



INDEEP Phase 2 Report (No. 2) to the Total Foundation

January – December 2015

1. PROJECT DETAILS

Title: INDEEP – International Network for Scientific Investigations of Deep-Sea Ecosystems

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Working Group Leads:

Dr Adrian Glover, Natural History Museum, London (UK) – WG1

Dr Tammy Horton, National Oceanography Centre (UK) – WG1

Dr Tim O'Hara, Museum Victoria (Australia) – WG2

Dr Derek Tittensor, Dalhousie University (Canada) – WG2

Dr Anna Metaxas, Dalhousie University (Canada) – WG3

Dr Eva Ramirez-Llodra, Norwegian Institute for Water Research (Norway) – WG3

Dr. Ana Hilario, University of Aveiro (Portugal) – WG3

Dr Andrew Thurber, Oregon State University (USA) – WG4

Dr Andrew Sweetman, International Research Institute Stavanger (Norway) – WG4

Hosting Institutions:

IFREMER, France & University of Southampton, National Oceanography Centre, UK

Project Outline:

INDEEP will develop and synthesise our understanding of global deep-sea biodiversity and functioning, providing the framework to bridge the gap between scientific results and society. INDEEP will develop as a service provider for industry, policy makers, NGOs and society, facilitating the increasing demand for the development of guidelines based on robust data for sustainable use of marine resources and conservation.

Participants:

The INDEEP network has attracted great interest. Current registered participants number 823 from 43 countries. Membership has grown steadily since October 2011 when INDEEP had 280 participants from 30 countries. Membership is largely made up of deep-sea ecologists but there are also a significant number of other deep-sea stakeholders including industry, NGOs, policy makers, economists and social scientists.

2. WORKING GROUP Activities 2015

WG1- Taxonomy & evolution (leads: Adrian Glover & Tammy Horton)

- **INDEEP World Register of Deep-Sea Species:** The Deep-Sea Biology Symposium in 2012, NZ, saw the launch of the World Register of Deep-Sea Species (WoRDSS), a new web portal which brings together the most up-to-date taxonomy with a suite of identification tools (online keys, monographs and papers) recommended by taxonomic experts. The primary goal of this ongoing project has been to build a comprehensive database of known deep-sea species and to present this as a thematic species database (TSD) of the World Register of Marine Species (WoRMS). The criterion for inclusion in the WoRDSS database is the presence of any species at or below a depth of 500m. The 500m criterion excludes primarily shelf species with bathymetric distributions that extend marginally beyond the shelf break, and falls within various definitions of the boundary between 'shallow' and 'deep' seas (Gage & Tyler, 1991; Spalding et al., 2007; UNESCO, 2009). In July 2015, the 200+ taxonomic editors of WoRMS and all INDEEP members were invited to make additions and edits to WoRDSS. As a result of these invitations good responses were received providing additions and corrections to WoRDSS including: Nematodes: Miljutin et al., 2010 paper on all known deep-sea nematodes added to WoRDSS. 6 existing species in WoRMS were added to the context. A number of species in the paper were not in WoRMS/NeMys and this was passed to the appropriate editor to add. 253 species were

marked as checked in WoRDSS with this paper as the context source. Andrei Utevsky sent a paper on a new species of deep-water leech. There are already 25,005 species listed. Nevertheless, it is clear that continued focused work with expert taxonomists and deep-sea literature is needed to improve the World Register of Deep-Sea Species dataset. The next project of this type will be a revision of Deep-Sea Amphipoda led by Tammy Horton and Mike Thurston (NOC) to include all published depth ranges of the included taxa. In 2013 a dataset of deep-sea Amphipoda (Thurston, 2000) was matched against the WoRDSS dataset using the WoRMS taxon match tool. This added 636 species to the original dataset imported into WoRDSS from the Ocean Biogeographic Information System (OBIS). Current efforts are now focussed towards entering the depth ranges of the ~1500 deep-sea taxa included so far and on including new deep-sea taxa described since 2000. This is proceeding largely by working through major publications and cross checking with Amphipod Newsletters from the years 2000-2015. When complete this dataset will be of immense value to scientists studying the deep-sea, and to those working on taxonomic revisions. The dataset will be available on WoRMS and WoRDSS and also be published as a peer-reviewed paper in due course, incorporating further analyses and knowledge of deep-sea Amphipoda.

- **INDEEP/EU LIFEWATCH Grants:** A paper was published resulting from these grants awarded to INDEEP to add species data and information to WoRDSS. INDEEP WG1 is acknowledged and WoRDSS database is cited in the paper: Merrin & Poore 2015. Nomenclatural changes in two families of asellote isopods (Acanthaspidiidae and Ischnomesidae). *Zootaxa* 4013 (1): 139–142. A second round of LIFEWATCH grants was opened in 2015 and Tammy Horton was successful in an application to revise the Lysianassoid Amphipoda. This work will feed into WoRDSS as many of the >1000 species in the group are deep-sea.
- **14th Deep Sea Biology Symposium, Portugal:** Many members of WG1 attended and presented on the work achieved in WG1 including presentations on WoRDSS and the Deep Sea ID app. Following the conference much interest was sparked and further additions and corrections sent for inclusion in both of these deep-sea tools.
- **INDEEP Deep-Sea ID App:** Deep Sea ID, an iOS field guide app to the marine life of the deep sea, became available for free download for iPhone and iPad from 14th March 2013. This has been an unprecedented success for INDEEP and has (as of 17th December 2015) been downloaded by 33,100 users. Users from a wide range of countries from around the world indicate that there is public and scientific interest in deep-sea life from countries in both the developed and the developing world. It allows offline access to WoRDSS and currently stores on your device the

taxonomic information for over 25,000 deep-sea species, ~500 high-resolution photographs of deep-sea specimens as well as links to online taxonomic tools, sources and important references. In July 2015 there was an update to version 1.2 with additional features to the current iOS version released. These included: 5,000 new accepted species and 100+ new images; clickable email and web links on the picture credit pages; alternate taxa get the image of their valid taxon; intermittent problems related to the keyboard on the search page and rotation have been fixed; updated stats on "about" page; an alternate "small credit name" which is displayed under the picture in the details view (the full name is shown in the credits) now added; added introduced species context source type, status Taxon inquirendum, source type Emendation and language Persian; general speedup and improved dynamic memory usage; changed the italic species title font to better match the later iOS look; removal of superfluous "(common)" from front of common names; moved "[unassigned]" from the beginning to the end of taxon names so they don't all appear at the beginning of the list. In September 2015 an additional version of Deep-Sea ID went live on Android and went live on Amazon Appstore.

- **Taxonomic List and Taxonomic Keys:** These items were both regularly updated during 2015.

WG2 – Global biodiversity and biogeography (leads: Tim O’Hara & Derek Tittensor)

- **Global map of deep-sea biodiversity for ophiuroids:** This map, currently in peer-review, provides significant insight into the forces structuring biodiversity in this, and possibly other, taxa. When published it will provide a useful resource for upcoming policy processes, such as the proposed forthcoming United Nations policy instrument on biodiversity beyond national jurisdiction. This work was presented at the 14th Deep-Sea Biology Symposium in Portugal.
- **Deep-Sea OBIS Node:** WG2 has been involved with discussions to facilitate the propagation of more deep-sea biodiversity data into the Ocean Biogeographic Information System (OBIS). The intent is to mobilize data which are currently held by individual scientists, and ensure that they are put into OBIS so that its deep-sea data resources continue to be added to. Derek Tittensor (co-lead WG2) attended a Global Ocean Commission (GOC) meeting on the High Seas in Oxford during Nov. 2015 and presented on topics including deep-sea biodiversity. A prospect was identified to ensure that databases (e.g. OBIS) are properly searchable for High-Seas data, including in the deep ocean (e.g. the water column from 3,000-5,000m in areas beyond national jurisdiction). This would again make deep-sea data more accessible for upcoming international policy processes, and a small proposal to apply for funding to develop this further may be worth pursuing.

- **Schmidt Ocean Expedition Proposal:** The proposal submitted in December 2014 entitled "Sequencing the High Seas: an international collaborative study to explore abyssal biodiversity using advanced genomics" was unsuccessful. However, a further similar proposal will be attempted in future.
- **Expedition to survey abyssal biodiversity off Australia's east coast:** This 35-day expedition is funded by the Australian National Marine Facility and will now commence in 2017 owing to ship delivery delays.

WG3 – Population connectivity (leads: Anna Metaxas, Eva Ramirez-Llodra, Ana Hilario & Maria Baker)

- **Recruitment Project:** A metadata depository has been created, where information on all colonisation frame deployments and recoveries is archived. Currently, 24 frame deployments have taken place, including deployments on a blowout preventer (TransOcean), scientific landers, permanent observatory (ONC, DELOS) and with ROVs. Of these deployments, 2 have taken place on the shelf, 7 on the slope, 8 in canyons, 5 on abyssal plains, 2 on hydrothermal vents and 2 on cold seeps. The regions studied so far include the NE Atlantic (Rockall Trough, Claire Ridge, Baltimore Canyon), SW Atlantic (Brazil), SE Atlantic (Angola), NE Pacific (Barkley canyon) and Caribbean (Cayman rise). A summary is published in Deep-Sea Life Issue 5. The North Atlantic samples from the TransOcean deployment are being analysed at the National Oceanography Centre in Southampton (UK) by Drs Andrew Gates, Jon Copley & Maria Baker. The samples from off Vancouver Island (2013-2015) will be part of a PhD project co-supervised by Dr. Anna Metaxas (Dalhousie University) and Dr. Marjolaine Matabos (IFREMER). Six frames deployed on the margin and deep basin off Brazil have been collected and are going to be analysed by a post-graduate student of Dr Angelo Bernardino and Dr Paulo Sumida (Universidade Federal do Espirito Santo) in 2016. The frames recovered from the DELOS observatory on the African margin off Angola (Deep-ocean Environmental Long-term Observatory System, www.delos-project.org) were recovered in September 2015 and the samples are either being shipped to NOCS for analyses, or maybe shipped to Namibia for analyses during the capacity development workshop in April (see below).
- **Publications:**
 - Hilario A, Metaxas A, Gaudron S, Howell K, Mercier A, Mestre N, Ross RE, Thurnherr A, Young C (2015). Estimating dispersal distance in the deep-sea: challenges and

applications to marine reserves. *Frontiers in Marine Science* 2: 6. doi: 10.3389/fmars.2015.00006.

- Baco-Taylor A, Etter R, Ribeiro P, von der Heyden S, Beerli P, Kinlan B (Submitted and in review). A synthesis of genetic connectivity in deep-sea fauna and implications for marine reserve design. *Molecular Ecology* (September 2015).

➤ **Capacity Development Workshop:** The organisation is well underway for an INDEEP capacity development workshop in Namibia entitled: “Biodiversity and connectivity of deep-sea ecosystems in areas targeted by deep-sea mining”. The Namibian government has given permission for the workshop which will take place at the Ministry of Fisheries National Marine Information and Research Institute (NatMIRC), in Swakopmund, Namibia, from 11th to 21st April 2016. The focus of the workshop is on methods to conduct baseline studies of benthic ecosystems and analyses aimed at addressing potential significant impact that will inform decision makers. The training will include theoretical and practical work, both in the field (2-day sampling cruise at sea) and in the laboratory. The course will be offered to 18-20 participants from African countries, selected based on their potential to disseminate the acquired knowledge in their country. In addition, the INDEEP expert tutors will engage with UNAM (University of Namibia) by giving invited lectures to their staff and students both during and after our workshop. The training course has additional financial support from the International Seabed Authority Endowment Fund and an application for a Visiting Scholar has been submitted (4 Dec. 2015) to SCOR.

WG4 – Ecosystem function (leads: Andrew Thurber & Andrew Sweetman)

➤ **Freezer Science Project - Data collection and curation:** During the previous year WG4 have continued to analyze and amass frozen samples from colleagues from around the world. With the addition of already sequenced data and additional collaborators our global database of deep-sea 16S rRNA gene sequences was expanded during 2015 from 109 to 299 samples including key additions from the Arctic, Antarctic, canyons, seamounts, and the Central Pacific. Final sequencing runs are underway with all data in place planned by Jan 1 2016. Preliminary results from these were presented at the 14th Deep-sea Biology Symposium (by Thurber) and at the Western Society of Naturalists by L. Johnson (REU Undergraduate).

Deep-Ocean Stewardship Initiative (DOSI) (leads: Maria Baker, Lisa Levin, Kristina Gjerde & Elva Escobar)

DOSI replaces INDEEP WG5 from phase 1 on anthropogenic impact and science policy (see INDEEP Phase 1 final report for details). DOSI has been progressing well and continues to engage deep-sea stakeholders through publications, workshops, discussions and statements, surveys, symposia, webinars and other activities. DOSI now merits a dedicated secretariat and resources necessary to expand its international activities, engage developing countries and achieve global impact. Funding applications were recently submitted to both Fondation Total and JM Kaplan Foundation. Highlights this year are included in the additional activities sections below and further details are available on the new DOSI website (www.dosi-project.org). In addition, two new DOSI working groups have formed, taking the total to 10:

- **CLIMATE CHANGE:** Leads: Nadine Le Bris (Pierre and Marie Curie University, France) & Lisa Levin (Scripps Institution of Oceanography, USA). This group aims to provide a platform to centralize information about scenarios and observations to better assess the impact of climate change on deep-sea ecosystems and to address cumulative pressures. The goal is to facilitate integration of this information in environmental impact assessment and management plans and in the design of Marine Protected Areas. The WG also aims to identify high-vulnerability areas and foster interdisciplinary approaches to investigate how deep-sea ecosystems interact with climate on a functional basis. Both experimental and theoretical support is required to improve predictive models for this overlooked but largest component of the Earth system. The new working group started its activities in August 2015, building on the COP21-related initiatives and sessions at the 14th Deep-sea Biology Symposium to build an international network. This new group presently has 51 members from 16 countries. A short consensus statement written by the DOSI WG to COP21 on the inclusion of the deep ocean in climate discussions was signed by 272 deep-sea scientists and delivered during the COP21 proceedings. Levin and Le Bris spoke during COP21 Oceans and Climate session on the importance of the climate change effects in the deep ocean. DOSI has officially joined the Ocean and Climate Platform, a group of NGOs, scientists, academic institutions, professional associations and politicians dedicated to raising the profile of the ocean in climate negotiations. In advance of COP 21 Levin and Le Bris published a Perspectives piece in Science called ‘The Deep Ocean Under Climate Change’ DOI: 10.1126/science.aad0126.

- **NEW TECHNOLOGIES:** Lead: Dhugal Lindsay (JAMSTEC, Japan). This group will gather information concerning new technologies for environmental impact assessments in the deep sea. Environmental Impact Assessments depend on our ability to determine whether variability in biological community compositions, organism abundances, distributions, sizes and reproductive status are within naturally-occurring levels or have occurred as the result of anthropogenic disturbances. For disturbances that are likely to cause local extinctions, such as some deep-sea mining scenarios, larval supply and their ability to recruit to and survive in the altered habitat will govern the recovery potential at any given site. The acquisition of such baseline data should ideally be done in a minimally intrusive fashion so as not to impact the environment as a result of such baseline surveys. Protocols for surveys, subsequent analysis and data sharing should be standardized to enable comparisons of datasets obtained at different sites, at different times and by different people. This DOSI working group aims to identify and disseminate technologies that would enable the above goals to be met. A first workshop aiming to identify and review current and emerging technologies relating to underwater image acquisition, real-time and post-cruise image annotation, data sharing and archiving was convened in November 2015 in JAMSTEC and was funded by JAMSTEC, the Schmidt Ocean Institute and the Australian Embassy in Tokyo. See [report](#) for further detail. Outcomes of this workshop will be presented at the Marine Video Workshop scheduled for March 2016, Rhode Island.

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: Lenaick Menot)

- **Catalogues and keys of deep-sea corals:** Interactive keys for the identification of deep-sea coral species from images have been developed or are under development but still in beta versions. The first key is a didactic key, which aims at helping students identifying cnidarians from images at low taxonomic resolution, down to Order level. The key has been developed and sent to experts for comments and improvements. The key is being finalized. Two others keys are under development, which aim at identifying the antipatharians and alcyonaceans to genus level. We have been working with two specialists of these groups, Tina Molodtsova and Andrea Braga-Henriques, to develop the keys. We are however facing a couple of issues. The main one deals with the software used to develop Xper, the biodiversity collaborative management

platform, has been updated to cope with security issues in Java. The new version no longer suits our need and we may need to find alternative software to post the interactive keys on a website.

- **Improving knowledge on the distribution of cold-water corals in the Bay of Biscay:** We have developed a collaboration between NOCS and Ifremer, which allowed Inge van den Beld (PhD student, Ifremer) to participate in a cruise led by Veerle Huvenne (NOCS) to the Whittard canyon. This collaboration will foster a comparison of coral habitats in the Northern and Southern canyons of the Bay of Biscay.
- **Improving the management of cold-water coral habitats:** We have contributed to the development of a typology of Cold-Water Coral (CWC) habitats from over 50 photographic transects in canyons of the Bay of Biscay. This typology has been used to update the French “Typologie des habitats marins d’Atlantique”, which will further provide inputs to EUNIS, the European Nature Information System. The analysis of the distribution of CWC habitats was further used in recommendations for the designation of a Natura2000 network for offshore reefs in the Atlantic. In addition, a total of 4292 records of CWC occurrences in the Bay of Biscay have been provided to the Working Group on Deep-water Ecology of ICES/NAFO.

3. ADDITIONAL ACTIVITIES

Stakeholder engagement tools/ outreach

- **Website:** www.indeep-project.org - The INDEEP website is regularly updated with new community and outreach resources, information on working group activities and upcoming events. In addition, the INDEEP website hosts webpages for two associate programmes to which we are closely linked: [DOSI](#) (as described above) and [VentBase](#). DOSI now has its own website: www.dosi-project.org
- **Regular INDEEP Emails:** The INDEEP office keeps the global community informed about deep-sea issues, publications, cruise blogs, job opportunities, student opportunities, capacity development opportunities, specimen and data requests, deep-sea stakeholder surveys, meetings, webinars, training courses, obituaries etc. This communication is greatly valued as judged by emails and comments received by many individuals within the community who say they would otherwise feel disconnected. Email traffic is kept to a reasonable level so as not to discourage membership. The track record is good with only around 1 or 2 withdrawals per year from the mailing list, and these usually owing to moving out of the deep-sea realm.
- **INDEEP and Twitter:** The INDEEP office makes regular use of Twitter by tweeting relevant information concerning INDEEP activities and other activities relevant to the deep-sea

community. We currently have 720 followers (an increase from 450 followers this time last year).

- **Deep-Sea Life publication:** Deep-Sea Life is an informal publication for the deep-sea biology community, distributed to over 1000 people. This newsletter aims to deliver current news regarding projects, new papers, meetings and workshops, cruises, student progress, jobs and training opportunities, opinion pieces and other useful information for the science community and all interested parties. Deep-Sea Life is edited by Dr Maria Baker at the INDEEP Office, Eva Ramirez-Llodra and Abigail Pattenden. In 2015, two further issues have been produced and all six issues can be downloaded from the INDEEP resources webpage: <http://www.indeep-project.org/documents>. This publication has been very well received by the community and so it will continue in the foreseeable future.
- **INDEEP/DOSI Webinar Series 2:** This is an increasingly popular mechanism for international network communication and following on from the success of series 1, a second series of webinars have just been completed, produced by INDEEP and DOSI, informing members of the deep-sea community (including a wide variety of stakeholders) about deep-ocean issues. The second webinar series is entitled "Deep-Sea Promises and Challenges". There is a lot happening in the deep sea: new science, new industrial activity, new proposals for management, and new challenges to tackle. We want to talk to people in the midst of it all. We want to know what's happening. Series 2 heard from the following 9 deep-ocean experts:
 - Samantha Smith and Charles Roche - Industrial Mining in the Deep Sea: Social and Environmental Considerations (14 May 2015)
 - Rob O'Brien - The Oil Industry's Technological Advancements for the Ocean Environment (BP) (17 June 2015)
 - Charles Goddard and Maria Damanaki - The Deep Blue Economy (16 September 2015)
 - Claire Nouvian and Glen Wright - Deep-Sea Fisheries (21 October 2015)
 - Lisa Levin - Deep Ocean Stewardship Initiative - A Way Forward (18 November 2015)
 - Harriet Harden-Davies - Deep-Sea Genetic Resources: Governance, Science and Stewardship (16 December 2015)

See link for all webinar recordings : <http://dosi-project.org/dosi-outputs>.

- **Speaking textbook:** DOSI and INDEEP have initiated a comprehensive free online deep-sea ecology and stewardship "speaking textbook" aimed at all stakeholders. This dedicated [YouTube channel](#) was launched in August 2015 and currently has 5 lectures. Others are in production and many are expected to be completed in the coming months.

- **DIVE Project – Deep-Sea Image and Video Enterprise:** An INDEEP office initiative started in August 2015, a questionnaire has been developed to gather data for a comprehensive online map showing the coverage of deep-sea image and video data collected from around the globe. The questionnaire is currently under review by a small group of deep-sea image experts before wider dissemination to the community. This online tool, available to all, will improve accessibility to, and awareness of, the wealth of high-quality data available from institutions around the world. In return for completion of the questionnaire, respondents will likely have increased use of their image/video data (subject to their approval) and as the map will also cite papers related to these data, respondents will see increasing citations and visibility for their funders.
- **Deep-sea Experts Database:** The INDEEP deep-sea experts' database (www.deepseaexperts.org) is growing and is being used by all stakeholders to help bridge the gap between accurate scientific information and management of our deep oceans. It is a good and up-to-date way of finding experts for a specific area of expertise or geographical area. The database currently has 205 respondents.
- **Deep-sea Data Repository Listing:** Compilation and provision of an [online searchable listing](#) of all known open-access deep-sea data repositories for the deep-sea biology community. The INDEEP office has started work on this and the first iteration is now available on the resources page of the INDEEP website.
- **Deep-sea Interest Groups Listing:** Compilation of a comprehensive listing of national and international groups, programmes, institutions etc. with an interest in the deep-sea (and hence potentially INDEEP and DOSI). This listing is being used to enhance communication within the wider community and was last updated in October 2015.
- **Deep-sea Videos Online Searchable Listing:** INDEEP has created a comprehensive listing of online videos relating to the deep sea that will be of interest to the INDEEP and DOSI communities. There are links to over 250 videos specifically related to the deep sea on subjects such as climate change, ocean acidification, hypoxia, circulation, disposal (CO₂, 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 are useful for teaching purposes and teachers can search by subject area to see if there is any material relevant to their specific course. Other useful information is

also listed and searchable such as video title, presenter, affiliation, series type, duration and upload date. This list is regularly updated.

- **Potential deep-sea science funding sources:** A list of potential funding sources for use by the community, with details of deadline dates and funding strategies, has been compiled and was last updated in August 2015.
- **NOC Open Day April 2015:** INDEEP and DOSI were showcased during the annual National Oceanography Centre, Southampton, UK open day which attracted over 2000 visitors.
- **Deep-Sea Exhibition, Russia:** From December 2015, a new deep-sea exhibition will be available for viewing and INDEEP and DOSI member, Tina Molodstova from P.P. Shirshov Institute of Oceanology will present INDEEP and DOSI at the opening events in December 2015.
- **Deep-Sea Mining Online Open-Access Bibliography:** The DOSI and INDEEP community now have a comprehensive library containing over 200 papers on a variety of aspects of deep-sea mining. We decided to use Mendeley as a platform for this library as it is simple to access and a good tool for future collaboration. <https://www.mendeley.com/groups/7241201/literature-on-deep-sea-mining/papers/>
- **UN World Ocean Assessment:** INDEEP ensured deep-sea community input to the first UN World Ocean Assessment (WOA) review process for deep-sea relevant chapters (Feb 2015).
- **INDEEP and DOSI Engagement with Deep-Sea Mining Regulation formation:** The INDEEP office facilitated engagement with input to stakeholder engagement requests from the UN International Seabed Authority (ISA) in terms of their draft regulations for exploitation guidelines. In addition, INDEEP facilitated contribution to the SPC-EU Deep Sea Minerals Project guidance frameworks for Pacific-ACP States. INDEEP contributed to the Pacific Regional DSM Scientific Research Guidelines and also the Pacific Regional Environmental Management Framework for DSM Activities.

Organisation of and participation in symposia, meetings and workshops (in reverse date order)

- **DOSI Town Hall at Ocean Sciences Meeting, New Orleans, February 2016.** An abstract has recently been accepted to present DOSI during this international ocean meeting.
- **International Seabed Authority Workshop, Ghent, December 2015:** “Taxonomic methods and standardization for meiofauna in the Clarion Clipperton Zone”. INDEEP members recently took part in this cross-sector workshop to bring together international deep-sea meiofauna experts with representatives of ISA contractors to facilitate the establishment of a standardized taxonomy for baseline studies of meiofauna associated with mineral resources in the Area. This

one of a series of workshops that INDEEP members have attended previously where standardisation of taxonomic methods for megafauna and macrofauna have been addressed.

- **DOSI at COP21, Paris, 3-4 December 2015.** DOSI WG on Climate Change leads, Nadine Le Bris and Lisa Levin made the case for consideration of climate-change effects on deep-sea ecosystems and processes during ocean sessions at COP21. They both presented during the Ocean and Climate Platform event and also at other side events.
- **Science informs Policy, House of Lords, London, December 2015:** ACOPS (Advisory Committee on the Protection of the Sea) organised a dialogue on Deep-Sea Mining at the Houses of Parliament. INDEEP and DOSI members attended and contributed.
- **Deep-Sea Tailing Placement (DSTP) Meeting, Chile, November 2015.** A collaborative meeting between the Norwegian NYKOS project on submarine mine tailings and the Chilean DSTP initiative was funded by the Norwegian Research Council. A group of 15 Norwegian and Chilean participants discussed potential synergy and sharing of information amongst the two projects and their links to international initiatives. Eva Ramirez-Llodra presented INDEEP and NYKOS.
- **Global Ocean Commission (GOC) Meeting, Oxford, November 2015.** INDEEP PIs and WG leads Maria Baker, Eva Ramirez-Llodra and Derek Tittensor and DOSI leads, Kristina Gjerde and Jeff Ardron, attended this interdisciplinary meeting which focused on high seas to explore knowledge gaps, understand how to fill them and look to the future in terms of ocean use, management and potential problems. INDEEP will continue to aid with feeding deep-sea science into management and to strengthen collaborations with the GOC.
- **Science and Technology in Society Forum (STS), Tokyo, October 2015.** INDEEP and DOSI member, Patricia Miloslavich, was invited to this forum to raise discussions on the importance and relevance of observing biological and ecological variables in the ocean and with a focus on the deep sea. For this, Patricia presented INDEEP and DOSI during her speech and discussions.
- **Presentation of INDEEP and DOSI to FT, France, September 2015.** INDEEP and DOSI member, Lenaick Menot, was invited to introduce the two projects during the “Entretiens de Port-Cros” organized by Fondation Total.
- **14th Deep-Sea Biology Symposium, Portugal, August – September 2015.** INDEEP and DOSI both featured prominently during this 3-yearly symposium which always attracts key people from the field of deep-sea biology and increasingly attracts other deep-sea stakeholders. INDEEP and DOSI sessions were very well attended with over 130 participants for the DOSI planning meeting on the day before the symposium and good audiences for the INDEEP and

DOSI Town Meetings. All INDEEP working groups were represented during oral and poster presentations given by the WG leads. DOSI also opened the symposium with a session on Deep-Ocean Stewardship Issues. Once again, INDEEP secured funds from the International Seabed Authority Endowment Funds to enable six scientists from developing nations (Brazil, Chile, Trinidad & Tobago, Argentina and South Africa) to attend, present and network at this symposium.

- **INDEEP Community Award, Portugal, September 2015.** The first INDEEP Community Award for consistent delivery of inspirational scientific presentations/lectures on the deep-sea was presented during the 14th DSBS. Our community often gives excellent recognition to students during student poster and presentation awards at various meetings, and INDEEP also wished to recognise those that are now established deep-sea biologists/ecologists who have inspired so many of our community over the years with their pearls of wisdom and excellent ability to communicate their science. INDEEP community members were invited to nominate a candidate and during the closing session of the DSBS Professor Lisa Levin was presented with this award which was shared with Professor Paul Tyler, who was behind by only one vote.
- **NEKTON Foundation Meeting, Oxford, August 2015.** INDEEP office participation in new initiative to raise funds to explore and research the deep oceans.
- **INDEEP Leads Meeting, Skype, July 2015.** Management meeting to discuss ways forward for programme through 2016.
- **Digital Horizons meeting, July 2015, Natural History Museum, London.** Investigation of digitizing deep-sea specimen collections. Contribution by Tammy Horton, INDEEP WG1 co-lead.
- **EcoDeep-SIP Workshop, Tokyo, June/July 2015.** This workshop on “assessing deep-sea ecosystems in the Pacific Ocean” brought together experts to discuss conservation criteria for environmental management plans in the deep-sea including ecosystem services, to examine the potential intensity of the impacts taking into account cumulative impacts, identify major knowledge gaps and the technological developments needed to assess and monitor environmental impacts. Hiroyuki Yamamoto and Lenaick Menot, members of DOSI and INDEEP, were among the organizers of the workshop.
- **Workshop: “From seafloor hydrothermal systems to the sustainable exploitation of massive sulphide deposits: myths and realities of the deep sea”, Bergen, Norway, June 2015.** INDEEP and DOSI leads and representatives attended and contributed to this meeting.

- **Workshop on Deep-Sea Tailings Placement, Lima, Peru, June 2015.** INDEEP and DOSI co-organised and co-funded this discussion workshop between industry, policy makers and scientists.
- **Workshop “Towards the development of a strategic Environmental Management Plan for deep seabed mineral exploitation in the Atlantic basin” - SEMPIA, Azores, June 2015.** INDEEP and DOSI members co-organised and attended this workshop which came about via DOSI WG on minerals.
- **28th Session of UN IOC UNESCO, June 2015, Paris.** INDEEP PI, Maria Baker, was invited to join as part of the UK delegation to this years’ session of the Intergovernmental Oceanographic Commission. DOSI was presented to IOC delegates during a side meeting.
- **WoRMS Steering Committee, June 2015, Crete.** INDEEP WoRDDS discussed during this meeting by INDEEP WG1 co-lead, Tammy Horton.
- **Deep-seabed mining and Pacific cultures symposium, April 2015, Hawaii.** INDEEP and DOSI members organised and attended this meeting.
- **Science informs policy, House of Commons, London, UK, January 2015** This UK Parliamentary event on the impacts of deep-sea fisheries was organised in partnership with the Deep Sea Conservation Coalition and Bloom Association. INDEEP members, including Maria Baker, presented and attended.

Participation in international initiatives (coordinated from the office: Dr Maria Baker, Uni. Southampton, UK)

INDEEP is now recognised as a major body for deep-sea scientific information and links with all other stakeholders and, as such, has been involved in global initiatives establishing links with a wide array of partners (e.g. GOBI, IUCN, WOC, GOC, UN, DEFRA). New and ongoing involvement of INDEEP in international initiatives:

- **DOSI Highlights 2015:** A summary of all DOSI activities are found on the DOSI website. Highlights this year include 2 articles in Science: “Deep ocean under climate change” by Lisa Levin and Nadine Le Bris and “Managing mining of the deep sea” Wedding et al. 2015; Climate statement from INDEEP and DOSI scientists to COP21; DOSI is now a partner of the Oceans and Climate Platform; Minerals WG workshops on deep-sea mining and conservation issues (e.g. SEMPIA workshop, Azores, June 2015 – Towards the development of a strategic Environmental Management Plan for deep seabed mineral exploration and exploitation in the Atlantic basin, Deep-seabed mining and Pacific cultures symposium, Hawaii, April 2015); DOSI compiled input

to ISA drafts for regulatory framework for mineral exploitation in the area, May 2015; DOSI compiled review of Secretariat of Pacific Communities reports on standards for scientific research and mineral exploration of SMS, August 2015; Establishment of a new deep-sea mining transparency group; Deep-Sea Tailings Placement workshop, Lima June 2015 – organised by DOSI WG on DSTP and co-funded by INDEEP, NFR, IMO; DSTP review paper (Ramirez-Llodra et al. 2015) and current DOSI DSTP paper in prep; DOSI planning workshop, Aveiro, Portugal, August 2015, funded by Kaplan Foundation. In addition, at the time of writing, we have been informed by JM Kaplan Foundation of our successful funding proposal for upcoming DOSI activities and some limited coordination support.

- **1st UN World Ocean Assessment:** Following on from the successful call from the INDEEP office for members of the deep-sea science community to become actively involved in the “World Ocean Assessment”, the [pool of experts](#) comprises many deep-sea experts who have contributed towards this important process. INDEEP also called for expert reviews of the 58 WOA chapters. A large number of INDEEP scientists took part in this review process. Maria Baker organised for Alan Simcock of the WOA Group of Experts to visit the NOC to present WOA background and summary of results. The final 1st WOA is coming in 2016.
- **UN IOC-UNESCO:** During the 28th Session in June, DOSI was presented to delegates and we are working towards strengthening collaborations between INDEEP, DOSI and the IOC on a number of levels including with respect to the INDEEP WG3 Capacity Development efforts and the DOSI Climate Change WG.
- **The [Global Ocean Commission \(GOC\)](#):** INDEEP and DOSI have had important interactions with the GOC and have had significant input to their high-seas policy papers. Interactions continue. The latest interaction was in November at a workshop in Oxford (see detail above).
- **International Seabed Authority (ISA):** Several INDEEP members play important roles at the ISA, including the Legal and Technical Commission (Dr David Billett, Dr Elva Escobar) and Research experts (Dr Craig Smith, Uni. Hawaii; Dr Chuck Fisher, Pennsylvania State Uni.; Dr Cindy Van Dover, Duke Uni., Dr. Tammy Horton, NOC, Dr. Lenaick Menot, Ifremer). INDEEP has close links with the ISA biological activities. INDEEP and DOSI scientists continue to take part in ISA stakeholder consultations on regulations for deep-sea mining. DOSI are currently working with ISA to secure observer status and will attend the next ISA sessions in 2016.
- **IUCN Theme Group on Ecosystem Management and Deep-Sea Mining ([Link](#))** has recently been established in 2014. The group is led by Dr Malcolm Clark (NIWA, NZ and INDEEP Oversight Committee) and has the participation of other INDEEP members (e.g. Ashley Rowden,

Eva Ramirez-Llodra). A brochure on deep-sea mining facts has been produced: https://www.iucn.org/about/union/commissions/cem/cem_work/ecosystem_management_and_deep_sea_mining/

- **IABO (International Association of Biological Oceanography):** This association is being revamped and updated and INDEEP WG1 lead, Adrian Glover, is involved in this initiative and will be able to directly involve INDEEP in the new activities.
- **WoRMS (World Register of Marine Species):** WG1 lead, Tammy Horton, is on the WoRMS Steering Committee and Editorial Board.
- **IUCN Theme group Red List of Ecosystems:** INDEEP co-PI Eva Ramirez-Llodra participates in this group and will attend a first meeting in March 2015.
- **Working Group on Deepwater Ecology of the ICES:** INDEEP and DOSI members continue to contribute their expertise to this working group. The group met in February and December 2015. During the February meeting, expertise was provided regarding the potential impact of deep-sea mining on Vulnerable Marine Ecosystems and a system to weight the reliability and significance of VME indicator records was further developed. In December, the VME database was quality controlled and updated.
- **VentBase:** This is a forum where academic, commercial, government and other stakeholders can develop a consensus on the best way to manage the mining of seafloor massive sulfide (SMS) deposits. VentBase produces best-practice documents to inform stakeholders, and highlight state of the art science to underpin effective management. INDEEP has been involved in this initiative since the first meeting in Galway 2012 and DOSI now has close links also. A paper on deep-sea conservation genetics has recently been submitted and is under review (Boschen et al. A primer for use of genetic tools in selecting and testing the suitability of set-aside sites protected from deep-sea floor massive sulphide mining activities. Ocean and Coastal Management). INDEEP has contributed to this effort. Other papers underway are one on deep-sea MPAs (Clark et al.) and hydrothermal vent ecosystem services: identification of services and communication of value (Turner et al.). A 3rd VentBase workshop is currently being organised for 2016 in the Azores – dates TBD – which will concentrate on mining plumes.
- **INDEEP is a partner with the Marine Ecosystem Services Partnership (MESP),** having joined together with them to coordinate and execute the first two webinar series on deep-ocean stewardship (outlined above).
- **MOOC on “Exploring our Oceans”:** INDEEP and DOSI are featured (in week 6) in this Massive Online Open Course developed by the University of Southampton which was broadcast in

February 2014. Owing to popular demand, it has been run again in October 2014 and August 2015. The course attracted around 16,000 people from across the globe (<https://www.futurelearn.com/courses/exploring-our-oceans>).

- **European Marine Board:** INDEEP and DOSI are acknowledged in European Marine Board publication *Delving Deeper: Critical challenges for 21st century deep-sea research*, launched in September 2015. We are strengthening our collaborations with the EMB deep-sea group.
- **ECOMINA:** This Norwegian-led initiative on Arctic Mid-Ocean Ridge (AMOR) deep-sea mining has direct links with INDEEP. ECOMINA was a small 1 year pilot desktop project (2015) and has produced 3 main outputs: 1) established a national network of Norwegian scientists with an interest in deep-sea mining and with links to international initiatives (INDEEP, DOSI, ISA, IUCN); 2) Prepare a brochure on deep-sea mining with a focus on the AMOR; 3) Prepare and submit a new proposal for a 3 year project to design a Strategic Environmental Management Plan and an Environmental Management Plan for the AMOR within Norwegian jurisdiction. The outcome of the proposal will be announced in January 2016.