GOBI

Global Ocean Biodiversity Initiative

Newsletter

Autumn 2019

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A review of EBSAs, prepared for the Secretariat of the Convention on Biological Diversity and the Global Ocean Biodiversity Initiative by Duke University's Marine Geospatial Ecology Lab, assesses the coverage of the global EBSA portfolio in order to identify potential gaps and trends. The first of two analytical approaches was to overlay the 321 existing EBSAs on jurisdictional areas, biogeographic features, specific habitats, and areas of enhanced management status. Their global distribution was analysed in terms of latitude and depth against pelagic and benthic provinces, and within Large Marine Ecosystems and Marine Ecoregions of the world. The second approach reviewed individual EBSA descriptions to characterise the type of EBSA, the criteria met, and the role of endemic species and connectivity.

Results of the EBSA review were presented by MGEL's Prof. Pat Halpin to the CBD Informal Advisory Group on EBSAs on 1 August 2019, providing the basis for an in-depth discussion. The group is charged by the CBD COP (Decisions XIII/12 and XIV/9) to develop guidance for the CBD Executive Secretary on the organisation of new workshops and scientific gap analysis and/or thematic analysis which could complement existing regional workshops, together with planning of EBSA workshops to ensure provision of appropriate knowledge and the development of voluntary guidelines for scientific peer-review processes. Prof. Halpin stressed the need for caution when interpreting simple map overlays but put forward a compelling argument for updating EBSAs, with possible thematic considerations and a suggestion to focus on geographic gaps, basin-wide scales and knowledge-poor areas.

This latest EBSA review stresses that it is important to make links with mechanisms that can provide access to new data. It also highlights recent functionality improvements to the Ocean Biogeographic Inforamtion System (OBIS), new three-dimensional biogeographic frameworks, and the rapid pace of technological developments in ocean observing. Lastly, and importantly, it brings into focus the value and utility of the outputs emerging from GOBI's IKI-funded research, a synopsis of which provides the main content for this issue of the GOBI newsletter.

David Johnson, GOBI Coordinator

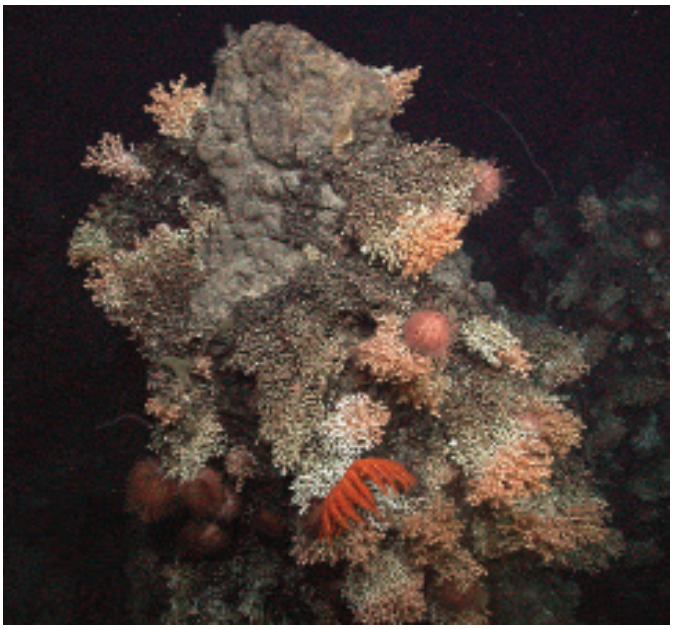
DAVID ROBINSON / CORAL REEF IMAGE BANK

Life after 'death' of a hydrothermal vent

by Cindy Lee Van Dover, Nicholas School of the Environment, Duke University

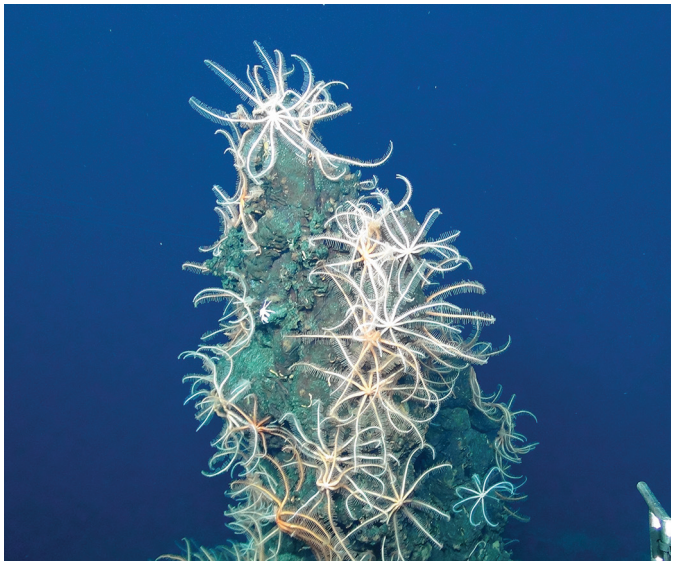
To humans, the deep seabed is arguably the most remote and hostile ecosystem on Earth, and as a result, knowledge of its biodiversity develops slowly. We know now with certainty that the depths of the ocean are far from the barren biological deserts they were once considered to be, and that some of the most exotic communities of deep-sea creatures thrive around hydrothermal vents. Hydrothermal vents – submarine hot springs – develop on the ridges that girdle the ocean floor, marking the boundaries between shifting tectonic plates.

At active hydrothermal vents, pressurised super-heated water laden with dissolved minerals gushes out from deep beneath the seafloor. In this lightless, highly energetic and seemingly toxic environment, dense aggregations of uniquely adapted species prosper by harnessing the power of chemical reactions that can only take place under such extreme conditions. At the same time, as the jets of hot water cool, dissolved minerals such as metal sulphides precipitate out of solution and accumulate like limescale in sizeable deposits, often forming tall tubular stacks or 'chimneys' around each vent.



Above: Inactive sulphide chimney with corals and urchins, Kermadec Arc. Image courtesy Rachel Boschen-Rose and Neptune Minerals Inc.

Active vents may persist for days or decades, and in certain places, even for thousands or hundreds of thousands of years. It is the longer-lasting vents that are of interest to the deep-sea mining industry, because these are the places where the metal sulphide accumulations are largest. Eventually, however, every active vent 'dies' as fluid flow ceases and its specialised cast of resourceful residents perish.



Above: Inactive chimney with brisingid seastars at Pito Seamount, SE Pacific. Image courtesy Mike Cheadle & Barbara John, University of Wyoming.

The mining industry has recently turned its attention to inactive or 'dead' vents, where large, commercially viable copper and zinc sulphide deposits may have accumulated over thousands of years during the active depositional phase of the vent. For decades, inactive vent habitats largely escaped the notice of deep-sea biologists, who were drawn instead to the extraordinary inhabitants of active vents. The question arising now is whether inactive vent habitats and the leftover metal sulphide deposits also support diverse communities of unusual organisms. Emerging evidence is ambiguous, with some defunct vents and mineral deposits appearing devoid of life, whereas others are ornamented with a variety of organisms that may also occur on other hard substrates. Microbiologists already know that inactive vents teem with microbes that rely on electron-donor molecules stored in metal sulphides and that may employ other unfamiliar biochemical pathways not found in more commonplace environments. We do not yet know if there are any animal species exclusive to the inactive vent habitat that take advantage of local microbial production in the otherwise food-limited deep sea.

Growing interest in the exploitation of metal sulphide accumulations at deep-sea hydrothermal vents requires that scientists work with the mining industry and its regulators to accelerate our understanding of vent ecosystems and to ensure that a precautionary approach to any potential mining activity is in place to protect active vent communities and their dependent organisms. GOBI and its partners are helping to lead the discourse for conservation of active hydrothermal vents in the area of the ocean floor that falls beyond national jurisdictions, highlighting their rarity, biodiversity and benefits to society, while noting protective measures already taken by many States for the conservation of such ecosystems.

In October 2019, GOBI and its partner Duke University leading this work, with the Pew Charitable Trusts and the Ryan Institute of the National University of Ireland (Galway), will convene a group of scientific experts from academia and industry to review the current state of knowledge regarding the definition and biodiversity of inactive vents and to identify critical knowledge gaps that must be filled to inform wise environmental management of metal sulphide mining. Inactive vent sulphide deposits may yield a wealth of undiscovered biodiversity – of life after death – but it is too soon to say.

Reference: Erickson, K.L., Macko, S.A., and Van Dover, C.L. (2009). Evidence for a chemoautotrophically based food web at inactive hydrothermal vents (Manus Basin). Deep Sea Res. Part II Top. Stud. Oceanogr. 56, 1577–1585. doi: 10.1016/j.dsr2.2009.05.002

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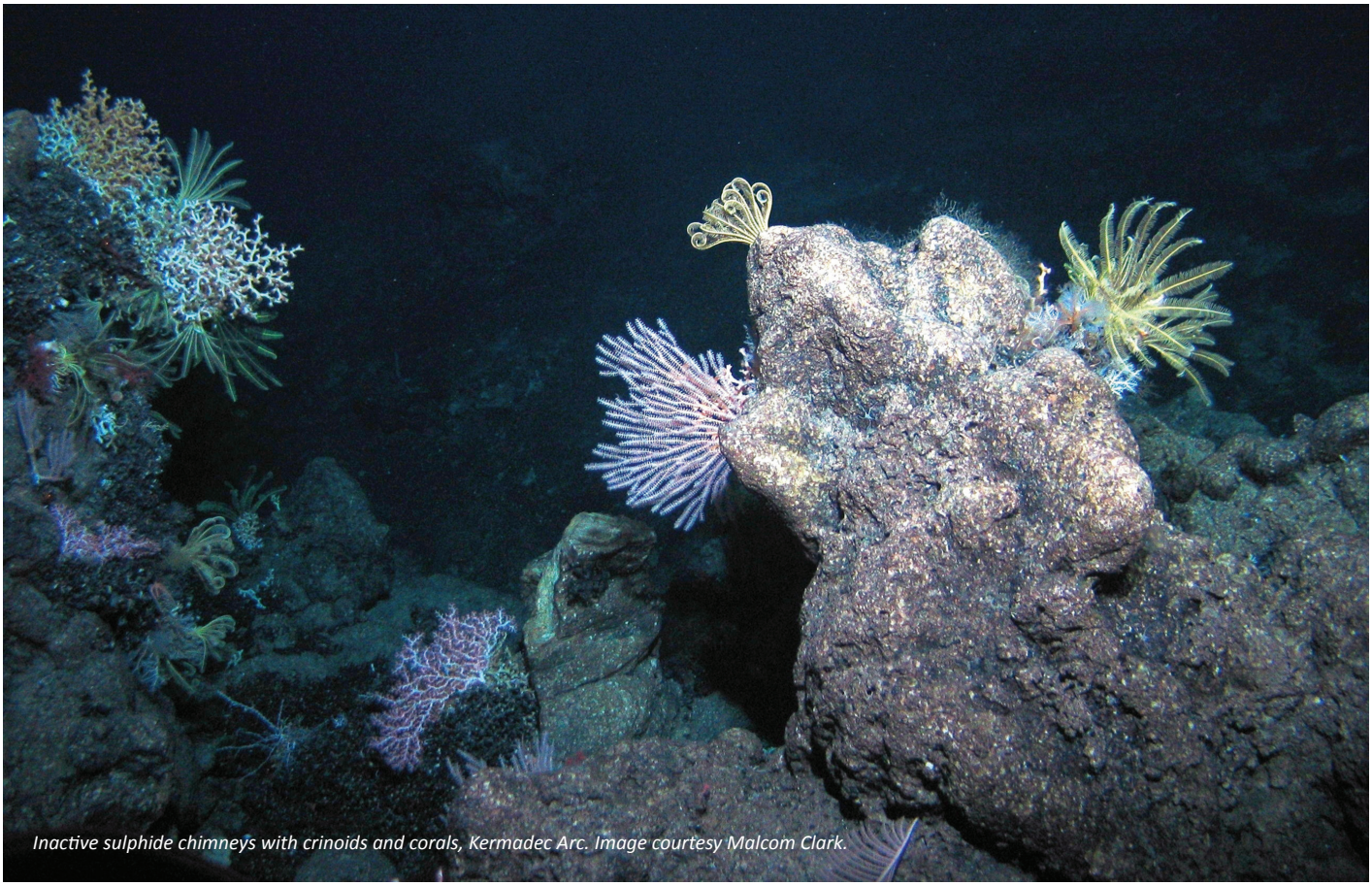
Inactive Sulfide Ecosystems in the Deep Sea: A Review

Van Dover C.L. (2019) Inactive Sulfide Ecosystems in the Deep Sea: A Review. Front. Mar. Sci. 6:461. doi: 10.3389/fmars.2019.00461

Dunn, D.C., Van Dover, C.L., Etter, R.J., Smith, C.R., Levin, L.A., Morato, T., et al. (2018) A strategy for the conservation of biodiversity on mid-ocean ridges from deep-sea mining. Sci. Adv., 1–16. doi:10.1126/sciadv.aar4313.

Van Dover, C., Arnaud-Haond, S., Gianni, M., Helmreich, S., Huber, J., Jaeckel, A., et al. (2018) Scientific rationale and international obligations for protection of active hydrothermal vent ecosystems from deep-sea mining. Mar. Policy 90, 20–28. doi:10.1016/j.marpol.2018.01.020.


Inactive sulphide chimneys with crinoids and corals, Kermadec Arc. Image courtesy Malcom Clark.

Promoting the conservation and governance of the Costa Rica Thermal Dome

by Gustavo Arias, MarViva Foundation

Shutterstock

The Costa Rica Thermal Dome (CRTD or Dome, for short) is a unique oceanographic feature in the Pacific Ocean, which expands and contracts seasonally off the coast of Central America. In this region, trade winds and marine currents result in the upwelling of cold nutrient-rich waters from the deep. A high concentration of nutrients at the ocean surface favours the growth of millions of microalgae, which sustain a complex and dynamic food web. This high primary productivity makes the Dome vital for marine biodiversity in the Eastern Tropical Pacific Ocean.

The core and adjacent areas of the Dome encompass important migratory, feeding and breeding grounds for many marine species, including cetaceans, sharks, rays, turtles, pelagic fish and seabirds. The Dome is also an important carbon sink and therefore a crucial ecosystem to counteract the cause of global climate change.

Many economic activities from Central America and beyond are supported by the Dome's productivity. Blue whales travel from the west coast of North America to the Dome to feed and breed. On their return, they attract whale-watching tourism activities, thus contributing to local economies. The Dome also sustains lucrative fishing operations, since it is one of the largest tuna catch zones in the world, and an important feeding area for large pelagic fish, which are the basis of profitable sport fishing activities.

Despite its huge ecological and economic value, areas of the Dome that extend beyond national jurisdiction have received little attention. Valuable scientific efforts have been made to increase knowledge and understanding of the Dome ecosystem, but these are in stark contrast to the ongoing illegal fishing activities, poorly managed maritime traffic, pollution and global warming threats that are eroding this marine oasis. Moreover, the lack of legal frameworks and governance instruments at a regional scale makes it difficult to manage those areas beyond national jurisdiction.

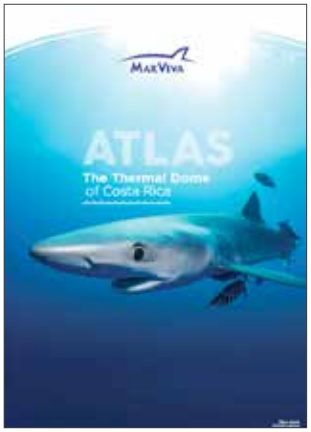
Since 2016, MarViva Foundation, a regional organisation aimed at the conservation and sustainable use of coastal and marine resources, has been leading scientific and political efforts to increase the knowledge of the CRTD and create awareness about the importance of preserving high seas ecosystems. In doing so, MarViva draws attention to threats faced by the Dome and the need to adopt governance schemes that allow its protection through the establishment of regulations and spatial ordering of human activities in the high seas.

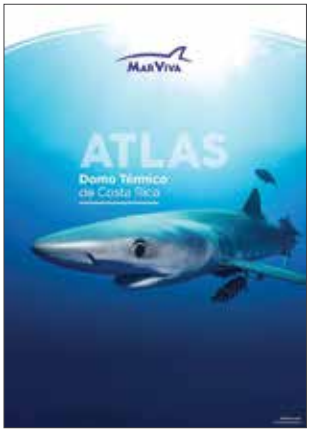
In 2017, MarViva led a scientific expedition to the Dome with the aim to study its oceanography and biodiversity. A team of experts collected scientific data and confirmed the presence of olive ridley turtles, silky and thresher sharks, manta rays, billfish and cetaceans. Water samples obtained at the Dome revealed diverse plankton communities, but also the presence of microplastics, which demonstrated the high degree of connectivity between the high seas and coastal ecosystems.

A significant outcome of MarViva's work under this initiative has been the production of an Atlas of the Thermal Dome of Costa Rica. The Atlas compiles and interprets relevant scientific data, presenting maps that describe the climatic and oceanographic conditions at the Dome, as well as species distributions, their migratory movements, the main fishing areas and maritime traffic routes. In addition, the Atlas brings some estimates on the economic benefits perceived by Central America, as a result of the goods and services provided by the Dome. The Atlas was launched at the third session of the intergovernmental conference on an international legally binding instrument under the United Nations Convention on the Law of the Sea on the conservation and sustainable use of marine biological diversity of areas beyond national jurisdiction (New York, August 2019). Furthermore, an open-access geoportal with interactive maps is being prepared to expand the scope of the Atlas.

In 2018, the Government of Costa Rica recognised MarViva's efforts around the Dome and assumed a leadership role in the regional promotion of the CRTD initiative, seeking Dome's recognition through regional coordination with Central American governments. Environmental authorities, regional entities and invited experts attended two workshops focused on governance and biodiversity. These sessions allowed the identification of regional needs and opportunities for the conservation of Dome's natural heritage.

In May 2019, the Council of Ministers of Environment of the Central American Commission of Environment and Development accepted the incorporation of the CRTD initiative in the Regional Coastal and Marine Agenda, recognising the Dome's ecological and economic relevance for the region. The next steps for MarViva will be to work together with the national contact points to design a work plan aimed at achieving a governance scheme for the Dome, to be presented at the next Council of Ministers.





Left: The scientific team at work in the Dome in 2017.

Right, from top: MarViva's Jorge Jimenez addresses participants at the CRTD biodiversity workshop in early 2019; the Striped marlin, Kajikia audax*, a regular visitor to the Dome but a prime target for sport fishing; sunset over the Costa Rica Thermal Dome; the Costa Rica Thermal Dome species Atlas, released in summer 2019 and available in Spanish and English.*

How seabird tracking data can identify important areas for conservation on the high seas

by Carolina Hazin and Tammy Davies, BirdLife International

Arctic tern. Image courtesy Ben Lascelles.

Tagging animals with trackers that monitor their movement via satellite is a powerful way of observing them even when they are out of sight. Data generated with such tags can provide insights into a species' habitat preference, its behaviour, the timing of its migration, and the factors that shape its abundance and distribution. Developments in tracking technology, including increased reliability and reduced size and cost of tags, mean that an increasing number of species have been the focus of tracking studies.

Seabirds are more accessible for tracking studies than other wide-ranging marine animals because they return to land to breed. The Seabird Tracking Database (www.seabirdtracking.org) hosted by BirdLife International, contains tracking data for almost half of the world's seabird species, totalling more than 12 million data points that have been shared through collaboration with 196 researchers. This collaboration has greatly increased the conservation impact of these data and broadens the questions that can be addressed.

Remote tracking data can not only help identify and understand important sites for seabird conservation, such data can also be combined with data on human uses of land and sea, or on the location of natural resources, and by looking at the overlap, it enables the evaluation of potential conflicts of interest. In this way, seabird tracking data can provide valuable information for the management of biodiversity in the high seas.

Some important elements being considered within the ongoing negotiations of a legally binding instrument for the conservation and sustainable use of marine biodiversity beyond national jurisdiction include: (1) area-based management tools, including marine protected areas, (2) environmental impact assessments, and (3) capacity building and the transfer of marine technology. The insights provided by seabird tracking data can inform all three of these elements.

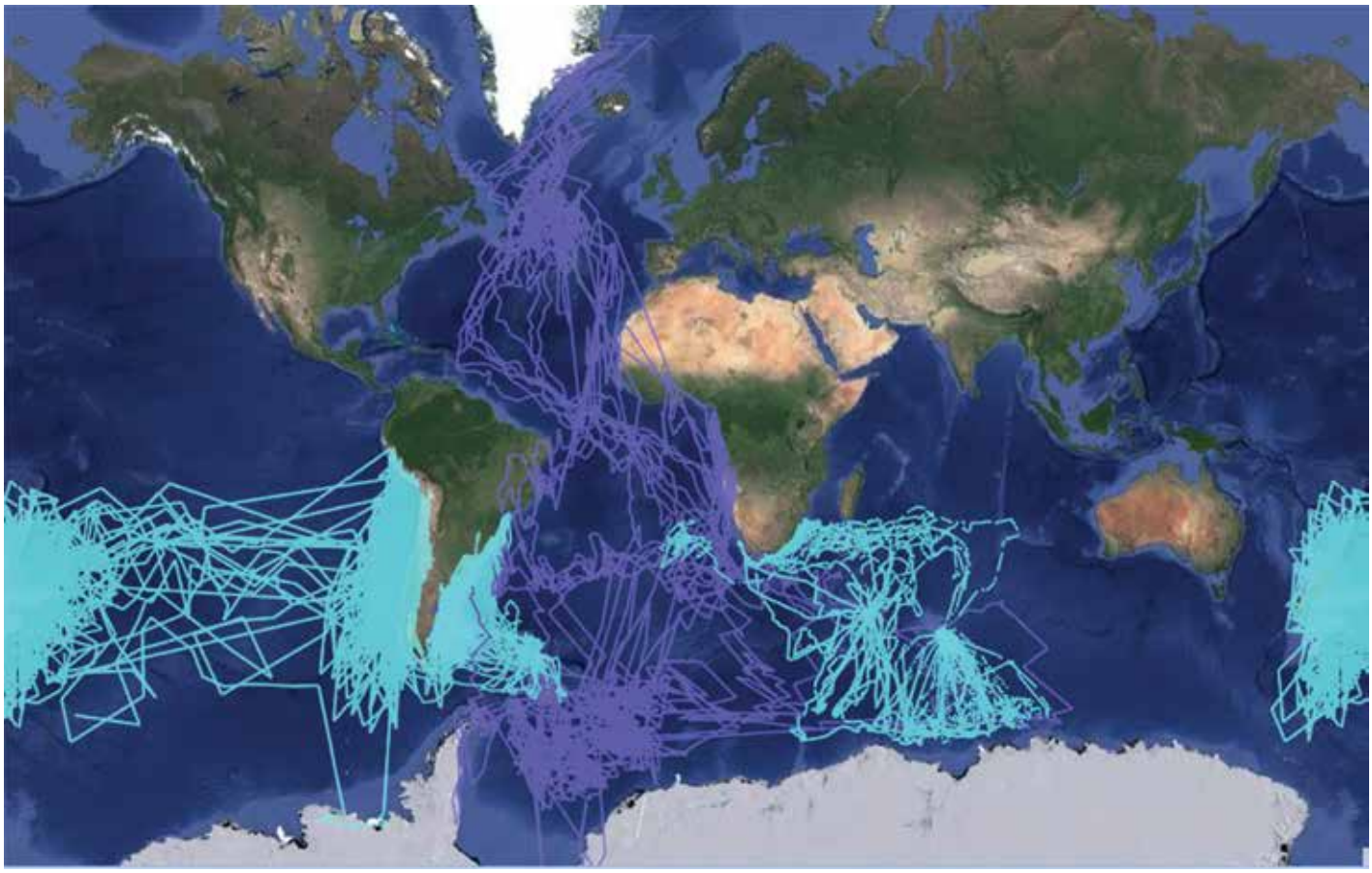
Area-based management tools, including marine protected areas: Seabird tracking data can be used with objective site-selection criteria to identify important areas for seabirds that may warrant conservation measures. One example is the use of seabird tracking data to identify marine Important Bird and Biodiversity Areas (mIBAs) within the national waters of countries and in the high seas. Once identified, these sites can support global processes such as the efforts to describe Ecologically or Biologically Significant Marine Areas (EBSAs). So far, over 600 mIBAs have been used to inform the scientific basis for EBSAs. The identification of these sites – marine IBAs or EBSAs – has no management implications, however, they can assist countries in locating the most important sites for biodiversity conservation, contributing to their achievement of global commitments to protect marine environment. Other examples of how seabird tracking data can be applied to area-based conservation include the provision of such data to Regional Seas Conventions (e.g., the OSPAR Convention in the northeast Atlantic Ocean, and the Nairobi Convention area in the western Indian Ocean) to improve the representation of seabirds across their network of marine protected areas. In the OSPAR Convention area, seabird tracking data have revealed a previously unknown foraging area for 22 seabird species from both the North and South Atlantic. This area has been proposed as a new marine protected area and its adoption is under consideration within the OSPAR process.

Environmental impact assessment: A global assessment of threats to all seabird species, as well as an ongoing assessment of the distribution of such threats, will constitute an important baseline to inform environmental impact assessments on seabirds and mIBAs in the high seas. Such knowledge, in addition to improving our understanding of how and where seabirds spend their time on the high seas, is indicative of where human activities may potentially have negative effects over seabirds and on biodiversity as a whole.

Capacity building and the transfer of marine technology: The continuous effort to augment and improve BirdLife International's seabird tracking database through regular cooperation with scientists across the world translates into an increase of capacity and knowledge transfer in the countries where BirdLife International operates. Regional or in-country training on data collection, on how to use and apply the data as part of marine spatial planning, and on how to best display and share information about important bird areas, directly contributes to the development of capacity for every aspect of conservation.

Ultimately, by continuing to expand the seabird tracking database and the types of analysis it supports, we will be able to better understand the connectivity between national waters and high seas, identify countries' responsibilities on hosting species, and encourage cooperation across borders to effectively protect migratory seabirds over the whole of their range.

Above: White-chinned petrel. Image courtesy Ross Wanless.



Above: Tracklines of Artic tern, Sterna paradisaea *(purple) and white-chinned petrel,* Procellaria aequinoctialis *(blue). Image: Seabird Tracking Database, BirdLife International. Data Holders: Carsten Egevang, David Thompson, Henri Weimerskirch, Paul Sagar, Richard Phillips/BAS.*

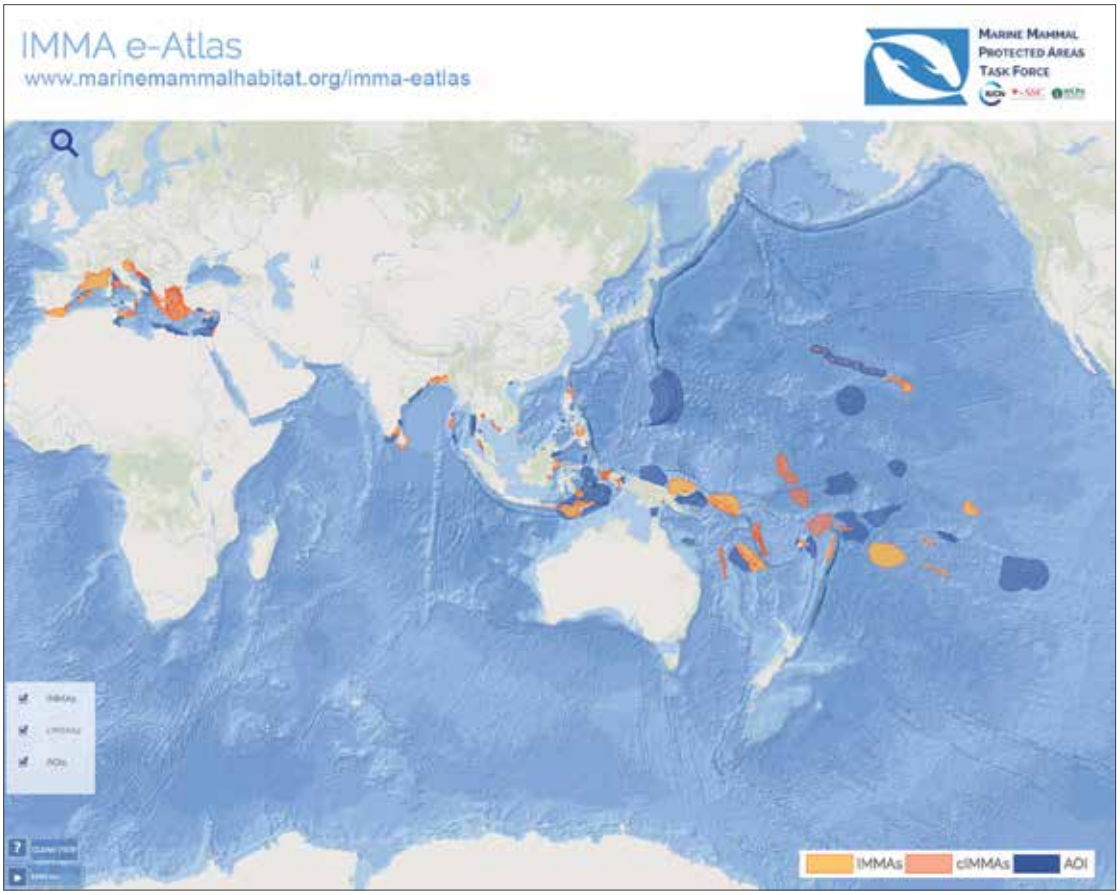
Making Important Marine Mammal Areas work

by Erich Hoyt, Co-chair of Co-chair, IUCN MMPA Task Force / Research Fellow WDC / Tethys Research Institute

Embarking on the Important Marine Mammal Area (IMMA) programme in 2016 with GOBI, the IUCN SSC-WCPA Marine Mammal Protected Areas Task Force faced the challenge of putting a new conservation tool into practice for the first time. Task Force co-chair Giuseppe Notarbartolo di Sciara and I had spent three years gaining support for the IMMA concept from IUCN, CMS, CBD and other agreements. With IMMA Coordinator Michael J. Tetley, we had developed criteria and subjected it to extensive review from outside scientists and the public. We had begun to work on providing guidance for implementing this new tool. We planned to build the identification of IMMAs around expert regional workshops across most of the Southern Hemisphere. Although each workshop lasts only five days, the process of creating peer-reviewed IMMAs in a given region takes about 10 months, requiring the identifying of experts for different species and areas, delineating sub-regions and the limits of coverage, gathering background data, compiling an 'inventory of knowledge', soliciting and gathering 'areas of interest', as well as drawing on EBSAs and MPAs that could be considered against the IMMA criteria. Each workshop also addresses threats in its region and strategies for utilising the resulting IMMA identifications. Following each workshop, candidate IMMAs (cIMMAs) are submitted to an independent review panel. Subsequently there is an exchange amongst experts and reviewers before about 70% of the submitted cIMMAs are accepted as full IMMAs. The results are published on a web-based e-Atlas (pictured right), complete with background documents and detailed maps.

The IMMA process has had a number of unexpected developments. Most rewarding has been the interest from other agencies in our work. Only weeks after GOBI's IKI grant was approved in 2016 for work in the Pacific and Indian Oceans, the MMPA Task Force secured funding from the MAVA Foundation for an IMMA workshop covering the Mediterranean Sea. We decided that this would be a valuable pilot workshop. Then in 2018, we were approached by the French Biodiversity Agency offering support for an IMMA Workshop on Antarctica and the Extended Southern Ocean. While there have been difficulties fitting this workshop into

Tropical dolphins, Pacific Ocean. Image courtesy NOAA/OAR/OER



Left: Screenshot of the online IMMA e-Atlas, available at www.marinemammalhabitat.org/imma-eatlas

our schedule, the Extended Southern Ocean proved valuable for the many pinniped habitats as well as for species drawn to the shifting ice edge.

Support from GOBI's IKI grant has also enabled us to visit three IMMAs to encourage the implementation of relevant management and conservation actions. The Micronesian archipelago of Palau and the Andaman Islands of India were the first two locations. In both cases, we worked on the ground with local researchers, stakeholders and government to prepare an implementation plan around a newly identified IMMA. We saw the importance of working with an experienced local team. We acted as sources of information about what the IMMA could do, as well as advisors regarding tourism, dealing with various threats, and making management plans. The third implementation visit is planned for Bazaruto Archipelago Inhambane cIMMA, in Mozambique, in November 2019. Further opportunities to test the value of IMMAs have included a series of workshops and meetings around how to reduce the risk of whales being struck and killed by ships. All of this work gives us a clearer idea of how IMMAs can be used by governments, international agreements and stakeholders in future.

The biggest challenge for the IMMA identification and implementation process continues to be the scarcity of data on the high seas. In the Pacific and Indian Oceans, few data holdings extend outside national waters. Only in the Antarctic did our work include areas of the high seas. To remedy this situation, the Task Force has engaged with researchers to pose a challenge for the next few years to acquire data on the high seas. Inspired by the current UN BBNJ process, a special session of talks is planned for the World Marine Mammal Conference in Barcelona in December 2019, focusing on contributions from environmental DNA (e-DNA), satellite and remote surveillance technologies, passive and active acoustic monitoring, and supplementary spatial habitat modelling.

Over the next 18 months, the IMMA process focuses on Australia-New Zealand and the southeast Indian Ocean (February 2020) followed by the South East Tropical and Temperate Pacific Ocean (late 2020). Beyond that, the Task Force is already exploring opportunities for an IMMA effort in the Arctic. We hope to complete the global picture for marine mammals within the following 5-6 years, depending on funding availability; this will include considering aquatic mammal habitats in inland waters. If the next decade can also be focussed on filling the data gaps in the high seas, it would be valuable to revisit each region, updating existing IMMAs and identifying new cIMMAs. Meanwhile the IMMA implementation process in each region is being carried on as a legacy of the IMMA workshops. We hope that our efforts will make a lasting difference for ocean biodiversity conservation.

The connectivity quest

by Daniel Dunn and Corrie Curtice, Marine Geospatial Ecology Lab, Duke University

As part of its contribution to GOBI, the Marine Geospatial Ecology Lab (MGEL) has spearheaded the development a prototype online system to describe migratory connectivity in the oceans. Migratory connectivity – the geographical linking of individuals and populations throughout their migratory cycles – is critical to the conservation of biodiversity beyond national jurisdictions.

Conceiving and developing such a system has been no small feat of logistics, organisation and innovation, involving an exhaustive literature review and the assembly of a diverse audience of partners including researchers, experts in the field of migratory species, and policy/management implementation practitioners. Support for the concept has been steady, but feedback pushed us to evolve the concept from "literature review and development of migratory species database" into the creation of a working prototype system that allows users to geographically explore both the output of the literature review as well as new synthetic analyses of telemetry data. Arise the Migratory Connectivity in the Ocean system!

Launched in April 2019, the Migratory Connectivity in the Ocean (MiCO) system is a comprehensive geospatial web-based interface serving synthesised knowledge about how marine migratory species use the ocean to support life-cycle activities such as feeding, breeding, calving, nesting, and migration routes among these areas. Termed "nodes" and "corridors", these areas have rich metadata (such as the number of tagged animals, months of the year during which an area is used, sex, age or age class) that are made available in graphical and tabular formats (see Fig. 1). The system is intended to support researchers and policy makers to access and use knowledge on migratory connectivity for decision-making, gap analyses, and guidance on future research

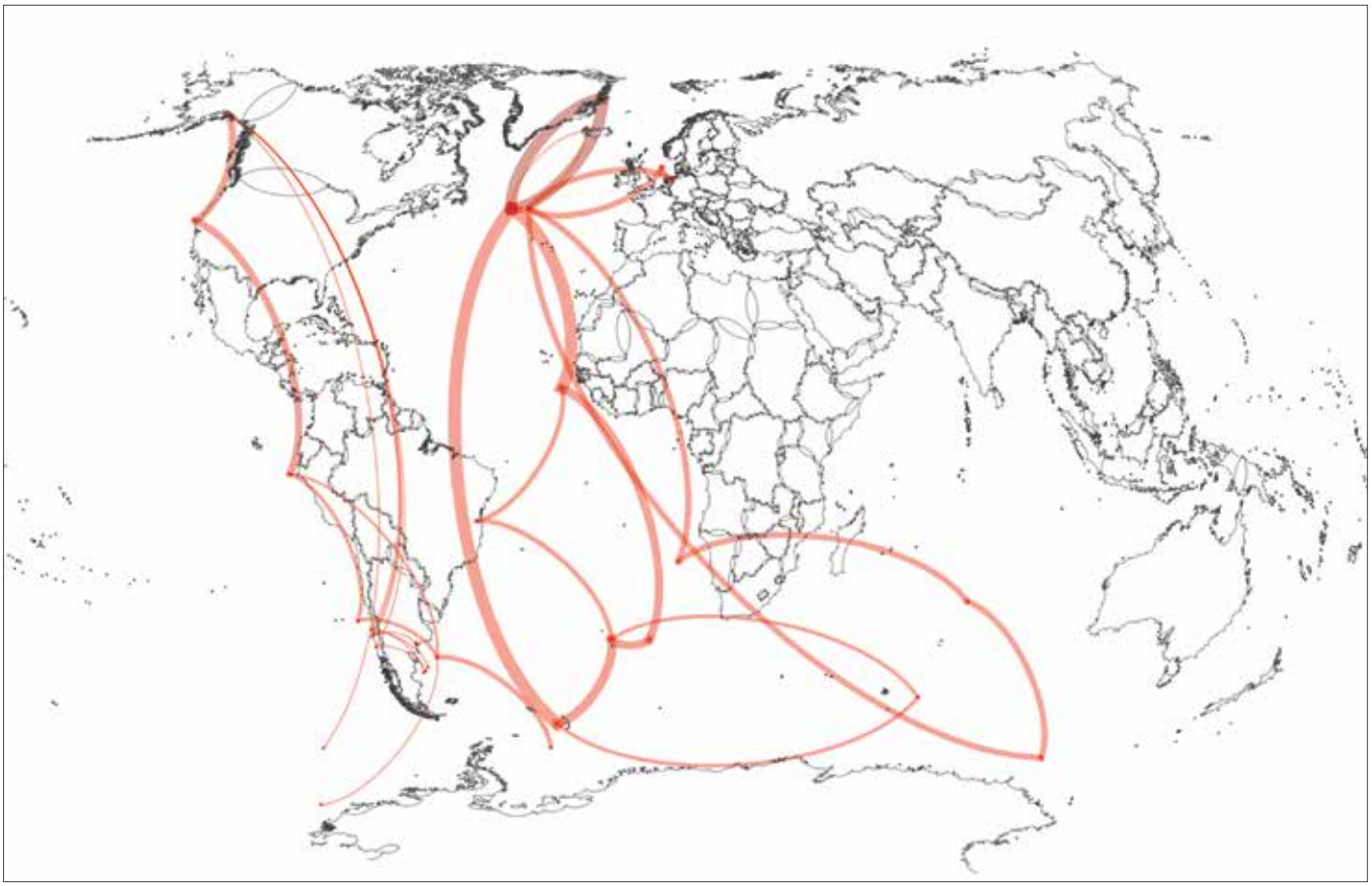


Figure 1: Arctic tern migratory connectivity network diagram, based on telemetry data that intersect the Western Indian Ocean or the Eastern Tropical and Temperate Pacific, taken from the MiCO literature review.

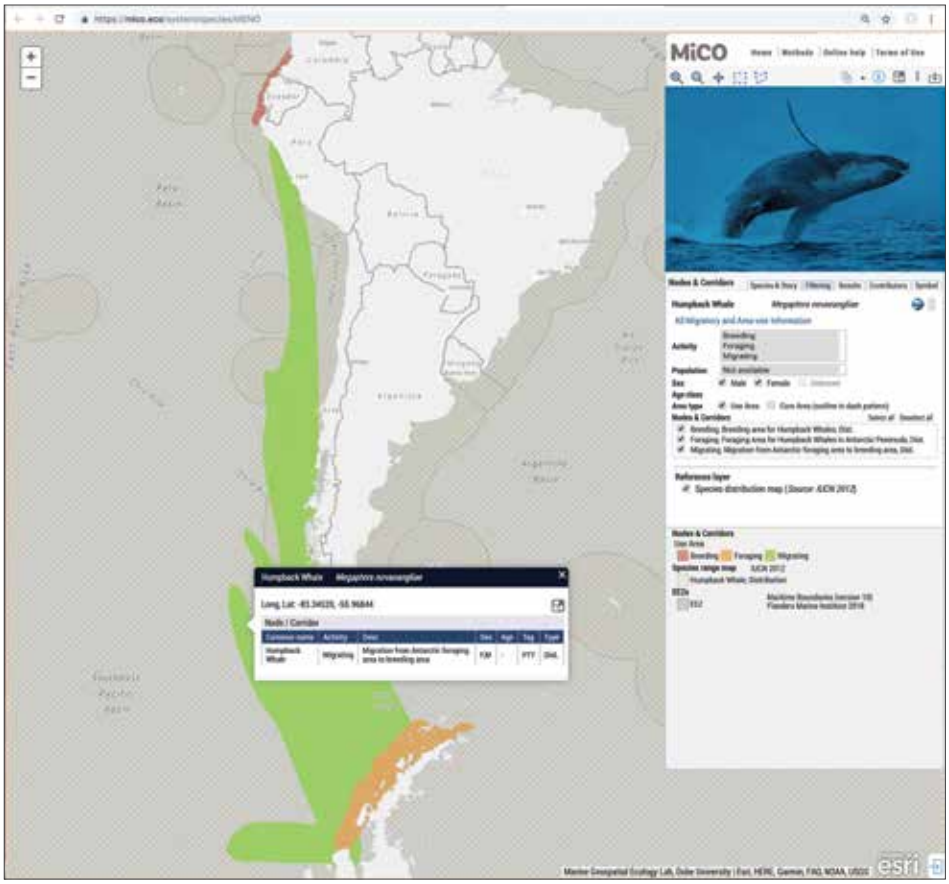


Figure 2: The MiCO system contains information on area use and migratory connectivity of marine species, such as these two nodes (red/orange) and one corridor (green) for humpback whales that migrate from feeding grounds in Antarctica to a breeding/calving area off the west coast of South America.

efforts. Critically, data are tracked from contributor to final product, so synthesised products can be attributed to the original contributors and the impact of the researcher's work can be tracked.

Many challenges have been overcome to bring the system online and many are still being addressed, from completion of the literature review to the continued hosting and development of MiCO. Even with full-time staff and students reading papers, the mountain of available telemetry-based studies is time-consuming to climb. Roughly 16,000 papers were returned by the bespoke search queries, each of which was evaluated for relevance, yielding over 1,400 relevant papers. Each of these papers is read for the extraction of details to be included in the literature review analysis. Additionally, study extents and animal locations are identified, along with the connections among them to facilitate generation of network diagrams (see Fig. 2). All of this work ensures that knowledge generated by these studies is not lost in a sea of scientific literature and that it will be more accessible to managers and policy makers.

Challenges and questions remain for the MiCO system prototype, including the improvement of accessibility by a non-technical audience, finalising the integration of literature review products and data analysis products, and better integration of network and area-use model visualisations. Looking to the future, MiCO has just scratched the surface of available information on how migratory species use and connect the ocean. With time and further support, we intend to continue to pull in new data and information from telemetry studies, but also to expand and incorporate knowledge generated from studies using mark-recapture, acoustic telemetry, stable isotopes and genetics. All of this will lead to a better understanding of the scope of marine migratory connectivity. Work is also underway to have MiCO products incorporated into the management and policy processes. Strong connections have been made with Regional Seas Organisations, the BBNJ process, and the CMS, but more work needs to be done on outreach to the International Whaling Commission, International Maritime Organization, Regional Fisheries Management Organisations, and the International Seabed Authority. More critically, incorporation into national reporting and area-based planning, and use by industry to support environmental impact assessments and investment siting will be important as MiCO moves into the future.

In addition to the extensive work on MiCO, another strand of MGEL's work under GOBI is a review of the outputs from all the EBSA regional workshops, synthesising the information contained within EBSA descriptions and better understanding the intent behind describing each EBSA. Once complete, the review will provide critical information on thematic gaps in the EBSA process and improve access to the information contained therein. An initial version of the EBSA review has already been submitted to the CBD as a technical report.

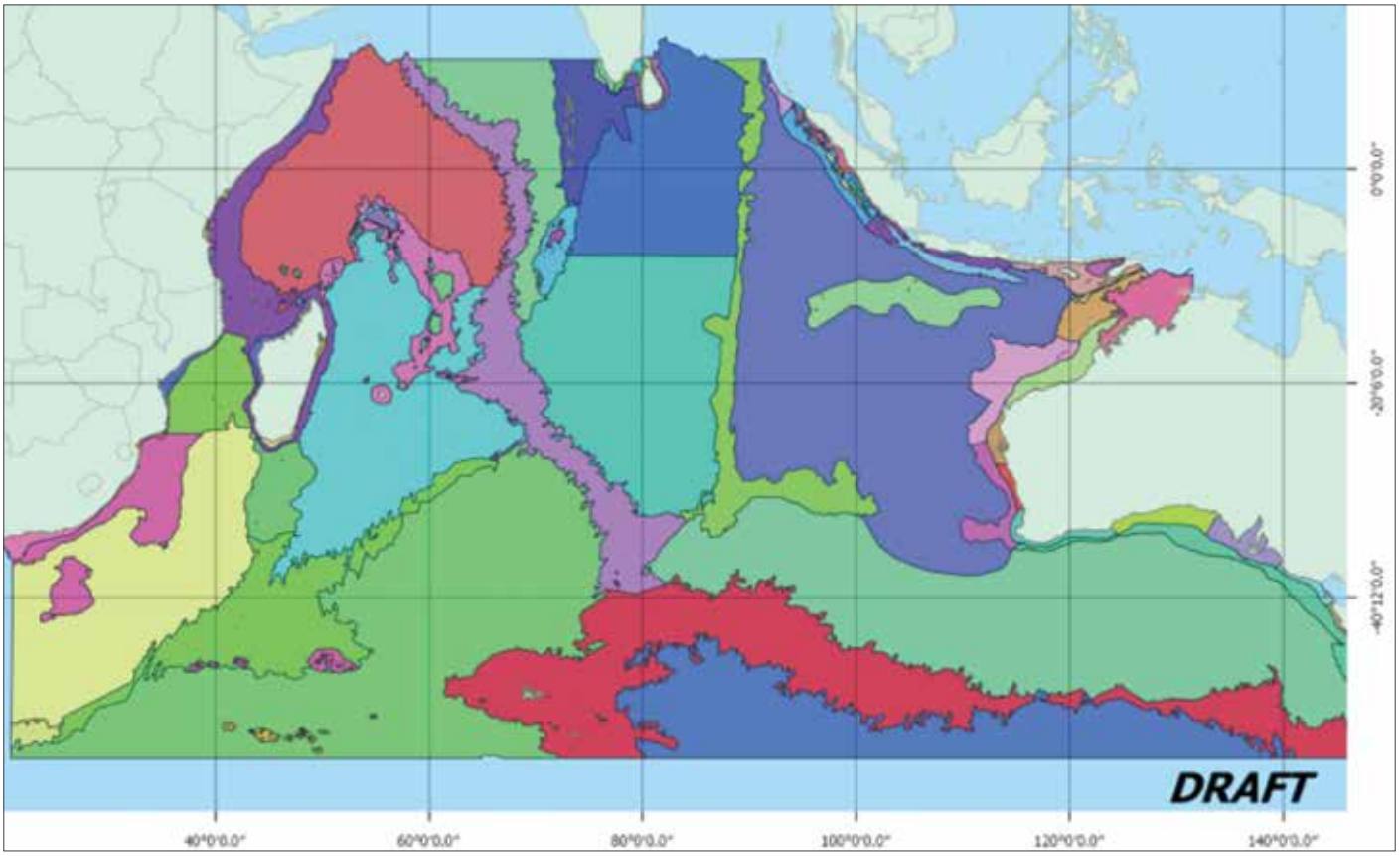
Bioregionalisation for the Indian and South West Pacific oceans

by Piers Dunstan, CSIRO

The distribution of species is a function of many controlling influences operating at a range of scales, including environmental variability and stability in space and time, genetic and evolutionary history, intra- and inter-species interactions such as predation, competition and facilitation, dispersal dynamics, and human-caused as well as non-human disturbances. Irrespective of historical distribution, present-day species occurrence patterns can be organised spatially to create a biogeography. Equipped with knowledge of where all species exist, scientists would be in a better position to understand why species are distributed as they are - a fundamental line of biogeographic inquiry. Moreover, managers would be in a better position to manage species and their assemblages for a variety of applications, including the conservation and sustainable use of biodiversity and ecosystems, and their associated goods and services.

As part of GOBI's grant from IKI, CSIRO has developed sub-regional bioregionalisations for the western South Pacific Ocean and the Indian Ocean through expert workshops and novel statistical analysis of physical and biological data. They have combined approaches that CSIRO developed in Australia and used in the Bay of Bengal (in collaboration with BOBLME) with similar approaches that have been used throughout the Indian Ocean to derive a single combined bioregionalisation.

New bioregionalisations for the western South Pacific and Indian oceans incorporate understanding of shallow, deep and pelagic species, ecosystems, physical environments and their likely boundaries based on the latest available information. The expert-based bioregionalisations will be supported by development of statistical analysis of datasets of selected species groups to identify bioregions specific for each taxon, drawing on data from the Ecologically or Biologically



Above: Draft benthic provinces in the Indian Ocean. Image courtesy CSIRO.

CSIRO's Skip Woolly discusses province boundaries (above) and qualitative ecosystem models (below) with expert workshop participants in Cape Town, April 2019.

Significant Marine Areas (EBSA) process, and additional regional biogeographies based on new invertebrate and fish collections.

This work draws on expertise at CSIRO and from the wider GOBI partners, using approaches currently being trialled in Australia and around the Antarctic margins. It has been carried out in close collaboration with a range of regional and national stakeholders to ensure a consistent approach.

The work to date has provided a description and boundary of each bioregion, from coastal regions to the deep sea benthic regions, and for pelagic ecosystems. For each bioregion, a qualitative ecosystem model has also been developed for the key ecosystem in that region. Qualitative models represent a working hypothesis about how an ecosystem works. They: a) identify the important components and processes in the system; b) document assumptions about how these components and processes are related; c) identify the linkages between these components/processes and anthropogenic pressures; and d) identify knowledge gaps or other sources of uncertainty.

Accessing data remains a challenge for across all bioregions in the Indian and Pacific Oceans. Even well described and sampled pelagic systems have data gaps. The areas with the least data are deep-sea benthic areas and the mesopelagic, between the surface waters and the seafloor.

Outputs of this work will be used for the management of marine ecosystems across these two ocean basins. They are already being used by the FAO Nansen Program in capacity building programmes, by national governments in assessing the likely impacts of climate change and new activities, in the State of Marine Conservation report for the South West Pacific, and by fisheries agencies (ie IOTC and SPC) in both the Indian and Pacific oceans. Results will provide information that can be used to inform the application and monitoring of spatial management tools.

Can EBSA information help minimise the impact of shipping on marine biodiversity?

by GOBI Secretariat

GOBI, in partnership with WWF and the National University of Singapore, has recently completed a preliminary scoping study on whether information contained within EBSA descriptions can be of use to parties interested in protective measures within the purview of the International Maritime Organization (IMO). The IMO is responsible for the safety and environmental sustainability of international shipping activities across the oceans and has developed a suite of agreed standards and regulations to achieve this.

Biological information gathered during the EBSA process could, in principle, be useful in highlighting areas where wildlife is at risk from shipping, for example through collision or pollution by chemicals, noise or light. GOBI partners around the world were encouraged to provide information on EBSAs that could benefit from an assessment of these risks, and nine case studies were selected for closer review. The review looked at the natural characteristics of EBSAs and the nature of shipping activities that take place within them. A qualitative assessment of whether shipping activities have the potential to adversely affect an EBSA's natural assets was performed, whilst also considering potential risk posed by other human activities in the area.

The results of the exercise were varied, reflecting both the breadth of criteria that qualify areas as EBSAs and the diversity of risks presented by ships in different contexts. Where the potential for vulnerability of wildlife was perceived, relevant and precedented measures were identified that could minimise the risk of interaction between shipping and the EBSA's natural assets, such as re-routing of marine traffic or considering possible Areas To Be Avoided. None of the nine case studies was conclusive in the requirement for any measure to be recommended.

The difference between the scale of some EBSAs and the scale at which IMO measures can be implemented, together with the scientific and legal burden of proof required to propose any measure, presents a challenge to the complementarity between the EBSA descriptions and IMO processes. This limits the extent to which EBSA information can be readily used to support IMO measures. Additional research is necessary to make both approaches more compatible and complementary to one another. It is hoped that the report resulting from this investigation can inform further discussions at both the IMO and the CBD to improve the synergies between them.

P. Clapham/NOAA Photo Library

Sustainable Ocean Initiative teams with GOBI to bring capacity building to The Maldives

by GOBI Secretariat

Ishan Hassan / Coral reef Image Bank

On 17-19 June 2019, GOBI stalwarts David Johnson, Piers Dunstan and Vikki Gunn travelled to Dhiffushi island in the Maldives to deliver a capacity building workshop on behalf of the Sustainable Ocean Initiative (SOI), funded by the Ministry of Oceans and Fisheries of the Republic of Korea. Working in collaboration with colleagues at The Maldives Ministry of Environment, the three-day workshop delivered a programme that centred around examining The Maldives' ocean estate for areas that might meet the EBSA criteria. The workshop also touched on uses of and threats to marine biodiversity in the Maldives, and how the results from the workshop could support marine spatial planning efforts. Workshop participants represented a broad spectrum of stakeholder communities, including the Ministries of Environment, Tourism, Economics, Fisheries, Planning and Defence, as well as scientific research centres, NGOs and local conservation groups.

The Maldives EEZ spans some 90,000 km^2, of which only 1% is land in the form of coral reef atolls. In addition to its corals, the area is important for a range of species, including cetaceans, elasmobranchs (manta and mobula rays, hammerhead sharks and whale sharks) and mangroves. These charismatic species are a huge draw for tourists, which are an important contributor to the local economy. During the workshop, participants considered how protection of areas of ecological or biological importance could be balanced with economic and social drivers, and what role planning strategies could play in achieving this. The Government of The Maldives hopes to build on the results of this workshop to help meet Aichi Targets and NBSAP commitments.

Above, top: Participants at the SOI national workshop for The Maldives. Bottom: participants discuss characteristics of marine areas that might meet the EBSA criteria.

SUSTAINABLE OCEAN INITIATIVE

Planning for the United Nations Decade of Ocean Science for Sustainable Development

by David Johnson, GOBI Coordinator

The First Global Planning Meeting for "The Science We Need for the Ocean We Want" took place in Copenhagen, Denmark on 13-15 May 2019. This marked the start of formal preparations for the upcoming UN Decade of Ocean Science for Sustainable Development. Discussion amongst the 200 or so invited ocean leaders, which included several GOBI partners, initiated a dialogue around the Decade's six societal objectives:

- A Safe Ocean
- A Sustainable and Productive Ocean
- A Transparent and Accessible Ocean
- A Clean Ocean
- A Healthy and Resilient Ocean
- A Predicted Ocean

The Decade's Preparatory Phase, coordinated by UNESCO's Intergovernmental Oceanographic Commission (IOC), is a two-year effort to hit the ground running. It is a chance to build partnerships, highlight knowledge gaps and science priorities, give appropriate attention to ocean literacy and capacity building needs and, above all, to seek sufficient targeted funding to build ocean awareness and foster science-policy dialogues.

Main lines of reasoning put forward to contribute towards the Decade include an imperative to benefit society through countering the deterioration in ocean health, accepted as posing major threats to marine ecosystems and their capacity to provide services essential to life. Dr Vladimir Ryabinin, IOC's Executive Secretary, has called for "*an evolution in the way we conduct oceanography and a real social contract for ocean science […] to achieve a paradigm shift in ocean science organisations for oceanography to meet the six societal needs identified for the Decade: a clean, healthy and resilient, sustainably harvested, safe, predicted and transparent ocean*".

The Decade is seen by many as a "*once-in-a-lifetime opportunity for ocean science to leave its box and offer society new and transformative solutions for conserving and sustainably using our ocean and marine resources*". As such, it is as much about education and communication as filling data gaps and methodologies.

In the margins of the 30th Session of the IOC Assembly (26 June - 4 July 2019), IOC organised an Ocean Science Day giving an opportunity to discuss the contribution of ocean science to society in the next decade. IOC aim to mobilise worldwide governments and national actors through eight regional workshops across all ocean basins and a Second Global Planning Meeting is scheduled for May 2020. According to the IOC, the May 2020 global meeting will finalise the Decade's Preparatory Phase and launch an Implementation Plan to be presented at the second UN Ocean Conference in June 2020, and considered by the UN General Assembly ahead of the Decade's official launch in 2021 (www.ioc-unesco.org).

Left: Delegates discuss the Ocean Decade's six societal objectives in Copenhagen.

Hot off the press

30X30 A Blueprint for Ocean Protection - How We Can Protect 30% of Our Oceans by 2030, by University of Oxford, University of York and Greenpeace. 2019. 96 pages

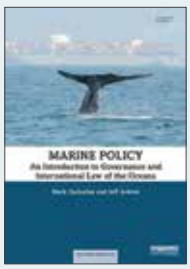
This study – based on biological, oceanographic, biogeographical and socioeconomic data – charts how the recommended 30% protection of the world's oceans could be achieved, to protect the full spectrum of marine life on the high seas.

Enabling Effective and Equitable Marine Protected Areas – guidance on combining governance approaches, by Peter JS Jones and colleagues. 2019. UN Environment Regional Seas Reports and Studies 203, 52 pages

This guide draws on case studies to provide evidence-based advice on how to use the governance of MPAs to promote conservation and share sustainable marine resources. It recognises that there is no 'one size fits all' solution and promotes a flexible approach to governance applicable to any MPA on an ongoing basis.

Using Systematic Conservation Planning to support Marine Spatial Planning and achieve marine protection targets in the transboundary Benguela Ecosystem, by Stephen P. Kirkman and colleagues. 2019. Ocean and Coastal Management 168: 117-129

This study uses systematic conservation planning to prioritise areas for protection to achieve networks of MPAs that are representative of national and regional biodiversity in Angola, Namibia and South Africa. Priority conservation areas are identified that include coastal, inshore and offshore features.



An Introduction to Governance and International Law of the Oceans, 2nd Edition, by Mark Zacharias, Jeff Ardron. 2019. Routledge. 346 pages. DOI: 10.4324/9781351216227

This book provides a foundation in policy development and analysis, describing how legal mechanisms are applied to the marine environment. It presents a systematic treatment of all aspects of marine policy, including climate change, energy, environmental protection, fisheries, mining and transportation.

Eight urgent, fundamental and simultaneous steps needed to restore ocean health, and the consequences for humanity and the planet of inaction or delay, by Dan Laffoley and colleagues. 2019. Aquatic Conservation: Marine and Freshwater Ecosystems 1-15. DOI: 10.1002/aqc.3182

Eight themes are presented to restore ocean health: (1) addressing global warming, (2) adopting a High Seas Treaty, (3) enforcing standards for MPAs and expanding their coverage, (4) pausing progress on deep-sea mining, (5) ending excessive and destructive fishing practices, (6) reducing pollution, (7) establishing a financing mechanism for ocean management and protection, and (8) scaling up science and data sharing.

Hot off the press

The Ongoing Biodiversity Loss and How It Can Be Stopped, by Yann Laurans and Aleksandar Rankovic. 2019. IDDRI Issue Brief 6, 4 pages

This report underlines that global trends remain alarming, while some are deteriorating. IDDRI identifies and highlights a number of points in the recently launched IPBES Global Assessment on Biodiversity and Ecosystem Services that it considers particularly striking, pointing to avenues for action.

Summary for Policymakers of the Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 2019. IPBES, 39 pages.

This report is the definitive new global synthesis of the state of nature, ecosystems and nature's contributions to people. It highlights key messages, findings and options compiled by 150 leading international experts. It is also the first global assessment to examine and include indigenous and local knowledge, issues and priorities. It represents the best available evidence now available to all decision-makers for people and nature.

The Future of Ocean Governance and Capacity Development, by Dirk Werle and colleagues. 2018. Brill-Nijhoff, 564 pages. DOI: 10.1163/9789004380271

In this book, experts explore future challenges and opportunities for ocean governance and capacity development. Major themes include the law of the sea, ocean sciences, integrated coastal and ocean management, fisheries and aquaculture, communication and negotiations, maritime safety and security, ocean energy, and maritime transportation.

Biodiversity and Health in the Face of Climate Change, by Melissa R. Marselle and colleagues. 2019. Springer Open, 26 pages. DOI: 10.1007/978-3-030-02318-8

This book explains why biodiversity matters, exploring ecosystem-based approaches to tackle climate change, nature-based solutions for food production, and green infrastructure in cities and elsewhere to positively affect human health.

Biodiversity Loss Is a Development Issue: A Rapid Review of Evidence, by Dilys Roe and colleagues. IIED Issue Paper, April 2019

Biodiversity loss affects poorest communities first and hardest as they cannot pay for lost natural goods and services. This paper sets out the evidence that biodiversity loss is much more than an environmental problem – it is an urgent development challenge.

Biodiversity: Finance and the Economic and Business Case for Action, report prepared for the G7 Environment Ministers' Meeting. 2019. OECD, 96 pages

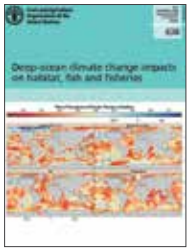
This report presents an assessment of biodiversity-related finance flows. It discusses key gaps to be addressed in order to underpin effective monitoring of both the pressures on biodiversity and the actions needed to address them. It also provides recommendations on priorities for scaling up action on biodiversity.

Climate Change Considerations Are Fundamental to Sustainable Management of Deep-Seabed Mining. DOSI Policy Brief March 2019

Climate change is altering ocean conditions in all regions targeted for deep seabed mining. Impacts from climate change could interact with impacts from mining activities. This brief argues that mining could also affect climate, and that this ought to be recognised and mitigated by relevant authorities.

Deep-ocean climate change impacts on habitat, fish and fisheries, by Lisa Levin and colleagues. 2019. FAO Fisheries and Aquaculture Technical Paper 638, 186 pages

This publication focuses on the impacts of climatic changes on demersal fisheries, and the interactions of these fisheries with other species and vulnerable marine ecosystems. Predicted changes are not always as expected. Suggestions for adaptive monitoring and management are provided to ensure that the environment remains healthy and productive.



Global Observing Needs in the Deep Ocean, by Lisa A. Levin and colleagues. 2019. Frontiers in Marine Science 6: 241. DOI: 10.3389/fmars.2019.00241

This article discusses the scientific need for globally integrated deep-ocean observations and the key scientific questions and societal mandates driving observing requirements over the next decade. Opportunities for new and expanded synergies among deep-ocean stakeholders are presented, as well as examples of existing and emerging deep-sea methods and technologies.

High seas governance that benefits all: understanding area-based management tools, by Daniela Diz. IIED Briefing, March 2019, 4 pages. http://pubs.iied.org/17641IIED

This briefing establishes the rationale for designing ecologically sound area-based management tools that recognise and meet the needs of coastal developing states. It also calls for guidance, criteria and standards developed in international conventions on biodiversity to be incorporated into the UNCLOS BBNJ instrument.

Well-being Outcomes of Marine Protected Areas, by Natalie C. Ban and colleagues. 2019. Nature Sustainability 2: 524-532 DOI: 10.1038/s41893-019-0306-2

MPAs are often seen as beneficial to biodiversity and people, yet some can impact on people's livelihoods. This review revealed that no-take, well-enforced and old MPAs had positive effect on human well-being. Further work on new MPA networks should also assess human well-being.

Evolving the Physical Global Ocean Observing System for Research and Application Services Through International Coordination, by Bernadette M. Sloyan and colleagues. 2019. Frontiers in Marine Science DOI: 10.3389/fmars.2019.00449

This paper highlights the latest developments of the global ocean observing system (GOOS), focusing on physical variables that maximize support for fundamental research, climate monitoring, forecasting on different timescales, and society.

Global Ocean Biodiversity Initiative

Global Ocean Biodiversity Initiative

Providing the scientific basis for conserving biological diversity in the global ocean

The Global Ocean Biodiversity Initiative is an international partnership of organisations committed to advancing the scientific basis for conserving biological diversity in the marine environment. In particular, GOBI contributes expertise, knowledge and data to support the Convention on Biological Diversity's efforts to identify ecologically and biologically significant marine areas (EBSAs) by assisting a range of intergovernmental, regional and national organisations to use and develop data, tools and methodologies.

GOBI also undertakes research to generate new science that will enhance the value of EBSAs and their utility for promoting environmental protection and management for specific areas of the world's oceans. The intention is ultimately to reduce the rate of biodiversity loss through the application of ecosystem approaches to the management of human activities, and to support the establishment of networks of representative marine protected areas in national and international waters.

The GOBI partnership and activities are coordinated by a Secretariat team, provided by Seascape Consultants Ltd. GOBI is funded by the International Climate Initiative (IKI). The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) supports this initiative on the basis of a decision adopted by the German Bundestag.

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