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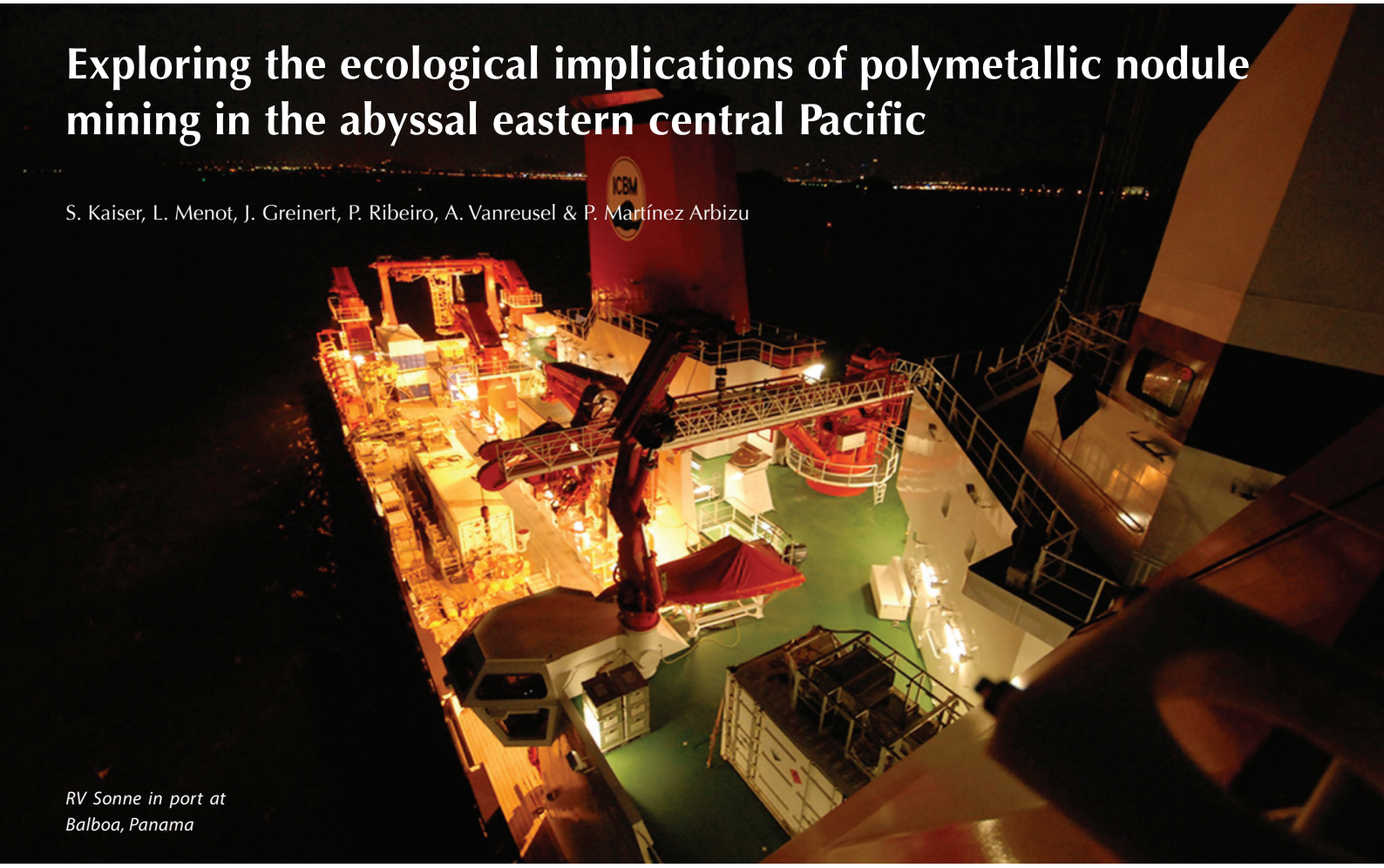
MANAGING IMPACTS OF DEEP SEA RESOURCE EXPLOITATION

Spring 2015 Issue 4

Exploring the ecological implications of polymetallic nodule mining in the abyssal eastern central Pacific

S. Kaiser, L. Menot, J. Greinert, P. Ribeiro, A. Vanreusel & P. Martínez Arbizu



RV Sonne in port at Balboa, Panama

How will deep-sea mining affect the environment and associated faunal communities? What is the potential of the fauna to recolonise disturbed areas, and from where will recolonisation take place? European scientists from 11 different nations are currently aboard the new German research vessel *Sonne* to further investigate these questions. The EcoResponse (Ecology, Connectivity and Resilience of Polymetallic Nodule field Systems, SO239) cruise, led by the Senckenberg Institute, started on 11 March in Balboa (Panama). Other MIDAS partners participating in this cruise include IFREMER, GEOMAR, Gent University, IMAR-U. of Azores and CONISMA, who will contribute to WPs 1, 4 and 6 respectively. During this 50-day expedition biological, geochemical and geological information will be collected in different European mineral exploration areas (licensed to Germany, Belgium and France) across the Clarion Clipperton Fracture Zone. Extensive sampling will be conducted using the ROV 'Kiel 6000', the AUV 'Abyss', various corer (gravity corer, TV-guided multicorer (MUC), box corer) and lander systems as well as CTD casts and ship-based multibeaming to characterise benthic habitats and fauna. Environmental physical parameters are being monitored by two landers (the Bottom Boundary lander 'BoBo' from NIOZ, and the DeepSea Observatory System lander 'DOS' from GEOMAR) as well as the NIOZ thermistor mooring equipped with 200 sensors.

Nodule mining may potentially disturb large areas of the abyssal seafloor and these disturbances may, in the best-case scenario, last for decades if not centuries. In the worst-case scenario, the nodule fauna will never recover from mining as nodules provide the substrate and habitat for species.

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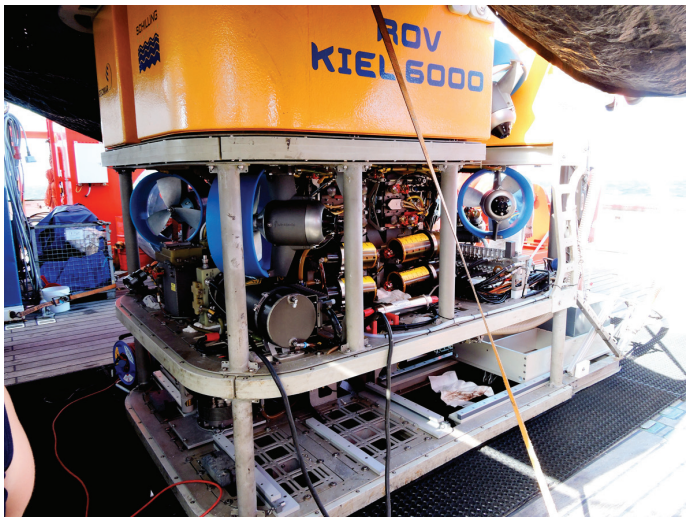
MIDAS has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under Grant Agreement no. 603418. For more information about MIDAS visit the project website at www.eu-midas.net



The ROV Kiel 6000, ready for action in the CCFZ. Photo courtesy A. Vanreusel

Although the International Seabed Authority has designated nine Areas of Particular Environmental Interest (APEI) to protect and preserve marine biodiversity, it is not known to what extent these areas are representative or how connected they are with the areas of seafloor that will be mined. A number of major unknowns still impede the environmental management of nodule mining:

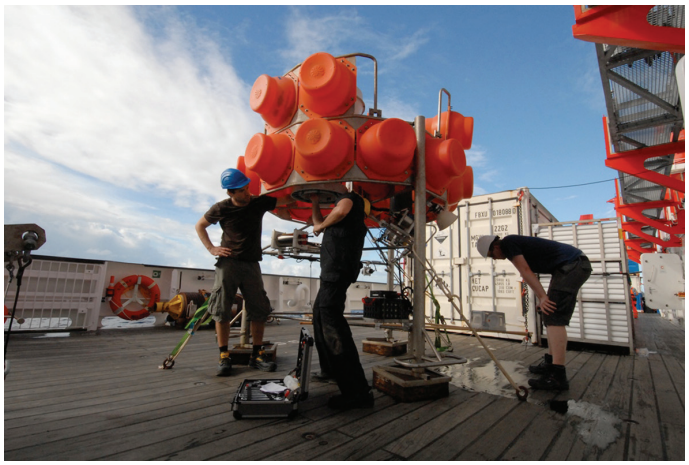
The spatial footprint and impact of sediment re-suspension and particle dispersal during mining operation are poorly understood

To address these issues, an experiment has been designed to track the dispersal and chemical behaviour of a sediment plume created by an epibenthic sledge (EBS) deployment. BoBo, DOS and two LBL-moorings equipped with additional turbidity sensors were placed downstream of the prevailing currents in the area in order to detect and monitor the distribution of a plume created by the EBS. Both landers are equipped with sediment traps to take samples in high temporal resolution, and three further ADCPs will also detect passing sediment plumes as increased backscatter signals. A second part of the experiment was to sample the plume with a CTD; by deploying a Yoyo CTD we attempted to detect the plume by approaching the EBS-track from the south against the currents by closing the bottles when the turbidity sensors indicated the plume. The sensor only detected increased particle densities directly at the EBS track. A second CTD then sampled the plume very close to the seafloor.

Timescales of recovery processes have never been studied

The recovery of benthic communities generally involves successive stages. Opportunistic species are the first to colonise the disturbed areas and may potentially facilitate the settlement of other species. Understanding and scaling these processes are needed to predict recovery as well as to monitor timescales. These questions will be tackled by studying four tracks from different dredging devices made half a year, 3 years, 20 years and 37 years ago. In each area, AUV dives will allow high-resolution sidescan, multibeam and photo mapping of the seafloor.

To assess the recovery of physico-chemical and biological conditions, a TV-guided MUC will sample sediments as well as microbial and meiofaunal communities inside and outside the tracks. By comparison of the sediment characteristics and fauna from in and outside the tracks, these small-scale experiments will provide insights into the processes and time scales of recolonisation, and may help to predict future mining impacts. Here, the AUV Abyss provided useful imagery, as it mapped the exact location of previous sampling activity that were used as target locations for the TV-MUC sampling campaign to recover samples from inside and outside the disturbed areas.



Preparation of the DOS lander. Image courtesy H. Robert, RBINS.

The distribution of species and connectivity among populations

Information on population and community connectivity will give us better estimates of the resilience of the deep-sea fauna to mining impacts. Connectivity as a proxy for realised dispersal capability can help to predict how fast species may recolonise impacted areas. During the EcoResponse cruise the degree of faunal connectivity will be analysed across different faunal size classes (mega-, macro-, and meiofauna), taxonomic levels (population, species) and spatial scales (km to 100s of kms) using both genetic and morphological methods. Furthermore, seamounts rising nearly 2000 m

above the surrounding seafloor will be visited with ROV Kiel 6000 to document fauna on hard substrate, since they may act as a refuge or source for nodule fauna.

APEIs have never been sampled and how representative they are is unknown

The APEIs have been designed and located according to existing information about the environmental conditions (e.g. productivity gradients) and the ecology of abyssal communities in the CCFZ. However, this knowledge is very limited so it still needs to be ascertained whether the APEIs capture the full heterogeneity of benthic habitats and their biota. During this cruise we therefore aim to describe the mega-, macro-, meio- and microfaunal communities in one of the APEIs located in the north-eastern part of the CCFZ. Characteristics of habitats and fauna from this APEI will be compared with those of the different license areas to give an indication of how connected the APEIs are with other areas in the CCZ.

The EcoResponse cruise is part of the JPI Oceans Pilot Action "Ecological aspects of deep-sea mining". Within JPIO, 112 days of ship time were granted to study of the effects of polymetallic nodule mining on the abyssal benthic fauna. Two further cruises on RV Sonne to the DISCOL (DISturbance and re-COLonisation) Experimental Area in the south-east Pacific will take place in summer 2015. You can folow the progress of the expedition online at http://www.oceanblogs.org/eadsm/

Right: Recovery of the box corer. Photo courtesy A. Vanreusel

The VAMOS project: Viable Alternative Mine Operating System

A new research project has been funded under the Horizon 2020 programme to enable the exploitation and rehabilitation of underexploited and abandoned European mineral deposits, particularly those that are under water. The VAMOS project will enable access to high grade reserves of deeper seated minerals by providing a new safe, clean and low visibility mining technique and will prove the environmental and economic viability of extracting currently unreachable mineral deposits.

Driven by the safety requirements of the mining industry and the environmental concerns of the general public regarding mining waste, VAMOS will develop a novel automated solution for the exploration, extraction and pre-processing of ores found in flooded onshore mines or shallow marine sites, which have previously been abandoned due to the high cost or technical challenge of extracting the ore under difficult conditions, the small size of the deposit, or the low grade of mineralisation. The value of such unexploited European mineral resources at a subsurface depth of 500-1,000 metres is estimated at around €100 billion.

A key objective of VAMOS is the development of a prototype underwater, remotely controlled mining system with associated launch and recovery equipment, including new cutting technology, slurry transportation and floating winch technology. VAMOS will develop new technology and adapt existing systems to overcome the limitations of current underwater sensing, spatial awareness, navigational and positioning technology. Of most relevance to MIDAS is the intention to provide an integrated solution for efficient real-time monitoring of environmental impacts during the mining operation.

MIDAS partner Fugro EMU is a partner in VAMOS and will provide a link between the projects, focusing on the development of the real time environmental monitoring systems and an effective impact assessment framework and methodology for these shallow water mining projects. For more information about VAMOS please visit the project website at www.vamos-project.eu.

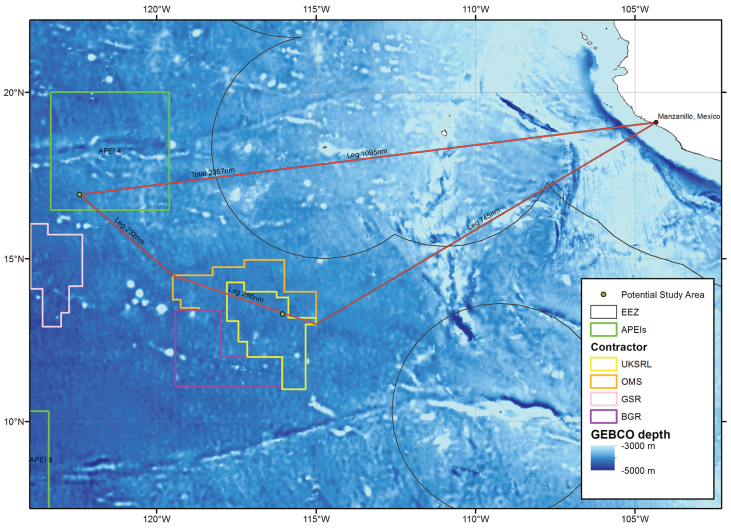
A Pacific odyssey: RRS *James Cook* prepares for a 5-week expedition to the Clarion-Clipperton Zone

Dan Jones, NOC

The UK Natural Environment Research Council ship James Cook is soon to set off on a cruise to study the biology and geochemistry of an area of the Clarion Clipperton Zone. The JC120 cruise will set off from Manzanillo, Mexico, on a 34-day voyage out to the north-easternmost Area of Particular Environmental Importance (APEIs). There are a total of 9 APEIs. These are large areas, of around 400 x 400km (200x200km core protected area with an additional buffer zone of 100km), that are set aside by the International Seabed Authority (ISA) from mining activities. In the spatial management plan for the CCZ the APEIs will form the largest of the protected areas within the CCZ mining area. Smaller set-aside areas will also be left within the mining claim areas themselves, but these will be determined later in the mining process. Currently, these APEIs remain largely unexplored.

We hope to gather a large dataset on the subsea landscape of the APEI we visit. We will make maps at several scales. We will first map a wide area of several thousand kilometres squared, with the shipboard multibeam bathymetry system (EM120) on the James Cook. We will then use the autonomous underwater vehicle Autosub 6000 to map the seafloor at progressively finer scales, hopefully ending up with small areas mapped acoustically at a resolution of 10s of centimetres! This will allow us to very accurately characterise the seafloor habitats of the area. Although we are on an abyssal plain, we are expecting there to be some variation in habitats, with different slopes, densities of nodules and even nodule sizes. It will be really important to understand these so we can better predict how the biology responds to the seafloor environment and how areas with mining may be affected by the industrial activities. It will be important to get good quality images of the seafloor in these areas to assess patterns. The Autosub 6000 vehicle is also equipped with two colour still camera systems, so we will be able to take high-resolution photographs of the seafloor, one every second for missions lasting over a day. This will give us an impressive archive of images showing the nodules on the seafloor and the biology of the area over the landscape. We hope to obtain images from several of the seafloor habitats we have identified in the mapping. In addition to the Autosub 6000 photographs, we have a towed vehicle called HyBIS, which we will be able to use to obtain high-definition video of the seafloor and its denizens.

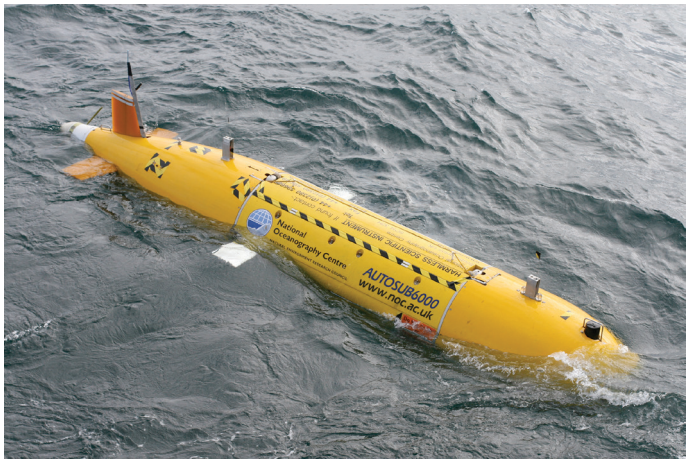
Samples of seafloor sediments, animals and overlying water will be taken from across the APEI. We are hoping to get a strong multi-disciplinary dataset from the area, with information on various sizes of fauna (megafauna, macrofauna, meiofauna and protozoans), the sedimentary environment and its geochemistry and the overlying (and pore) water. We will obtain a range or cores up to 3 m deep for geochemical analysis. This will include assessment of metals, including rare-earth metals, and some dissolved gasses (e.g. Oxygen) in the sediments and pore fluids and assessment of the physical characteristics of the sediments. This will give us a much better understanding of the formation mechanisms of the nodules and some of the controls on life in the region.



Above left: RRS James Cook undergoing preparations for departure in Southampton. Above right: the planned expedition route within the CCZ.

Smaller samples will be taken to assess the biodiversity and community composition of the fauna of the region, quantitatively for many faunal groups. In addition, the team from the Natural History Museum in London, along with some other scientists from elsewhere, will be collecting a range of fauna to add into their database of the fauna of the Clarion-Clipperton Zone that will include linked photographic, genetic and morphological data from all the common species we find. Having an accurate taxonomic database is vital in understanding the connectivity between different areas of the CCZ and will help in ultimately determining how areas disturbed by mining will recover. Finally, we hope to collect some nodules and fauna with trawls over the seafloor. All of these samples will give us a strong baseline dataset from the APEI, allowing us to evaluate this area and assess any future changes. We will also be able to make comparisons with the mining claim areas to better understand broad scale patterns. We are working hard with the other MIDAS partners to ensure data are all collected in the same way on all the different cruises to ensure that these comparisons are robust and useful to both science and environmental managers working for the nascent seafloor mining industry.

The cruise will be underway from 15 April until 19 May 2015. You can follow our progress via the cruise blog at www.jc120.wordpress.com. Wish us luck!



Autosub 6000 - an essential tool for environmental mapping during the cruise

Chatham Rock Phosphate decision: lessons for the environmental regulation of deep-sea mining activity?

In February of this year, New Zealand's Environmental Protection Authority (EPA) ruled to deny an application for mining phosphates in New Zealand's Extend Economic Zone. Chatham Rock Phosphate Limited (CRP), the company concerned, had sought permission to mine phosphate nodules on an area of approximately 820 square kilometres on the Chatham Rise, a large underwater feature located 450 kilometres east of Christchurch at approximately 400m depth. According to the EPA, this would have been the first deep-sea mining operation in the world.

Whilst phosphate mining is not within the scope of the MIDAS Project, the decision of the EPA addresses a range of issues relevant to the work of the MIDAS project including restoration, mitigation and adaptive management, the impact on vulnerable species and ecosystems, the return of waste material to the seafloor, and scientific uncertainty.

The CRP argued in its submissions that some aspects of CRPs proposed activities could enhance environmental protection and knowledge of New Zealand's biodiversity. Nonetheless, the EPA concluded that impacts on the seabed and associated benthic fauna of the technology that CRP was planning to use would include the destruction of communities dominated by protected stony corals which are potentially unique to the Chatham Rise and that these effects could not be avoided, remedied or mitigated. Moreover, the habitat would not return to its present form after the mining occurred but rather would be transformed wholly into soft sediment habitat.

The EPA also expressed concern over the reliance placed on insufficiently validated modelling to predict the impacts of the project and that the potentially significant impact of the deposition of sediment on the areas adjacent to the mining blocks and on the wider marine environment, could not be mitigated by any set of conditions or adaptive management regime that might reasonably be imposed.

The report of the ruling in full can be found on the EPA website at http://www.epa.govt.nz/EEZ/chatham_rock_phosphate/Pages/default.aspx

Central American Gap winds and abyssal CCZ plumes

By Mark Inall, Dmitry Aleynik, Andy Dale and Annemiek Vink

It seems strange to think that coastal winds of Central America might significantly impact near bed water velocities at 4000 m depth some 4000 km from shore. In this article we trace the 318 day journey of a full-depth oceanic eddy from the Central American coast to the Clarion Clipperton Fracture Zone (CCZ). We show its near bed velocity signal, and model the influence of that signal on the advection and dispersion of a near bed plume.

The Tehuantepecer is a cool, dry northeasterly wind that blows periodically through mountain gaps of eastern Mexico. Violent 'Tehuantepecer events' have been observed to exceed 200 km/h. These winds drive strong coastal upwelling, supporting an abundance of coastal sea life. Constrained by the gap in the mountains, the upwelling region is only ~50 km wide, and rapidly adjusts to form an oceanic eddy which then propagates slowly westward. It is known that the influence of surface eddies in this region can penetrate to abyssal depths (Demidova et al., 1993; Kontar & Sokov, 1994).

Beginning in June 2012 an unusual train of events began, clearly visible in satellite sea surface height fields (Figure 1). Two eddies, one originating from eastern Mexico and the other from further south, most likely formed by the Papagayo gap-winds of Nicaragua, merged to form a single 'super-eddy'. Normally, Tehuantepecer eddies track westward at a latitude of approximately 12-13^0 north, but this 'super-eddy' propagated westward at around 15 to 20 cm/s at a lower latitude (Figure 1). This path led it directly over the mining areas of the CCZ some 300 days later. This sequence of eddy genesis, merger and westward propagation is well captured in satellite sea surface height fields, from which surface geostrophic velocities may be calculated (Figure 1). The unusual nature of the event is also evident in the satellite derived time series of eddy kinetic energy for the CCZ region.

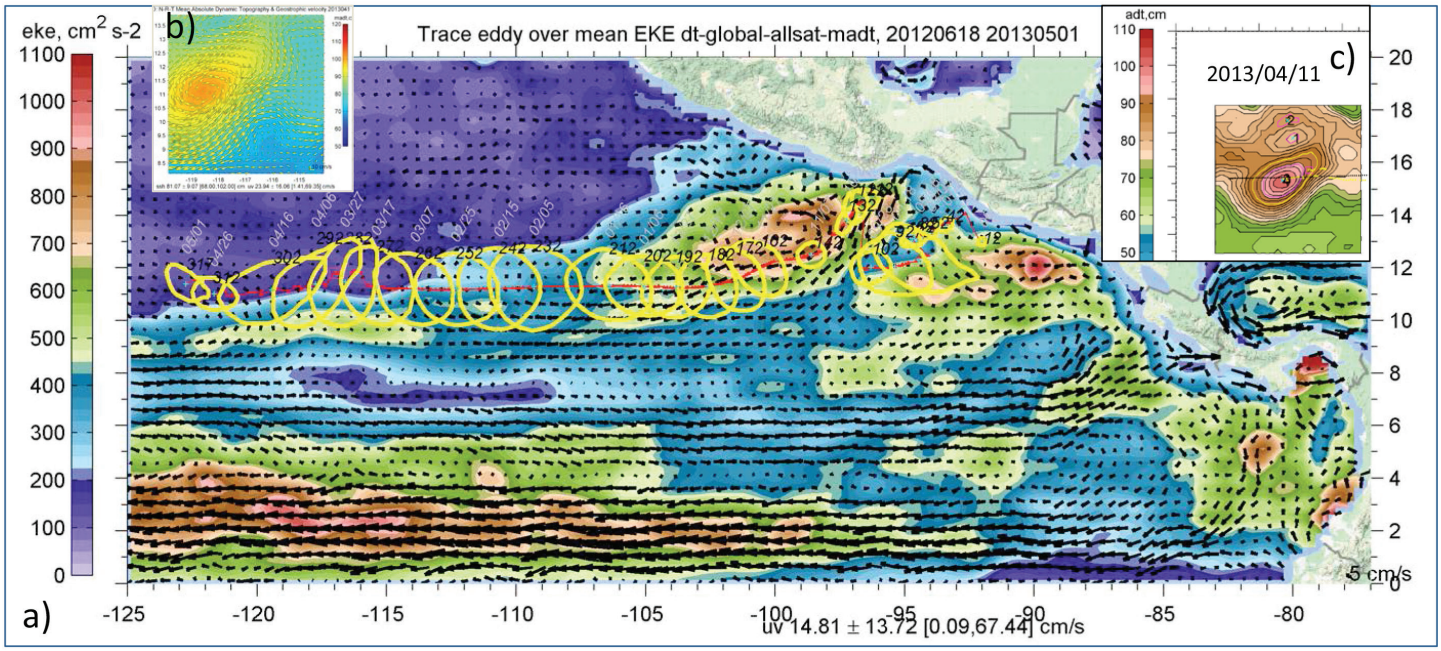


Figure 1: Unusual events in the Pacific eddies

(a) Eddy track over 318 days from 2012/06/18, shown with yellow circles to indicate >80 cm sea surface height (SSH) anomaly (ADT, AVISO) with 10-day intervals. Mean EKE is shown with colours and superimposed with mean velocity vestors over the period 2012-2014.

(b) SSH anomaly and geostrphic currents field over the CCZ BGR area on the date of mooring deployment

(c) SSH anomaly with a contour of 80cm highlighted for the same date.

(d) Timeseries of EKE over the mooring location.

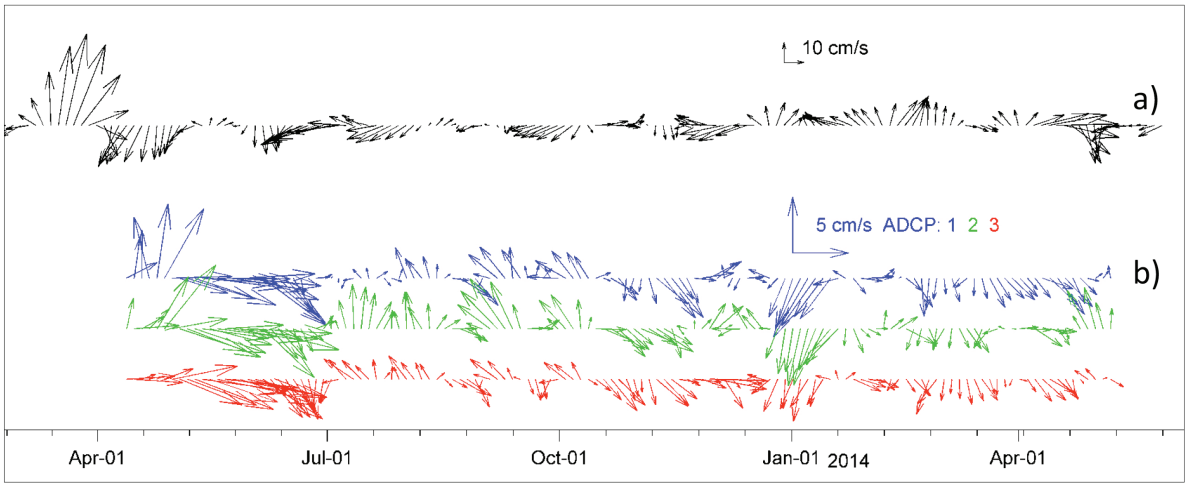


Figure 2: (a) Black vectors show sea surface geostrophic velocities derived from mean absolute dynamic topography (AVISO) and averaged over day intervals. High velocities in March-April 2013 and April 2014 are associated with a westward-drifting eddy. (b) Colour arrows show 13 months of near-bottom currents with 3-day averaging, measured by three RDI-ADCP instrum,ents at layers 10-178m above the seafloor (averaged) and deployed on 11 April 2013. atr a depth of around 4128 m, 8km apart at 11°52'N 116°58'W n the BGR area in the CCZ. Data accessed thanks to A. Vink, BGR.*

** The eddy westward propgation speed was 5-10cm/s until November 2012, then after crossing 100°W it accelarated to c. 20 cm/s (17km per day). Altimeter products were produced by Ssalto/Duacs and distributed by AVISO, with support from Cnes (www.aviso.altimetry.fr/duacs)*

On 11 April 2013, just as the eddy was passing through the German CCZ area, BGR deployed three near-bed Doppler current meters (velocities shown in Figure 2, locations in Figure 3). Sea surface velocities and near bed velocities at all three sites clearly shows the influence of the eddy. Surface velocities peaked at 40 cm/s, and near bed velocities at 10 cm/s lagged in time by 10 days or more (Figure 2). Though no sediment resuspension was observed, the intensity of these near bed currents was unusual in long term records from this site.

To study the influence of such an eddy on a near-bed plume, a high resolution simulation of the region was performed using the MITgcm model. The model was forced with a combination of observed currents and predicted tidal currents. The effect of the passing eddy can clearly be seen in the simulation (Figure 3). As the eddy passes, the direction of plume spreading backs to the north, elongating in that direction and dispersing the plume more rapidly.

Should mine operators in the CCZ be concerned about coastal mountain-gap winds occurring a year before and 4000 km from their abyssal activities? We have shown near bed velocities in excess of 10 cm/s are related to long-lived coastal-origin eddies, and that the direction of spread of simulated plumes is strongly affected. Whether eddy-induced bed velocities may cause significant resuspension at 2 km depths (Zhang et al., 2014) remains to be seen for these twice deeper sites, but there is no doubt that these eddies influence the fate of any pre-existing plume.

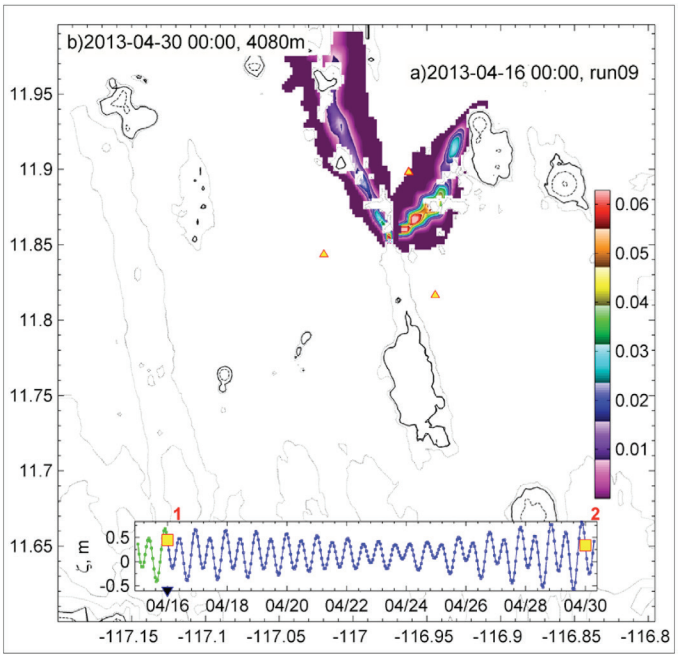


Figure 3. Neutrally buoyant plume spreading patterns according to the high-resolution MITgcm model a CCZ –BGR area after 5 (a) and 19 (b) days from the model start. The source was centred between three ADCP mooring sites shown with triangles Δ. Model was forced with combination of OTIS inversion tidal solution (Egbert et al, 2002) and daily mean near-seabed flow extracted from the westernmost mooring. Modelled SSH (ζ, m) is also shown.

References

Demidova et al. (1993) Phys. Oceanogr., 4(1), 53-61.

Kontar & Sokov (1994) Deep Sea Research Part I: Oceanographic Research Papers, 41(7), 1069-1089.

Zhang et al. (2014) Sci. Rep., 4.

MIDAS engages with NGOs in the debate on environmental impacts of deep-sea mining

Matt Gianni, Gianni Consultancy

A number of NGOs based in Europe are active on the issue of deep-sea mining and have engaged with the MIDAS Project as well as the European Commission and others to raise concerns and provide their views and recommendations on the development and regulation of deep-sea mining. The Deep Sea Conservation Coalition (DSCC) and Seas At Risk organised a workshop in November 2014 in Brussels at which representatives of the MIDAS Project, the European Commission, ECORYS and the DSCC made presentations. The workshop was well attended and generated considerable discussion and debate amongst participants. Seas At Risk – a European wide coalition of NGOs – subsequently made a presentation to the meeting of the MIDAS Science Policy Panel on behalf of its members as well as WWF, Oceana and the DSCC.

Amongst the key themes that these NGOs have highlighted is the need to place emphasis on reuse and recycling of materials rather exploring for new sources of minerals in the deep-sea. If deep-sea mining does occur it should not take place until regulations are in place and the regulations must be robust and include conservation and management objectives, procedures and requirements based on the precautionary approach and comprehensive prior environmental impact assessments. Moreover the drafting and adoption of any mining regulations must be transparent and participatory and include a real assessment of the potential benefits to society.

NGOs also noted the range of responses to the European Union's Stakeholder consultation on seabed mining last year. Numerous NGOs, private companies, state agencies (including environmental and archeological agencies) and research institutes responded to the survey as did hundreds of individual citizens. The messages from the latter group expressed strong concern over the potential damage to the ocean environment from deep-sea mining.

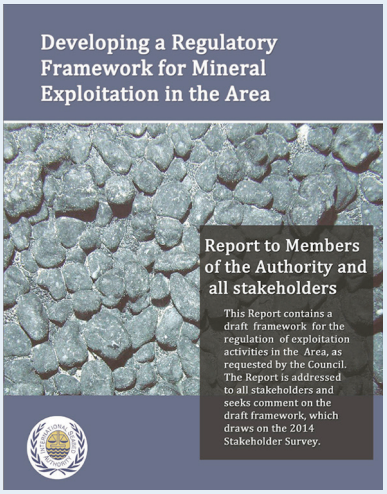
Another NGO workshop is tentatively planned for the summer of 2015, most likely in June in Brussels (dates and venue to be announced) at which further discussion of the MIDAS project and a number of other seabed mining-related projects currently funded by the European Commission is planned, as well as a debate over the role of the European Union and Member States in the development of mining regulations by the International Seabed Authority. Notice will be posted to the MIDAS website once the date and venue for the workshop have been decided.

For further information:

- Presentations and summary of the debate at the November 2014 workshop at www.seas-at-risk.org/news_n2.php?page=705
- Submission by the Deep Sea Conservation Coalition to the International Seabed Authority Stakeholder survey at www.savethehighseas.org/publicdocs/DSCC-RESPONSE-TO-ISA-STAKEHOLDER-SURVEY-MAY-2014.pdf
- Oceana's call for action at http://oceana.org/blog/deep-sea-mining-threatens-european-oceans.

New ISA stakeholder report available

The ISA has published a report containing a draft framework for the regulation of exploitation activities in the Area. This report draws on input to the stakeholder survey that was carried out by the ISA in 2014 and to which MIDAS made a response. This new report again asks for input and since several sections are of direct relevance to our research activities we will submit a MIDAS response. The report includes a draft action plan that divides activities into priorities A, B and C, with priority A activities due to be initiated by July 2015 and priority B activities due to be initiated by February 2016. Priority C activities are for later consideration. Most of the environmental issues fall into the priority B category. We anticipate that our response will alert the ISA to the relevance of our research and that this will lead to a number of follow-up actions. The report can be accessed at: www.isa.org.jm/files/documents/EN/Survey/Report-2015.pdf. See also Dave Billett's update on ISA activity on the next page...



New developments in the regulation of deep sea mining at the International Seabed Authority

David Billett, Deep Seas Environmental Solutions

The 21st Session of the International Seabed Authority (ISA) has started with an initial meeting of the Legal and Technical Commission (LTC), in Kingston, Jamaica from the 16th to 27th of February 2015. The main issues addressed by the Legal and Technical Commission (LTC) were:

- Consideration of a draft framework for the development of regulations for the exploitation of mineral resources in 'The Area'
- Consideration of procedures and criteria for applications for extensions of contracts for exploration
- An application for polymetallic nodule exploration by China Minmetals Corporation
- The development of a new template for annual reporting by contractors
- A review of the recommendations for the guidance of contractors on the reporting of actual and direct exploration expenditures
- Issues relating to the implementation of an Environmental Management Plan for the Clarion Clipperton Zone in the equatorial eastern Pacific Ocean and ii) consideration of the development of other environmental management plans in 'The Area'
- The selection of candidates for training for a COMRA (China Ocean Minerals Research and Development Association) cruise to the Clarion Clipperton Zone (CCZ).
- Consideration of two reports on international workshops organised by the ISA on i) polymetallic nodule resource classification, Goa, India, 13-17 October 2014, and ii) the standardisation of macrofauna studies, Uljin, Korea, 23-30 November 2014.

There has been considerable progress in the development of a draft framework for the further development of draft Regulations for the exploitation of deep-sea mineral resources in The Area. The main aim of LTC was to create an open document for dissemination to ISA Member States and to all stakeholders, requesting feedback in time for the LTC and ISA Council meetings in July 2015. The document is available on the ISA web pages at http://www.isa.org.jm/news/seabed-authority-issues-draft-framework-regulation-exploitation-activities. The document has 5 parts: 1) an Executive Summary, 2) a draft framework for the Exploitation Regulations, 3) a summary of the LTC responses to the ISA Stakeholder Survey submissions, 4) a summary of the high level issues that remain to be solved, and 5) an action plan for the way forward to mid-2016 with a list of priorities.

Overall I think progress has been significant. There has been considerable attention paid to the responses to the 2014 Stakeholder Survey. These responses are also available to a large degree on the ISA website. I think the inclusion of responses to the Stakeholder Survey has been very positive and is something the ISA should take great credit for. The closing date for responses to the ISA consultation document is Friday 15 May 2015.

Documents relating to other items discussed by the LTC will appear on the ISA web pages over the coming months.

Left: Photo of the ISA Legal and Technical Commission 2015 taken at the end of the first week of meetings.

Taxonomic methods and standardisation of macrofauna in the Clarion Clipperton Fracture Zone

Gordon Paterson, Natural History Museum

A workshop organised by the International Seabed Authority (ISA) and the Korea Institute of Ocean Science and Technology (KIOST) at the East Sea Research Institute, Korea, 23 - 30 November 2014.

Despite nearly 30 years of exploration and investigation of the nodule province of the Clarion–Clipperton Fracture Zone (CCFZ), our knowledge of the biodiversity and, in particular, the taxonomy of most major macrofaunal invertebrate groups remains rudimentary at best. This lack of taxonomic knowledge is finally being recognised as one of the critical impediments preventing credible and sustainable management plans for the region. As the pace of exploration increases and the contractors start to plan seriously for exploitation, the need to address this gap in our knowledge has become urgent.

The ISA has instigated a series of workshops to identify what needs to done to mobilise taxonomic effort, to ensure standardisation of taxonomy between the various contractors and provide infrastructure, protocols and standards for current and future work. The second workshop in this series focused on macrofaunal taxa and brought together 12 taxonomic experts and 26 scientists from 13 contractors, hosted by KIOST, in South Korea. The first one was on megafauna (Briefing paper 02/14; http://www.isa.org.jm).

The workshop provided an opportunity to discuss taxonomic issues and standards associated with the identification of different taxa, the need to integrate molecular methods into identification and to identify the problems and challenges facing the contractors. In addition, lessons from other offshore industries, such as oil and gas, were presented and discussed to look for common issues and potential solutions. There were practical sessions as well as presentations and discussions, which enable the taxonomists to assess the quality of the material being produced and the potential diversity of the fauna. Although time for these sessions was short, they were productive and useful, enabling taxonomists and the contractors to establish contact and exchange information. In fact the diversity of the fauna from the small set of samples examined turned out to be very high with almost each specimen being a different species. In most cases these were likely to be new but in some groups such as the polychaetes and isopods there were morphotypes which were recognised from other studies.

A practical session during the workshop

The main result of the workshop was a series of recommendations, agreed by all participants. These recommendations were submitted for consideration by governing body of the ISA, the Legal and Technical Commission. It is hoped that many of the recommendation will be accepted and find their way into the regulations governing mineral exploration and exploitation. There were 20 recommendations in all, covering four areas: i) sampling and processing; ii) taxonomic resolution; iii) technical cooperation, and iv) data access and availability. The topics ranged from practical considerations such as sampling protocols and ensuring the quality of material, to issues such as focussing on biological studies rather than tacking biology on to other disciplines, and how taxonomic studies could be supported and funded in the future.

The issue facing the ISA, contractors and the academic community is that there is very little time to try to develop the taxonomic knowledge base that is vital for management. It is, therefore, essential that our efforts are focused and co-ordinated. These workshops are a step on the road towards this goal.

A full report on the workshop, including the videos of the presentations can be accessed via the ISA website at:

http://www.isa.org.jm/workshop/workshop-taxonomic-methods-and-standardization-macrofauna-clarion-clipperton-fracture-zone#Presentations

Updates from the SPC-EU Deep-Sea Minerals project

Alison Swaddling, Environment Advisor, Deep Sea Minerals Project

Kiribati signs contract with the International Seabed Authority

Deep sea minerals, such as sea floor massive sulphides, cobalt-rich ferromanganese crusts and manganese nodules located in international waters can only be accessed via sponsorship of a State.

Kiribati, through its State-owned company, Marawa Research Exploration Limited, early this year signed a contract with the International Seabed Authority and, by doing so, joined Nauru and Tonga; Pacific countries that have also signed contracts for exploration in international waters.

Kiribati's contract is for an exploration license for polymetallic nodules in the Clarion Clipperton Fracture Zone in the east Pacific.

In addition to this, Kiribati is undertaking public consultation on their draft Deep Sea Mining Policy, and is in the process of drafting specific deep sea minerals legislation with the assistance of the SPC-EU Deep Sea Minerals Project.

Tuvalu sets new standards with Seabed Minerals Act

By passing its Seabed Minerals Act in December 2014, Tuvalu became the second country in the world, after Tonga (who passed its Act in August 2014), to put a law in place that manages seabed mineral activities both within its national jurisdiction and under its sponsorship in international waters.

The Act establishes the Tuvalu Seabed Minerals Authority and a Seabed Advisory Council composed of Government and Tuvalu community representatives. The Tuvalu Seabed Minerals Act highlights the importance placed by Tuvalu on the protection and preservation of the marine environment and public consultation with coastal communities. What sets the Tuvalu Act apart is the requirement of the Seabed Advisory Council to ensure that coastal communities are consulted prior to approving mining projects, not only within Tuvalu's Exclusive Economic Zone, but also for projects under its sponsorship in international waters.

Tuvalu now joins Tonga, Cook Islands, and Fiji as Pacific Island countries who have enacted Deep Sea Mineral specific legislation.

Access Tuvalu's Act here: http://faolex.fao.org/docs/pdf/tuv140149.pdf

Introducing New 'Expert Q&A' Video Series

The SPC-EU Deep Sea Minerals Project has launched at new video series, 'Expert Q&A', where experts in deep sea biology, law, geology will be interviewed to answer frequently asked questions regarding deep sea mining. This is part of the Deep Sea Minerals Project's awareness raising on deep seabed mining in the Pacific Islands region.

The first Expert Q&A is with Professor Cindy Van Dover, professor of Biological Oceanography at the Duke University in the United States, and an expert on deep ocean biology and exploration.

The video shows underwater footage from Seafloor Massive Sulphide sites bringing to life the surrounding environment. Prof. Van Dover answers such questions as:

- What kind of organisms live near the vents?
- Why is it important to learn about these organisms?
- Why should scientists be involved in commercial mining activities?
- What can be done to minimise the impacts of mining?
- Why is it important to protect life around the vents?
- Will deep sea mining have an impact on fish resources?
- What do we need to do to protect these resources?

To view the video please visit:
http://www.sopac.org/dsm/index.php/q-a

Towards the development of a strategic EMP for deep seabed mineral exploration and exploitation in the Atlantic basin

A workshop dedicated to identifying elements for a strategic Environmental Management Plan (EMP) for deep seabed mineral exploration and exploitation in the international (ABNJ) area of the Atlantic basin will take place in Horta, Azores on 1-3 June 2015. The intention is to learn lessons from the Clarion-Clipperton Zone EMP and to draw on output from the 2010 Dinard Workshop[1].

The workshop is being organised by members of MIDAS and DOSI/INDEEP with support from the European Commission, the Azores Regional Government, the Pew Foundation, the Kaplan Fund, Oceans5 and the Deep Sea Conservation Coalition. The event will bring together the main stakeholders, including representatives of the International Seabed Authority (ISA), region-specific exploration contractors and prospectors, together with scientists from different disciplines, to evaluate current knowledge and to consider how and when information gaps might be filled.

Key objectives of the workshop are to:

- Gather and review the adequacy of available baseline information on the marine environment including the location of sensitive deep-sea habitats/ecosystems and charismatic fauna such as long range migrating species;
- Identify gaps in the baseline information and discuss how to fill them;
- Consider the relevant laws, policies and regulations at international, regional and national levels;
- Identify the nature, distribution and intensity of pressures and impacts associated with mining as they interact with other anthropogenic activities and stresses;
- Agree upon a 'road map' for the development of an EMP for the Atlantic in the Area, and the strategic aims and goals of such a plan.

Attendance at this workshop is by invitation only. Details of the preliminary workshop programme will be available on the MIDAS website in due course.

[1] *Dinard Report on Environmental Management of Deep-Sea Chemosynthetic Ecosystems: Justification of and Consideration for a Spatially-Based Approach. ISA Technical Study No. 9, Kingston 80pp.*

Upcoming meetings, workshops and conferences

Workshop on environmental standards for deep seabed mining: 8-9 May 2015, Arctic University of Tromsø. For more details see https://esillawseaig.wordpress.com/2015/01/20

From seafloor hydrothermal systems to the sustainable exploitation of massive sulfide deposits: Myths and realities of the deep sea: 11-13 May 2015, University of Bergen. For more details contact ana.marques@geo.uib.no

Workshop to initiate an Environmental Management Planning process for the Mid-Atlantic Ridge: 1-3 June 2015, Azores.

International Workshop and Conference on marine disposal of mine tailings and associated wastes from mining operations: 10-12 June 2015, Lima, Peru. For more details please email eva.ramirez@niva.no

The crafting of seabed mining ecosystem-based management: Assessing deep sea ecosystems in the Pacific Ocean: 29 June - 1 July 2015, French Embassy, Tokyo. For more details contact: lenaick.menot@ifremer.fr

21st Annual Assembly of the International Seabed Authority: 13-25 July 2015, Kingston, Jamaica. www.isa.org.jm

14th International Deep Sea Biology Symposium: 31 August – 4 September 2015, Aveiro, Portugal. http://14dsbs.web.ua.pt/14dsbs

The MIDAS newsletter is published quarterly. The deadline for articles for the summer 2015 issue is Friday 17 July - please email vikki.gunn@seascapeconsultants.co.uk with your contributions.