineering and Applied Science, Department of Earth Sciences, Department of Ocean Sciences, and Department of Physics and Physical Oceanography. World-class research infrastructure is available at the National Research Council's large-scale tow tank, ice tank and wave basin, as well as flume tanks at the Marine Institute and seawater flumes and the deep-sea facility at the Ocean Sciences Centre (see also http://www.mun.ca/research/ocp/creait/). The Research Chair will therefore be able to interact and collaborate with a broad base of researchers at the University and in the local community that have significant interest and expertise in the development of novel instrumentation for the collection of seafloor and water column data.

Memorial University is the largest university in Atlantic Canada. As the province's only university, Memorial plays an integral role in the educational and cultural life of Newfoundland and Labrador. Offering diverse undergraduate and graduate programs to almost 18,000 students, Memorial provides a distinctive and stimulating environment for learning in St. John's, a very safe, friendly city with great historic charm, a vibrant cultural life, and easy access to a wide range of outdoor activities.

Details of the Canada Research Chairs program can be found at www.chairs.gc.ca.
The deadline for receipt of applications is October 30, 2013. Interested persons should send a statement of research interests, resume, and the names and addresses of three referees to the Dean of Science (deansci@mun.ca). Please use reference number VPA-EASC-2013-001.

All qualified candidates are encouraged to apply; however, Canadian Citizens and permanent residents will be given priority. Memorial University is committed to employment equity and encourages applications from qualified women, men, visible minorities, aboriginal people and persons with disabilities.

2014 Postdoctoral Fellowship Program

Applications for the postdoctoral fellowship program at the Monterey Bay Aquarium Research Institute (MBARI) are currently being accepted. MBARI is dedicated to the development of state-of-the-art instrumentation, systems, and methods for scientific research in the oceans. Ongoing programs in marine robotics, ocean physics, chemistry, geology, and biology as well as information management and ocean instrumentation research and development exist at MBARI. Located in Moss Landing, California at the head of Monterey Bay, MBARI enjoys convenient access to diverse oceanographic environments. The institute operates research vessels equipped with remotely operated vehicles, autonomous underwater vehicles, and diverse oceanographic equipment. In addition, MBARI operates the MARS seafloor cabled observatory. MBARI is a non-profit oceanographic research institute supported by the David and Lucile Packard Foundation.

Offers will be made to candidates from the fields of biological, chemical, physical oceanography, marine geology, and ocean engineering. Candidates must be awarded the Ph.D. degree prior to commencing the two-year appointment and start during the 2014 calendar year. Applicants are encouraged to communicate with potential research sponsors at MBARI for guidance on project feasibility, relevance to ongoing research projects, and resource availability.

Application deadline: Wednesday, December 11, 2013
Selected candidates will be contacted in early March 2014.

Application requirements:
1. Curriculum vitae
2. At least three professional letters of recommendation
3. Succinct statement of the applicant's doctoral research
4. Potential research goals at MBARI
5. Supplemental information form

Address your cover letter to:
MBARI, Human Resources
Job code: Postdocs-2014
7700 Sandholdt Road
Moss Landing, CA 95039-9644

Please submit your application materials by email to jobs_postdocs@mbari.org (preferred), or by mail to the above address, or by fax to (831) 775-1620.

MBARI is an equal opportunity and affirmative action employer. MBARI considers all applicants for employment without regard to race, color, religion, sex, national origin, age, disability, or covered veteran status in accordance with applicable federal, state, and local laws.

MBARI Welcomes Diversity

Name	Affiliation	Email	Request
Nataliya Budaeva	University Museum of Bergen, Norway	BERGEN.nataliya.budaeva@um.uib.no; nataliya.budaeva@gmail.com	Any specimens of polychaetes of the genus *Hyalinoecia* preserved in ethanol (or any fixative suitable for genetic analysis) from any geographical location. These samples are for a collaborative study combining morphological and phylogenetic aspects of this group that Natalyia leads and includes Pedro Ribeiro (Portugal), Pilar Haye (UCN, Chile) and Javier Sellanes(UCN, Chile).
Kevin Kocot	University of Queensland, Australia	kmkocot@gmail.com	I'm working on the phylogeny of Aplacophora, a group of shell-less, worm-like, mostly deep sea molluscs. They may be found wrapped around soft corals or loos in epibenthic sled/multicore/trawl samples. Ideally, I would like to get at least one specimen of each morphospecies fixed in formalin, ethanol, and RNAlater but specimens in ethanol would be the most important for my work. For large specimens, the anterior and posterior thirds of the body can be fixed in formalin with the middle or just a small piece from the middle in ethanol and/or RNAlater
Regina Wetzer	NHM of Los Angeles County, USA	rwetzer@gmail.com	I would be very interested in receiving 95% ethanol preserved peracarid specimen for a planned NSF project on Peracarida . Especially deepwater, hard to get families would be tremendously helpful.
Simone Nunes Brandao	Universidade Federal do Rio Grande do Norte, Brazil	Brandao.sn.100@gmail.com	I am specially interested in deep sea ostracods, so if you have material you are willing to share (see below) please contact me: 1) Ostracoda from epibenthic sledges from the world oceans; 2) any Ostracoda from samples below 2000m from the Pacific, Indian and Southe Oceans.
Tina Molodtsova	P.P. Shirshov Institute of Oceanology RAS	tina@ocean.ru	I am looking for specimens of black corals (Anthozoa: Antipatharia) from the North East Atlantic and Mid-Atlantic Ridge to review local antipatharian fauna. Specimens with polynoid symbiotic worms are specially welcome.