
INDEEP Phase 2 Report (No. 3) to the Total Foundation

January – December 2016

1. PROJECT DETAILS

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

Principal Investigators: Dr Lenaick Menot, Ifremer-Brest (France), Dr Maria Baker, University of Southampton (UK), Dr Eva Ramirez-Llodra, Norwegian Institute for Water Research (Norway), Dr Bhavani Narayanaswamy, Scottish Association for Marine Science (UK)



Oversight Committee: Prof Paul Tyler, University of Southampton (UK) – Chair, Prof Craig Smith, University of Hawaii (USA), Dr Malcolm Clark, National Institute of Water and Atmospheric Research (NZ), Prof Robert Carney, Louisiana State University (USA), Prof Myriam Sibuet, Institut Océanographique de Paris (France)



Working Group Leads:

WG1: Dr Adrian Glover, Natural History Museum, London (UK) & Dr Tammy Horton, National Oceanography Centre (UK). WG2: Dr Tim O'Hara, Museum Victoria (Australia) & Dr Derek Tittensor, Dalhousie University (Canada). WG3: Dr Anna Metaxas, Dalhousie University (Canada), Dr Eva Ramirez-Llodra, Norwegian Institute for Water Research (Norway) & Dr Ana Hilario, University of Aveiro (Portugal), Dr Maria Baker, University of Southampton (UK). WG4: Dr Andrew Thurber, Oregon State University (USA) & Dr Andrew Sweetman, Herriot-Watt University (Scotland)



Hosting Institutions:

IFREMER, France & University of Southampton, UK

INDEEP Mission Statement

INDEEP is a global collaborative scientific network dedicated to the acquisition of data, synthesis of knowledge, and communication of findings on the biology and ecology of our global deep ocean, in order to inform its management and ensure its long-term health.

Participants:

During the course of the first 2 phases of INDEEP, the network has grown from 280 participants from 30 countries in October 2011 to 979 from 45 countries and membership continues to grow, almost on a daily basis. Membership is largely made up of deep-sea ecologists ranging from students through established scientists but there are also a significant number of members from other deep-sea stakeholders including scientists from other disciplines, NGOs, policy makers, industry, economists and social scientists.

2. WORKING GROUP Activities 2016

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

- **INDEEP World Register of Deep-Sea Species:** Since the launch in 2012, the World Register of Deep-Sea Species ([WoRDSS](#)), a comprehensive, thematic species database (TSD) of the World Register of Marine Species ([WoRMS](#)), has gone from strength to strength, with key input from INDEEP community members (as detailed in previous reports to FT). The collection now comprises the most up-to-date taxonomy of deep-sea species with a suite of identification tools (online keys, monographs and papers), and has been of immense benefit to the scientific community. Deep-sea ecologists and taxonomists use it for teaching, as do researchers both on board research vessels and in research labs globally. There are now 25,274 species listed. Work will continue to improve the WoRDSS dataset in the future using focussed work by expert taxonomists and newly published literature. The INDEEP WG1 leads, with support from the INDEEP office, will strive to secure funding to aid these revisions. During 2016, a [LifeWatch](#) grant was awarded to undertake the taxonomic editorship and the addition of taxonomic data (basonym, missing authorships, original description, type locality, type species, environment, depth distribution, keys and guides) for the Amphipoda, Lysianassoidea. The Lysianassoidea is a large superfamily containing 22 families, 173 accepted genera and 1042 accepted species currently in the World Amphipoda Database ([WAD](#)) list. These edits provide information that has also filled gaps in WoRDSS. A peer-reviewed publication providing a global overview of deep-sea Amphipoda is underway and will be submitted in 2017. The LifeWatch grant work has been conducted by Tammy Horton and Michael Thurston (NOC), both of whom are editors of the World Amphipoda Database (WAD). The project will also provide the known depth ranges of all lysianassoid species in WoRDSS (495 species). This dataset is of immense value to scientists studying the deep-sea, and to those working on taxonomic revisions. The total LifeWatch grant of €38,075 was awarded for “Improving the WoRMS Taxonomic Backbone: Amphipoda Editor Workshop” and coordination of 4 editor data grants, December 2015-May, 2016.
- **INDEEP Deep-Sea ID App:** Funded by INDEEP, the Deep Sea ID, a field guide app to the marine life of the deep sea, became available for free download for iPhone and iPad in March 2013. In July 2015 version 1.2 was launched with additional features. Subsequently, in September 2015 the app went live on Android. This product (available from the [iTunes](#) and [Amazon](#) app stores)

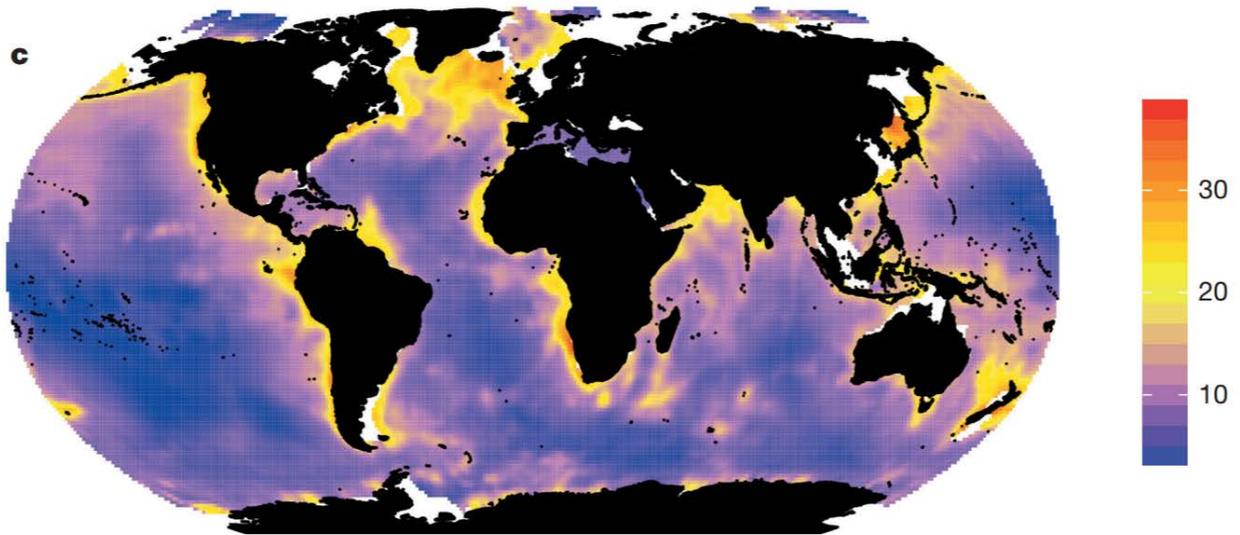
has been a great success for INDEEP and has been downloaded by 36,600 users. Users from a wide range of countries from around the world indicate that there is public and scientific interest in deep-sea life from countries in both the developed and the developing world. It allows offline access to WoRDSS and currently stores on your device the taxonomic information for 25,274 deep-sea species, including 584 high-resolution photographs of deep-sea specimens as well as links to online taxonomic tools, sources and important references. The DeepSea ID app will continue to be updated and the INDEEP WG1 leads, with support from the INDEEP office, will work to secure funding for both WoRDSS and the app in combination in the future. External requests for collaborations are still received, including this year from NOAA, who recognise the importance of the strong taxonomic hierarchy behind the app and wish to make use of our platform to host high quality deep-sea photographs from upcoming fieldwork.



- **Taxonomic List and Taxonomic Keys:** The [taxonomist list](#) continues to be updated when necessary, and taxonomic keys and revisions are added to WoRDSS (and WoRMS), on an ad hoc basis when they are published.

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

- **Global mapping of deep-sea biodiversity for ophiuroids (brittle stars):** This work is now published (in the journal *Nature*) and provides significant insight into the forces structuring biodiversity in the Ophiuroidea, an important component of seafloor fauna, and possibly a proxy for other taxa. It also provides a general framework linking deep-sea to shallow water biodiversity. The findings provide a global baseline for conservation efforts across the sea floor, and demonstrate that deep-sea ecosystems show a biodiversity pattern consistent with ecological theory, despite being different from other planetary-scale habitats such as terrestrial or coastal marine realms. It also provides a useful resource for upcoming policy processes, such as the United Nations policy instrument on biodiversity beyond national jurisdiction (BBNJ) currently under discussion. The publication: Woolley S, Tittensor D, Dunstan P, Guillera-Arroita G, Lahoz-Monfort J, Wintle B, Worm B & O’Hara T (2016). Deep-sea diversity patterns are shaped by energy availability. *Nature* 553: 393-396 is available [here](#).



Global patterns of ophiuroid species richness in the deep-ocean (2,000-6,500m). From Woolley et al. 2016, Nature.

In addition to the publication above, WG2 is continuing to build upon this newly available global deep-sea biodiversity database and map. A publication on ‘Global priorities for protecting deep-sea biodiversity’, using these new patterns and hotspots to determine priority regions for protection, is in final preparation. The findings above are explicitly linked to global biodiversity policies and goals (such as the CBD Aichi Targets and the UN Sustainable Development Goals). We anticipate that these findings will also be able to feed directly into the BBNJ discussions. Furthermore, work exploring the links between deep-sea biodiversity and remotely-sensed global fishing effort, particularly fishing targeting the deep-sea, is at an early stage.

➤ **Deep-Sea OBIS Node:** WG2 has been collaborating with the Ocean Biogeographic Information System ([OBIS](#)) to facilitate the propagation of more accessible deep-sea biodiversity data into OBIS. The intent is to mobilize data that are currently held by individual scientists, and ensure that they are uploaded to OBIS. To that end, the first INDEEP-OBIS training workshop was held in October 2016 at the UNESCO-IOC project office for IODE, Oostende, Belgium and attended by 33 participants from 16 countries (Australia, Belgium, Canada, Colombia, Ecuador, France, Germany, Jamaica, Mauritania, Norway, Poland, Portugal, Spain, Trinidad and Tobago, United Kingdom and United States). The participants represented 20 different deep-sea programmes and data systems. The meeting brought together deep-sea biologists and data managers and created the momentum to build an international alliance of young scientists with a common vision to provide open access to deep-sea biodiversity data and enhance our understanding of the deep-ocean ecosystem in order to better inform ocean governance and management. The group called for: (1) The establishment of a data-sharing platform, built on OBIS, with the aim to provide a single integrated access point to high-quality data and information on the diversity, abundance and distribution of all deep-sea organisms and their ecosystem properties, including habitat and environmental characteristics. (2) The promotion of guidelines and best practices in data management and to make these principles common practice through training the next generation of deep-sea scientists. (3) The deposition of all primary biodiversity data in open-access archives and data integrators such as OBIS as a mandatory condition for publically funded research, which should also apply for scientific publications, as is common practice for DNA sequences in [GenBank](#). In order to ensure the highest quality of data, the group recommended that each dataset be reviewed by an expert before it is put in the public domain and published through OBIS. An automatically generated dataset report providing summary statistics on data quality could assist this process. Workshop participants were trained in OBIS data standards and best practices in quality assurance (e.g. WoRMS and LifeWatch tools) and data publishing as well as in data access and analytical and visualization tools using the R OBIS package and GIS software (see [OBIS Manual](#)). All the training materials, including video presentations, are available on [Ocean Teacher](#). The further development of a deep-sea OBIS node and data portal is a shared responsibility of this group and the wider deep-sea scientific community. The success will depend on the dedication of a few people, backed with extra resources such as a full-time data manager. We currently have a funding bid in for this purpose. The sharing of new data will be encouraged through a biennial review paper on the status of

deep-sea data in OBIS and all new data contributors will be invited to join this effort. The inclusion of comprehensive deep-sea data in OBIS would ensure its accessibility for upcoming key international policy processes.



Group picture, from left to right: Leen Vandepitte, Fabio De Leo, Ward Appeltans, Matt Dornback, Abbie Chapman, Timothy O'Hara, Amber Coble, Greg Reed, Pieter Provoost, Ana Ramos, Jeroen Ingels, Catherine Borremans, Sidi Mohamed Mohamed Moctar, Christopher Olson, Maria Baker (and Tammy Horton on Skype), Daphnis De Pooter, Andrew Davies, Severine Martini, Doreen Mcveigh, Jill Bourque, Marina Cunha, Stefan Brager, Franziska Althaus, Andrea Polanco, Christopher (Nicolai) Roterman, Ascensão Ravara, Magdalena Blazewicz, Diva Amon, Torben Riehl, Etienne Rastoin, Meri Bilan, Nicholas Higgs, Thomas Dahlgren.

- **Expedition to survey abyssal biodiversity off Australia's east coast:** This 35-day expedition is funded by the Australian National Marine Facility and will commence in 2017 owing to ship delivery delays.

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

- **Recruitment Project:** Currently, 36 frame deployments have taken place, including on a blowout preventer (TransOcean), scientific landers, permanent observatory ([Ocean Networks Canada](#), [DELOS](#)) and with ROVs. Deployments have been made of a wide variety of habitat types including on the shelf, slope, in canyons, on abyssal plains, on hydrothermal vents, and on cold seeps. The regions studied so far include the NE Atlantic (Rockall Trough., Claire Ridge, Baltimore Canyon), SW Atlantic (Brazil), SE Atlantic (Angola), Gulf of Mexico, NE Pacific (Barkley canyon) and Caribbean (Cayman rise). 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) have been analysed and will be part of a PhD project co-supervised by Dr. Anna Metaxas (Dalhousie University) and Dr. Marjolaine Matabos (IFREMER). A publication will be prepared and submitted in 2017. Six frames deployed on the margin and deep basin off Brazil have been collected and will be analysed by a post-graduate student of Dr Angelo Bernardino and Dr Paulo Sumida (Universidade Federal do Espirito Santo) in 2016. Unfortunately, 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 during the course of posting the samples to Namibia for the INDEEP Capacity Development workshop, they were destroyed at the border in Angola – an error by the shipping company.

- **Genetic connectivity in the deep-sea review paper:** Baco, A.R., Etter, R.J., Ribeiro, P.A., Von der Heyden, S., Beerli, P. & Kinlan, B. (2016). A synthesis of genetic connectivity in deep-sea fauna and implications for marine reserve design. [Molecular Ecology: 25, 3276–3298](#). With anthropogenic impacts rapidly advancing into our deeper waters, there is growing interest in establishing deep-sea marine protected areas (MPAs) or reserves. Reserve design depends on estimates of connectivity and scales of dispersal for the taxa of interest. This paper compiles population genetics studies of deep-sea fauna and estimated dispersal distance for 51 studies. The results provide the first rough estimate of the range of dispersal distances in the deep sea and allow comparisons to shallow-water assemblages. The analyses suggest the scales of dispersal and connectivity for reserve design in the deep sea might be comparable to or slightly larger than those in shallow water. This work will form the basis for future MPA design in the deep ocean.
- **Namibia Capacity Development Workshop, April 2016:** The first INDEEP capacity development workshop, granted by the Namibian government, entitled: “Biodiversity and connectivity of deep-sea ecosystems in areas targeted by deep-sea mining” was undertaken in April 2016. In order to address the limited capacity in Namibia in terms of benthic and pelagic ecosystem effects of potential deep-sea phosphate mining, the workshop considered not only the fundamental principles of benthic ecology, but also addressed the main concerns of a variety of deep-sea anthropogenic activities. Funds from Fondation Total and the International

Seabed Authority (ISA) enabled us to invite 28 participants from Namibia, Kenya, Madagascar, Mauritania and Angola to attend the workshop at the National Marine Information Research Centre of the Ministry of Fisheries and Marine Resources headquarters in Swakopmund. The workshop was a great success and the training involved theoretical and practical work, both in the field and in the laboratory. Six INDEEP expert tutors (Maria Baker, Lisa Levin, Ana Hilario, Anna Metaxas, Verena Tunnicliffe and Paul Tyler) led the training. A funding proposal has just been submitted (December 2016) to conduct critical research in the region to support a comprehensive EIA in advance of phosphate mining in the region and to hold a series of further capacity development workshops. [Link to Namibia Workshop report.](#)



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

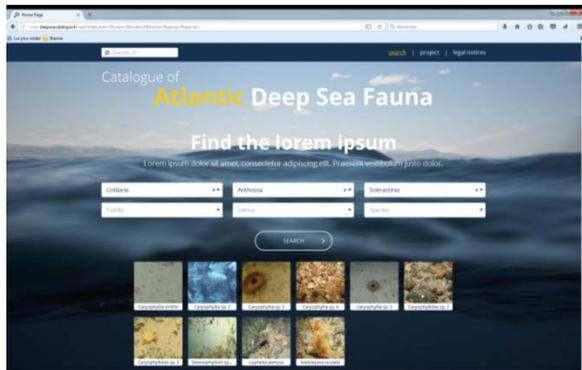
- **Freezer Science Project - Data collection and curation:** During the previous year WG4 have continued to analyze and amass frozen samples from colleagues from around the world. With the addition of already sequenced data and additional collaborators our global database of deep-sea 16S rRNA gene sequences was expanded during 2015-16 from 109 to 351 samples including key additions from the Arctic, Antarctic, canyons, seamounts, and the Central Pacific.

The resulting database is among the largest comparable database assembled from the deep sea, with over 182 thousand operational taxonomic units identified within the 26 million sequences analysed from all deep-sea habitats. 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). A paper discussing the findings of this important global data collection is in preparation and will be submitted in 2017.

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). INDEEP and DOSI are hence intrinsically related to each other, with DOSI a value-added component of INDEEP. 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. Successful funding applications submitted to JM Kaplan Foundation and Pew Environment have led to enhanced outputs. Highlights for 2016 are included in the additional activities sections below and further details are available on the new DOSI website (www.dosi-project.org). In addition, a new DOSI working group on policy has been established, taking the total number of working groups to 11. The mission of the Policy Working Group is to enhance the linkage between INDEEP and DOSI science and the formulation of policy related to the deep ocean, both within and beyond national jurisdictions. The Policy Group will build on the policy-related activities of DOSI across Working Groups and provide connections to external legal entities and instruments. It will maintain a broad perspective across all sectors and themes to ensure efficient communication, coordination, and consistency within DOSI, and enhance the visibility of DOSI and INDEEP efforts on a global scale.

Case study: A catalogue of the Atlantic Deep Sea Fauna (Lead: Lenaick Menot)



In collaboration with the University of Plymouth and the NOAA, Ifremer is maintaining a catalogue of images used as morphotypes of the specimens identified from videos and pictures. The images are picturing all morphotypes identified so far in the Bay of Biscay. In the framework of INDEEP, the catalogue is now available online <http://www.deepseacatalogue.fr/> (beta version).

3. ADDITIONAL ACTIVITIES

Stakeholder engagement tools/ outreach/publications



➤ **Deep-Sea Life publication:** Deep-Sea Life is an informal publication for the deep-sea biology community, distributed to thousands of people. This newsletter delivers current news regarding deep-sea research projects, new publications, meetings and workshops, cruises, scientist profiles, jobs and training opportunities, opinion pieces and other useful information for the science community and all interested parties. Deep-Sea Life is edited by Maria Baker at the INDEEP Office, Eva Ramirez-Llodra and Abigail Pattenden. In 2016, two further issues have been produced and all eight 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 we hope to be able to continue production for the foreseeable future.

➤ **INDEEP Website:** www.indeep-project.org - The INDEEP website had an overhaul in the summer with the inclusion of an INDEEP promotion video which gives an overview of the work conducted within the first 6 years of project. The website is regularly updated with new community and outreach resources, information on working group activities and upcoming events. It

also now has the INDEEP twitter feed embedded in order to further enhance communication within the community. In addition, the INDEEP website hosts a webpage for an associate programme to which we are closely linked: [VentBase](#).

- **DOSI Website:** DOSI was previously incorporated into the INDEEP website but we have now developed and maintain a separate website for this project: www.dosi-project.org.
- **Regular INDEEP Emails:** As always, and one of the widely-valued functions of this network, 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.
- **INDEEP and Twitter:** The INDEEP office makes regular use of Twitter (@INDEEP_Project) by tweeting relevant information concerning INDEEP activities and other activities relevant to the deep-sea community. We currently have 1079 followers (an increase from 740 followers this time last year). DOSI also now has a Twitter feed and we will be stepping up the activity on this feed in 2017.
- **Deep-sea Experts Database (www.deepseaexperts.org):** The INDEEP deep-sea experts' database 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 field of expertise or geographical area. The database currently has 257 experts.
- **Deep-Sea Mining Online Open-Access Bibliography:** The INDEEP and DOSI community have a comprehensive library containing over 200 papers on a variety of aspects of deep-sea mining that is updated regularly. <https://www.mendeley.com/groups/7241201/literature-on-deep-sea-mining/papers/>
- **INDEEP supported publication:** INDEEP supported the open-access publication of a VentBase publication: Boschen et al. (2016) A primer for use of genetic tools in selecting and testing the suitability of set-aside sites protected from deep-sea seafloor massive sulfide mining activities. Ocean and Coastal Management. [Link to paper](#).
- **INDEEP and DOSI Engagement with Deep-Sea Mining Regulation formation:** Further to previous engagement with input to stakeholder engagement requests from the UN International Seabed Authority (ISA) in terms of their draft regulations for exploitation guidelines, we have once again submitted an official commentary to the call (November 2016). The ISA responded: "DOSI's valuable contribution and continued support on the Authority's work towards the

formulation of the regulatory framework for exploitation in the Area is greatly appreciated”. We also compiled and submitted a commentary from the DOSI Minerals WG on the “Periodic review of the ISA pursuant to UNCLOS Article 154” (October 2016). Moving forward, we have secured funding from Kaplan and PEW to conduct further in-depth work on the environmental regulations from the ISA that should be available for stakeholder input before the end of 2016.

- **DOSI and ISA:** DOSI was awarded Observer Status at the International Seabed Authority during the 22nd ISA Session in July 2016. The photograph to the left shows some of the DOSI members who attended the Session – Philip Turner, Jen Le, Torsten Thiele, Maria Baker, Kristina Gjerde.
- **DOSI Mineral WG publication:** Levin et al. (2016) Defining “Serious Harm’ to the Marine Environment in the Context of Deep-Seabed Mining. Marine Policy [Link to paper](#).
- **DOSI Oil & Gas WG publication:** Cordes et al. (2016) Environmental impacts of the deep-water oil and gas industry: a review to guide management strategies. Frontiers in Environmental Science [Link to paper](#).



- **DOSI Fisheries WG engagement at the UN and EU:** Matt Gianni, co-lead of this WG, has been working tirelessly at the UN and at the EU on issues relating to deep-sea fisheries and has been facilitating open discussions via the WG. In December 2016, the UN General Assembly adopted the new fisheries [resolutions](#) with positive outcomes for deep-sea fisheries conservation. Also this month the European Parliament voted to adopt a new regulation on deep-sea fishing including a ban on bottom trawling below 800m. [Link to report](#).

➤ **DOSI Deep-sea Tailings Placement WG progress:** Contributions from WG members were made to the International Maritime Organisation (IMO) report on DSTP during 2016. This report is in its final editing phase and will be made available when it is published by the IMO. In parallel, members of the DSTP working group are progressing with a Scoping Paper, which will identify and discuss current trends and major knowledge gaps on the disposal of tailings in deep waters. The publication will highlight the main research needs in this topic and provide a tool to help all stakeholders to better understand DSTP. The paper will also provide guidelines for best available practices.

- **DOSI Climate WG contributions:** The DOSI climate group provided a statement to the new

Oceans and Cryosphere IPCC scoping group, June 2016 – [A case for the deep ocean](#). In addition, a DOSI Brief was submitted to the second meeting of the UN BBNJ PrepCom, August-September 2016 – [Climate Change in Oceans Beyond National Jurisdiction](#). In September, the WG also contributed comments to the Global Ocean Forum report: Towards a Strategic Action Plan on Oceans and Climate, 2016-2021. WG Lead Lisa Levin attended the GO2NE (oxygen network) meeting at UNESCO in Paris in September to represent DOSI. Finally, in November, WG leads Lisa Levin (photographed left) and Nadine Le Bris attended COP22 in Morocco and presented “Climate change and the deep half of the planet” – [link to session footage](#).

- **DOSI Policy WG activities:** The DOSI Policy WG submitted a brief to the second meeting of the UN BBNJ PrepCom, August-September 2016. The WG also coordinated DOSI input to the [IPBES](#) draft scoping report of the thematic assessment of the sustainable use of biodiversity in October 2016.
- **DOSI Deep-Sea Genetic Resources WG Survey and UN submission:** The DSGR WG conducted a survey to ascertain the priorities for facilitating marine scientific research relating to MGR in Areas Beyond National Jurisdiction (ABNJ) and produced a discussion paper in March 2016. The group submitted a letter and summary of survey results to UN 1st Preparatory Committee (PrepCom) meeting for the development of a new legal instrument for the conservation and sustainable use of marine biodiversity beyond national jurisdiction under the UN convention on the Law of the Sea (23rd March 2016).
- **DOSI Knowledge Gaps and Global Ocean Assessments WG:** Both INDEEP and DOSI have been involved with the production of the 1st World Ocean Assessment which was published in January 2016. [Link to Assessment](#).

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

- **DOSI Meeting during the 6th International Symposium on Chemosynthesis-Based Ecosystems, WHOI, USA, Aug-Sept. 2017.** Funding secured from Kaplan and FAO. DOSI will also co-sponsor the Chemosynthetic Habitats and Society session of this meeting.
- **DOSI Side-Event at 23rd Session of ISA, Jamaica, August 2017.** Funded by Kaplan.
- **Future Earth Ocean Knowledge Action Network Workshop, December 2016.** Moriaki Yasuhara presented DOSI at this meeting.
- **Offshore and deep-sea mining conference, London, November 2016.** INDEEP and DOSI member Amber Cobley attended this meeting and promoted INDEEP and DOSI Minerals WG.

- **DOSI at COP22, Morocco, November 2016.** DOSI WG on Climate Change lead, Lisa Levin presented the importance of climate-change effects on the deep-sea. [Link to presentation.](#)
- **INDEEP-OBIS workshop for a new deep-sea node, October 2016.** See details in WG2 section above.
- **Workshop “Towards the development of a strategic Environmental Management Plan for deep seabed mineral exploitation in the Atlantic basin” - SEMPIA, Azores, October 2016.** INDEEP and DOSI members co-organised and attended this workshop which came about via DOSI WG on minerals. The plan and publication should be finalised early 2017.
- **Underwater Mining Institute Conference, October 2016.** Amanda Netburn (NOAA) presented DOSI during this predominantly industry meeting.
- **Challenger Deep-Sea Special Interest Group Meeting, Liverpool, UK, September 2016.** The UK deep-sea community (all INDEEP members) gathered for this meeting to present an overview of their work and thought for the future. The future of INDEEP was also discussed.
- **UK Deep-Sea Mining Panel Discussion Event, Liverpool, UK, September 2016.** Amber Cobley and Adrian Glover led a multi-stakeholder discussion on the UK perspective of deep-sea mining and discussions led to a submission from the UK deep-sea community to the ISA regarding the draft regulations for exploitation.
- **Royal Society Meeting, London, September 2016.** Lisa Levin attended to discuss climate change in the deep ocean on behalf of DOSI.
- **UN second PrepCom meeting for the development of the new agreement on biodiversity beyond national jurisdiction, September 2016.** DOSI attended and presented statements on Policy and Climate. [Link to statements.](#)
- **Focus workshop - "Conserving the other 50% of the world: status and opportunities in area-based management beyond national jurisdiction, Canada, July/August 2016.** This workshop was held during the International Marine Conservation Congress and INDEEP and DOSI members attended.
- **UN International Seabed Authority 22nd Session, July 2016.** Attended by Maria Baker from INDEEP/DOSI and DOSI members, Dan Jones, Kristina Gjerde, Matt Gianni, Duncan Curries, Philip Turner, Jennifer Le and others. Dan Jones presented DOSI during side-meeting and DOSI obtained official Observer Status.
- **DOSI/PEW Workshop on Enhancing Stakeholder Participation and Transparency in the ISA Process, Jamaica, July 2016.** DOSI members attended and presented at this workshop. [Link to report.](#)

- **3rd VentBase Meeting, Azores, June 2016.** The topic for the 3rd VentBase workshop, attended by INDEEP members, was to review the impacts of plumes on the ecosystem and all of its components as well as its applications for plume modelling.
- **29th Session of UN IOC UNESCO, June 2016, Paris.** DOSI MGR WG lead, Harriet Harden-Davies was invited to join as part of the UK delegation to this year's session of the Intergovernmental Oceanographic Commission.
- **WoRMS Steering Committee, June 2016, Oostende, Belgium.** INDEEP WoRDSS discussed during this meeting by INDEEP WG1 co-lead, Tammy Horton. Tammy Horton elected Chair for WoRMS Steering Committee.
- **Establishing Community Standards for Underwater Video Acquisition, Tagging, Archiving and Access, USA, June 2016.** DOSI WG on new technologies contributed to this meeting.
- **Griffith Law School and ISA Workshop on Environmental Assessment and Management for Exploitation of Minerals in the Area, Australia, May 2016.** DOSI and INDEEP members had significant input to this important meeting. [Link to report.](#)
- **Deep Seabed Mining Payment Regime Workshop, San Diego, USA, May 2016.** DOSI Minerals WG members contributed to this meeting. [Link to report.](#)
- **INDEEP Leads Meeting, Skype, May 2016.** Management meeting to discuss ways forward for programme for INDEEP phase 3 (see below).
- **World Amphipoda Editor Training Workshop, Oostende, Belgium, April 2016.** INDEEP WG1 co-lead Tammy Horton presented results of LifeWatch grant on Lysianassoidea.
- **UN first PrepCom meeting for the development of the new agreement on biodiversity beyond national jurisdiction, March 2016.** DOSI attended and presented statements on Marine Genetic Resources.
- **Washington DC Public Policy Forum, March 2016.** Lisa Levin attended for DOSI.
- **DOSI Town Hall at Ocean Sciences Meeting, New Orleans, February 2016.** DOSI co-lead Lisa Levin chaired this meeting.
- **INDEEP and Challenger 2022, London, February 2016:** Many INDEEP members led an inaugural meeting to discuss a new programme to conduct an up-dated version of the Challenger Expedition, 150 years on.

Participation in international initiatives

INDEEP is 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). Recent involvement of INDEEP in international initiatives:

- **DOSI Highlights 2016:** A summary of all DOSI activities are found on the DOSI website and within this report documenting interactions with high-level policy.
- **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. The 1st WOA was published in January 2016. [Link to assessment.](#)
- **United Nations General Assembly** – The DOSI WG on deep-sea fisheries has had significant input to the recent UNGA fisheries resolution process.
- **UN IOC-UNESCO:** During the 29th Session in June, Harriet Harden-Davies worked towards strengthening collaborations between INDEEP, DOSI and the IOC on a number of levels including with respect to DOSI Deep-Sea Genetic Resources WG efforts.
- **International Seabed Authority (ISA):** Several INDEEP and DOSI members play important roles at the ISA, including the Legal and Technical Commission (Dr David Billett, Dr Elva Escobar) and Research experts (e.g. Dr Craig Smith, Uni. Hawaii; Prof. Verena Tunnicliffe, Dr Chuck Fisher, Pennsylvania State Uni.; Dr Cindy Van Dover, Duke Uni., Dr. Tammy Horton, NOC, Dr. Lenaick Menot, Ifremer, Dr Lisa Levin, Scripps). INDEEP looks forward to working with the new Legal and Technical Commission including the 3 INDEEP biologists assigned to the group – Dr Malcolm Clark, NZ, Dr Gordon Patterson, UK and Dr Se-Jong Ju, Republic of Korea. INDEEP has close links with ISA environmental activities. INDEEP and DOSI scientists continue to take part in ISA stakeholder consultations on regulations for deep-sea mining. In 2016 DOSI acquired ISA observer status.
- **[IABO \(International Association of Biological Oceanography\)](#):** This association is being re-vamped and updated and INDEEP WG1 lead, Adrian Glover, is involved in this initiative is linking information via INDEEP in order to raise awareness of their new activities.
- **[WoRMS \(World Register of Marine Species\)](#):** WG1 lead, Tammy Horton, has recently been elected as Chair of the WoRMS Steering Committee and is a member of the Editorial Board.
- **IUCN Theme group [Red List of Ecosystems](#):** INDEEP co-PI Eva Ramirez-Llodra participates in this group.

- **IUCN Theme Group on Ecosystem Management and Deep-Sea Mining:** This group was established in 2014 and is led by Malcolm Clark (NIWA, NZ and INDEEP Oversight Committee) and has the participation of other INDEEP members (e.g. Ashley Rowden, Eva Ramirez-Llodra, Craig Smith). 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/. Malcolm Clark and Craig Smith participated in the IUCN World Conservation Congress in Hawaii (Sept. 2016) and presented on deep-sea mining entitled: Deep-sea mining: environmental issues associated with deep-sea minerals exploitation. [<https://portals.iucn.org/congress/session/9836>] and Current research on the ecological impacts of seabed mining: global efforts to inform effective management. [<https://portals.iucn.org/congress/session/10480>].
- **Working Group on [Deepwater Ecology of the ICES](#):** INDEEP and DOSI members continue to contribute their expertise to this working group.
- **[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 sulphide (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 was published this year (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 and supported this effort in terms of open access. 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 took place in the Azores in June 2016. The main topic of this year VentBase to review the impacts of plumes on the ecosystem and all of its components as well as its applications for plume modelling. A review paper on plume impacts will be drafted and hopefully submitted to an open access journal.
- **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.

- **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 and again in 2016. The course attracted around many thousands of people from across the globe (<https://www.futurelearn.com/courses/exploring-our-oceans>).
- **ECOMINA:** This was a Norwegian-led project on Arctic Mid-Ocean Ridge (AMOR) deep-sea mining, co-funded by INDEEP. ECOMINA has produced a brochure on deep-sea mining issues for the Arctic Mid-Ocean Ridge. The ECOMINA partners also submitted a proposal for a 3-year project to the Fram Centre call for proposals in 2015, but unfortunately, the proposal was not funded. However, the discussions and collaborations amongst Norwegian researchers working in topics related to deep-sea mining has been strengthened and new research proposals are being discussed.

Plans for INDEEP Phase 3

INDEEP members are working towards securing funding in order that this important deep-sea scientific network may continue into the future. Without INDEEP, community collaboration to address global basin scale knowledge gaps for the deep ocean and communication between scientists from different countries and disciplines will undoubtedly suffer. We have applied for 2 large funding awards (from Arcadia and from the Research Council of the UK). The outcome of these funding applications will be known in February 2017. Some of the areas we hope to secure funds to work on include the following aspects, which were instigated during the first 6 years of INDEEP:

- Continue updates to WoRDSS and the Deep-Sea ID App
- Move forward with global mapping of biogeography and the use of these maps in deep-sea conservation
- Continue to support the OBIS deep-sea node
- Continue with global recruitment experiments
- Ground-truthing of biophysical models of connectivity
- Deep-sea barcoding project to enhance ID knowledge of deep-sea fauna
- Examine functional links between deep pelagic and benthic systems
- Undertake a synthesis of caballed array data to further understand ecosystem function
- Undertake deep-sea fauna resilience studies
- Capacity Development to continue work that started in Namibia. This work will also expand to deep-sea environmental issues of mining and fishing faced in South Africa, India and St. Helena.

Discussions are also underway with respect to planning for CD workshops in South Pacific.

- DIVE Project – Deep-Sea Image and Video Enterprise: Development of comprehensive online map showing the coverage of deep-sea image and video data collected from around the globe.
- Continue to support the triennial Deep-Sea Biology Symposium (next one in Monterey Bay, USA in 2018)

Thank you

Finally, the INDEEP community would like to extend sincere thanks to Fondation Total for their 6 years of financial support from January 2011 through December 2016. All that this global community has achieved would not have been possible without your support. We hope that INDEEP will secure the resources to continue and that we will work alongside Fondation Total again in the future.